Outlaw Trail Wind Energy Project

Technical Project Proposal

Prepared for:
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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

BluEarth Renewables Inc. (BluEarth) is proposing to develop a wind energy project (the Project) in the rural municipalities of Hart Butte (RM. No. 11) and Happy Valley (RM. No. 10), Saskatchewan (Figure 1-1). The Project is located approximately 20 km east of the village of Coronach, in south-central Saskatchewan, and approximately 14 km north of the US/Canada border. The Project is proposed to be up to 200 MW with a maximum of 50 wind turbine generators (WTGs). BluEarth is applying for 60 WTG locations, including 10 alternative locations. Construction of the Project is expected to begin in 2019, and commissioning to commence in 2020. BluEarth has developed this Technical Project Proposal (TPP) to describe the Project, identify existing environmental conditions, potential environmental effect pathways, proposed mitigation, and residual and cumulative effects of the Project on environmental components. The TPP describes the Project and factors that were considered in the siting of the Project both at a regional (i.e., general location in southern Saskatchewan) and local scale (i.e., location of the layout and individual turbines and infrastructure). BluEarth is committed to developing a Project that is compliant with regulatory requirements and commitments made in this TPP.

Project Proponent and Project Team

BluEarth is a Calgary-based private, independent renewable power producer focused on the acquisition, development, construction, and operation of wind, water, and solar projects in Canada. BluEarth's mission is to be the renewable energy leader by owning and operating a diverse portfolio that optimizes people, planet, and profit. BluEarth contracted Stantec Consulting Ltd. (Stantec) to prepare the TPP for regulatory review. Stantec has extensive experience in evaluating the environmental effects of wind projects within Saskatchewan and across Canada.

Project Need

In November 2015, the Province of Saskatchewan announced that by 2030 it would produce 50% of its energy from renewable sources, an increase from approximately 25% at the time. An announcement by SaskPower following shortly after that of the Province's indicated that a large proportion of this new energy would come from wind energy development; SaskPower planned to procure 100 MW in 2016 and an additional 1,600 MW between 2019 and 2030. The Project will help fulfill SaskPower's goal of increasing the proportion of renewable energy generation for the Saskatchewan grid.

Project Planning and Siting

BluEarth began advancing development activities in the Project area in 2015 when it was announced that SaskPower would be contracting Independent Power Produces (IPPs) to supply new sources of renewable energy. Through 2015, 2016 and 2017 BluEarth, with support from Stantec, studied the Project area and refined the target lands and Project layout.

The Project is sited primarily in an agriculturally dominated landscape and the construction footprint will be approximately 373 ha. The disturbance footprint during operation will decrease due to the reclamation of temporary workspaces and the narrowing of construction access roads.

Engagement

Engagement activities for the Project began in 2016. Targeted audiences for engagement activities have included the public (individual landowners, and local communities), Indigenous communities, government (RMs) and the Saskatchewan Ministry of Environment (SK MOE). The engagement program has included two public open houses (June 7, 2016 and June 8, 2017), three in-person meetings with the SK MOE (June 27, 2016; March 30, 2017; and January 18, 2018), presentations to the RMs (March and December 2016 and December 2017), in-person meetings, telephone calls, direct mailing, email, publication of newspaper notices, and posting of information on a dedicated Project website.

Feedback from the community included concerns related to visual impacts, groundwater issues, and tourism impacts.

Environmental Assessment Scope

Environmental components that may be affected by the Project were evaluated for potential effects pathways and for inclusion in the TPP. The environmental component selection process used knowledge of the construction and operation of wind energy projects, engagement feedback, and available desktop resources to evaluate existing conditions and select environmental components to include in this TPP. The list of environmental components that were included in the TPP is:

- Terrain and Soils
- Vegetation and Wetlands
- Wildlife and Wildlife Habitat
- Heritage Resources
- Human Environment

The existing conditions for each environmental component were characterized. This characterization, completed through a desktop review and field surveys, is important to determine potential effects resulting from Project activities.

The assessment of potential effects for each environmental component began with a description of the pathways whereby specific Project activities and actions could result in an environmental effect. For each environmental component, the Project's potential effects pathways were identified and assessed in the context of the environmental component's existing conditions and any input received from the engagement process to date. Where effects pathways were identified, mitigation measures were considered to reduce or avoid potential effects.

Following the identification of effects pathways and mitigation measures that may reduce or avoid those potential effects, the residual effects of the Project activities were evaluated and discussed for each environmental component. These residual effects were assessed in the context of the environmental component's existing conditions, which included its biophysical or socio-economic requirements and characteristics. Mitigation were applied to reduce or avoid each potential effect. Residual environmental effects (i.e., the environmental effects that remain after mitigation has been applied) are described and have taken into account the potential magnitude, extent, duration, reversibility, frequency and likelihood of occurrence. Effects were reviewed on a Project-wide basis and, where relevant to the assessment, a discussion of possible site-specific effects is presented.

A cumulative environmental effects assessment was conducted following the requirements outlined in the *Technical Proposal Guidelines* (Government of Saskatchewan 2014). For each environmental component where there was a residual effect, a description was provided of how the Project and other past, existing or future projects might cumulatively affect the environmental component. Residual cumulative effects were characterized in consideration of planned site-specific mitigation.

Environmental Setting

The Project is located within the Wood Mountain Plateau and Coteau Lakes Upland landscape areas of the Mixed Grassland ecoregion. This landscape area is characterized by extensive areas of native mixed-grass prairie in association with quartzite-covered plateaus and gullied lands containing a variety of grasses and shrubs and trees in depressional areas with more moisture (Acton et al. 1998). Soils in the plateau areas are commonly brown loam soils with Regosolic soils in the more strongly gullied areas. The soils are typically limited for crop production, and where suitable, tend to grow cereals and small amounts of forage (Acton et al. 1998).

The broader Mixed Grassland is a semi-arid grassland ecoregion that covers a large portion of southwestern Saskatchewan and portions of southeastern Alberta that forms part of the shortgrass prairie of the North American Great Plains. The native vegetation community of the region is characterized by spear grass, blue grama grass and a variety of shrubs and herbs, including sagebrush.

The Big Muddy Valley is located approximately 2.0 km to the north of the Project. The Big Muddy Lake Important Bird Area (IBA) is approximately 7.3 km to the east, and Willow Bunch Lake IBA approximately 11.1 km to the northwest. Both IBAs have associated wind energy avoidance buffers extending 5 km from the IBA boundaries. *Wildlife Habitat Protection Act* (WHPA) lands, which are included in avoidance zones (SK MOE 2017a), are found north and east of the Project Development Area (PDA). Project infrastructure is not proposed for any WHPA lands. The Project is in compliance with SK MOE's Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects (SK MOE 2017a).

Potential Effects Assessment Results

The following provides a summary description of potential effects based on currently available information.

Terrain and Soils

Portions of the Project overlap terrain with steep slopes (≥ 15% slope). Where such a change in terrain does occur, during construction, the magnitude of the potential effect on terrain and soils will be low as it will be a small percentage of the Project Development Area (PDA) and Local Assessment Area (LAA). Any other effects such as soil erosion will be mitigated through diligent application of mitigation measures. Soil quality and quantity within the PDA is expected to be maintained based on implementation of the proposed mitigation measures including constructing during frozen conditions where possible and implementing erosion control measures. With the application of mitigation measures, residual effects of the Project on soil quality and quantity will likely be localized and limited.

Vegetation and Wetlands

The assessment of potential effects on vegetation and wetlands focused on native vegetation, wetlands and plant Species of Management Concern (SOMC). The PDA is a total of 373 ha and consists of predominantly cultivated land (70.2%) with the remainder comprised of hayland (15.1%), native grassland (5.8%), tame pasture (5.7%), urban/developed (1.4%) and wetlands (1.4%).

The Project layout avoided native grassland during siting of the turbine foundations and turbine temporary workspaces. During the siting of other permanent infrastructure, native grassland was avoided where possible. The residual effect on native grassland will be a loss of a total of 21.6 ha of native grassland; however additional refinements to infrastructure will be made in the field to further reduce the level of this effect. Conservatively, this assessment assumes a complete loss of vegetation along rights-of-way for the overhead collector lines. However, during operation the entire right-of-way will not be utilized, rather it will be limited to the turbine and above ground pole locations.

Wetlands are avoided whenever possible. There are 4.15 ha of Class I-II wetlands and 0.97 ha of Class III-IV wetlands for a total of 5.12 ha of wetlands located within the PDA. Where avoidance is not possible, appropriate mitigation measures, as approved under the Aquatic Habitat Protection Permit (AHPP), will be implemented to reduce direct effects to wetlands. Indirect effects from the Project are possible through changes in wetland function from sedimentation and surface runoff. Erosion control measures, specific wetland mitigation and setbacks will reduce or avoid potential effects to wetlands.

A total of 34 vegetation community sites were surveyed, 24 in 2016 and 10 in 2017. During the surveys, 176 vascular plant species were observed including two plant SOMC at two locations within the PDA and six plant SOMC species at 37 locations within the LAA. There were also eight noxious or nuisance weed species observed in the LAA during the surveys. No prohibited weed species were observed during the field surveys. Pre-construction rare plant surveys will confirm the locations of rare plants in the PDA. The TPP describes the process and mitigation response that will occur in the event that plant SOMC are identified.

Residual effects of the Project on vegetation and wetlands are unlikely to effect the long-term persistence or viability of a plant species (including plant SOMC), native vegetation types, or result in permanent loss of wetlands.

Wildlife and Wildlife Habitat

The assessment of potential effects on wildlife and wildlife habitat focused on habitat availability and mortality risk for wildlife (including SOMC).

At baseline, 70.2% of the PDA consists of cultivated lands, which provide minimal habitat for wildlife. Siting of the Project has focused on utilizing cultivated lands as much as possible, as evidenced by the proportion of cultivated land in the PDA (70.2%) compared to the LAA (28.5%). Combined, tame pasture and hayland are the second most abundant land cover type in the PDA (20.8%). The PDA avoids native grassland and water/wetlands where possible as shown by the relatively small amount of these habitat types (5.8% and 1.5%, respectively) as compared with the Wildlife LAA (46.6% and 3.0%, respectively).

There is one ferruginous hawk nest whose 1 km setback overlaps the location of overhead and underground collector lines. It does not overlap however with the WTG locations or access roads. Construction activities at this location will occur outside of the activity restriction period (March 15 to July 15) and be confined to the construction workspace for those components.

There are six leks whose 400 m setbacks overlap the PDA. Two leks (SW-31-02-24-W2M, and SE-04-03-24-W2M) have a 400 m setback that overlap access roads and collector lines, two leks (SE-35-02-25-W2M, NW-33-02-24-W2M) have setbacks that overlap collector lines only, and two leks (SW-01-03-25-W2M and SE-02-03-24-W2M) setback overlap access roads, collector lines and temporary workspaces around WTGs. No WTG locations are within the leks' 400 m setback. Construction activities at these locations will occur outside of the activity restriction period (March 15 to May 15) and will be confined to the construction workspace.

A total of five breeding ponds for northern leopard frogs were detected during the field surveys. The breeding ponds are not affected by the PDA; however, the 500 m setback around each breeding pond overlaps the PDA, including WTG pads, temporary workspaces, access roads, and underground and overhead collector lines. Construction activities at these locations will be confined to the construction workspace.

The Project is located on the southern edge of the Big Muddy Valley which is characterized by a ridge of forested coulees. Control sites for the bird movement surveys were sited along the valley in order to assess if this landscape feature could act as a corridor for migrating birds and therefore have higher number of birds than within the Project area. However, results from the bird movement surveys showed that bird movement rates at the control sites were similar to those within the Project area. Based on the data collected, it appears that the Big Muddy Valley, to the north of the Project, does not concentrate bird movement during migration. Furthermore, there are no other prominent features on the landscape near the Project area that could serve as a concentration site for birds (e.g., a large body of water) thereby lowering the potential for an increased level of interaction between the Project and birds.

The Alberta ESRD (2013b) identifies categories for various levels of migratory bat activity to establish potential risk to bats. These categories are: less than 1 migratory bat passes per detector night; 1 to 2 migratory bat passes per detector night; and greater than 2 migratory bat passes per detector night. In the context of this Project, bat activity rates were 0.2 migratory bat passes per detector night during the 2016 spring monitoring period. There were 2.0 migratory bat passes per detector night in 2015 and 2.4 migratory bat passes per detector night in 2016 during the fall monitoring period (August 1 to September 10) at the elevated detectors. The 2015 and 2016 fall bat activity rates fall within the moderate to high category for migratory bat fatality risk according to Alberta ESRD (2013b).

Heritage Resources

The heritage resources assessment focused on the Project's potential effects on heritage resources which include Precontact period and Historic period archaeological sites, built heritage sites and structures of historical and/or architectural interest, and palaeontological sites. Based on a referral from the Heritage Conservation Branch (HCB) and Stantec's review of the results against the PDA, 32 quarter sections required a heritage resource impact assessment (HRIA). An HRIA will be completed in advance of construction. In order to address the findings of the HRIA and to fulfill the requirements of the *Heritage Property Act*, all heritage resources must be avoided or mitigated fully under the direction of the HCB. Once the HRIA is completed and mitigation measures are developed to the HCB's satisfaction, there will be no residual effects of the Project on heritage resources.

Human Environment

The human environment assessment considered geopolitical administrative bodies (e.g., rural municipalities, towns, etc.), land use, groundwater users, existing infrastructure, noise and visual aesthetics.

The Project is not expected to affect groundwater users and with mitigation, residual effects on existing infrastructure are not anticipated.

The PDA overlaps 4 quarter sections of leased agricultural crown land; however, BluEarth will obtain a permit to construct WTGs and infrastructure on these lands from the Ministry of Agriculture.

The majority (70.2 %) of the PDA currently consists of cultivated land. Native grassland consists of a small percentage (5.8%) of the PDA. Native grassland was avoided were possible during Project siting.

Within the LAA there were 830 quarter sections of WHPA lands; however, there are no WHPA lands within the PDA. There are no quarter sections of private conservation lands within the PDA or LAA.

Noise from the Project will be in compliance with Alberta Utilities Commission (AUC) Rule 012; Noise Control (AUC 2017) requirements. As such, no residual Project environmental effects on noise are anticipated.

To provide information about the potential visual impacts of the Project on the viewscape, BluEarth completed visual simulation figures from six pre-selected vantage points. Vantage points were selected based on local communities, primary roads, and points of interest. The figures created before and after views of the landscape where turbines locations are proposed at each of six locations. The figures show that the WTGs will be an additional feature on the landscape. The relative visibility of the turbines depends on the particular vantage point. Since the surrounding landscape consists of level topography, the WTGs will be visible within the LAA. Potential disruption to the visual aesthetics of the landscape was not identified as a concern by stakeholders during engagement activities completed to date.

Cumulative Effects

In addition to assessing Project-related residual effects, the *Technical Proposal Guidelines* (Government of Saskatchewan 2014) requires that the assessment consider potential cumulative effects. The TPP concluded that of the Project-related residual effects, three were likely to act in a cumulative manner: change in native vegetation and wetland abundance and distribution; change in wildlife habitat; and, change in wildlife mortality risk. In order to complete the cumulative effects assessment a Project and activity inclusion list was developed that identified other past, present and reasonably foreseeable projects and physical activities within the human environment Regional Assessment Area (RAA) (because it is the largest RAA) with residual effects that could overlap spatially and temporally with the Project. Projects identified in the activity inclusion list, such as the Poplar River Coal Mine and SaskPower's Outlaw Trail Transmission Interconnection project, were identified with potential for acting cumulatively with the Project.

The Project will result in a loss or disturbance of approximately 21.6 ha of native grassland (5.8% of the PDA and 0.6% of the LAA), and 5.1 ha of wetlands (1.4% of the PDA and 0.1% of the LAA). Other past and present projects in the RAA, such as land conversion for agriculture and resource extraction activities, have potential effects on native grassland and wetlands. Future projects, such as the continued expansion of the Poplar River Coal Mine and SaskPower's Outlaw Trail Transmission Interconnection project, will also result in a change in native vegetation and wetland distribution and abundance. The Poplar River Coal Mine Expansion will result in the excavation of 464 ha of native vegetation, including 230 ha of WHPA land and 8 ha of wetlands, and the loss of individuals of six species of provincially at risk plant species (SK MOE 2010). The RAA overlaps with the entire footprint of the Poplar River Coal Mine Expansion area. Due to the uncertainty of the specific siting of SaskPower's Outlaw Trail Transmission Interconnection project, the extent to which native vegetation will be affected is difficult to estimate. However, its reasonable to assume that the line will likely follow previously disturbed road allowances where possible.

The total amount of native vegetation and wetlands affected by the Project and other projects and activities in the RAA is relatively small. As such, the cumulative effects on native vegetation and wetland abundance and distribution can be addressed through mitigation.

During the operation and maintenance phase for the Project and future projects, no additional direct habitat loss will occur.

Given that the assessment of cumulative effects results in a low proportion of the respective RAAs affected, cumulative loss of native vegetation, wetlands, and wildlife habitat is not expected to have population-level effects on native grassland, plant SOMC and wildlife in the RAA.

The modified landscape of the RAA has already been and continues to be a source of mortality risk to wildlife due to agricultural practices, vehicle traffic on roads, and collisions with existing transmission lines. The construction phases of the Project and future projects will contribute to a change in mortality risk from ground compaction and vegetation removal, which could result in mortality of wildlife species through vehicle collisions and destruction of nests if activities occur during the nesting period. Construction activities primarily pose a risk to less mobile species, such as amphibians, and bird nests. Assuming that the Project and future projects implement appropriate mitigation measures (e.g., vegetation clearing outside of migratory bird nesting period, pre-construction nest surveys to avoid active nests, monitoring), potential cumulative effects on mortality risk during construction will be limited.

Potential cumulative mortality from wildlife collisions with turbines and overhead lines exists for some species or guilds (e.g., waterbirds) where potential for collision exists for all types of structures (i.e., transmission lines, distribution lines and wind turbines). For other species or guilds, the potential for collision may be largely limited to turbines or transmission lines. Given the limited overlap in species guilds with the potential for collision with turbines and power lines, there is likely to be a small cumulative effect on change in mortality risk as a result of the Project and future projects. Overall, the contributions of future projects within the RAA, including the proposed Project, to wildlife mortality risk are not anticipated to change current wildlife abundance and diversity in the RAA.

Given the limited overlap in species guilds with the potential for collision with turbines and power lines, there is likely to be a small cumulative effect on change in mortality risk as a result of the Project and future projects. Overall, the contributions of future projects within the RAA, including the proposed Project, to wildlife mortality risk are not anticipated to change current wildlife abundance and diversity in the RAA.

Conclusion

The TPP has incorporated a defensible methodology to scope potential effects pathways, acquire appropriate data (both field and desktop), analyze data, and discuss potential levels of residual effects subsequent to implementation of mitigation measures. Using this process, the TPP concluded that potential effects from the Project on the physical, biological and human environment can likely be avoided or mitigated both at a local and regional level. Most effects will be addressed through application of proven environmental design and mitigation measures, a commitment to environmental monitoring during construction and post-construction reclamation and wildlife mortality monitoring. Adaptive management responses to mortality may be required in response to results from the post-construction monitoring program.

In summary, the Project is expected to have residual effects that are manageable and allow for appropriate development of the Project to help meet SaskPower's goal of increasing the proportion of renewable energy generation in the Province of Saskatchewan.

Abbreviations

AAFC	Agriculture and Agri-Food Canada
AHPP	Aquatic Habitat Protection Permit
AMP	Adaptive Management Plan
AUC	Alberta Utilities Commission
BCR	Bird Conservation Region
BluEarth	BluEarth Renewables Inc.
CLI	Canada Land Inventory
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EAB	Environmental Assessment Branch
EMP	Environmental Management Plan
ESRD	Environment and Sustainable Resource Development
GIS	Geographic Information System
GPS	global positioning system
ha	hectare
HCB	Heritage Conservation Branch
HDD	horizonal directional drilling
HRIA	Heritage resource impact assessment
IBA	Important Bird Area
IPP	Independent Power Producers
km	kilometer
km/hr	kilometer per hour
kv	kilovolt

LAA	Local Assessment Area
m	meter
m^2	square meter
m/s	meter per second
MET	meteorological tower
MW	megawatt
PDA	Project Development Area
RAA	Regional Assessment Area
RFQ	Request for Qualifications
RM	Rural Municipality
SAR	Species at Risk
SARA	*Species at Risk Act*
SK	Saskatchewan
SKCDC	Saskatchewan Conservation Data Center
SKMOE	Saskatchewan Ministry of Environment
SKSID	Saskatchewan Soil Information Database
SOMC	Species of Management Concern
SOP	Standard Operating Procedures
Stantec	Stantec Consulting Ltd.
TPP	Technical Project Proposal
WEP	Wind Energy Project
WHPA	*Wildlife Habitat Protection Act*
WTG	wind turbine generators

1.0 INTRODUCTION

BluEarth Renewables Inc. (BluEarth) is proposing to develop a wind energy project (the Project) in the rural municipalities of Hart Butte (RM. No. 11) and Happy Valley (RM. No. 10), Saskatchewan (Figure 1-1). The Project is located approximately 20 km east of the village of Coronach, in south-central Saskatchewan, and approximately 14 km north of the US/Canada border. The Project is proposed to be up to 200 MW with a maximum of 50 wind turbine generators (WTGs). BluEarth is applying for 60 WTG locations, including 10 alternative locations. Other permanent Project infrastructure includes access roads to each WTG, padmount transformers, above and below-ground electrical collector system, a transformer substation, communications and control system, operation and maintenance building, and other ancillary equipment.

BluEarth retained Stantec Consulting Ltd. (Stantec) to evaluate and prepare a Technical Project Proposal (TPP) for the Project for submission and review by the Saskatchewan Ministry of Environment's (SK MOE) Environmental Assessment Branch (EAB). Stantec has prepared this TPP for the Project in accordance with the SK MOE *Technical Proposal Guidelines* document (Government of Saskatchewan, 2014). This document is intended to fulfill the requirements of a TPP under *The Environmental Assessment Act* and will describe the Project, existing environmental conditions and potential effects of the Project on environmental components. It also describes how efforts have been made to reduce or avoid potential effects on the environment. Residual Project and cumulative effects are also described and assessed in the document.

1.1 PROJECT PROPONENT

BluEarth is a Calgary-based private, independent renewable power producer focused on the acquisition, development, construction, and operation of wind, water, and solar projects in Canada. BluEarth's mission is to be the renewable energy leader by owning and operating a diverse portfolio that optimizes people, planet, and profit.

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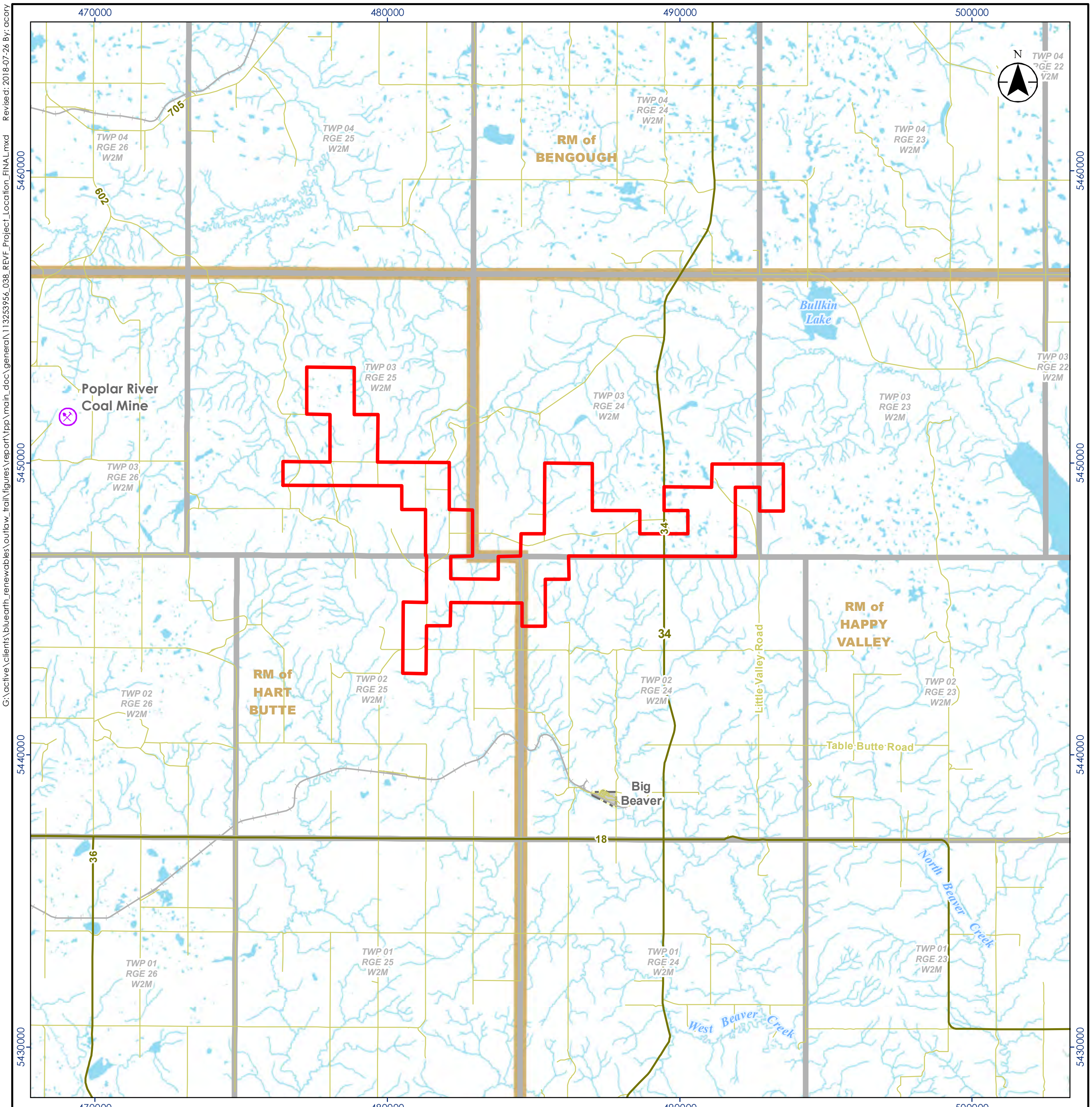


- Target Lands*
- Rural Municipality
- Major Road
- Minor Road
- Railway
- Watercourse
- Waterbody
- Town/City
- Township

0 2.5 5 Kilometres

1:200,000 (at original document size of 8.5x11)

Stantec BluEarth RENEWABLES INC

Project Location
Near Coronach, SK

113253956-038 REVF
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
1-1

Title
Project Location

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license from the Government of Saskatchewan and the Government of Canada.
3. * The target lands are leased and BluEarth has land control of this area.

1.2 PROJECT TEAM

BluEarth has assembled a team of individuals responsible for various aspects of the Project, including planning, stakeholder engagement, and environmental assessment (see Table 1-1).

Table 1-1 Project Team

Team Member	Role	Organization	Contact
Tom Bird	Director, Regulatory	BluEarth	519-362-7232
Gareth McDonald	Director, Development	BluEarth	587-324-4247
Kerrie Skillen	Project Manager	Stantec	306-667-2462
Neil Cory	Project Technical Director	Stantec	306-667-2455

Various additional discipline specialists were part of the Project team for Noise, Terrain and Soils, Vegetation and Wetlands, Wildlife and Wildlife Habitat, Heritage Resources, and Engagement.

1.3 REGULATORY REQUIREMENTS

This TPP describes the Project, the existing environment in which the Project is located, engagement activities, potential effects and proposed mitigation measures to reduce or avoid potential residual effects. Collectively, this information is intended to assist the EAB in making a determination for approval to construct or if additional investigations and approval is required as per the requirements under the Saskatchewan *Environmental Assessment Act*. If approval to construct is received from the EAB, the Project will be subject to additional regulatory requirements prior to construction, such as site-specific permitting which may include those described in Table 1-2. Alternatively, the EAB may request BluEarth to complete an Environmental Impact Statement if the Project is deemed a 'development' as defined in the *Environmental Assessment Act*.

No federal environmental assessment triggers have been identified under the *Canadian Environmental Assessment Act*.

A review of applicable legislation has identified the following environmental regulatory requirements that may apply to this Project (Table 1-2).

Table 1-2 Regulatory Requirements and Approvals

Regulation	Description	Action Required
Federal Regulatory Requirements		
Fisheries Act, 1985, amended 2013	Applies to projects conducted in or near waterbodies and watercourses that are part of or that support commercial, recreational, and Indigenous fisheries. The *Act* requires that projects avoid causing serious harm to fish, unless authorized. The Act also provides standard measures and mitigation to avoid causing serious harm to fish.	The Project infrastructure is not proposed to interact with waterbodies or watercourses that are fish-bearing.
Migratory Birds Convention Act and Regulations, 1994	Applies to all lands where migratory birds breed and nest and prohibits the disruption or loss of active migratory bird nests. It prohibits the taking of migratory birds, their eggs or nests unless permitted.	Strategies such as timing of construction and pre-construction surveys will be utilized to avoid the disruption or loss of active migratory bird nests. BluEarth will avoid construction clearing on lands suitable for migratory bird nesting or breeding during the breeding and nesting seasons (approximately mid-April to end of August). If avoidance of this period is not possible, trained biologists will survey all lands subject to clearing prior to any activity to determine if birds are nesting within the Project construction limits. Monitoring of bird mortality as a result of Project operation will be used to determine if adaptive mitigation will be required to reduce bird mortality rates.

Regulation	Description	Action Required
Species at Risk Act, 2002 (SARA)	Protects endangered or threatened species and their habitats in Canada. *SARA* outlines the methods for steps that need to be taken to help protect existing habitat, and recover threatened habitats.	Mitigation or avoidance of *SARA*-listed species for infrastructure siting reflect the SK MOE 2017 Activity Restriction Setbacks for Sensitive Species to avoid disturbance of *SARA*-listed species. Monitoring of mortality to *SARA*-listed species will occur during operation to determine if there are additional mitigation measures required to reduce or avoid impacts to *SARA*-listed species.
Transport Canada	Responsible for ensuring proper marking and lighting on tall structures in accordance with Transport Canada's Standard 621.	An Aeronautical Assessment Form for Obstacle Marking and Lighting will be submitted to Transport Canada for their review. Approval will be required prior to construction.
NavCanada	Responsible for issuing approval related to land use in proximity to airports.	A Land Use Submission Form will be submitted to NavCanada for their review. Approval will be required prior to construction.
Saskatchewan Provincial Regulatory Requirements		
The Environmental Assessment Act, 1980	TPP reviewed by SK MOE to determine if the Project is deemed a development under the Act.	After submission of TPP to SK MOE, approximately 30 days for review and determination by SK MOE, assuming no additional information requests.
Environmental Management and Protection Act, 2010	Provides for the protection of aquatic habitat from development or alterations to waterbodies or watercourses.	Aquatic Habitat Protection Permits (AHPP) will be required for wetlands, streams and water bodies that may be impacted by construction activities.
Heritage Property Act, 1980	Protects and conserves heritage resources on provincial and municipal lands.	A heritage resource impact assessment (HRIA) will be conducted on all locations deemed to have high heritage value and submission to the Heritage Conservation Branch will occur prior to construction.

Regulation	Description	Action Required
Weed Control Act, 2010	The *Weed Control Act* designates weeds into three categories: Prohibited, Noxious, and Nuisance. The objective of the Act is to promote early detection and eradication of these weeds.	Observations of weeds listed under the *Act* were documented during the vegetation community surveys and will be forwarded to landowners or land occupants. Additional observations made during rare plant pre-construction surveys will also be provided to landowners or occupants.
Wildlife Act, 1998	Plant and animal species at risk as defined in the *Wildlife Act*, are protected from being disturbed, collected, harvested, captured, killed, sold or exported without a permit.	Field permits were obtained through the Fish and Wildlife Branch of SK MOE for the 2016 and 2017 field seasons as per the requirements in those years for field surveys completed. Mitigation or avoidance may be required if species at risk are identified within the Project area.
The Wildlife Habitat Protection Act (WHPA), 1992	This Act allows the protection of wildlife habitat on Crown Land within the agricultural region.	Permitting or crossing agreements may be required for any potential alteration to protected lands. Project infrastructure is not proposed for any WHPA lands.
The Highways and Transportation Act	Governs the movement of loads that exceed what is normally permitted to travel on provincial roads.	An Overweight and Over-Dimensional Load Permit will be required during construction to allow the movement of trucks carrying heavy equipment and Project components on provincial roads.
Municipal Regulatory Requirements		
The Planning and Development Act, 2007	The Act allows the rural municipalities (RMs) to address land use and development issues through the adoption of an official community plan and zoning bylaw.	BluEarth has consulted with the RMs of Heart Butte and Happy Valley to determine the permits required for the Project.

In addition to legislation described in Table 1-2, other guidelines exist that influence the development of the Project, such as:

- *Technical Proposal Guidelines* (Government of Saskatchewan, 2014)
- Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects (SK MOE 2017a)
- Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017b)

1.4 SCOPE OF ASSESSMENT

In accordance with the *Technical Proposal Guidelines* (Government of Saskatchewan, 2014), the scope of this TPP describes the physical, biological, and human environment components associated with the Project. The environmental components scoped for inclusion in this TPP, due to their likelihood of being affected by the Project, are described in Section 4. This TPP also identifies the potential effects and proposes mitigation measures to address the potential effects associated with the construction, operation and maintenance, and decommissioning of the Project. Those physical, biological and human environment components carried forward following scoping in Section 4, are described in Section 5.

1.5 PROJECT SCHEDULE

The Project consists of four phases: development, construction, operation and maintenance, and decommissioning. The Project is currently in the development phase which includes: facility interconnection planning with SaskPower; permitting and approvals including environmental studies; ongoing stakeholder engagement; detailed Project design and engineering; equipment procurement; and Project financing.

The construction schedule is dependent on the timing of:

- Design and build of SaskPower's distribution line to Project site;
- Regulatory approvals;
- Equipment supply; and,
- Suitable construction season and conditions.

The schedule of key project activities and milestones are presented in 3.

Table 1-3 General Schedule of Project Milestones

Project Phase	Project Schedule
Stakeholder Engagement	2014 through 2018 and ongoing
Regulatory Engagement	2015 through 2018
Detailed Environmental Studies	April 2015 to June 2017
TPP Submission to SK MOE	July 2018
Pre-Construction Planning and Permitting	2016 through 2019
Construction* (*assuming award of contract with SaskPower)	2019 – 2020
Commercial Operation Date	2020
Operations	2020 – 2050
Decommissioning	2050

2.0 PROJECT DESCRIPTION

2.1 PROJECT NEED AND BENEFITS

In November 2015, the Province of Saskatchewan announced that by 2030 it would produce 50% of its energy from renewable sources, an increase from approximately 25% at the time. An announcement by SaskPower following shortly after that of the Province's indicated that a large proportion of this new energy would come from wind energy development; SaskPower planned to procure 100 MW in 2016 and an additional 1,600 MW between 2019 and 2030. The Project will help fulfill SaskPower's goal of increasing the proportion of renewable energy generation for the Saskatchewan grid.

2.2 ENVIRONMENTAL MANAGEMENT FRAMEWORK

BluEarth will oversee the development of programs to maintain the safety of humans and the natural environment throughout the life of the Project. A brief description of the purpose and key elements of each program are included in this section.

2.2.1 Occupational Health and Safety

During construction, all contractors will be responsible for ensuring everyone on site follows safety requirements complying with health and safety policies and standards, as well as current provincial and federal health and safety legislation (Government of Saskatchewan 1996, 2013). The contractor will be responsible for developing and incorporating a safety program that conforms to the *Saskatchewan Employment Act and Saskatchewan Occupational Health and Safety Regulations* and will apply to all Project facilities and operations, employees, contractors, and visitors. This program should include, but not be limited to, providing for worker and visitor orientations, daily tailgate meetings and on-site hazard assessments prior to work commencing, along with appropriate hazard controls. The same responsibilities will be maintained by the operation and maintenance service provider during Project operation.

During construction, the contractor will be responsible for providing health and safety materials to personnel. Areas will be set aside as designated first aid stations so that a basic level of emergency response and health care will be provided on-site during construction. For example, first aid stations will be located on-site at each contractor's work area and the Project will meet the requirements of the *Saskatchewan Occupational Health and Safety Regulations* (1996).

2.2.2 Emergency Response Plan

An Emergency Response Plan will be developed to direct actions in the event of a Project-related emergency. Notification of the appropriate regulators will take place in the event of any health or environmental emergency. A spill prevention program will be implemented and followed throughout construction and operation of the Project. Equipment will be maintained and inspected by the contractors regularly to limit the potential for malfunctions. Any spills that occur because of equipment refuelling or leaks will be isolated, reported, and cleaned up immediately using appropriate absorbent materials, containment berms, floating booms, and any other required or appropriate measures.

2.2.3 Environmental Management Plan

BluEarth, in consultation with appropriate contractors, will prepare a Project specific Environmental Management Plan (EMP) prior to construction. It is anticipated that the EMP will address construction mitigation and environmental monitoring for Project activities to mitigate potential environmental effects due to expected interactions between the Project and certain environmental components.

The EMP would include procedures and plans based on regulatory requirements and accepted site practices and as appropriate may include the following plans:

- Traffic Management Plan
- Hazardous and Non-Hazardous Waste Management Plan
- Environmental Monitoring Plan
- Adaptive Management Plan
- Training Plan

2.3 PROJECT PLANNING AND DESIGN

BluEarth began advancing development activities in the Project area in 2015 when it was announced that SaskPower would be contracting Independent Power Produces (IPPs) to supply new sources of renewable energy. Prior to this, the Project area had been identified and land rights had been secured to develop the site for wind energy. BluEarth has obtained several years of wind resource data to confirm the area is suitable for participating in a competitive wind energy procurement process. The Project would connect to a nearby SaskPower transmission line.

Stantec was retained by BluEarth in 2015 to complete a fatal flaw analysis of the initial target lands using desktop resources. This assessment identified the potential for raptors, and in particular ferruginous hawks, to inhabit the target lands and surrounding area. Following this assessment, initial surveys for bat activity rates and raptor nests through the Project area were conducted to determine whether these species groups would result in constraints that could pose site development concerns. After reviewing the information collected during 2015 surveys, BluEarth elected to proceed with further assessment of environmental components of the Project area while simultaneously expanding the target lands to provide additional flexibility in siting Project infrastructure.

In spring and summer 2016, a full suite of surveys was completed at the site to characterize wildlife resources in the Project area and to characterize the vegetation community composition of natural land cover. The assessment approach and surveys included were discussed with SK MOE on June 27, 2016 to obtain feedback on the surveys completed, to discuss the implications of the draft Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects (hereafter Siting Guidelines) and to obtain SK MOE feedback on the site. The emphasis on avoiding native grasslands within the Siting Guidelines was noted and resulted in a re-examination of target lands within the Project area to determine how best to comply with this directive.

Through the course of the fall 2017 and winter 2017, BluEarth identified additional lands to expand options for turbine siting in order to comply with the Siting Guidelines and activity restriction setback guidelines (e.g., sharp-tailed grouse leks). These lands were considered are the final target lands.

With the additional quarter sections of target lands identified after the 2016 suite of field surveys, Stantec designed a supplementary field program to assess suitable habitat for wildlife species identified as likely occurring in the Project area. This supplementary program included species or species groups with activity restriction setbacks but did not include additional bird and bat movement surveys as they previously assessed movement patterns across the landscape and did not require supplementary effort. On March 30, 2017, prior to implementing the 2017 survey program, BluEarth and Stantec met with SK MOE to review current information on the Project and to again identify concerns or additional constraints. During the meeting the SK MOE agreed with the surveys completed to date but asked that breeding amphibian surveys be added to the 2017 field program.

The project description and results of the environmental assessment included in this TPP focus on the refined target lands. All figures in this TPP show the lands proposed for the development of the Project.

The Project layout was developed to balance of the following objectives:

- Provide economically viable wind resource use
- Meet Project engineering and design requirements
- Avoid native grassland
- Respect activity restriction setbacks of identified wildlife features
- Address landowners' preferences for minimizing interference with their land use practices
- Comply with Alberta Utilities Commission (AUC) Rule 012 noise guidelines
- Conform to municipal development requirements
- Consider input from stakeholder engagement processes
- Incorporate feedback from regulatory agencies, public and other parties engaged in the development process

Several resources were considered during development of the Project layout. These included:

- Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects (SK MOE 2017a)
- The Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017b)
- Sensitive areas and features, including biophysical sensitivities e.g., native prairie and wetlands), and heritage resources

2.3.1 Wind Resources

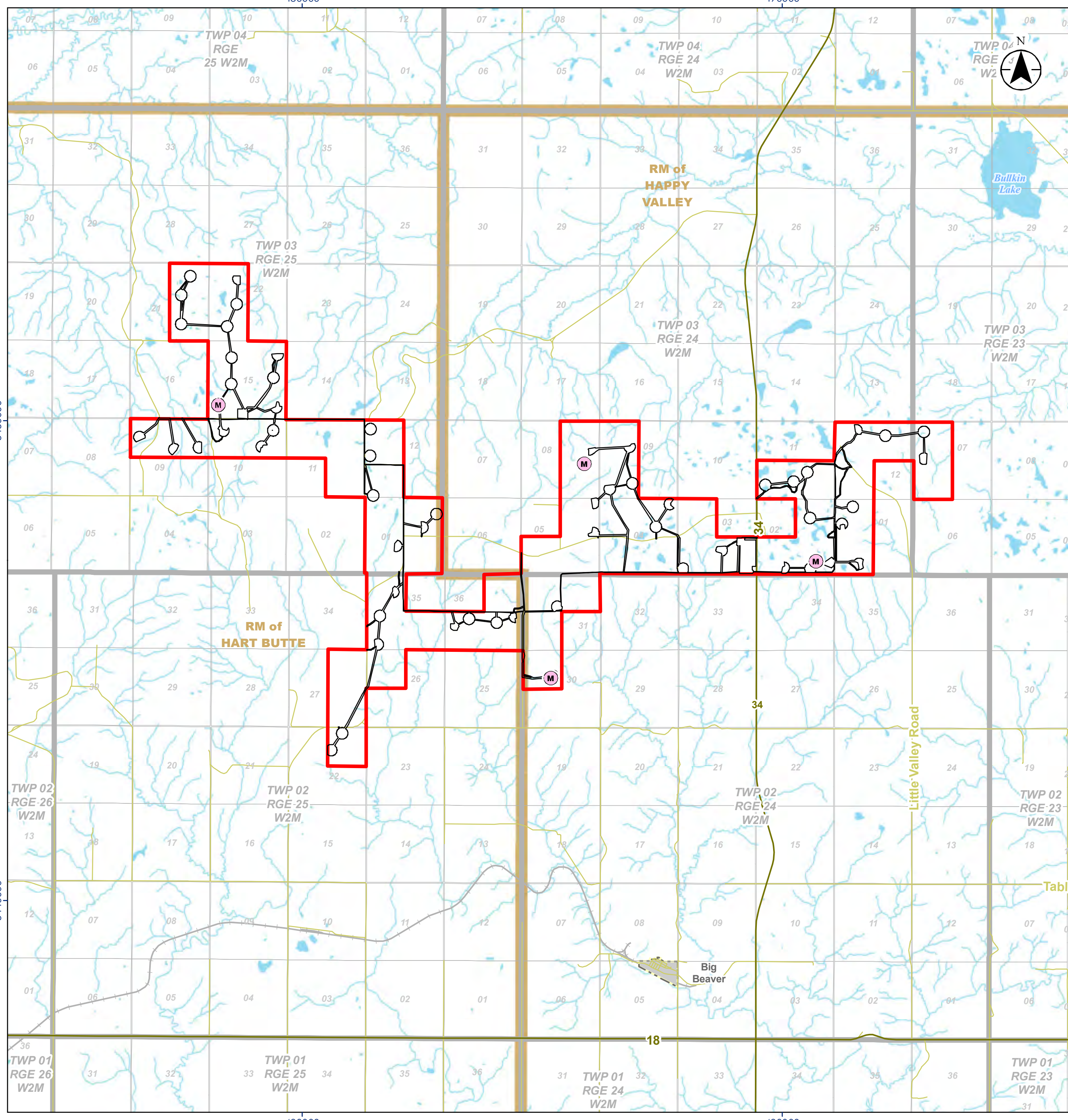
The wind resource in the Project area has been monitored since 2010 at four meteorological tower locations (Figure 2-1). This lengthy monitoring program has provided long-term data on wind resource variability within the target lands to inform the Project layout.

2.3.2 Project Location and Layout

SaskPower indicated in the Request for Qualifications (RFQ) process that they plan to request proposals for either 100 MW or 200 MW independent wind power projects and may select one large or two smaller projects for their first award. BluEarth has designed a 200 MW layout using up to 50 turbines of approximately 4.2 MW capacity (Figure 2-1). BluEarth is applying for 60 WTG locations, including 10 alternative locations.

The Project is located approximately 20 km east of the village of Coronach, in south-central Saskatchewan, and approximately 14 km north of the US/Canada border.

G:\active\clients\bluearth_renewables\outlaw_trail\figures\report\tpp\main_doc\general\113253956_039_REVH_Project_Infrastructure_Layout_FINAL.mxd Revised: 2018-07-26 By: acory



Project Development Area

Met Tower

Target Lands*

Rural Municipality

Major Road

Minor Road

Railway

Watercourse

Waterbody

Town/City

Township

Section

0 1 2 3 Kilometers

1:125,000 (at original document size of 8.5x11)

Stantec BluEarth

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license from the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: BluEarth v3, Jan 22, 2018.
4. * The target lands are leased and BluEarth has land control of this area.

Project Location
Near Coronach, SK

113253956-039 REVH
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
2-1

Title
Project Infrastructure Layout

2.4 PROJECT ALTERNATIVES

BluEarth did not evaluate other potential locations for a wind energy project. After evaluating the wind energy resource at the Outlaw Trail site, the existing land lease agreements, landowner interest, low population densities, and the proximity to a transmission line, the Outlaw Trail site was considered favourable and chosen for further evaluation and development. Numerous locations for infrastructure within the general Project area were assessed before final locations were chosen. Final locations were based on the findings of the environmental assessment completed as part of this TPP.

2.5 PROJECT COMPONENTS AND ASSOCIATED INFRASTRUCTURE

This section provides a description of the major equipment and infrastructure associated with operation of the Project.

2.5.1 Wind Turbine Generators

The proposed Project has been designed around the installation of up to 50 WTGs, with each WTG being approximately 4.2 MW generating capacity. BluEarth is applying for 60 WTG locations, including 10 alternative locations. Final turbine selection will made at the time of procurement.

A summary of the specifications of the 4.2 MW turbine models being considered is provided below.

Each WTG will include the following components:

- Steel support tower that will be fastened to the concrete foundation
- Nacelle containing the electrical generator
- Hub structure containing the turbines blades
- Three blades
- Controller

Detailed information about the 4.2 MW turbine models is provided in Appendix A.

Table 2-1 Basic Turbine Specifications

Operating Data	Specification
General	
Rated capacity (MW)	4.2
Cut-in wind speed (m/s)	3 m/s
Cut-out wind speed (m/s)	22.5 - 25 m/s
Dimensions	
Rotor diameter (m)	117 - 150 m
Blade length (m)	57.2m - 73.7m
Swept area (m^2)	10,751 – 17, 671 m2
Hub height (m)	82 m
Tip height (m)	139.2 – 155.7 m

2.5.2 Temporary Workspace around Wind Turbine Generators

To accommodate equipment and staging of WTG components, a temporary workspace around the turbine site is required. The temporary workspace will be used for construction of the turbine foundation and assembly of the turbine, a crane pad where the crane(s) will rest during turbine installation, equipment staging, construction parking, and foundation spoil pile. The temporary workspace dimensions vary depending on location, as the footprint has been modified to avoid sensitive features. On average the temporary workspaces are 30 m^2.

All temporary workspace for each WTG location will avoid native grassland. When construction is complete, as much of the temporary workspace areas as possible will be returned to the pre-construction land cover. A small area around the base of each WTG will be required for maintenance activities.

2.5.3 Electrical Collection System

The electrical collection system will consist of transformers, buried or above-ground collector lines installed between WTGs and a substation.

The voltage of electricity produced by the WTG will be stepped-up to 34.5 kV by a transformer, located inside the nacelle or outside the tower at the base of each WTG. The power will then be conveyed through above or underground collector lines to a substation.

There will be approximately 56 km of collector lines installed for the Project of which 21 km will be installed overhead and 35 km will be underground. Where possible, the underground and/or overhead collector lines have been incorporated into the design of the access roads to reduce the area required for construction and minimize the potential construction impacts. Where possible, collector lines will parallel existing linear infrastructure, such as roads, to reduce the disturbance footprint.

Some sections of the collector system may have to be installed above ground if required to avoid sensitive natural features or other obstacles.

The substation will consist of a prepared area of approximately 200 m^2. The substation will house the switching, control, protection, communication and metering systems required to support the operation of the substation. At the substation, the accumulated power from the collector lines will be converted from 34.5 kV to 138 kV and transported by overhead 138 kV transmission lines constructed, owned and operated by SaskPower (see Section 2.8). Approvals for system tie-in transmission lines and other transmission infrastructure will be completed by SaskPower under a separate approval process and are not considered as part of this TPP.

2.5.4 Permanent Access Roads

Gravel access roads will be constructed to each WTG location and to the substation for use during construction and reduced in size for operations. Approximately 36 km of gravel access roads will be constructed. Access roads have been sited to avoid impacts to natural land cover as much as possible.

2.5.5 Permanent Maintenance/Storage Facilities/Office

An operation and maintenance building will be required to facilitate the day-to-day operations of the Project. The operation and maintenance building will include the building itself, space for parking and on-site storage.

The Project will be operated, monitored and controlled 24-hours a day. To facilitate this monitoring, fibre optic data cable and/or wireless technology would be used. If data cabling is used it will generally be installed in conjunction with the collector line system, from each wind turbine to the substation and then to the operation and maintenance building.

Temporary construction facilities will be erected at or delivered to the Project site for use as maintenance, storage, office and bathroom facilities. The office and storage facilities will be located adjacent within the construction footprint of other Project components. All temporary facilities will be removed at the completion of construction and the area they occupied will be reclaimed to pre-construction conditions.

Water required during the construction phase will be brought to site.

2.5.6 Temporary Construction Laydown Area

A laydown area will be sited on previously disturbed land (i.e., agricultural land) to temporarily accommodate storage of materials and equipment. The area will be graded and graveled.

A temporary concrete batch plant will be established in the construction laydown area to prepare concrete for the turbine foundations.

2.5.7 Meteorological Tower(s)

Four temporary (one 80 m high and three 60 m high) meteorological (MET) towers are currently operated and maintained in the Project area. The MET towers are continuously monitoring several parameters including wind speed and direction, and air temperature and humidity. The MET towers will be decommissioned and removed following Project construction and will be replaced by a permanent MET towers to support operation.

2.6 PROJECT ACTIVITIES

The following sections describe the anticipated activities involved in the construction, operation and maintenance, and decommissioning phases of the Project.

2.6.1 Construction

Construction of the Project accounts for the most intensive period of activities and is sub-divided below into several stages of this Project phase.

2.6.1.1 Site Preparation

During construction, clearing (i.e., removing vegetation) and grading of the Project footprint will occur in preparation for installation of the WTGs and construction of the access roads. The construction area at each WTG will include the foundation, a crane pad adjacent to each foundation, and an area for blade assembly and storage of WTG components.

2.6.1.2 Access Roads

During construction, access roads will be approximately 20 m wide to accommodate heavy equipment used to erect the WTGs. Once construction is completed, access roads will be reduced for use by maintenance vehicles only during the operation and maintenance phase of the Project.

To construct the access roads, surface material will be stripped, stockpiled and reused to the extent possible during reclamation of the construction footprint. The road construction for each turbine is expected to utilize excavators, dump trucks and compaction equipment. The access road to each turbine will typically take one to three days of construction time.

2.6.1.3 Foundations

Foundation for the turbines are expected to be approximately 3 m deep and 20 m in diameter however the final dimensions, depth and type of foundation design will depend upon a qualified geotechnical engineer’s evaluation of local soil and surficial geological characteristics, wind forces on the selected WTG model, and site-specific location details.

Excavators, dump trucks and dozers are expected to perform the excavation for the foundation. Concrete will be delivered from the temporary batch plant to each WTG location and poured into the excavations to form the foundation. After the concrete is set, it will be left to cure for approximately 2-4 weeks prior to bearing any weight.

Surface material will be stripped, stockpiled and reused to the extent possible during reclamation of the construction footprint. Excess surface material may be feathered into the adjacent agricultural fields in consultation with the landowners. Construction of the foundations will utilize temporary erosion-control measures to reduce siltation in any erosion-prone areas; these measures will be outlined in the EMP.

2.6.1.4 Turbine Assembly

Each WTG will be anchored to the concrete foundation using large diameter anchor bolts. Turbine assembly will occur at each WTG location and within its associated construction footprint. The various components of a single WTG will be erected and assembled using a crane and ground crew. If needed, matting and leveling around the WTG location may be required to stabilize the crane. The assembly and erection of each WTG is expected to take a few days depending on weather conditions.

2.6.1.5 Electrical Collector Line System

The underground and/or overhead collector lines will be installed using appropriate techniques to help reduce effects on the land. Directional drilling or overhead installation of electrical collector and fibre-optic communication cables will be used at water and road crossings if required by regulatory requirements or agencies.

2.6.1.6 Operation and Maintenance Building

To construct the operation and maintenance building, surface material will be stripped, stockpiled and reused to the extent possible during remediation of the construction footprint. The construction the operation and maintenance building is expected to utilize excavators, dump trucks and compaction equipment.

2.6.1.7 Materials and Equipment Use

The materials and equipment needed for Project construction will be dependent on the construction contractor's strategy for completion and construction schedule. Materials that could be expected to be required during construction include, but are not limited to:

- WTG components
- Concrete for WTG foundations
- Gravel for access road construction

- Fuel, lubricants, and other fluids for the operations and maintenance of equipment
- Water for dust control (if required) and concrete mixing
- Electrical lines, fibre optic lines and conduit

The construction of the Project will require several pieces of equipment and machinery, including but not limited to:

- Hand tools
- Generators and light plants
- Vehicles and trailers
- Cranes
- Heavy equipment including excavators, bulldozers, dump trucks, compaction equipment, and graders
- Construction trailers
- Cement trucks

2.6.1.8 Fuel Storage

Fuel may be stored on-site during the construction phase. A mobile service truck will be used to refuel most of the larger construction equipment (i.e., cranes, backhoes, etc.).

The contractor will be required to site all fuel-storage a minimum distance of 100 m away from any waterbody. At all times, the contractor will be required to have materials available at the construction sites to contain and recover fuel spills in accordance with provincial regulations (i.e., *The Environmental Management and Protection Regulations* (Government of Saskatchewan 2010a).

2.6.1.9 Transportation of Components

During construction, turbine components will be transported to each WTG site. The majority of traffic will be associated with concrete pouring for foundations and will occur over a short period of time (i.e., a few days for each WTG foundation). Caution signage will be posted, as required, in the vicinity of construction activities to advise local traffic of the construction activity.

2.6.1.10 Waste Management

During construction, waste material will be generated at, and transported from, the Project area. A waste management plan will be developed and implemented for construction of the Project. The plan will ensure that all applicable waste management legislation is adhered to. The plan may address:

- Implementation of third-party waste disposal contracts with licensed service providers;
- Proper sewage and wastewater disposal;
- Implementation of a recycling program; and
- Hazardous material collection and storage facilities in accordance with the *Environment Management and Protection Act, 2010* (Government of Saskatchewan 2010a).

2.6.2 Operation and Maintenance

Operation activities include daily monitoring of the WTGs, use of the operation and maintenance building, maintenance activities, and monitoring of meteorological data.

2.6.2.1 Turbine Operation

The proposed Project has been designed around the installation of 50 WTGs each of which has approximately 4.2 MW generating capacity.

It is expected the WTGs will continuously operate for the life (estimated for at least 30 years) the Project; however, periodic shutdowns may occur because of planned or unplanned maintenance activities and/or unfavourable weather conditions. During operation, the computerized control system of the WTGs will automatically adjust the nacelle and rotate to face the wind and alter the blade pitch so that the wind capture and power output is optimized. The system can control individual turbines to reduce power output, limit blade rotation or stop them as needed. WTGs will be operated in accordance with standard industry practices and will comply with manufacturer's recommendations to maintain equipment warranties and achieve the expected operational life. WTGs will be maintained in accordance with manufacturer's recommendations and services by trained wind-energy technicians.

2.6.2.2 Routine Maintenance

During the operation and maintenance phase of the Project, the WTGs will require routine maintenance; however, the frequency of the servicing will be dependent on the specifications of the WTGs to be used for the Project. Monitoring of the WTGs will occur 24 hours a day/7 days a week at the operation and maintenance building and remotely at an off-site control centre. The monitoring system will identify any potential problems so that pro-active inspections and maintenance can be undertaken.

Scheduled maintenance will include:

- Visual inspection
- Inspection of mechanical components, stormwater management, high voltage systems
- Inspection of electrical components
- Lubrication, oil changes and general maintenance

Oil changes will be completed in accordance with oil analysis recommendations. Following WTG maintenance all surplus lubricant and soiled rags will be removed and disposed of in an approved manner at a designated disposal facility. The clean up protocol will be included in the EMP. All transportation, handling and disposal of hazardous waste will be in accordance with appropriate regulations.

2.6.2.3 Unplanned Maintenance

In the event of component failure, the WTG will be out of service until the faulty component is repaired. WTG manufacturers have standard operating procedures (SOPs) and maintenance protocols specific to the make and model of each WTG. These SOPs generally relate to safety, training, and contingencies for incidents like fire and equipment malfunctions.

Other unscheduled maintenance activities will include repairs to electrical infrastructure, substation, and the operations and maintenance building.

2.6.3 Decommissioning

It is expected that decommissioning of the Project would not occur for at least 30 years, which is the approximate lifespan of the WTGs. In the unlikely event that the WTGs are not refurbished or replaced, all Project components will be decommissioned. Decommissioning would entail removal of facility components and reclaiming the land to an appropriate condition based on consultation with the landowners and regulatory requirements at that time. The costs for removal of Project infrastructure will be the responsibility of the owner of the Project.

2.6.3.1 Reclamation

At the time of decommissioning a reclamation plan will be prepared in consultation with regulatory agencies, to comply with applicable laws, regulations and the Project's conditions of approval. The following list has been developed to provide context as to what activities are expected to occur during reclamation of the Project:

- Gravel pads and access roads could be removed
- Concrete foundations will be removed to a depth of 1m
- Underground collection cables will be cut and left in place (approximately 1 m below grade)
- Materials may be salvaged for use elsewhere when economically and technically feasible. If materials are unable to be salvaged, they may be disposed of at an appropriate waste management facility
- Disturbed areas may be deep ripped to alleviate compaction issues
- Sites may be contoured to match surrounding topography and restore pre-development surface drainage patterns

- Sites may be cultivated and seeded in consultation with the landowner

2.7 WORKFORCE

2.7.1 Construction

It is anticipated that approximately 150 construction personnel will work on the Project during peak construction times(s). Each component of Project construction will require workers with different types and levels of skills and training (e.g., road construction, foundation construction, erection of the WTGs). Positions required for the construction of the Project will include, but are not limited to, electricians, iron workers, and heavy equipment operators. Where possible, qualified local contractors will be employed, with the sourcing of other qualified personnel from other locations when necessary. Project construction contractors will be selected through a procurement process.

2.7.2 Operation and Maintenance

During Project operation, it is anticipated that six permanent wind technician positions will be needed to maintain the site. Positions required for the on-site operation and maintenance of the facility will include WTG technicians and a facility supervisor.

2.8 ANCILLARY PROJECTS

2.8.1 SaskPower Connection

To transmit the electricity generated by the Project into SaskPower's primary transmission network, an interconnection line will be required to run from the Project's substation to the existing transmission line located approximately 7 km to the east. The interconnection line, which will now be referred to in this TPP as the SaskPower Outlaw Trail Interconnection Project, would be constructed, permitted, owned and operated by SaskPower. The details of this line have not been determined at the time of the TPP submission as the Project has not yet been selected by SaskPower for an IPP contract. Once the Project is selected, the development of this ancillary project will proceed through SaskPower in accordance with the SK MOE regulatory review process and all other requirements.

3.0 ENGAGEMENT

The engagement process is an important component of both the Project development, construction, and operational phases. The overall objective of the engagement activities is to provide an opportunity for local public, stakeholders and other interested groups to review the proposed Project through the course of its development phase, and to provide a means to engage directly with BluEarth in the process. Engagement with stakeholders and interested parties allows for an iterative process to develop a Project that meets the objectives of the developer, may provide additional benefits to stakeholders, and allows for feasible modifications of a project in response to concerns raised during the process. The information obtained during the engagement activities to date have been described in this section and included in this TPP.

3.1 OBJECTIVES AND APPROACH

The objectives of the public engagement activities were the following:

- To present information about wind energy projects, their construction, operation, and potential effects to the human and natural environments
- To present the specific Project design and location, field studies, schedule and regulatory process requirements
- To obtain local knowledge about the Project area, ideas, concerns and information to assist in Project planning process
- To inform participants about how their input and concerns will be considered in the Project planning process
- To discuss any modifications made to the Project design or development process

Public engagement activities included three activities: public open houses, direct stakeholder engagement, and information distribution.

3.2 IDENTIFICATIONS OF INTERESTED STAKEHOLDERS

3.2.1 Stakeholders

For this TPP, individuals and organizations were identified that may have an interest in the Project. A list of potentially interested individuals and organizations was generated which included:

- Local residents and landowners within the Project area
- Landowners within 2 km of the Project area

BluEarth understands that through the community engagement process, additional interested individuals and organizations will be identified and therefore the list of interested stakeholders will be updated on an on-going basis and included in future consultation efforts.

Through the engagement process an organization called Big Muddy Tours was identified as being interested in the Project and was added to the contact list.

3.2.2 Government and Regulatory Agencies

As the Project is located in the RMs of Hart Butte and Happy Valley, BluEarth consulted with both RMs throughout the development of the Project. Presentations were made to the RMs Council's (Hart Butte in March and December 2016, and December 2017; Happy Valley in March 2016 and December 2017) to update them on the Project development, and to obtain feedback on items of interest to the municipalities. BluEarth also regularly communicates with the administrator for both RMs. The RMs will continue to be engaged through the life of the Project.

BluEarth has communicated Project information to the SK MOE through phone calls, meetings and presentations.

3.2.3 Indigenous Communities

A contact list of potentially affected Indigenous communities was compiled based on geographical proximity and potential interest.

The Indigenous communities identified are:

- Wood Mountain First Nation
- Willow Bunch Métis Local 139

BluEarth understands that through the engagement process, additional Indigenous communities may be identified and therefore the list of communities will be updated on an on-going basis and included in future engagement efforts. Engagement will continue with the Indigenous communities as needed or requested and updated will be provided as the Project progresses.

3.3 ENGAGEMENT METHODS

BluEarth used a range of engagement tools through the TPP to make information accessible and provide opportunities for participation and feedback by interested parties. The tools use are described in more detail in the sections below.

3.3.1 In-Person Meetings and Phone Calls

BluEarth met with and/or made direct calls to landowners, municipal leadership and government ministries and organizations throughout Project development. The objective of these meetings was to supplement information provided by other means, and allow BluEarth to focus attention on specific comments and questions of a particular stakeholder or group.

3.3.2 Open Houses

Two open houses were held in Big Beaver, SK to provide Project information to potentially interested members of the public, Indigenous communities, government and regulatory agencies and non-government organizations. Representatives from BluEarth and Stantec were on hand to answer questions, address concerns and discuss various aspects of the Project.

The open houses were advertised in the local newspapers, the South Central Star and Coronach Triangle, two weeks period to each open house. Invitations were also mailed directly to landowners in and within 2 km of the Project area.

The open houses provided opportunities for the public to learn about the Project including project planning and development activities, ask questions or express concerns about the Project and meet the BluEarth project team. Feedback mechanisms such as comment forms were used to receive feedback and provide opportunity for follow up. Attendance sign-in sheets were used to track the level of attendance at each open house.

An overview of the content shared through the open houses is summarized in Section 3.3.2.1 and 3.3.2.2. Section 3.3.2.3 summarizes the feedback recorded at the open houses.

3.3.2.1 Public Open House No. 1

A public open house was held on June 7th, 2016 at the Big Beaver community hall from 5:30 to 8:30 pm. At the event, the following information was presented;

- poster boards describing the Saskatchewan government commitment to renewable energy generation and the upcoming Request for Proposals for wind energy projects (see Appendix B)
- poster boards describing the Project, including a figure showing the general Project area (see Appendix B)
- poster boards describing the community benefits, pre-construction environmental studies and post-construction monitoring (see Appendix B)

There were a total of 21 public participants that attended the event.

3.3.2.2 Public Open House No. 2

A public open house was held on June 8th, 2017 at the Big Beaver community hall from 5:30 to 8:30 pm. At the event, the following information was presented;

- a video presentation was shown as a continuously playing loop depicting the construction process of BluEarth's Bull Creek wind energy project completed in Alberta.
- poster boards depicting the locations of a 100 MW and 200 MW project layout were presented for discussion (see Appendix B)
- poster boards describing the Project phases, schedule, regulatory process, surveys and other relevant Project information were presented (see Appendix B)
- six visual simulations for a 100 MW and 200 MW project layout of before and after turbine siting from selected vantage points were provided (see Appendix B)

There were a total of 9 public participants that attended the event, including one representative of a construction company seeking information about the contracting process.

3.3.2.3 Summary of Public Open House Comments

Table 3-1 summarizes comments made at the public open houses as well as BluEarth's response to the comments.

Table 3-1 Summary of Public Open House Comments

Concern/ Comment	Summary of Discussion	Commitments/Explanations to Address Concerns	Outstanding Concerns and Actions
Health Effects	Concern related to the potential health effects to cattle.	Provided feedback regarding experiences with cattle at other projects and the absence of concerns from cattle ranches with wind turbines on their properties.	Committed to follow-up with additional health information and material
Land Agreements	Interest in landowner compensation and possibility of including his property in project.	Explained the current proposed project layout does not require additional land. Explained at a high-level how agreements are structured but that we could not disclosed specific terms and compensations as they are confidential.	No further concerns or follow up actions
Visual Impact	Concerns related to visual impact. Landowner explained that the valley is beautiful, and they wish the turbines weren't going to disturb the natural beauty. However, the landowner believes progress is good and understands why the project is moving forward.	Discussed that visual simulations were done to show the change in the landscape caused by the project.	No further concerns or follow up actions
Impacts to Groundwater and Soil Compaction	Concern over vibrations from the turbines causing soil compaction and impacting groundwater movement and availability in the area.	Provided documentation and research that discussed these concerns related to another wind project in Alberta. Studies demonstrate that wind projects are extremely unlikely to cause compaction resulting in issues with aquifers and groundwater.	No further concerns or follow up actions
Substation Location	Concern related to the proximity of one of the proposed substation locations and its proximity to a residence. Landowner would prefer that an alternate substation location is chosen.	Feedback was considered and that potential location was removed from consideration. This decision was communicated to the landowner.	No further concerns or follow up actions
Wind Technician Jobs	Discussion on how many permanent job opportunities would be available and what would the salary ranges be for the roles.	Provided the salary ranges for a wind technician and the number of positions that would be anticipated for the project.	No further concerns or follow up actions

Concern/ Comment	Summary of Discussion	Commitments/Explanations to Address Concerns	Outstanding Concerns and Actions
Investment Opportunity	Inquiry on how one could invest in the project.	Provided feedback that the company is not publicly traded and that investment opportunities are not available.	No further concerns or follow up actions
Impact to local tourism industry	Discussion on how the project may impact the tourism in the area.	Arranged a follow-up meeting with tourism operator to discuss the project, review the proposed layout, review the tour route and discuss incorporating the wind project into their tour if it proceeds. Agreed to provide project information to the tour operator that they can use to incorporate the wind project into their tour if the proceeds.	No further concerns or follow up actions
Community Benefits	Discussion of what local benefits the project would bring to the area.	Arranged presentations with both RM Councils to discuss the project benefits and explain the number of permanent jobs, construction jobs and local spending and long-term property tax expected for the municipalities. Communicated the benefits at the most recent public open house.	No further concerns or follow up actions

3.3.2.4 Future Open Houses

Open houses will be planned to update potentially interested members of the public, Indigenous communities, government and regulatory agencies and non-government organizations on the Project. Open houses may include a meeting prior to beginning of construction.

An open house will be planned for local companies, contractors and individuals working on the Project during construction.

3.3.3 Regulatory Engagement

BluEarth, with support from Stantec, engaged SK MOE to introduce the Project, obtain input from staff regarding the required biophysical assessment surveys and any potential regulatory concerns or constraints related to the site.

Regulatory engagement activities included three meetings with the SK MOE Environmental Approvals Branch at their office in Regina, SK.

3.3.3.1 Meeting with SK MOE on June 27th, 2016

On June 27th, 2016, a meeting was held between BluEarth, Stantec, and staff from SK MOE. Attendees included:

- Tom Bird, BluEarth
- Gareth McDonald, BluEarth
- Brianne England, SK MOE
- Ryan Fisher, SK MOE
- Rick Espie, SK MOE
- Kerrie Skillen, Stantec
- Jean-Michel DeVink, Stantec

The objective of the meeting was to introduce the Project, its location, and the suite of biophysical surveys completed or planned for the assessment of environmental constraints in the Project area.

Following an introduction to BluEarth, and the Project, Stantec presented the list of surveys. A discussion ensued about the survey design and target locations identified for surveys. As well, it was stated that target locations for surveys followed the SK MOE protocols and focused on areas of suitable habitat. The SK MOE agreed with the surveys listed for completion of the Project assessment. Section 5.4.1.3 includes the surveys agreed to by the SK MOE.

The SK MOE requested that vegetation surveys also be completed to characterize the vegetation community of the Project area. A vegetation community survey (see Section 5.3) was included as part of the field studies plan. There was also discussion of a snake hibernacula survey, as there are historical detections of snakes in the area (e.g., eastern yellow-bellied racer, smooth greensnake, and bullsnake). Stantec was aware of these occurrences and planned to conduct snake hibernacula surveys as pre-construction surveys when a confirmed Project infrastructure layout could focus the areas to survey.

3.3.3.2 Meeting with SK MOE on March 30, 2017

On March 30th, 2017, a meeting took place between BluEarth, Stantec, and SK MOE to discuss results of surveys completed in 2016, and to re-engage SK MOE on the anticipated plan to develop the Project. Attendees included:

- Tom Bird, BluEarth
- Jean-Michel DeVink, Stantec
- Kerrie Skillen, Stantec (participated by phone)
- Brianne England, SK MOE
- Brady Pollock, SK MOE

The objective of the meeting was to discuss the implications of the SK MOE Wildlife Siting Guidelines for Wind Energy Projects (September 2016), the surveys completed to date, and plans for 2017 to supplement previous surveys on additional lands included in the Project area. Following a review of the information provided about surveys completed in 2016 and those planned for 2017 and post TPP submission as pre-construction surveys, SK MOE requested that amphibian surveys be completed to provide a complete assessment of potential constraints prior to submitting the TPP. These surveys were included in the spring 2017 survey program and results have been included in Section 5.4.

There was also concern about the extent of native grassland in the Project area and encouraged BluEarth to consider this land cover carefully when siting turbines and other infrastructure. As a result, no turbines or turbine temporary workspaces have been sited on native grassland.

SK MOE also inquired about the potential heritage sensitivity of the area, and Stantec indicated that an initial screening was completed for the preliminary Project target lands. Once the layout was received, an HCB referral would be completed to determine the need to complete an HRIA.

3.3.3.3 Meeting with SK MOE; January 18th, 2018

On January 18th, 2018, a meeting was held between BluEarth, Stantec, and staff from SK MOE. Attendees included:

- Tom Bird, BluEarth
- Jean-Michel DeVink, Stantec
- Kerrie Skillen, Stantec

The objective of the meeting was to discuss the surveys completed to date, including survey points and results, regional context and plans for a 2018 regulatory submission. During the meeting the SK MOE expressed satisfaction with the suite of surveys completed for the Project. BluEarth also provided an update on engagement activities including stakeholder feedback to date. During the meeting the SK MOE confirmed that the AMP Guidelines would be finalized soon.

3.3.4 Indigenous Engagement

Project information packages were mailed to Wood Mountain First Nation and Willow Bunch Métis Local. Information provided included a description of the Project, Project layout and studies completed.

A follow-up phone discussion regarding the Project was held with Willow Bunch Métis Local in December 2017. The discussion involved questions about the Project location, including siting of the operations and maintenance building, and benefits to the local economy.

3.3.5 Information Materials and Sources

Project information handouts were made available at the open houses and online through the Project website.

Project information packages were mailed to all landowners within 2 km of the Project area in May 2017. Information provided included an overview of the Project and a development schedule.

3.3.6 Project Website and E-mail Address

A Project website was developed at www.bluearthrenewables.com/portfolio/outlawtrail/. The Project website provides a widely accessible venue for interested parties to obtain Project information, including a Project summary, preliminary layout figures, information about the open houses, Project contact information, and links to additional information. Open house information includes dates, poster boards, a frequently asked questions document, and visual simulations.

BluEarth has an email address (projects@bluearth.ca) and phone number (1-844-214-2578) to receive comments, collect feedback and answer questions related to the Project.

3.3.7 Tracking and Documentation

Throughout the engagement process, contact information of interested parties was maintained in a database that was updated as required. Issues, concerns, comments and questions have been, and will continue to be, logged in an engagement database for further consideration and/or action, where appropriate.

4.0 ASSESSMENT METHODS

The TPP focuses on environmental components, which are physical, biological or human elements of particular value or interest to regulators and other parties and are identified based on the elements listed in the *Technical Proposal Guidelines* (Government of Saskatchewan 2014). For the purposes of this assessment, the term *environment* refers broadly to any physical, biological or human element.

Project-related residual and cumulative environmental effects are both assessed in this TPP. Potential Project-related effects and the pathways through which they act are discussed first, taking into consideration Project components, associated activities and mitigation measures. Any residual Project-related environmental effects are evaluated quantitatively, where possible, or qualitatively with consideration of the direction, magnitude, geographic extent, duration, frequency and likelihood of occurrence. All potential residual environmental effects from this Project are subsequently evaluated with the residual environmental effects from other projects to assess the potential for cumulative effects.

4.1 ENVIRONMENTAL SCOPING

To focus the TPP on likely interactions of the Project with the surrounding biological, physical, and human environments, a variety of sources are used to identify those components within the Project area. These include:

- Federal and provincial regulatory requirements
- Input from the Project's Consultation and Engagement Plan (see Section 3.0)
- Existing regional information and documentation regarding environmental (biophysical and socio-economic) components (e.g., SAR)
- Documentation relating to other existing and proposed projects and activities in the Regional Assessment Area of the Project (see Section 4.6)
- Results of Project-specific desktop reviews and field studies
- Professional judgment of the environmental assessment practitioners, based on experience with similar projects elsewhere
- BluEarth's experience constructing and operating similar projects

4.1.1 Spatial Boundaries

As discussed in Section 2.3, BluEarth began advancing development activities in the Project area in 2015 when it was announced that SaskPower would be contracting Independent Power Produces (IPPs) to supply new sources of renewable energy. Through 2015, 2016 and 2017

BluEarth, with support from Stantec, studied the Project area and refined the target lands and Project layout. Refer to Table 4-1 for a complete list of quarter sections that were investigated as part of Project siting and therefore field surveys this area (herein referred to as the "Project Area"). The Project Area is shown as the target lands presented in Figure 2-1.

Table 4-1 Quarter Sections in the Project Area

Quarter Sections	
NW-4-3-24-W2	NE-27-2-25-W2
NE-31-2-24-W2	NW-1-3-24-W2
SW-5-3-24-W2	SE-36-2-25-W2
SW-12-3-25-W2	SE-11-3-24-W2
NW-26-2-25-W2	NW-12-3-24-W2
NW-9-3-24-W2	NE-15-3-25-W2
SW-3-3-24-W2	NE-12-3-24-W2
SE-8-3-24-W2	SE-15-3-25-W2
SE-4-3-24-W2	NW-15-3-25-W2
SW-35-2-25-W2	NE-5-3-24-W2
NW-9-3-25-W2	SW-7-3-23-W2
SE-11-3-25-W2	NE-4-3-24-W2
SW-12-3-24-W2	SE-21-3-25-W2
NE-1-3-25-W2	SW-1-3-24-W2
SW-2-3-24-W2	SE-5-3-24-W2
NE-10-3-25-W2	SW-1-3-25-W2
NE-9-3-25-W2	NW-30-2-24-W2
SE-35-2-25-W2	NE-2-3-24-W2
SE-2-3-24-W2	NW-1-3-25-W2
NW-12-3-25-W2	SW-15-3-25-W2
SW-4-3-24-W2	SW-36-2-25-W2
NE-11-3-25-W2	NW-7-3-23-W2
NE-8-3-24-W2	SE-1-3-25-W2
NW-22-3-25-W2	NW-3-3-24-W2
NW-31-2-24-W2	SW-31-2-24-W2
SE-27-2-25-W2	NW-35-2-25-W2
NW-10-3-25-W2	SW-9-3-24-W2
NW-11-3-25-W2	NE-36-2-25-W2
NE-21-3-25-W2	SW-11-3-24-W2
SW-22-3-25-W2	SE-3-3-24-W2
NE-22-2-25-W2	

For this TPP, three defined areas are used for the assessment of the Project's residual and cumulative effects. The three spatial boundaries are as follows:

- **Project development area (PDA)**: Encompasses the Project footprint and is the anticipated maximum area of physical disturbance associated with the construction and operation of the Project. The PDA includes 373 ha of land as displayed in the Project layout (Table 4-2) and includes the temporary (during construction) and permanent physical disturbance footprint area.
- **Local assessment area (LAA)**: Encompasses the area in which a) Project-related environmental effects (direct or indirect) can be predicted or measured with a level of confidence that allows for assessment; and b) there is a reasonable expectation that those potential effects in the LAA will be a concern. The LAA encompasses the PDA and is environmental component-specific (Table4-2).
- **Regional assessment area (RAA)**: The area within which potential cumulative effects—the residual effects from the Project in combination with those of past, present and reasonably foreseeable projects—are assessed. The extent of the RAA spatial boundaries are environmental component-specific (Table 4-2).

Table 4-2 Extent of LAA and RAA Environmental Components

Environmental Component	LAA Extent (m from PDA)	RAA Extent (km from PDA)
Terrain and Soils	PDA only	PDA only
Vegetation and Wetlands	300 m	10 km
Wildlife and Wildlife Habitat	1,000 m	10 km
Heritage Resources	PDA only	PDA only
Human Environment (except for Noise and Groundwater Wells)	RM of Happy Valley and RM of Hart Butte (RMs where the Project occurs)	RM of Happy Valley, RM of Hart Butte, and nearest service centers to the Project; specifically, the Towns of Willow Bunch, Bengough, and Assiniboia.
Noise	1.5 km	None
Groundwater wells	800 m	None

4.1.2 Temporary Boundaries

Temporal boundaries identify when an environmental effect will be evaluated in relation to specific Project phases and activities (i.e., "slices in time" during the life of the Project). Temporal boundaries for assessment of the Project's residual and cumulative effects include the following phases:

- **Construction:** Project construction is scheduled to last approximately 18 months, with clearing beginning 2019 (Table 1-3).

- **Operation and Maintenance:** The Project has an anticipated in-service date of 2020 (Table 1-3) and will operate for an anticipated 30 years before potential refurbishment or decommissioning.
- **Decommissioning**: The decommissioning phase is expected to last approximately six months.

Specific activities during the construction or operational phases may be identified if potential effects can be isolated to certain activities.

4.1.3 Selection of Environmental Components

Environmental components that may be affected by the Project in this landscape were evaluated for potential effects pathways and for inclusion in the TPP. The environmental component selection process used knowledge of the construction and operation of wind energy projects and available desktop resources to evaluate existing conditions and select environmental components to include in this TPP. The list of potential environmental components and a rationale for their inclusion or exclusion from the TPP is presented in Table 4-3.

Table 4-3 Screening Rationale for Environmental Components

Environmental Component	Potential Project Interaction	Included for Assessment in the TPP	Rationale for Inclusion or Exclusion in the TPP
Air Quality	Y	N	It is not anticipated that air quality will be affected because Project-environment interactions are primarily limited to construction activities and are short-term in duration and can be addressed through standard, well-established mitigation measures and best-management practices. Therefore, this environmental component was not included for evaluation in the TPP.
Surface Water	N	N	It is not anticipated that the Project will directly affect surface hydrology as there are no permanent or seasonal waterbodies in the PDA. Existing drainage patterns in the landscape will be maintained with the use of appropriate mitigation measures during construction (e.g., culverts), and standard well-established mitigation measures such as erosion control measures will be implemented; therefore, the Project is not expected to cause a change in drainage patterns and drainage areas in the Project and surrounding areas. Surface water as it relates to wetlands is considered in the Vegetation and Wetlands component. Therefore, this environmental component was not included for evaluation in the TPP.
Groundwater	N	N	Groundwater quality and quantity are not expected to be adversely affected by excavation and dewatering (if necessary) with the use of standard mitigation techniques and best management practices. Groundwater flows and recharge are not expected to be altered because disturbance related to foundation construction will be highly localized and shallow, and a very small proportion of the PDA will be developed as impervious surfaces. However, groundwater as it relates to water wells and use is discussed in the Human Environment component. Groundwater as it relates to wetlands is included in the Vegetation and Wetlands component. Therefore, this environmental component was not included for evaluation in the TPP.
Terrain and Soils	Y	Y	The Project has the potential to affect terrain and soil through a change in terrain stability, and changes in soil quality and quantity. Potential effect pathways include rutting, admixing, compaction, a reduction in slope stability, as well as wind and water erosion as a result of soil exposed during site preparation. Therefore, this environmental component was included for evaluation in the TPP. Mitigation measures are listed in Section 5.2.

Environmental Component	Potential Project Interaction	Included for Assessment in the TPP	Rationale for Inclusion or Exclusion in the TPP
Wildlife and Wildlife Habitat	Y	Y	Potential effects on wildlife and wildlife habitat from Project activities include a change in wildlife habitat, and wildlife mortality risk. Therefore, this environmental component was included for evaluation in the TPP. Mitigation measures are listed in Section 5.4.
Fish and Fish Habitat	N	N	Project activities will not affect fish or fish habitat as there are no fish bearing waterbodies within the PDA. Therefore, this environmental component was not included for evaluation in the TPP.
Vegetation and Wetlands	Y	Y	Potential effects from Project activities on vegetation and wetlands may include a change in native vegetation and wetland abundance and distribution and a change in plant species of management concern (SOMC) abundance and distribution. Therefore, this environmental component was included for evaluation in the TPP. Mitigation measures are listed in Section 5.3.
Heritage Resources	Y	Y	Heritage resources have potential to occur in the Project area. Project activities could result in changes to the environment that have potential to affect heritage resources therefore, this environmental component was included for evaluation in the TPP. Mitigation measures are listed in Section 5.5.
Human Environment	Y	Y	Potential effects from Project activities on the human environment may include a change in land use, groundwater, infrastructure, noise and visual aesthetics. Therefore, this environmental component was included for evaluation in the TPP. Mitigation measures are listed in Section 5.6.

4.2 BASELINE CONDITIONS

Once environmental components were identified and potential interactions considered, the existing conditions for each environmental component were characterized. This characterization, completed through a desktop review and field surveys, is important to determine potential effects resulting from Project activities. A full description of the desktop reviews and field surveys completed for the Project, including methods and results, is presented in Section 5.

4.3 POTENTIAL EFFECTS PATHWAYS

The assessment of potential effects for each environmental component begins with a description of the pathways whereby specific Project activities and actions could result in an environmental effect. For each environmental component, the Project's potential effects pathways are identified and assessed in the context of the environmental component's existing conditions and any input received from the engagement process to date.

4.4 MITIGATION

Where effects pathways are identified, mitigation measures are considered to reduce or avoid potential effects. The *Technical Proposal Guidelines* (Government of Saskatchewan, 2014) outline the expectation for environmental mitigation measures for the construction, operation and decommissioning of the Project to avoid or reduce the potential effects to each environmental component. These measures consider:

- Site-specific and standard industry practices
- Compliance with legislation, regulations and guidelines
- Planning activities
- Other measures applicable to the Project

These mitigation measures and their link to specific potential effects are identified in Section 5.

4.5 ASSESSMENT OF RESIDUAL EFFECTS

Following the identification of effects pathways, and mitigation measures that may reduce or avoid those potential effects, the residual effects of the Project activities are evaluated and discussed for each environmental component. These residual effects are assessed in the context of the environmental component's existing conditions, as well as its biophysical or socio-economic requirements and characteristics.

Available data are analyzed to quantify (where possible) and qualify the potential residual effects of Project interactions with each environmental component. The analytical methods applied to assess the effects are presented in each environmental component section. Residual environmental effects (i.e., the environmental effects that remain after mitigation has been applied) are described, taking into account how the proposed mitigation will alter or reduce the effect. Effects are reviewed on a Project-wide basis and, where relevant to the assessment, a discussion of possible site-specific effects is presented.

4.6 EVALUATION OF CUMULATIVE EFFECTS

In addition to assessing Project-related residual effects, the *Technical Proposal Guidelines* (Government of Saskatchewan 2014) requires that the assessment consider potential cumulative effects. This includes the Project's residual effects in combination with the potential residual effects of other past, present or reasonably foreseeable future developments or activities in the RAA.

Two conditions must be met to pursue an evaluation of cumulative environmental effects:

- The Project is expected to have residual effects on the environmental component.
- The Project's residual effects act cumulatively with effects of other projects or physical activities.

These two conditions are assessed for each environmental component following the assessment of Project effects. For potential effects where these conditions are not met, there is no expectation that the Project will contribute cumulatively to residual effects, and further assessment is not required. If both conditions are met, then the evaluation of cumulative effects is undertaken. This assessment also includes identification of potential mitigation measures that could reduce or avoid potential cumulative effects.

Section 5 presents existing conditions, effects pathways, mitigation measures, and residual effects for each of the environment components assessed. The potential for cumulative effects is discussed in Section 6. The approach taken for the assessment of cumulative effects follows the requirements outlined in the *Technical Proposal Guidelines* (Government of Saskatchewan 2014). As stated in the guidance document (Government of Saskatchewan 2014, page 14), the assessment of cumulative impacts associated with the proposed Project include consideration of the following:

- "The combined impacts from all stages of the project lifecycle;
- The effect of the proposed project when added to other past, present or reasonably foreseeable future projects or activities in the area;
- The combination of impacts from the existing project combined with the impacts of an expansion or alteration of the project;

- The total impact or risk of impact from operating the project over a long period of time, taking into account the likelihood of extensions or expansions to the project's operating life;
- The effect of ancillary facilities that may not be part of the proponent's project, but are essential to the project proceeding (e.g. pipelines, roads, transmission lines); and,
- Any additional activities or developments that may be enabled or encouraged as a result of the project proceeding."

4.6.1 Project and Activity Inclusion List

The Project and activity inclusion list identifies other past, present and reasonably foreseeable projects and physical activities within the human environment RAA (because it is the largest RAA) with residual effects that could overlap spatially and temporally with the Project. Reasonable foreseeable projects and activities are defined as those that: (a) have been publicly announced with a defined schedule and sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment, or (c) are in a permitting process.

A search was conducted using available information and online databases for existing and planned future projects and activities in the RAA including the following sources:

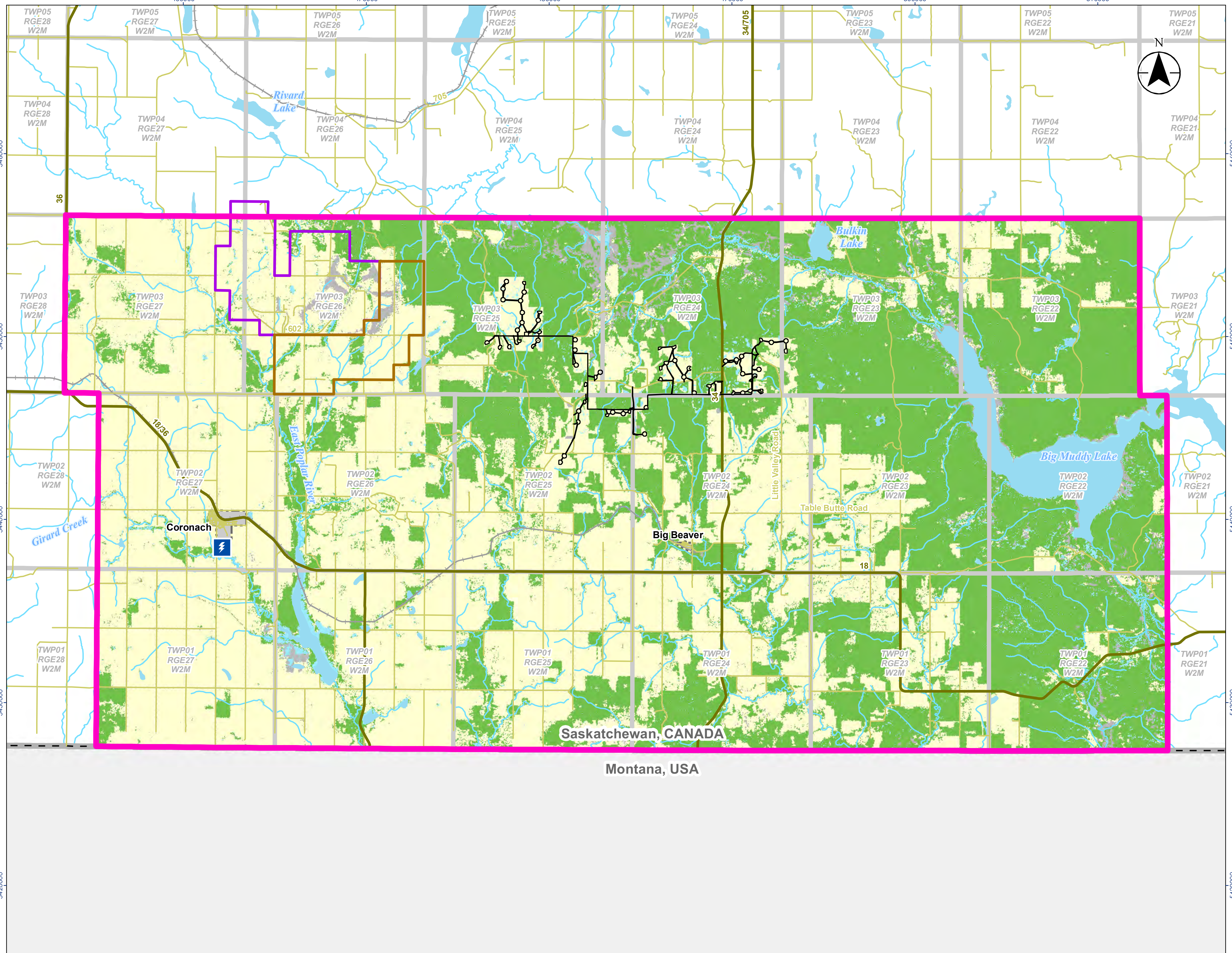
- Government of Saskatchewan 2018 Resource Map (Saskatchewan Ministry of Economy 2018)
- Saskatchewan Environmental Assessment Branch Project Review Map, maintained by Saskatchewan Ministry of Environment (SK MOE 2018a)
- National Energy Board Major Applications and Projects before the NEB (NEB 2016)
- SaskPower's Current Projects List (SaskPower 2018)

Projects and activities identified for inclusion in the cumulative effects assessment as of May 18, 2018 are presented in Table 4-3. Figure 4-1 shows the location of existing and future projects within the human environment RAA.

Table 4-4 Project and Activity Inclusion List

Project or Activity	Specific Project/Activity	Location	Description
Past and Present Activities and Resource Uses			
Agricultural Conversion	-	-	Historical and current agricultural conversion practices, including cultivation and seeding. Current land use in the RAA is characterized by a mixture of intensive cropland agricultural activities and range management practices. Intensive ongoing agricultural activities include ploughing, seeding, pesticide/herbicide spraying, and harvesting.
Residential Developments	-	-	Historical and current use of lands for residential development.
Oil and Gas Developments	-	-	Historical and current oil and gas developments.
Road and Rail Developments	-	-	Historical and current road (e.g., highways, gravel roads, access trails) and rail developments and maintenance activities.
Power Generation, Transmission, and Distribution	-	-	Historical and current power generation developments (e.g., electrical transmission lines, coal or natural gas plants, wind and solar energy facilities).
Power Generation, Transmission, and Distribution	Poplar River Power Station	Coronach, SK	A 582 MW coal-fired power station owned and operated by SaskPower. It is located approximately 15 km southwest from the Project.
Resource Extraction Activities	-	-	Historical and current resource extraction activities (e.g., gravel extraction, mining).
Resource Extraction Activities	Poplar River Coal Mine	Located approximately 7 km west of the Project	The Poplar River Coal Mine is an open pit coal mine owned and operated by Westmorland Coal. Expansion of the mine was approved in 2010 and is currently ongoing.
Future Activities			
Agricultural Conversion	-	-	Agricultural (e.g., ploughing, seeding, pesticide spraying, harvesting) and range management (e.g., grazing of livestock) activities occur in rural areas throughout the RAA and is expected to continue in the future.
Residential Developments	-	-	Residential developments will continue within villages, towns and cities located in the RAA.

Oil and Gas Developments	-	-	Oil and gas exploration will continue within the RAA depending on market conditions.
Road and Rail Developments	-	-	Road and rail developments and maintenance activities occur throughout the RAA and are expected to continue in the future.
Power Generation, Transmission, and Distribution	-	-	Power generation activities (e.g., electrical transmission, coal or natural gas plants, wind and solar energy facilities) occur throughout the RAA and are expected to continue in the future.
Power Generation, Transmission, and Distribution	SaskPower Outlaw Trail Interconnection Project	Proposed Outlaw Trail Wind Energy Project to SaskPower Switching Station	SaskPower transmission line to be built from Outlaw Trail substation to a SaskPower switching station. Location and design of transmission line and switching station are not known at the time of the TPP.
Resource Extraction Activities	Poplar River Coal Mine	Located approximately 7 km west of the Project	Open pit coal mining activity will continue into the future. The mine expansion will occur east and south of the original mine site. The ultimate build out of the mine lease area is anticipated to be complete by 2039 with a disturbance area of 1,711 ha.



Stantec
BluEarth Renewables Inc

Human Environment Regional Assessment Area
Project Development Area
Poplar River Power Station

Poplar River North Mine
Approved Mine
Extension

Land Cover
Cultivated
Developed
Native Vegetation
Water

Major Road
Minor Road
Railway
Watercourse
Waterbody
Township

0 5 10 Kilometres
1:215,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license with the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: Layout from BluEarth v3, Jan 22, 2018.
4. Land Cover: Mapped by Stantec, AAFC 2016.
5. Mine Boundary: PRNM EIS, Amec 2008. Power Station, Saskpower System Map, 2018

Project Location
Near Coronach, SK

113253956-040 REVC
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
4-1

Title
Human Environment RAA (Project Inclusion Boundary)

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5.0 EXISTING CONDITIONS, POTENTIAL EFFECTS AND MITIGATION

5.1 REGIONAL ENVIRONMENTAL SETTING

The Project is located within the Wood Mountain Plateau and Coteau Lakes Upland landscape areas of the Mixed Grassland ecoregion. This landscape area is characterized by extensive areas of native mixed-grass prairie in association with quartzite-covered plateaus and gullied lands containing a variety of grasses and shrubs and trees in depressional areas with more moisture (Acton et al. 1998). Soils in the plateau areas are commonly brown loam soils with Regosolic soils in the more strongly gullied areas. The soils are typically limited for crop production, and where suitable, tend to grow cereals and small amounts of forage (Acton et al. 1998).

The broader Mixed Grassland is a semi-arid grassland ecoregion that covers a large portion of southwestern Saskatchewan and portions of southeastern Alberta that forms part of the shortgrass prairie of the North American Great Plains. The native vegetation community of the region is characterized by spear grass, blue grama grass and a variety of shrubs and herbs, including sagebrush.

While the Project lies within the Prairie Pothole region (Bird Conservation Region 11) characterized by numerous wetlands that provide habitat for a diverse suite of waterbirds, and other wildlife, the location of the Project is within a well-drained landscape area that has an unusually low density of wetlands and waterbodies. A key conservation issue within BCR 11 includes conversion of native grassland for agricultural or other industrial purposes, which has led to the loss or decline of several upland bird species and their habitat along with habitat for rare plant species. Similarly, the draining of wetlands again for agricultural purposes is another key conservation issue for wetland-associated wildlife species and plants (EC 2013).

Landscape features beyond the RAA include the Big Muddy Valley located approximately 2.0 km to the north of the Project, the Big Muddy Lake IBA approximately 7.3 km to the east, and Willow Bunch Lake IBA approximately 11.1 km to the northwest. Both IBAs have associated wind energy avoidance buffers extending 5 km from the IBA boundaries. WHPA lands, which are included in avoidance zones (SK MOE 2017a), are found north and east of the PDA. Project infrastructure is not proposed for any WHPA lands. The Project is located outside of all avoidance zones identified by SK MOE (SK MOE 2017a).

5.2 TERRAIN AND SOILS

This section addresses terrain and soil in the context of the Project. This section outlines the methods and results of the desktop review in addition to identifying potential effect pathways, mitigation strategies, and residual effects. The terrain and soil environmental component was assessed using available online information only; no field surveys were required to quantify the soil types and assess potential effects of the Project.

5.2.1 Methods

Existing data was used to conduct a desktop analysis of baseline terrain and soil conditions within the PDA. Refer to Table 4-2 for a reminder that the LAA for Terrain and Soils is the PDA only.

Baseline terrain and soil conditions were obtained from the Saskatchewan Soil Information Database Version 4 (SKSID 4.0) (Saskatchewan Land Resource Unit 2009). The database provides a regional overview of terrain and soil resources for most of Saskatchewan.

The desktop soils analysis focused on a general classification and identification of soil characteristics in the PDA. These characteristics included soil agricultural capability limitations to agriculture ratings. SKSID 4.0 slope classes were further combined as finer detail was not required. Soil agricultural capability ratings were based on published values associated with SKSID 4.0 (Saskatchewan Land Resource Unit 2009). The SKSID 4.0 soil agricultural capability class ratings follow the Canada Land Inventory (CLI) rating system (Environment Canada 1972) of soil capability classification for agriculture. The CLI system rates climate, terrain and soil factors independently, as each factor can control the suitability of a tract of land for crop production.

5.2.2 Existing Conditions

5.2.2.1 Terrain

The majority of the topography in the PDA is within the 2.0-10.0% slope range (gentle to moderate slopes), making up 81.3% of these areas. Slopes of 10-15% occur in 9% of the PDA, gentle slopes (0.5-2.0%) make up 6.1% of the PDA, while steep slopes (15-30%) and nearly level to level slopes each consist of 1.8% of the PDA.

Table 5-1 Slope Classes within the PDA

Slope	Area in Hectares	Proportion of PDA (%)
Nearly level to level (0-0.5%)	6.9	1.8
Very gentle slopes (0.5-2.0%)	22.9	6.1
Gentle slopes (2.0-5.0%)	153.5	41.1
Moderate slopes (5.0-10.0%)	150.1	40.2
Strong slopes (10.0-15.0%)	33.7	9.0
Steep slopes (15.0-30.0%)	6.7	1.8

5.2.2.2 Soils

The soil agricultural capability ratings for soils in the PDA range from Class 3 to 6 with Class 4 having the highest percentage at 45.7% of the areas (Table 5-2). Class 4 soils have severe limitations due to a range of potential soil limitations such as undesirable structure, erosion, excessive stones, excess water, moisture holding capacity, topography, and salinity (CLI 1972). Topography (subclass T) is the most frequent primary limitation to agriculture within the PDA. Subclass T: Depicts a limitation in agricultural use of the soil as the result of unfavorable topography. It includes hazards to cultivation and cropping imposed by increasing degree of slope as well as by the irregularity of field pattern and lack of soil uniformity. (Saskatchewan Land Resource Unit 2009)

Lesser, but notable, portions of the PDA are limited by moisture limitation and wind and water erosion (Table 5-3).

Table 5-2 Soil Agricultural Capability Ratings within the PDA

Dominant Agricultural Capability Class[1]	Proportion of PDA (%)
1 (no significant limitations)	0.0
2 (moderate limitations)	0.0
3 (moderately severe limitations)	15.7
4 (severe limitations)	45.7
5 (very severe limitations)	33.7
6 (perennial forage crops)	5.0
7 (no capability for arable culture or permanent pasture)	0.0
[1] Source: Environment Canada (1972).	

Table 5-3 Primary Limitations to Agriculture within the PDA

Primary Limitation to Agriculture[1]	Area in Hectares*
C – Adverse climate	None
I – Inundation by streams or lakes	None
M – Moisture limitation	182.3
N – Salinity	None
P – Stoniness	None
S – Adverse soil characteristics	None
T - Topography	221.4
W – Excess water	18.0
E – Wind and Water Erosion	144.4
Grand Total	566.0
[1] Source: Saskatchewan Land Resource Unit (2009) * did not summarize based on a percentage of the PDA because of the double values in a portion of a polygon (i.e., this would result in double counting of areas)	

5.2.3 Effects Pathways and Mitigation Strategies

The Project has the potential to affect terrain and soil through changes in terrain integrity and soil quality and quantity. Terrain integrity includes surface expressions that are influenced by changes in slopes. Soil quality can be measured as agricultural capability because it is based on a number of soil features including soil classification, texture, topsoil depth, erosion, salinity, and stoniness. The effect pathway and mitigation strategies for potential effects are described below.

Potential effect pathways include rutting, admixing, compaction, a reduction in slope stability, as well as wind and water erosion as a result of soil exposed during site preparation.

5.2.3.1 Change in Terrain Integrity

5.2.3.1.1 Construction

Change in terrain integrity would only occur during the construction phase of the Project but may persist into the operation and maintenance phase. During construction, steep slopes (≥ 15% slope) may be disturbed by grading required for structure installation or access development within the PDA. Grading can change the terrain, creating new surface expressions on the landscape. This will affect a small portion of the PDA as only 1.8% is classified as having steep slopes.

Soil exposure from grading activities can lead to changes in terrain integrity through increased soil erosion, mass movement and changes in natural drainage patterns. The disturbance of the soil structure could possibly initiate or accelerate erosional processes.

5.2.3.1.2 Operation and Maintenance

No grading activities will occur during operation and maintenance. No additional changes to terrain integrity will occur.

5.2.3.1.3 Decommissioning

Change in terrain integrity during decommissioning will be similar to construction. Soil exposure from grading activities can lead to changes in terrain integrity through increased soil erosion, mass movement and changes in natural drainage patterns. The disturbance of the soil structure could possibly initiate or accelerate erosional processes.

5.2.3.2 Change in Soil Quality and Quantity

5.2.3.2.1 Construction

Change in soil quality and quantity will occur predominantly during the construction phase of the Project and can be measured as change in soil agricultural capability. Soil agricultural capability influences land use, as lower soil quality can restrict the productivity of land. Changes in soil quality and quantity can be caused by loss of topsoil, admixing, erosion, compaction and rutting. The construction activities that have the potential to affect soil quality include soil stripping, excavation, trenching, grading, and heavy equipment and vehicle traffic.

Topsoil loss can be caused by improper soil handling techniques during soil stripping and grading activities. Soil stripping will remove vegetation, organic materials and topsoil at locations where excavation and/or grading activities are required. Excavation would be necessary with the installation of Project-related infrastructure (e.g. turbine foundations). Grading will be required to level the Project footprint for proper drainage purposes and to facilitate construction activities. Topsoil may be lost during soil stripping activities if topsoil becomes incorporated into the subsoil layer.

Admixing could occur if the topsoil and subsoil are not stripped and/or stored separately. The admixing of subsoil with topsoil can decrease the quality of the topsoil through the loss of organic matter, changing soil chemistry (e.g., increasing soil salinity levels), and increasing stoniness.

Repetitive heavy equipment and vehicle traffic within the PDA can create the risk for admixing, erosion and topsoil loss through compaction and rutting. Compaction can result in admixing of the topsoil with subsoil and cause changes to infiltration capacity, water-holding capacity and bulk density of the soil. Reduced water-holding capacity can increase the surface runoff that could lead to water erosion. Rutting creates exposed soil that provides the opportunity for erosion and soil loss. Rutting increases when the soil is saturated, especially during high precipitation events and spring-melt conditions.

Exposed soil resulting from construction activities (e.g., topsoil and subsoil stockpiles, exposed ground within the PDA, etc.) can be at a higher risk for wind and water erosion.

5.2.3.2.2 Operation and Maintenance

Infrequent vehicle traffic along access roads during operation and maintenance is not expected to cause additional changes to soil quality and quantity.

5.2.3.2.3 Decommissioning

Change in soil quality and quantity during decommissioning will be similar to construction. Changes in soil quality and quantity can be caused by loss of topsoil, admixing, erosion, compaction and rutting. The decommissioning activities that have the potential to affect soil quality include soil stripping, excavation, trenching, grading, and heavy equipment and vehicle traffic.

5.2.3.3 Mitigation for Change in Terrain Integrity

Mitigation for potential Project related effects on terrain will focus on avoiding areas with poor slope stability by setting structures back from the edges of slopes, where practical. Prior to construction, access requirements will be reviewed and site-specific reclamation plans will be prepared for access to construction on steep slopes, if required. Access will be planned to avoid steep slopes, where possible, and to reduce potential for erosion and instability.

During construction and decommissioning, best management practices (e.g. soil handling practices, sediment and erosion control measures) and Project specific mitigation measures will reduce effects to terrain.

5.2.3.4 Mitigation for Change in Soil Quality and Quantity

Effects pathway mechanisms for changes to soil quality and quantity can be mitigated through soil handling procedures and best management practices.

Proper soil handling techniques such as stripping and storing topsoil and subsoil separately and maintaining adequate distance between topsoil and subsoil stockpiles are examples of effective mitigation measures for preventing topsoil loss. Topsoil loss and admixing will be reduced by using colour change as a guide for stripping topsoil and subsoil layers separately. Saline and stony soils are not expected to be found within the PDA. If saline or stony soils are encountered during construction and decommissioning activities, these soils will be stored separately to prevent adverse changes to soil quality and quantity.

Topsoil erosion will be reduced by using existing access roads and trails and constructing and decommissioning during frozen conditions where possible. Although areas of topsoil salvage during construction and decommissioning are expected to be limited, erosion control measures will be used as required to stabilize salvaged soil piles as a mitigation strategy for potential topsoil erosion by wind and water. Options to control erosion of soil piles include installing silt fencing around soil piles, leveling soil piles, and reducing the time between stripping and replacement.

Soil compaction and rutting will be mitigated by restricting heavy equipment and vehicle use to dry or frozen soil conditions where feasible. When soil conditions are suboptimal (i.e., saturated soils), mitigation measures will be implemented including installing matting and/or avoidance. Vehicle and equipment traffic will be limited to previously disturbed areas, where possible, to reduce new disturbance.

Topsoil stripping may be required where excavation and/or grading activities are required. In these cases, topsoil will be stripped, stored, and replaced following construction. Stripped areas will be subject to erosion protection measures as required and will promptly be revegetated. If rutting occurs, the area will be leveled and decompacted.

Construction in wetlands will be avoided if possible. If construction must occur within wetlands, construction will occur during frozen ground conditions where possible or with other mitigation measures in place such as matting. Any work in wetlands will be subject to obtaining an AHPP and mitigation conditions described in the permit.

Compaction on cultivated land will be mitigated after construction and decommissioning and might include tillage of compacted topsoil, subsoil tillage, and leveling to remove ruts.

5.2.4 Summary of Residual Effects

5.2.4.1 Change in Terrain Integrity

A change in terrain would occur on the steep slopes (≥ 15% slope) during construction. There will be an effort to avoid construction on steep slopes, which may be possible as steep slopes are only 1.8% of the PDA and LAA. Where a change in terrain does occur, the magnitude will be low as it will be a small percentage of the PDA and LAA.

Any other effects such as soil erosion will be mitigated through diligent application of mitigation measures.

5.2.4.2 Change in Soil Quality and Quantity

Maintaining soil capability for agricultural land use is a key issue for Project activities because land use associated with the Project is predominantly agricultural (i.e., cultivated) (see Section 5.3.2). Project activities have the potential to cause qualitative changes in the soil through processes such as loss of topsoil, admixing, erosion, compaction, and rutting. These qualitative changes could lead to a reduction of soil agricultural capability.

Soil quality and quantity within the PDA is expected to be maintained based on implementation of the proposed mitigation measures including constructing during frozen conditions where possible and implementing erosion control measures.

5.3 VEGETATION AND WETLANDS

This section addresses vegetation and wetlands resources in the context of the Project. These resources include native vegetation, wetlands, and plant SOMC. The Project is in an area comprised of a mixture of cultivated land, native grassland, hayland, tame pasture, and wetlands. This section outlines the methods and results of the desktop review and field surveys in addition to identifying the potential pathways, mitigation strategies, and residual effects.

5.3.1 Methods

5.3.1.1 Desktop Review

Provincial databases, aerial photography, and literature sources were reviewed for existing data on vegetation and wetlands. The databases and aerial photography were used to determine probable land cover, wetland boundaries, and wetland classes within the vegetation LAA (see Section 4.1.1). The desktop review included the identification of historical occurrences of plant SOMC within the vegetation LAA. Results of the desktop review were used to guide the selection of vegetation community and wetland survey locations.

5.3.1.1.1 Baseline Mapping and Classification of Land Cover Classes

Land cover classes were reviewed and updated in order to select survey locations, determine potential habitat for plant SOMC, and aid in Project siting. Land cover classes from the Agriculture and Agri-Food land cover (AAFC) dataset (AAFC 2015, 2016) were reviewed and refined through land cover mapping for the vegetation LAA. The land cover mapping was updated and corrected, where possible, based on aerial imagery using the following data sources, and observations during the vegetation community and wetland surveys.

- Ortho imagery (60 cm) (Saskatchewan Geospatial Imagery Collaborative [SGIC] Flysask 2008-2011 and 2012-2013 (composite image))
- Environmental Systems Research Institute (ESRI) World Imagery (October 2006 and September 2011 images) (ESRI 2017)
- Bing Maps ® (October 10, 2016 image)
- Google Earth ® (October 23, 2013 image) (Google Earth Pro 2017)

The AAFC (2015) land cover definitions were refined and used to establish land cover classification appropriate for the Project based on dominant land use and vegetation cover (see Table 5-4). Land cover mapping was completed at a 1:3,000 scale using a 0.04 ha minimum polygon size. Land cover polygons were corrected using field data obtained for the vegetation LAA.

To select vegetation community survey locations, the AAFC dataset was used to identify areas that could potentially be impacted by the Project layout.

Table 5-4 Land Cover Classification based on AAFC 2015

Land Cover Class	Description
Broadleaf	Land dominated by tree species (>10 m tall) including deciduous forest.
Cultivated	Land that is seeded and harvested each year for crops such as wheat, canola and lentils.
Drainage	Flowing water, may be seasonal drainages.
Dugout	Man-made wetland, functions as a Class V wetland for wildlife.
Exposed Land/Barren	Land that is undeveloped and barren of vegetation such as rock outcrops, gravel beds and sand spits.
Hayland	Land that has been seeded to annual or perennial species and cut for hay E.g., alfalfa (*Medicago sativa*), sweet clover (*Melilotus* spp.).
Native Grassland	Land where the sod layer has never been converted to agricultural production and is dominated by at least 51% native species cover. E.g., needlegrasses (*Hesperostipa* spp., *Nassella viridula*), wheat/wildrye grasses (*Pascopyrum smithii*, *Elymus* spp., *Leymus* spp.).
Pasture/Forages	Land that is periodically cultivated, includes tame grasses and other perennial crops such as alfalfa and clover grown alone or as mixtures for hay, pasture, or seed.
Shrubland	Land dominated by woody, multi-stemmed plants or trees larger than 2 m in height.

Land Cover Class	Description
Tame Pasture	Pasture land dominated by either intentionally seeded or invaded non-native perennial species, i.e. grasses and legumes, that may or may not have an understory of native species. Generally ploughed at one point in time. Used for grazing.
Urban/Developed	Land that includes buildings in urban and rural areas and farmsteads. Land that is predominantly developed including commercial and industrial plants, gravel pits, and mine structures. Human-constructed routes for vehicles including surfaced/paved highways and non-surfaced trails. Dugouts are included in this category.
Water	Watercourses of natural flowing water, directed flowing water, lakes and watering holes.
Wetlands[1]	Land with a water table near/at/above soil surface for sufficient time to promote wetland or aquatic processes.
Note: [1] Based on Stewart and Kantrud (1971) (Appendix E.1).	

Desktop mapping of wetland extent and class was completed to create a data layer for wetlands and determine field survey locations. Wetland classes and boundaries were reviewed and interpreted at a 1:3,000 scale (0.04 ha minimum polygon size). Wetlands were classified following the Stewart and Kantrud (1971) classification system (see Appendix E.1). Imagery from both wet and dry years was used to make a conservative estimate of the wetland boundary. This process may not identify every wetland because wetlands less than 0.04 ha in size were not identified during desktop mapping. Moreover, desktop mapping is limited by imagery. Thus, wetlands identified and delineated in the field were then incorporated into the wetlands data layer to further refine wetland numbers, location, class, and boundaries within the vegetation LAA. Wetlands were mapped in detail and classified within the vegetation LAA and not beyond the vegetation LAA, as that extent of detailed mapping was unnecessary to determine Project effects on vegetation and wetlands. The consideration of cumulative effects in the context of the RAA used the native AAFC landcover.

Drainages and dugouts were mapped because of their potential for providing wildlife habitat but are not included in the Stewart and Kantrud (1971) classification system (see Table 5-4).

5.3.1.1.2 Plant SOMC with Potential to Occur in the Vegetation and Wetlands LAA

A desktop review of publicly available information was used to identify plant SOMC that have the potential to occur in the vegetation LAA. Plant SOMC are defined as federally and provincially legislated species at risk, species identified in federal and provincial tracking lists, and activity restriction guidelines, including species:

- Listed under Schedule 1, Schedule 2, or Schedule 3 of the federal SARA as *endangered*, *threatened* or *special concern* (Government of Canada 2002)
- Listed in *The Wildlife Act* of Saskatchewan as *endangered*, *threatened* or *vulnerable* (Government of Saskatchewan 1998)

- Listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *endangered*, *threatened* or *special concern* (Government of Canada 2018) but not yet listed under SARA
- Assigned a ranking of S1, S2, or S3 (or a combination of these rankings) by the Saskatchewan Conservation Data Center (SKCDC) (SKCDC 2017a, 2017b)
- Included in the Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017b)

Federal and provincial ranking definitions are provided in Appendix C.

The federal status of plant SOMC are listed in SARA and recommendations for changes to this Act are provided by COSEWIC. Many, but not all, species designated by COSEWIC are also listed under SARA. This Act affords protection for plant SOMC and their residences, if they are listed as *extirpated*, *endangered*, or *threatened*, under Schedule 1 of SARA. It also provides protection for the critical habitat of these species.

At the provincial level, plant SOMC status are listed in the Saskatchewan *Wildlife Act* (Government of Saskatchewan 1998). Under this Act, the *Wild Species at Risk Regulations* (Government of Saskatchewan 1999) lists plant SOMC protected provincially. Currently, these provincially-listed plant SOMC are also listed under SARA. The SKCDC tracks plant SOMC provincially ranked as S1, S1?, S1/S2, S2, S2?, S2/S3, S3, S3?, SH based on a species' risk of extirpation (see Appendix C).

The SK MOE recommends a 300 m setback for S1 to S3 species for a high disturbance activity, which is the maximum setback distance. Wind energy projects are considered a high disturbance activity by SKMOE. (SK MOE 2017b)

The SKCDC database was searched for historical records of plant SOMC within the PDA and vegetation LAA (HabiSask 2017). The search was used to create a list of potential plant SOMC that could possibly exist within the PDA or LAA.

5.3.1.1.3 Weed Species with Potential to Occur in the Vegetation LAA

The *Weed Control Regulations* (SK MOE 2010b) under the *Weed Control Act* (SK MOE 2010c) designate some plant species as prohibited, noxious, or nuisance weeds (see Table 5-5). These resources were consulted to identify weed species that have the potential to occur within the LAA.

Table 5-5 Weed Designation Definitions as Defined Under the *Weed Control Act*

Provincial Designation	Definition[1]
Prohibited	Prohibited weeds pose a significant economic and/or environmental threat, and are absent or very rare. The regulatory objective for these weeds is early detection and eradication upon discovery in consultation with the weed inspector and the Saskatchewan Ministry of Agriculture.
Noxious	Noxious weeds are locally established within a limited area. The regulatory objective is to prevent invasion to uninfected areas.
Nuisance	Nuisance weeds are widely established, but may spread easily from one area to the next. The regulatory objective for these species is to address the underlying reason for their occurrences and to take measures to reduce their long-term effect.

NOTE:
[1] Brenzil 2010.

5.3.1.2 Field Surveys

5.3.1.2.1 Vegetation Community

Vegetation community surveys were completed in September 7-8, 2016 and June 26-29, 2017 to document the pre-disturbance site conditions, identify sensitive features, and determine the potential for rare plants. As discussed in Section 2.3, surveys were conducted in 2016 and 2017 to consider the additional quarter sections of target lands identified after the 2016 suite of field surveys. Areas of native grassland within the LAA were targeted for vegetation community surveys. There are four range ecosites within the LAA: loam, badlands, thin, and overflow (Thorpe 2014). Vegetation community survey sites were pre-selected to capture information from all four range ecosites. The protocol followed the *Rangeland Health Assessment for Native Grassland* (Saskatchewan Prairie Conservation Action Plan 2008) and the plant community was determined based on criteria given in the *Saskatchewan Rangeland Ecosystems: Ecosite Guide* (Thorpe 2014). Sites were surveyed using a 1 m^2 quadrat to determine the vegetation community. Data collected included the percent cover of all vascular plant species in the quadrat, UTM coordinates collected with a hand-held global positioning system (GPS) unit, the legal subdivision, and representative photos. When a plant SOMC was observed the plant species, number of individuals, UTM coordinates, and representative photos were documented. Noxious weed data was recorded if noxious weeds were encountered. No targeted rare plant or weed surveys were completed; however, they will be conducted as pre-disturbance surveys prior to construction.

5.3.1.2.2 Wetlands

Wetland surveys were completed concurrently with the vegetation community surveys from June 26-29, 2017. The wetland surveys were completed on a sub-set of wetlands, approximately 62%, within the LAA to confirm or adjust the desktop mapping. Wetland class was verified using the Stewart and Kantrud (1971) classification system for the central zone of the wetland (see Appendix E.1). Data collected included the wetland class, dominant plant species, UTM coordinates of the wetland, legal subdivision, and representative photos. The wetland boundary was confirmed in the field.

5.3.2 Existing Conditions

5.3.2.1 Desktop Review

5.3.2.1.1 Ecoregions and Landscape Areas in the Vegetation LAA

Ecoregions and landscape areas are used to describe the ecological characteristics of the vegetation LAA and surrounding landscape. The Project is in the Prairie Ecozone in the Wood Mountain Plateau and Coteau Lakes Upland landscape areas of the Mixed Grassland Ecoregion (Acton et al. 1998).

The Mixed Grassland Ecoregion is part of the prairie ecozone and comprises approximately 13% of Saskatchewan (Acton et al. 1998). Lying between the Moist Mixed Grassland Ecoregion and the Cypress Upland Ecoregion, the Mixed Grassland Ecoregion is considered to be the driest area of the province. The Mixed Grassland Ecoregion is comprised of a diverse landscape made up of a mosaic of undulating plains, hummocky uplands, sand dunes, bench lands, creeks, and valleys (Acton et al. 1998). This ecoregion is dominated by cultivated and agricultural land (62%) and native prairie (31%) (Hammermeister et al. 2001). The reference plant community is dominated by species such as wheatgrasses (*Elymus* spp., *Leymus* spp., and *Pascopyrom* spp.), and speargrasses (*Hesperostipa* spp. and *Nasella* spp.). In dry areas, blue grama grass (*Bouteloua gracilis*) and sedges (*Carex* spp.) predominate. June grass (*Koeleria macrantha*) is present in clay soils whereas shrublands typically contain pasture sage (*Artemisia frigida*), rose (*Rosa* spp.), willow (*Salix* spp.), silverberry (*Eleagnus commutata*), Saskatoon (*Amelanchier alnifolia*), snowberry (*Symphoricarpos occidentalis*), and choke cherry (*Prunus virginiana*).

Elevations in the Mixed Grassland Ecoregion range from 450 m in valleys, as at Saskatchewan Landing Provincial Park, to around 1400 m at the transition point between the Mixed Grassland Ecoregion and the Cypress Upland Ecoregion (Government of Canada 2016). The Project is situated in a plateau area of transition, averaging 800 m in elevation.

5.3.2.1.2 Historical Records of Plant SOMC

The SKCDC database was searched on March 2, 2018 to identify historical occurrences of plant SOMC within the PDA and vegetation LAA. The search of the SKCDC database (HabiSask 2017) found no historical occurrences of plant SOMC within the PDA and vegetation and wetlands LAA.

5.3.2.2 Field Surveys

This section describes the exiting conditions within the PDA and LAA for vegetation and wetland resources based on the field survey results. The field surveys included vegetation community surveys and wetland surveys. Additional information (i.e., land cover) collected during the field surveys was used to refine the desktop mapping in the vegetation LAA.

5.3.2.2.1 Confirmation of Land Cover

The proportion of area in the land cover classes was determined based on land cover identified during desktop review and confirmation during field surveys (see Table 5-6). The PDA is a total of 373 ha and consists of predominantly cultivated land (70.2%) with the remainder comprised of hayland (15.1%), native grassland (5.8%), tame pasture (5.7%), urban/developed (1.4%) and wetlands (1.4%). (see Figure 5-1, Table 5-6, and Appendix D).

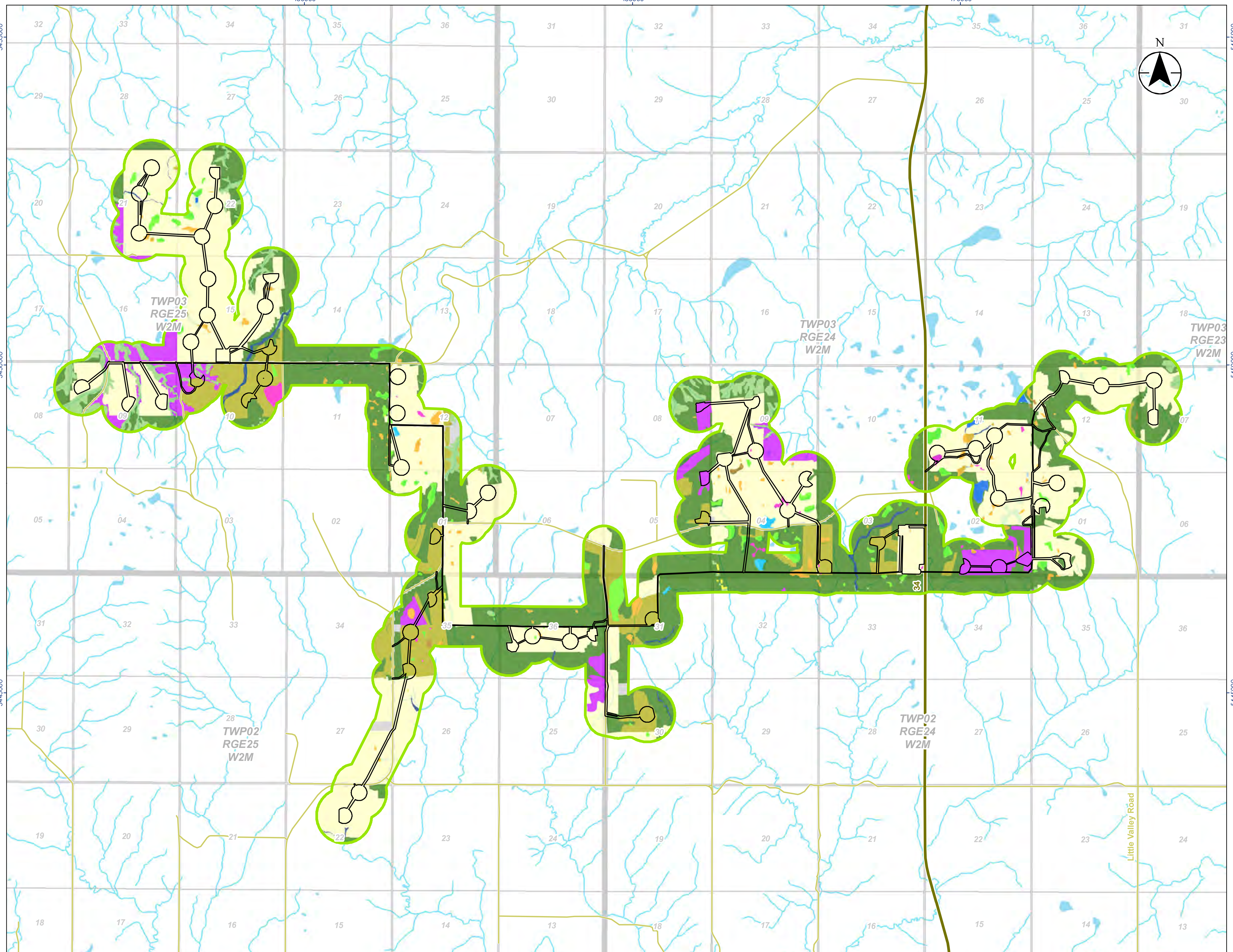
The LAA is dominated by cultivated land (42.0%) and native grassland (34.2%) with 9.0% hayland, 4.9% tame pasture and 4.0% wetlands. (see Figure 5-1, Table 5-6, and Appendix D).

Wetlands are discussed further in Section 5.3.2.2.3.

Table 5-6 Land Cover Classes within the Vegetation and Wetlands PDA and LAA

Land Cover Class	PDA [1]		LAA[1]	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Broadleaf	0.6	0.2	129.0	3.3
Cultivated	262.5	70.2	1,619.9	42.0
Drainage	0.6	0.2	20.3	0.5
Exposed Land/Barren	0.0	0.0	0.2	0.0
Hayland	56.6	15.1	347.0	9.0
Native Grassland	21.6	5.8	1,320.4	34.2
Pasture/Forages2	n/a	n/a	0.6	0.0
Shrubland	0.0	0.0	2.0	0.1
Tame Pasture	21.3	5.7	189.6	4.9
Urban/Developed	5.3	1.4	73.8	1.9
Water2	n/a	n/a	0.6	0.0
Wetlands	5.1	1.4	152.6	4.0
Total	373.7	100.0	3,856.0	100.0

[1] Land cover metrics are based on the desktop mapping.
[2] Data is based on AAFC 2015.



Stantec

BluEarth Renewables Inc

Land Cover

- Class 1 - Ephemeral Wetland
- Class 2 - Temporary Wetland
- Class 3 - Seasonal Wetland
- Class 4 - Semi-Permanent Wetland
- Class 5 - Permanent Wetland
- Drainage
- Dugout
- Agricultural
- Broadleaf
- Exposed Land / Barren
- Native Grassland
- Hayland
- Tame Pasture
- Shrubland
- Urban/Developed
- Water

- Vegetation and Wetlands Local Assessment Area
- Project Development Area
- Major Road
- Minor Road
- Watercourse
- Waterbody
- Township
- Section

0 1 2 Kilometres

1:60,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license with the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: Layout from BluEarth v3, Jan 22, 2018.
4. Land Cover: Mapped by Stantec.

Project Location: Near Coronach, SK

113253956-028 REVG

Prepared by acory on 2018-07-26

Technical Review by kskillen on 2018-07-26

Client/Project

BluEarth Renewables Inc.

Outlaw Trail Wind Project

Figure No.

5-1

Title

Land Cover Within the Vegetation and Wetlands LAA

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5.3.2.2.2 Vegetation Community Surveys

There was a total of 34 vegetation community sites surveyed, 24 in 2016 and 10 in 2017 (see Table 5-7 and Appendix D). The majority of sites were located on a loam ecosite. Loam ecosites are described as well-drained soils with medium to moderately fine textured soils (Thorpe 2014). Other ecosites observed were in areas with thin soils on steep slopes or in areas with high potential for erosion, in areas with exposed bedrock (badlands), or in low-lying meadows (subirrigated) (Thorpe 2014). The sites ranged from dry areas with communities dominated by northern wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*) and needle-and-thread grass (*Hesperostipa comata* ssp. *comata*) to moist shrubland communities dominated by chokecherry (*Prunus virginiana* var. *virginiana*) and Saskatoon (*Amelanchier alnifolia* var. *alnifolia*).

See Appendix E.2 for a comprehensive list of vascular plant species observed during the 2016 and 2017 vegetation community surveys. During the surveys, 176 vascular plant species were observed including two plant SOMC at two locations within the PDA and six plant SOMC species at 37 locations within the LAA (see Table 5-8 and Appendix E.2). The six plant SOMC species observed were prairie dunewort (*Botrychium campestre*), least mousetail (*Myosurus minimus*), low whitlowwort (*Paronychia sessiliflora*), blue wild phlox (*Phlox alyssifolia* ssp. *alyssifolia*), white milkwort (*Polygala alba*), and curved yellow cress (*Rorippa curvipes*). In the PDA, blue wild phlox was observed along the proposed location for an above-ground collector line between turbines No. 34 and No. 35 in native grassland. White milkwort was observed in the proposed footprint of turbine No. 48 in tame pasture. The SK MOE will be engaged to discuss appropriate mitigation measures.

There were also eight noxious or nuisance weed species observed in the LAA during the surveys. No prohibited weed species were observed during the field surveys. (see Table 5-9)

Table 5-7 Vegetation Community Survey Results from 2016 and 2017.

Site No.	Easting	Northing	Vegetation Community[1, 2]	Quarter Section	Dominant Plant Species
BE01MS	491372	5448837	MG-LM-H	SW-12-03-24-W2M	Western snowberry (*Symphoricarpos occidentalis*)– porcupine grass (*Hesperostipa curtiseta*)
BE02MS	491405	5448745	MG-LM-C	SW-12-03-24-W2M	Needle and thread grass (*Hesperostipa comata* ssp. *comata*)– northern wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*)
BE03MS	491472	5449437	MG-LM-H	NW-12-03-24-W2M	Western snowberry – porcupine grass
BE04MS	491729	5449272	MG-LM-H	NW-12-03-24-W2M	Western snowberry – porcupine grass

Site No.	Easting	Northing	Vegetation Community[1, 2]	Quarter Section	Dominant Plant Species
BE05MS	492268	5449015	MG-LM-G	SE-12-03-24-W2M	Crested wheatgrass (*Agropyron cristatum* ssp. *pectinatum*) – native grasses
BE06MS	491890	5448496	MG-TH-D	SW-12-03-24-W2M	Creeping juniper (*Juniperus horizontalis*)
BE07MS	491439	5447641	MG-LM-C	NW-01-03-24-W2M	Needle and thread grass – northern wheatgrass
BE08MS	485750	5448974	MG-LM-C	SE-08-03-24-W2M	Needle and thread grass – northern wheatgrass
BE09MS	485936	5449133	MG-LM-C	SE-08-03-24-W2M	Needle and thread grass – northern wheatgrass
BE10MS	485935	5448797	PEZ-SUB-D	SE-08-03-24-W2M	Chokecherry (*Prunus virginiana* var. *virginiana*)- Saskatoon (*Amelanchier alnifolia* var. *alnifolia*)
BE11MS	485961	5448321	MG-LM-E	NE-05-03-24-W2M	Pasture sage (*Artemisia frigida*)– needle and thread grass – northern wheatgrass
BE12MS	487092	5448587	MG-LM-F	SE-09-03-24-W2M	Blue grama (*Bouteloua gracilis)* – pasture sage – June grass (*Koeleria macrantha*)
BE13MS	487299	5448794	MG-LM-C	SE-09-03-24-W2M	Needle and thread grass – northern wheatgrass
BE14MS	485963	5447918	MG-LM-n.y.d.	NE-05-03-24-W2M	Smooth brome (*Bromus inermis*) – native grasses (not yet described)
BE15MS	489603	5447268	MG-LM-D	SW-02-03-24-W2M	Needle and thread grass – sedge (*Carex* spp.) – pasture sage
BE16MS	488313	5447725	MG-LM-C	NW-03-03-24-W2M	Needle and thread grass – northern wheatgrass
BE17MS	488024	5447812	MG-LM-H	NW-03-03-24-W2M	Western snowberry – porcupine grass
BE18MS	478300	5449819	MG-LM-D	NW-10-03-25-W2M	Needle and thread – sedge – pasture sage
BE19MS	482252	5448158	MG-LM-D	NE-01-03-25-W2M	Needle and thread – sedge – pasture sage
BE20MS	479615	5442738	MG-TH-D	SE-21-02-25-W2M	Creeping juniper
BE21MS	480801	5444805	MG-LM-C	NE-27-02-25-W2M	Needle and thread grass – northern wheatgrass
BE22MS	481306	5446407	MG-LM-G	NE-34-02-25-W2M	Crested wheatgrass – native grasses

Site No.	Easting	Northing	Vegetation Community[1, 2]	Quarter Section	Dominant Plant Species
BE23MS	484757	5445421	MG-LM-D	SW-31-02-24-W2M	Needle and thread – sedge – pasture sage
BE24MS	484821	5444750	MG-LM-D	NW-30-02-24-W2M	Needle and thread – sedge – pasture sage
V1	478781	5452864	MG-BD-B	NW-22-03-25-W2M	Western wheatgrass
V10	490144	5446696	MG-LM-B	NW-34-02-24-W2M	Western porcupine grass – northern wheatgrass – sedge – pasture sage
V11	492973	5448919	MG-BD-B	SW-07-03-23-W2M	Western wheatgrass
V13	486909	5443866	DMG-LM-E	SW-29-02-24-W2M	Blue grama – needle and thread grass – June grass – western wheatgrass
V2	476538	5449396	MG-LM-B	NW-09-03-25-W2M	Western porcupine grass – northern wheatgrass – sedge – pasture sage
V20	485985	5449429	DMG-LM-D	NE-08-03-24-W2M	June grass – needle and thread grass – pasture sage – blue grama
V4	479988	5448196	DMG-LM-D	NW-02-03-25-W2M	June grass – needle and thread grass – pasture sage – blue grama
V5	483097	5445495	DMG-LM-A	SW-36-02-25-W2M	Northern wheatgrass – needle and thread grass
V6	485310	5445987	MG-LM-C	SW-31-02-24-W2M	Needle and thread grass – northern wheatgrass
V7	484970	5444744	DMG-LM-A	NW-30-02-24-W2M	Northern wheatgrass – needle and thread grass

Note:

[1] Vegetation communities are defined in Thorpe (2014). An example of a vegetation community abbreviation for a reference community in the mixed grassland on a loam ecosite is MG-LM-A. Vegetation communities that are altered from the reference community are given sequential abbreviations (e.g., B, C, D, etc.).

[2]Legend:

DMG – dry mixed grassland

LM – loam

MG – mixed grassland ecoregion

n.y.d. – not yet described (community has no data in Thorpe [2014])

PEZ – prairie ecozone

SUB – subirrigated and overflow

TH - thin

Table 5-8 Plant SOMC Observed during Field Surveys within the Vegetation and Wetlands PDA and LAA

Scientific Name	Common Name	S-Rank	PDA	LAA
			# of Observations	# of Observations
Botrychium campestre	prairie dunewort	S2	0	2
Myosurus minimus	least mousetail	S3	0	1
Paronychia sessiliflora	low whitlowwort	S3	0	3
Phlox alyssifolia ssp. *alyssifolia*	blue wild phlox	S3	1	12
Polygala alba	white milkwort	S3	1	18
Rorippa curvipes	curved yellow-cress	S3	0	1
Total			2	37

[1] Taxonomy based on the SKCDC 2017a, 2017b.
[2] Weed designations are from the Saskatchewan *Weed Control Act* (Government of Saskatchewan 2010c).

Table 5-9 Weed Species Observed during Field Surveys Vegetation Community and Wetland Surveys in 2016 and 2017

Scientific Name[1]	Common Name	Weed Designation[2]	LAA
Arctium minus	common burdock	noxious	3
Cirsium arvense	Canada thistle	noxious	6
Elymus repens	creeping wild rye	nuisance	1
Hordeum jubatum ssp. *jubatum*	fox-tail barley	nuisance	12
Lactuca serriola	prickly lettuce	noxious	1
Salsola kali	Russian thistle	nuisance	1
Sonchus arvensis ssp. *arvensis*	field sow-thistle	noxious	1
Taraxacum officinale ssp. *officinale*	common dandelion	nuisance	3
Total			28

[1] Taxonomy based on the SKCDC 2017a, 2017b.
[2] Weed designations are from the Saskatchewan Weed Control Act (Government of Saskatchewan 2010c).

5.3.2.2.3 Wetland Surveys

Based on the field verified wetland mapping, there are 47 wetlands (5.1 ha) and 6 drainages (0.6 ha) within the PDA (see Table 5-10). Most of the wetlands are ephemeral, temporary or seasonal. Within the LAA there was a total of 250 wetlands (152.6 ha) and 18 drainages (20.3 ha).

Table 5-10 Wetland Classes and Drainages within the Vegetation and Wetlands PDA and LAA

Wetland Class	PDA			LAA		
	No.	Area (ha)	Proportion (%)	No.	Area (ha)	Proportion (%)
1 – Ephemeral	10	2.1	0.6	26	14.6	0.4
2 - Temporary	25	2.0	0.5	123	45.2	1.2
3 - Seasonal	11	0.9	0.2	80	73.1	1.9
4 – Semi-Permanent	1	<0.1	<0.1	4	6.9	0.2
5 - Permanent	0	0.0	0.0	5	9.0	0.2
Drainage	6	0.6	0.2	18	20.3	0.5
Dugout	0	0.0	0.0	12	3.9	0.1
Total	**53**	**5.7**	**1.5**	**268**	**172.9**	**4.5**

The following 31 wetlands were surveyed in the field to confirm wetland mapping and verify the wetland class and boundary. For representative photos of wetlands class 1, 2, 3 and 5 see Appendix E.3.

Table 5-11 Wetlands Surveyed in 2017

Label	Legal	Easting	Northing	Wetland Class
WL-1	NE 21-03-25 W2M	477416	5452907	3 - seasonal pond
WL-2	SE 21-03-25 W2M	477707	5452188	3 - seasonal pond
WL-3	NW 22-03-25 W2M	478342	5452540	5 - permanent pond
WL-4	NW 22-03-25 W2M	478344	5452640	3 - seasonal pond
WL-5	NW 22-03-25 W2M	478437	5452776	3 - seasonal pond
WL-6	NE 10-03-25 W2M	479093	5450015	2 - temporary pond
WL-7	NE 10-03-25 W2M	479542	5449844	3 - seasonal pond
WL-8	NE 10-03-25 W2M	479488	5449524	1 - ephemeral pond
WL-9	SW 35-02-25 W2M	481810	5445915	3 - seasonal pond
WL-10	SW 35-02-25 W2M	481693	5445801	1 - ephemeral pond
WL-11	SW 35-02-25 W2M	481641	5445669	3 - seasonal pond
WL-12	SW 35-02-25 W2M	481684	5445519	3 - seasonal pond
WL-13	SW 35-02-25 W2M	481803	5445479	1 - ephemeral pond
WL-14	SE 36-02-25 W2M	484175	5445796	1- ephemeral pond
WL-15	SE 36-02-25 W2M	484329	5445995	3 - seasonal pond
WL-16	NW 31-02-24 W2M	484733	5446170	3 - seasonal pond
WL-17	NW 31-02-24 W2M	485030	5446240	2 - temporary pond
WL-18	NE 08-02-24 W2M	485941	5449204	2 - temporary pond

Label	Legal	Easting	Northing	Wetland Class
WL-19	SW 02-03-24 W2M	489698	5447477	3 - seasonal pond
WL-20	SW 02-03-24 W2M	489846	5447477	2 - temporary pond
WL-21	SW 02-03-24 W2M	490057	5447528	3 - seasonal pond
WL-22	SW 02-03-24 W2M	490134	5447561	3 - seasonal pond
WL-23	SW 02-03-24 W2M	490166	5447509	3 - seasonal pond
WL-24	SW 02-03-24 W2M	490134	5447294	3 - seasonal pond
WL-25	SW 02-03-24 W2M	490233	5447143	2 -temporary pond
WL-26	SE 02-03-24 W2M	490361	5447199	2 - temporary pond
WL-27	SE 02-03-24 W2M	490858	5447099	2 - temporary pond
WL-28	SE 02-03-24 W2M	490657	5447537	2 - temporary pond
WL-29	NE 12-03-24 W2M	491705	5449451	5 - permanent pond
WL-30	NE 12-03-24 W2M	492147	5449944	3 - seasonal pond
WL-31	NE 12-03-24 W2M	492561	5449970	3 - seasonal pond

5.3.3 Effects Pathways and Mitigation Strategies

This section addresses the potential effects of the Project on vegetation and wetland resources. The potential effects from construction and operation and maintenance on vegetation and wetlands include change in native vegetation and wetland abundance and distribution and change in plant SOMC abundance and distribution. The effects pathways, mitigation measures, and residual effects are described below.

5.3.3.1 Change in Native Vegetation and Wetland Abundance and Distribution

5.3.3.1.1 Construction

The Project layout has reduced direct effects to native vegetation and wetlands by siting the Project on cultivated land (70.2%) and hayland (15.1%) where possible. As a result, areas of native vegetation including native grassland, shrubland, broadleaf, drainages, and wetlands comprises 7.6% of the PDA.

Project construction may cause a change in the abundance and distribution of native vegetation types due to the direct effects from vegetation clearing and grading during construction in the PDA. Vehicle and heavy equipment use within the PDA could alter the species composition of native vegetation due to soil compaction or the introduction of invasive/non-native weed species. The spread of invasive weed species is a potential threat to diversity, distribution and abundance of native vegetation because these species can out-compete native species.

Temporary material storage areas will be required during construction; however, these will be sited to avoid native vegetation (e.g., on cultivated land, etc.) and therefore, are not expected to result in any change in the abundance and distribution of native vegetation.

Wetlands of various sizes and classes are distributed throughout the PDA and complete avoidance may not be possible. Site selection has considered avoidance of wetlands; however, there is the potential for the alteration of wetlands to occur as a result of vegetation clearing for structure placement and soil damage by heavy equipment and vehicle use if these activities take place within a wetland or along its riparian zone.

Construction effects of the Project can largely be mitigated by reducing the effects on individual wetlands through infrastructure placement where possible and implementing construction mitigation measures such as directional drilling, constructing during frozen conditions or utilizing matting.

Project construction could cause a change in the abundance and distribution of native vegetation types in the LAA due to indirect effects (e.g., edge effects) on terrestrial vegetation communities due to introduction of invasive/non-native weed species, and change of vegetation structure. In addition, construction could have indirect effects on wetlands in the PDA and LAA through changes in surface water drainage, increases in impervious surfaces from infrastructure, changes in vegetation structure (e.g., removing the shrub layer surrounding wetlands), and loss of plant and wildlife habitat.

5.3.3.1.2 Operation and Maintenance

No incremental effects on native vegetation types and wetlands are anticipated as only infrequent vehicle use will occur along access roads. Indirect effects to native vegetation types may occur during operation and maintenance through the introduction/spread of invasive/non-native species from vehicle traffic.

5.3.3.1.3 Decommissioning

Activities during decommissioning will occur primarily on previously disturbed areas. Post-decommissioning, site reclamation will occur for areas of native vegetation types within the PDA. Use of native plant species seed mixes will result in an increase in native vegetation types in the LAA and return conditions to pre-construction levels.

5.3.3.2 Change in Plant SOMC Abundance and Distribution

5.3.3.2.1 Construction

No historical records of plant SOMC occur within the PDA, however two plant SOMC were observed in the PDA, and 37 in the LAA during the vegetation community surveys. There is potential for plant SOMC habitat within native grassland and potentially other habitats such as tame pasture and steep slopes. Rare plant surveys will be completed prior to construction to determine locations of plant SOMC in the PDA.

Project construction could change plant SOMC abundance and distribution within the PDA due to vegetation clearing and grading. However, known locations of plant SOMC will be avoided, where possible, by using the appropriate setbacks as defined by the 2017 *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE, 2017b). Plant SOMC loss or damage may occur due to soil compaction. Vehicle and heavy equipment use within the PDA could also introduce and/or spread invasive/non-native species, resulting in an indirect loss through increased competition from some species. Plant SOMC could also be indirectly affected by the edge effects resulting from the introduction and spread of invasive/non-native weed species during construction in the PDA.

5.3.3.2.2 Operation and Maintenance

No incremental effects on plant SOMC abundance and distribution are anticipated as only infrequent vehicle use will occur along access roads. Indirect effects to plant SOMC may occur during operation and maintenance through the introduction/spread of invasive/non-native species from vehicle traffic.

5.3.3.2.3 Decommissioning

Vehicle and heavy equipment use during decommissioning could introduce and/or spread invasive/non-native species, resulting in an indirect loss through increased competition from some species.

5.3.3.3 Mitigation for Change in Native Vegetation and Wetland Abundance and Distribution

In general, the best mitigation for native vegetation and wetlands is avoidance through careful siting. In areas where this is not possible, early Project planning is crucial to reduce potential effects. Standard industry practices and avoidance measures, along with specific mitigations, will be implemented during construction and operation and maintenance phases of the Project.

5.3.3.3.1 Construction

Detailed mitigation options to reduce or avoid construction effects of the Project to native vegetation and wetlands, include but are not limited to the following:

- Avoidance or mitigation of Project effects through Project siting.
- Staking sensitive features (e.g., native grassland, wetland boundaries, etc.) within the PDA prior to construction.
- Cleaning equipment should be carried out before moving equipment from any locations identified as having a noxious weed infestation.
- Using horizontal directional drilling (HDD) methods, where possible, for collector line installation under wetlands or trenching during frozen or dry conditions.

- Reducing surface disturbances (e.g., topsoil stripping, grading) in areas of native vegetation types and wetlands by minimizing the construction area for linear features such as access roads and collector lines.
- Using matting when sensitive environments (e.g. wetlands) cannot be avoided.
- Using qualified environmental monitors when constructing in sensitive features to ensure mitigations are followed.
- Implementing additional mitigation measures to reduce or avoid the potential effects from soil compaction (see soil mitigation in Section 5.2.3).
- Using proper soil handling techniques and stockpiling topsoil separately from subsoil.
- Stripping topsoil from the entire PDA on lands where localized noxious weed infestations are encountered. Store soil piles containing noxious weeds separately from soil without weeds to prevent mixing with the surrounding soils during re-grading and final clean-up.
- Monitoring topsoil piles for noxious weed growth during construction and implementing corrective measures (e.g., spraying, mowing, hand pulling) to avoid infestations when warranted.
- Implementing erosion control measures near wetlands such as silt fencing, hay bales, or other methods to reduce or avoid the movement of soil into adjacent wetlands and surface water.
- Reclaiming disturbed areas, including topsoil replacement and seeding when ground conditions and moisture levels permit.

5.3.3.3.2 Operation and Maintenance

Detailed mitigation options to reduce or avoid operation and maintenance effects of the Project to native vegetation and wetlands, include but are not limited to:

- Utilizing existing access trails during operation and maintenance.
- Reseeding native vegetation types and wetlands using a native seed mix immediately following construction. Native seed mix content and application methods will be developed in consultation with the SK MOE and landowner/lease.
- Maintaining erosion control measures (e.g., silt fencing, tackifiers, erosion control matting) in place until vegetation recovery is sufficient to stabilize soils and prevent effects to wetlands.
- Monitoring the effectiveness of reclamation success using a qualified environmental specialist. Develop additional site-specific measures in the event that reclamation is not successful.
- Developing weed control measures and only use herbicides approved for use in Saskatchewan, and only be those individuals who are provincially licensed for their application.

5.3.3.3.3 Decommissioning

Detailed mitigation options to reduce or avoid decommissioning effects of the Project to native vegetation and wetlands, include but are not limited to the following:

- Cleaning equipment should be carried out before moving equipment from any locations identified as having a noxious weed infestation.
- Implementing additional mitigation measures to reduce or avoid the potential effects from soil compaction (see soil mitigation in Section 5.2.3).
- Reclaiming disturbed areas, including topsoil replacement and seeding when ground conditions and moisture levels permit.

5.3.3.4 Mitigation for Change in Plant SOMC Abundance and Distribution

5.3.3.4.1 Construction

Best management practices, avoidance measures, and Project-specific mitigation measures will be used during construction. Detailed mitigation options to reduce or avoid construction effects of the Project to plant SOMC, include but are not limited to the following:

- The blue wild phlox located along the proposed location for the overhead collector line between turbine No. 34 and No. 35, will be avoided during pole placement.
- Conducting pre-disturbance rare plant surveys to identify plant SOMC locations and apply the appropriate setbacks.
- Complying with setback distances for plant SOMC including 300 m setback for federally-listed plant SOMC and 30 m setback for provincially listed plant SOMC (Government of Saskatchewan 2016). Environmental inspector(s) and appropriate resource specialist (i.e., Biologist) will confirm the appropriate buffer around each plant SOMC occurrence.
- Prior to construction, signage/staking/flagging sensitive features, e.g., plant SOMC, for avoidance. Maintaining markings during construction and reclamation to alert crews of the presence of the setback.
- In the event that plant SOMC are identified, during the vegetation community surveys as part of this TPP and/or during the pre-disturbance rare plant surveys, and the plant location or setback distances overlap with the PDA the following actions will be considered to reduce or avoid construction effects on plant SOMC: 1) Adjust location of project components to avoid plant SOMC; 2) Consult with the SK MOE regarding options such as; methods to minimize disturbance including protective measures (e.g., topsoil salvage, matting occurrences, and/or construction during dry or frozen conditions); methods to enhance conservation and survival of the impacted plant species and community through appropriate offsets, e.g., seed harvest; and, 3) as a last resort, compensate for the loss of rare plant species or rare habitats supporting those species.

5.3.3.4.2 Operation and Maintenance

Mitigation measures specific to plant SOMC during operation and maintenance include but are not limited to the following:

- Monitoring the effectiveness of reclamation success. Develop additional site-specific measures in the event that reclamation is not successful, or potential exists for weed proliferation into locations of plant SOMC.
- Developing weed control measures in conjunction with the landowner/lessee and only use herbicides approved for use in Saskatchewan applied by those individuals who are provincially licensed for their application.

5.3.3.4.3 Decommissioning

Vegetation management will be continued during decommissioning, therefore, the invasion and spread of non-native invasive species should be mitigated.

5.3.4 Summary of Residual Effects

5.3.4.1 Change in Native Vegetation and Wetland Abundance and Distribution

5.3.4.1.1 Construction

The Project layout avoided native grassland during siting of the turbine foundations and turbine temporary workspaces. During the siting of other permanent infrastructure, native grassland was avoided where possible however, a total of 21.6 ha of native grassland will be affected by the following Project components: temporary access road construction area (3.6 ha), permanent access roads (3.8 ha), underground collector lines (5.8 ha), and overhead collector lines (8.4 ha). Underground collector lines will be revegetated. Conservatively, this assessment assumes a complete loss of vegetation along rights-of-way for the overhead collector lines. However, during operation the entire right-of-way will not be utilized, rather it will be limited to the turbine and above ground pole locations.

Wetlands will be avoided whenever possible. Where avoidance is not possible, appropriate mitigation measures, as approved under the AHPP, will be implemented to reduce direct effects to wetlands. Indirect effects from the Project are possible through changes in wetland function from sedimentation and surface runoff. However erosion control measures, specific wetland mitigation and setbacks will reduce or avoid potential effects to wetlands.

There are 4.15 ha of Class I-II wetlands, and 0.97 ha of Class III-IV wetlands, for a total of 5.1 ha of wetlands are located within the PDA. Wetlands will be affected by the following Project components: turbine temporary workspace (2.2 ha), temporary access road construction area (0.6), permanent access roads (0.6 ha), under-ground collector lines (1.0 ha), overhead collector lines (0.7 ha), and turbine laydown area (0.05 ha). Construction activities will affect wetlands, though avoidance during the construction phase by site-specific planning for the placement of infrastructure (e.g., wetlands along the overhead collector lines will likely be avoided during tower placement), and through standard operating procedures for equipment operation near wetlands will reduce these effects.

An environmental monitor will confirm implementation of mitigation measures described in Section 5.3.3.3. Other mitigation measures may be required depending on site-specific conditions and issues that may arise during construction. However, an environmental monitor, in consultation with the SK MOE, and landowners, will identify areas that may pose environmental challenges for native vegetation and wetlands, including weedy areas and areas that need to be reclaimed, to mitigate these issues and effects.

5.3.4.1.2 Operation and Maintenance

Project operation and maintenance activities include infrequent vehicle traffic within the PDA on access roads. Indirect effects to native vegetation types may occur during operation and maintenance through the introduction/spread of invasive/non-native species from vehicle traffic.

A post construction reclamation plan will be developed during construction. Post-construction mitigations for native vegetation will consist of monitoring the success of reclamation where applicable and weed species control. It is anticipated that reclamation and weed control will mitigate these effects.

5.3.4.1.3 Decommissioning

Post-decommissioning, the infrastructure (e.g., WTGs, new access roads) will be removed and the land returned to its previous land cover class (or in consultation with the landowner), either through natural processes or assisted through mitigation. With mitigation, it is expected there will be an increase in the extent of native vegetation types and wetlands within the LAA that is comparable to its state prior to construction.

5.3.4.2 Change in Plant SOMC Abundance and Distribution

5.3.4.2.1 Construction

During the vegetation community surveys incidental occurrences of provincially-listed plant SOMC were observed within the PDA and LAA. Two plant SOMC were observed within the PDA. The blue wild phlox located along the proposed location for the overhead collector line between turbine No. 34 and No 35, will be avoided during pole placement. The white milkwort located in the proposed footprint of turbine No. 48 will likely be lost during construction and consultation with the SK MOE will need to occur. Since the plant SOMC observations were in native grassland and tame pasture, effects to plant SOMC are anticipated to be greater in those native vegetation types. According to the 2017 *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE 2017b), plant SOMC provincially ranked S1 to S3 have a year-round setback of 30 m and no construction activity is permitted within the setback area.

Pre-construction rare plant surveys will confirm the locations of rare plants in the PDA. As discussed in Section 5.3.3.4.1, in the event that plant SOMC are identified, during the vegetation community surveys as part of this TPP and/or during the pre-disturbance rare plant surveys, and the plant location or setback distances overlap with the PDA the following actions will be considered to reduce or avoid construction effects on plant SOMC: 1) Adjust location of Project components to avoid plant SOMC; 2) Consult with the SK MOE regarding options such as; methods to minimize disturbance including protective measures (e.g., topsoil salvage, matting occurrences, and/or construction during dry or frozen conditions); methods to enhance conservation and survival of the impacted plant species and community through appropriate offsets, e.g., seed harvest; and, 3) as a last resort, compensate for the loss of rare plant species or rare habitats supporting those species.

With the application of mitigation measures, it is not anticipated that the Project will impact plant SOMC species and community.

5.3.4.2.2 Operation and Maintenance

Project operation and maintenance activities include infrequent vehicle traffic within the PDA on access roads.

With the application of mitigation measures, it is not anticipated that the Project will impact plant SOMC species and community.

5.3.4.2.3 Decommissioning

With the application of mitigation measures, it is not anticipated that the Project will impact plant SOMC species and community.

5.4 WILDLIFE AND WILDLIFE HABITAT

This section addresses wildlife and wildlife habitat resources in the context of the Project. The wildlife species potentially found at or near the Project are typical of the broader ecoregion, most of which are common and abundant. While all wildlife species and their habitat are considered in this section, the focus is placed on SOMC (see Section 5.4.1.1 for a definition) that are known to occur or have the potential to occur in the LAA. This section will outline the methods and results of both the desktop review and field surveys completed in 2015, 2016, and 2017 in addition to identifying the potential pathways, mitigation strategies, and residual effects.

5.4.1 Methods

5.4.1.1 Desktop Review

Existing information from provincial and federal databases, satellite imagery and literature sources were reviewed to determine known occurrences of SOMC, as well as life history requirements, and habitat availability in the LAA and RAA.

Wildlife SOMC are defined as federally and provincially legislated species at risk and species identified in federal and provincial tracking lists and activity restriction guidelines, including species:

- Listed under Schedule 1 of the federal *Species at Risk Act* as *endangered, threatened* or *special concern* (Government of Canada 2002)
- Listed in *The Wildlife Act* of Saskatchewan as *endangered, threatened* or *vulnerable* (Government of Saskatchewan 1998)
- Listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *endangered, threatened* or *special concern* (Government of Canada 2018) but not yet listed under SARA
- Assigned a ranking of S1 or S2 (or a combination of these rankings) by the SKCDC (SKCDC 2018c, 2018d)
- Included in the Saskatchewan Activity Restriction Guidelines for Sensitive Species (SK MOE 2017b)

See Appendix C for federal and provincial ranking definitions.

The following data sources were reviewed:

- SKCDC wildlife database searched to the extent of the LAA (historical wildlife SOMC observations and sensitive wildlife habitat features; HabiSask 2017)
- COSEWIC status reports (Government of Canada 2018)
- Species at Risk Public Registry recovery strategies and action plans (Government of Canada 2018)
- Birds of North America Online database (Cornell Lab of Ornithology and the American Ornithologists' Union 2017)
- Important Bird Areas (IBA) in Canada Online Database (BSC and Nature Canada 2017)
- Land cover data from the AAFC (AAFC 2016) databases
- Satellite imagery such as ESRI World Imagery (ESRI 2017) and Google Earth Pro (2017)
- Publicly available GIS spatial layers of protected lands. The Saskatchewan Representative Area Network spatial layer includes protected private and public lands (e.g., Ducks Unlimited project areas, conservation easements, provincial parkland, national parks, provincial community pastures, WHPA lands, and migratory bird sanctuaries) (HabiSask 2017).

5.4.1.2 Wildlife Habitat Availability

Desktop review of data sources provided information about potential and historical SOMC occurrences, sensitive features (e.g., perennial nests), and habitat types present within the LAA (i.e., land cover classes). Historical records, species ranges, life history requirements, and land cover available in the RAA were used to compile a list of potential SOMC that may interact with the Project (see Table E.1 in Appendix E). Wildlife habitat availability was evaluated based on the land cover classes described in Table 5-4 (see Section 5.3.1.1). Because land cover classes represent broad habitat types (i.e., at a coarse scale), a habitat association approach was used to estimate habitat availability. Specifically, each land cover class was evaluated to determine whether or not it provided suitable habitat using knowledge of seasonal habitat requirements for each SOMC (see Table E.2 in Appendix E).

Land cover information from AAFC (2015) was incorporated into a GIS database and was used to identify the types of wildlife surveys required (i.e., target SAR and SOMC) and their target locations (i.e., areas with suitable habitat).

5.4.1.3 Field Surveys

As discussed in Section 2.3, wildlife field surveys were conducted in 2015, 2016, and 2017 to support refining the Project area and layout. Wildlife surveys for raptor stick nest and bat activity were conducted in 2015. Surveys in 2016 focused on revised target quarter sections and included sharp-tailed grouse lek, bird movement, breeding bird, burrowing owl, common nighthawk/short-eared owl, and yellow rail surveys. In 2017, the additional signed target quarter sections were surveyed for sharp-tailed grouse leks, breeding birds, burrowing owls, and amphibians. The field data reported in this section reflects observations made within the LAA after the Project layout was finalized. As a result, some wildlife survey sites are no longer sited within the LAA and data collected at those locations are not included in the results or residual effects assessment (Table 5-12). Bird and bat movement surveys are an exception and all data collected is presented as the surveys are used to determine movement patterns across the landscape. The Project is sited to avoid protected wildlife features (e.g., ferruginous hawk [*Buteo regalis*] nest) that were recorded during the 2015 and 2016 wildlife surveys. Survey locations are illustrated in the Biophysical Atlas in Appendix D.

Wildlife surveys followed the Saskatchewan Government species detection survey protocols (SK MOE 2014a, 2014b, 2014c, 2014d, 2015a, 2015b), Alberta survey protocols identified by SK MOE (Alberta Environment and Sustainable Resource Development [Alberta ESRD] 2013a) or internal Stantec Standard Operating Procedures (SOP) where the SK MOE protocols were not available (e.g., bird movement surveys). Internal Stantec protocols were reviewed and approved by SK MOE prior to surveys being conducted. All required SK MOE scientific research permits were obtained prior to conducting wildlife surveys (permits #16FW110, #17FW069) and data reported to the SK MOE in accordance with permit conditions.

Table 5-12 Wildlife Surveys Conducted During the 2015, 2016, and 2017 Field Seasons

Field Survey	Total Number of Survey Locations in 2015[1]	Total Number of Survey Locations in 2016[1]	Total Number of Survey Locations in 2017[1]	Number of Survey Locations in LAA[2]
Raptor[3]	helicopter	--	ground	--
Bat Activity[4]	7	7	0	7
Bird Movement[5]	0	8	0	6
Breeding Bird	0	24	26	39
Burrowing Owl	0	24	26	39
Common Nighthawk and Short-eared Owl	0	17	0	16
Sharp-tailed Grouse Lek	0	24	17	36
Amphibian	0	0	8	7
Yellow Rail	0	5	0	5

NOTE:
[1] Survey locations within initial target lands (See Section 2.3)
[2] Survey location within LAA after PDA finalized
[3] All quarter sections within the LAA surveyed by helicopter in 2015, quarter sections surveyed by ground in 2017
[4] Four of the seven survey locations represent MET towers, each with two detectors. A total of 11 detectors were set up within the LAA
[5] Surveys targeted bird movement across the landscape; as such, all survey locations were included even if they are outside of LAA

5.4.1.3.1 Raptor Nest Surveys

To identify the location of active stick nests suitable for raptors within the Project area, the LAA was surveyed using an aerial survey method in 2015. On April 30 and May 1, 2015, one Stantec biologist qualified to identify raptor nests and identify raptors from a helicopter conducted the survey using a transect method. Transects were flown at approximately 80 km/hr and at an elevation of 100 m along section lines in an east-west direction and suitable nesting structures were identified for further investigation. Areas of forested land cover were systematically surveyed at a slower velocity (~30 km/hr) to improve detection of stick nests. When target features (i.e., stick nests) were observed, the helicopter approached gradually until the nest was confirmed as either active or inactive. For active nests, the species was identified and confirmed by both biologists. Nest locations were plotted manually on hard copy maps, and a GPS location recorded using a hand-held GPS unit to verify accuracy of hand-plotted locations.

A ground-based raptor nest survey was conducted in spring 2017 following SK MOE's protocol (Alberta ESRD 2013a). Surveys were conducted prior to tree leaf-out throughout the LAA to identify any new stick nests and to confirm the continued occupancy of stick nests found in 2015.

5.4.1.3.2 Bat Activity Surveys

To estimate the rate of bat activity within the Project area nocturnal acoustic bat activity surveys were completed. Bat activity surveys were conducted following the SK MOE approved survey protocol outlined in Lausen et al. (2010) and Alberta ESRD (2013b). Based on the application of these protocols at the time of the surveys, one spring (May 1 to June 7, 2016) and two fall monitoring periods (July 14 to September 30, 2015, and July 28 to September 14, 2016) were surveyed, with the specific length of each monitoring period being based on regulatory guidance and professional judgement (Lausen et al. 2010) and Alberta ESRD (2013b).

Alberta's *Bat Mitigation Framework for Wind Power Development* (the "Alberta Framework"; ESRD 2013b) establishes guidelines for interpreting pre-construction acoustic bat monitoring data for potential mitigation. As there are no such pre-construction guidelines for bats in Saskatchewan, SK MOE regularly directs proponents to the Alberta Framework. The Alberta Framework states that migratory bat activity levels from the high detectors during the August 1 to September 10 monitoring period can be related to post-construction bat fatality. This is based on Baerwald and Barclay (2009) who reported a statistically significant relationship between migratory bat activity rates at 30 m above ground and corrected fatality rates observed at wind farms in southern Alberta with turbines greater than 65 m height. Pre-construction bat activity (i.e., bat pass per detector night) was correlated to post-construction fatality at a rate of roughly one bat pass per detector night to four bat fatalities per turbine per year (Baerwald and Barclay (2009). Based on this relationship, the thresholds of bat activity identified in Alberta ESRD (2013b) are:

- Less than 1 migratory bat pass per detector night as a potentially acceptable risk;
- 1 to 2 migratory bat passes per detector night indicates a potentially moderate risk. WEPs should explore mitigation measures such as alternative WTG siting and reduced turbine height and/or rotor length;
- Greater than 2 migratory bat passes per detector indicates that there is a potentially high risk of bat fatalities. WEPs will likely require mitigation measures such as alternative turbine locations and operational mitigation (e.g., changing cut-in speeds) to reduce bat fatality.

It should be noted that the correlation was relatively weak ($r2 = 0.31$, $P = 0.023$) and based on a sample size of only five data points (Baerwald and Barclay 2009) and other studies have not been able to reproduce a statistically significant relationship. Therefore, a high degree of uncertainty remains on the actual mortality rates of a WEP based on 69% of the variance in mortality rates remaining unexplained by this model. Also, the Alberta Framework only considers migratory bat passes per detector night in the context of the thresholds for bat fatalities because species detected by the high detectors are primarily migratory bat species.

The fall monitoring period dates in 2015 and 2016 were selected to capture at a minimum the period of August 1 to September 10 so that bat activity rates for the LAA could be compared to the Alberta Framework to assess the potential change in mortality risk for bats due to Project development (ESRD 2013b). For this report, data was analyzed for both the full fall monitoring period and the Alberta fall monitoring period stated by ESRD (2013b) (i.e., August 1 to September 10).

A total of 11 AnaBat SD1 CF bat detectors were installed at 7 sites within the Project area. Eight detectors were placed at the four MET tower locations: one low (2 m height) and one high (>30 m height) at each tower. Additionally, low (ground) detectors (2 m height) were placed at three locations to provide comprehensive coverage of the Project area. High detectors were installed to provide information on bat activity within the turbine rotor-swept altitude, as low detectors only reliably collect data on bats travelling from ground level up to approximately 30 m in height (Titley Scientific 2015). All detectors were installed at the same locations during the three monitoring periods (see Appendix F.1 for additional details).

Detectors were serviced on a bi-weekly basis to verify that equipment was functioning properly and to service the detector units and battery power systems. Call data were analyzed manually using AnalookW and summarized by species or species group in relation to environmental variables, monitoring dates, and detector height (see Appendix F.1 for additional details). Due to the inability to identify all bat passes to species due to call quality and overlapping call parameters between species, the following five groupings were used for species classification when individual species classification was not possible:

- **Low frequency bat**: includes big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*)
- **High frequency bat**: includes eastern red bat (*Lasiurus borealis*), long-eared bat (*Myotis evotis*), little brown myotis (*Myotis lucifugus*), and western small-footed bat (*Myotis ciliolabrum*)
- **Big brown bat or silver-haired bat**
- **Eastern red bat or little brown myotis**
- **Myotis species**: includes long-eared bat, little brown myotis, and western small-footed bat

5.4.1.3.3 Bird Movement Surveys

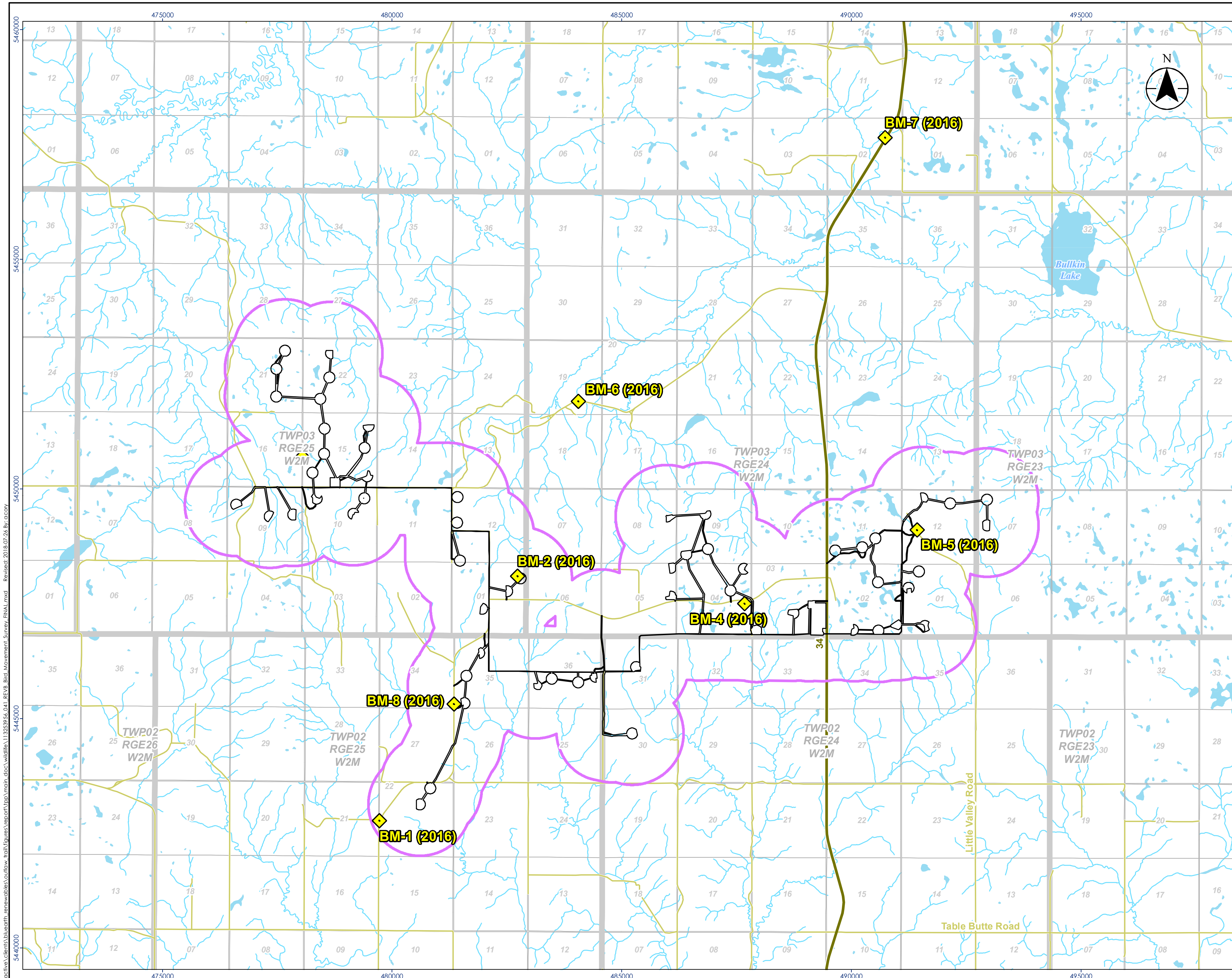
Bird movement surveys were conducted to document species, flight path (i.e., height and direction) and habitat use during peak migration in the spring and fall. Surveys were conducted according to Stantec's internal protocol that was reviewed and approved by SK MOE.

Surveys were conducted at eight sites in the spring and fall of 2016 (See Figure 5-2). Six sites (Sites 1-5 and 8) were located throughout the LAA to determine local movement patterns and two control sites (Sites 6 and 7) were located outside the Project area to provide a comparison of bird movement rates. The control sites were chosen to be along the Big Muddy Valley as this valley is potentially a flight corridor and, as such, could have higher bird activity than within the LAA. Having control sites allowed for a relative comparison of bird movement rates to better understand bird activity patterns within the LAA (e.g., are the movement rates within the LAA lower or higher than control sites which are expected to have higher bird activity).

Bird movement surveys consist of a 30-minute observation period. For all birds observed within a 1 km radius of the survey point center, the species, number of individuals, flight path and behavioural data (e.g., flapping, perched, soaring) were recorded. Observations made beyond the 1 km radius were recorded as incidental observations. Surveys were conducted when visibility was at least 800 m with a ceiling of 500 m or greater (e.g., precipitation no greater than a light rain, no fog). Wind speed can impede bird activity and surveys were generally discontinued if the wind was consistently above 30 km/h, except if it was a tail wind which can increase bird activity.

A total of three spring bird movement survey visits were conducted between April 21 and May 29, 2016 at each site. Each visit included two surveys consisting of one morning survey (between sunrise and 1100) and one afternoon survey (between 1100 and 1800).

A total of three fall bird movement survey visits were conducted between August 31 and October 1, 2016 at each site. Each visit included five surveys and targeted various bird guilds (i.e., waterbirds, landbirds, raptors). Waterbirds were surveyed twice each visit, once in the early morning a half hour before sunrise to one hour after sunrise and once in the evening one hour before sunset to a half hour after sunset. Landbirds were surveyed twice each visit, once in the morning between sunrise and 1100 and once in the evening between 1800 and sunset. Raptors were surveyed once each visit in the middle of the day between 1100 and 1800.



Stantec BluEarth Renewables Inc.

- Bird Movement Survey Site
- Wildlife Local Assessment Area
- Project Development Area
- Major Road
- Minor Road
- Watercourse
- Waterbody
- Township
- Section

0 1 2 Kilometres
1:85,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license with the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: Layout from BluEarth v3, Jan 22, 2018.

Project Location
Near Coronach, SK

113253956-041 REVB
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
5-2

Title
Bird Movement Survey Sites

5.4.1.3.4 Breeding Bird Surveys

Breeding bird surveys were conducted to document the presence of bird species, particularly SOMC, and their associated habitat. Surveys targeted representative habitat within the Project area including native grassland, tame pasture, hayland, and cropland so that occupancy rates could be assessed across the LAA based on habitat type.

Three survey visits were conducted at a total of 39 sites between May 24 and June 25, 2016 and May 31 and June 28, 2017 (see Appendix D for survey locations). In 2016, 23 sites were surveyed and, in 2017, 16 new sites were surveyed to gather data in locations that were not surveyed in 2016 due to revisions to the Project layout (See Section 2.3 for more information). Surveys were conducted under appropriate environmental conditions as outlined by the SK MOE (2014a) with modified temperature (air temperature above 0°C) and wind speed (winds not greater than 20 km/h) thresholds due to common environmental conditions during the spring in southern Saskatchewan (i.e., wind above 12 km/h and temperatures below 7°C). Each site was surveyed for a 10-minute observation period.

The dominant land cover (i.e., greater than 75% of the total habitat) for each site, within a 100 m radius of the point count center, was recorded. Potential land cover classes included cultivated (i.e., cropland), perennial (i.e., periodically seeded with perennial non-native grasses, such as hayland or tame pasture), and native grassland. Of the 39 sites, 23 were mixed cultivated and perennial (e.g., 50% cultivated and 50% native grassland), 12 native grassland, 3 mixed perennial (e.g., 60% native grassland and 40% hayland), and 1 cultivated.

5.4.1.3.5 Burrowing Owl Surveys

Burrowing owl (*Athene cunicularia*) surveys were conducted in conjunction with the breeding bird surveys to detect the presence of burrowing owls and active burrows.

Three survey visits were conducted at a total of 31 sites between May 24 and June 25, 2016 and May 31 and June 28, 2017 (see Appendix D for survey locations), concurrently with breeding bird surveys. In 2016, 15 sites were surveyed and, in 2017, 16 new sites were surveyed to gather data in locations that were not surveyed in 2016 due to revisions to the Project layout (See Section 2.3 for more information). Surveys were conducted under appropriate environmental conditions as outlined by the SK MOE (2014b) with modified temperature (air temperature above 0°C) and cloud cover (any percent cloud cover) thresholds due to common environmental conditions during the spring in southern Saskatchewan (i.e., temperatures below 22°C and high cloud cover).

5.4.1.3.6 Common Nighthawk and Short-eared Owl Surveys

Common nighthawk (*Chordeiles minor*) and short-eared owl (*Asio flammeus*) surveys were conducted concurrently. Surveys targeted areas of suitable habitat within a 500 m buffer of the Project area which represents the maximum activity restriction setback for short-eared owls (SK MOE 2017b), the largest setback of the two species.

Three survey visits were conducted at 16 sites (see Appendix D for survey locations) between May 26 and June 27, 2016, following the SK MOE's survey protocols (SK MOE 2015a, 2015b).

5.4.1.3.7 Sharp-tailed Grouse Lek Surveys

Sharp-tailed grouse (*Tympanuchus phasianellus*) lek surveys were conducted to detect the presence of leks (i.e., traditional dancing grounds used by sharp-tailed grouse during mating). Surveys targeted areas of suitable habitat (i.e., native grassland and tame pasture) and historically known lek sites (if applicable) within a 400 m buffer of the Project area which represents the maximum activity restriction setback for sharp-tailed grouse leks (SK MOE 2017b).

Sharp-tailed grouse lek surveys were conducted at 36 sites between April 19 and May 2, 2016 and April 18 and May 3, 2017.

Two survey visits were conducted at a total of 31 sites (see Appendix D for survey locations) between April 19 and May 2, 2016 and April 18 and May 3, 2017, following Alberta's survey protocol (Alberta ESRD 2013a), adopted by the SK MOE. In 2016, 22 sites were surveyed and, in 2017, 9 new sites were surveyed to gather data in locations that were not surveyed in 2016 due to revisions to the Project layout.

5.4.1.3.8 Amphibian Surveys

Auditory amphibian surveys were conducted to detect potential breeding ponds for northern leopard frogs (*Lithobates pipiens*) and Canadian toads (*Anaxyrus hemiophrys*) within a 500 m buffer of the Project area which represents the maximum activity restriction setback for northern leopard frogs (SK MOE 2017b).

Four survey visits were conducted at seven sites between April 29 and June 8, 2017, following the SK MOE's survey protocol (SK MOE 2014c) (see Appendix D for survey locations).

5.4.1.3.9 Yellow Rail Surveys

Yellow rail (*Coturnicops noveboracensis*) surveys targeted suitable breeding habitat (i.e., marshes) and were conducted within a 350 m buffer of the Project area which represents the maximum activity restriction setback (SK MOE 2017b) for breeding yellow rails.

Three survey visits were conducted at five sites between May 27 and June 26, 2016, following the SK MOE's survey protocol (SK MOE 2014d) (see Appendix D for survey locations).

5.4.2 Existing Conditions

The following section summarizes wildlife observations and wildlife habitat conditions in the PDA and LAA, as determined through desktop review of existing information and field surveys.

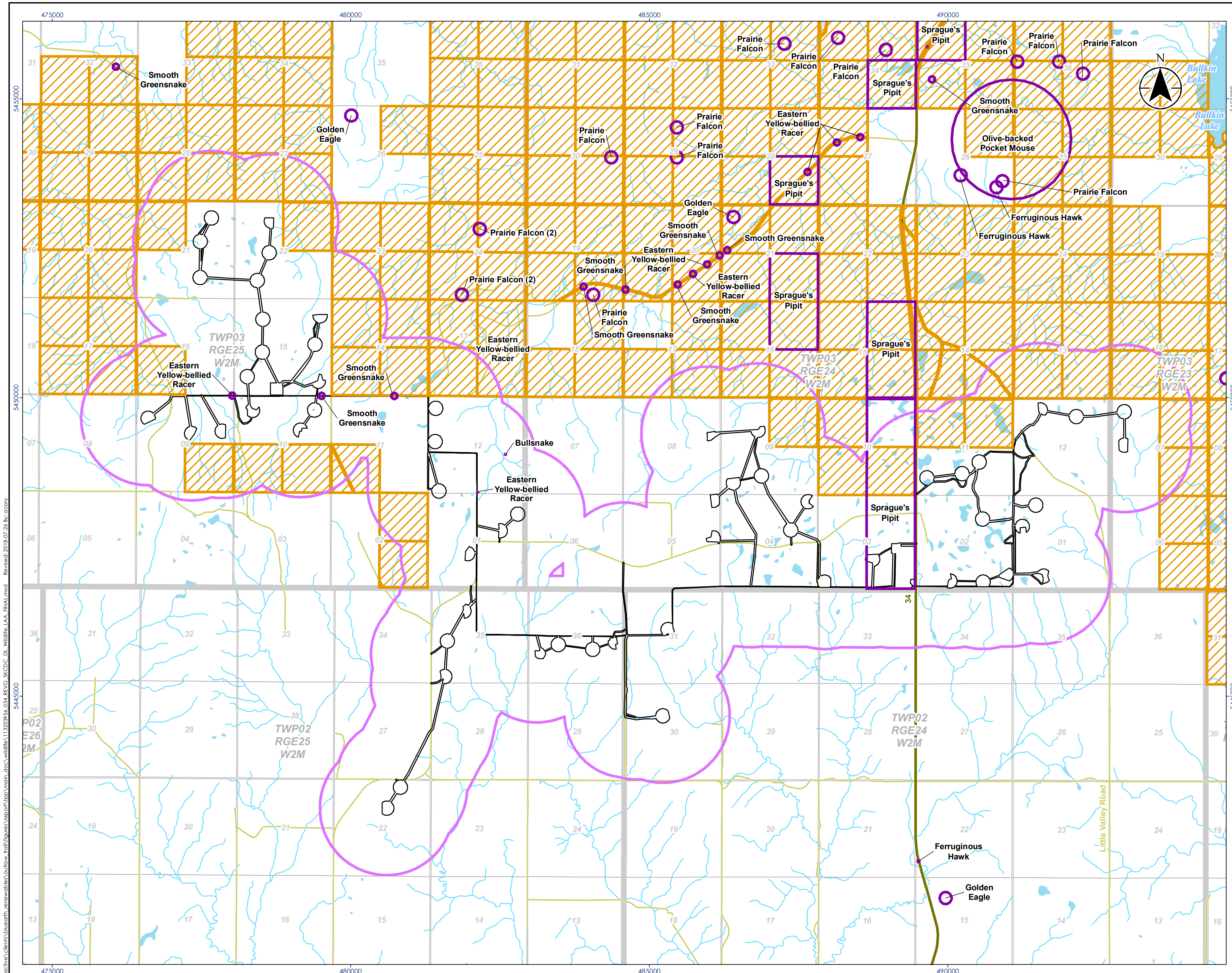
5.4.2.1 Desktop Review

The SKCDC database was searched on March 22, 2018, for historical occurrences of wildlife and designated lands (e.g., protected, sensitive) in the PDA and LAA. Records observed in the PDA and LAA in 2016 were excluded as these are observations that Stantec field crews made during the 2016 biophysical field surveys and are reported as observations in the appropriate results section (e.g., breeding bird survey). SOMCs observed in the PDA or LAA include eastern yellow-bellied racer (*Coluber constrictor flaviventris*), smooth greensnake (*Opheodrys vernalis*), bullsnake (*Pituophis catenifer sayi*)and Sprague's pipit (*Anthus spragueii*) (Table 5-13 and Figure 5-3).

Table 5-13 SKCDC Historical Occurrences of Wildlife SOMC and Designated Lands within the Wildlife and Wildlife Habitat PDA and LAA

Common Name	Scientific Name	No. of occurrences within PDA	No. of occurrences within LAA[1]
Amphibians and Reptiles			
Bullsnake	*Pituophis catenifer sayi*	0	1
Smooth greensnake	*Opheodrys vernalis*	2	0
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*	1	1
Birds			
Sprague's pipit	*Anthus spragueii*	1	0
Designated Lands[2]			
WHPA Lands		0	50

NOTES:
[1] Does not include records found within the PDA.
[2] Number of quarter sections.



Stantec

BluEarth Renewables Inc

- Historical Records of Wildlife Species of Management Concern
- Wildlife Habitat Protection Act Land
- Wildlife Local Assessment Area
- Project Development Area
- Major Road
- Minor Road
- Watercourse
- Waterbody
- Township
- Section

0 1 2 Kilometres

1:65,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license with the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: Layout from BluEarth v3, Jan 22, 2018.

Project Location
Near Coronach, SK

113253956-034 REVG
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
5-3

Title
SKCDC Wildlife Records and Designated Lands within the Wildlife LAA

5.4.2.2 Wildlife Habitat Availability

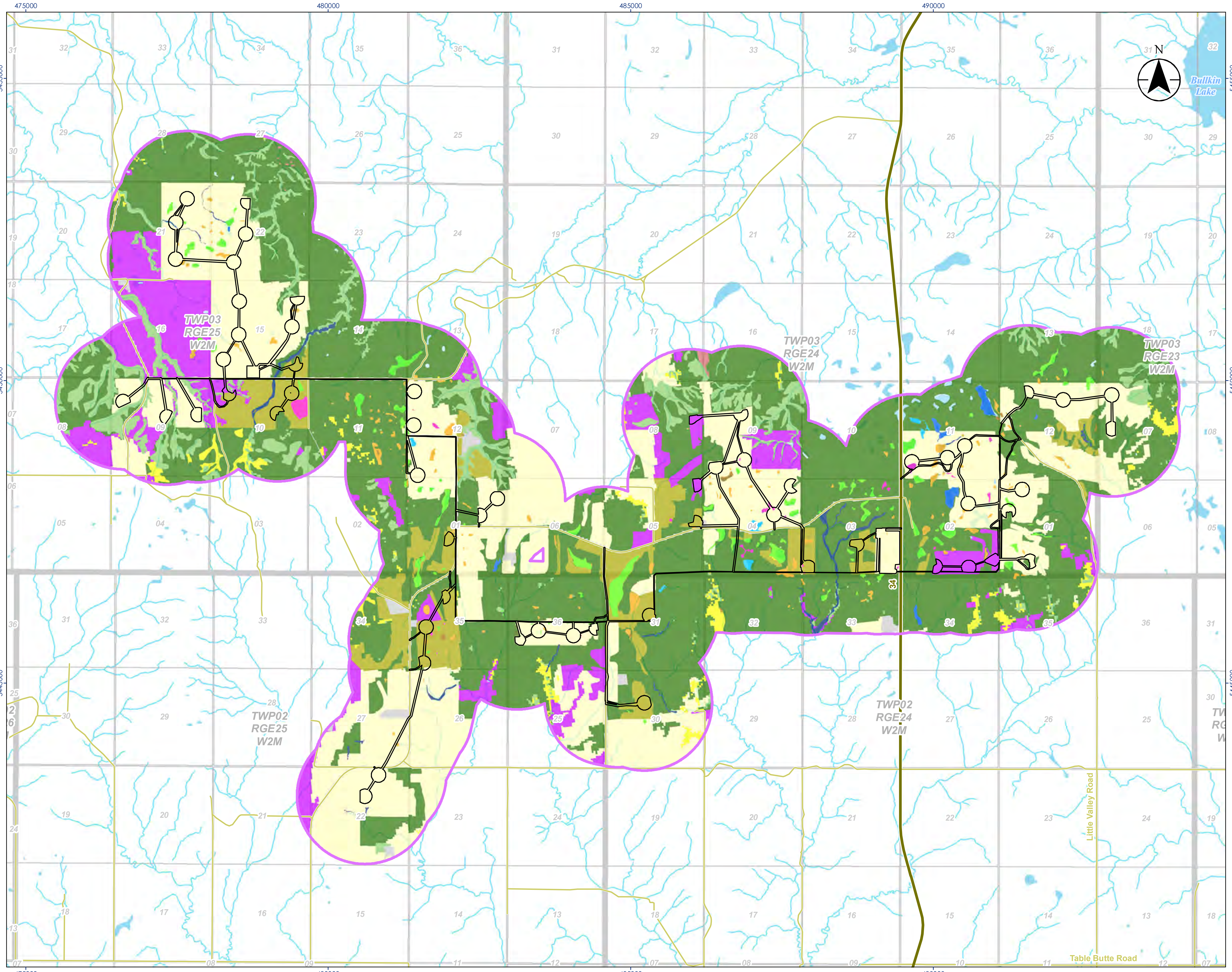
The Project is located in the Mixed Grassland Ecoregion, a semiarid climate, dominated by open grasslands with few trees, of which approximately 50% is under cultivation (Acton et al. 1998).

As described in Section 5.3.1.1, land cover in the PDA and vegetation LAA (see Section 4.1.1 for vegetation spatial boundaries and Table 5-4 for land cover definitions) was mapped using a field-verified version of the AAFC 2016 dataset. The portion of the wildlife LAA that doesn't overlap with the vegetation and wetlands LAA was mapped using non-field verified AAFC 2016 data. Due to the two different datasets used, some land cover categories differ between the PDA and LAA as the AAFC dataset does not differentiate between hayland and tame pasture or divide wetlands to classes. To make comparisons between the PDA and LAA, the land cover data for wetlands (Class I through VI), drainage, and dugout will be referred to in the text as water/wetland, to be the same as it is presented in the AAFC. Similarly, tame pasture and hayland will be discussed as a single land cover type (i.e., tame pasture/hayland) in the PDA and LAA as they are mapped together in the AAFC (see Table 5-13, Table 5-14 and Figure 5-4).

A total of 71 SOMC have the potential to occur within the RAA (Table F.1 in Appendix F). The PDA is primarily sited on previously disturbed lands (e.g., cultivated, hayland). At baseline, 70.2% of the PDA consists of cultivated lands, which provide minimal habitat for wildlife. Siting of the Project has focused on utilizing cultivated lands as much as possible, as evidenced by the proportion of cultivated land in the PDA (70.2%) compared to the LAA (28.5%). Combined, tame pasture and hayland are the second most abundant land cover type in the PDA (20.8%) and provide suitable habitat for 31 SOMCs (Table F.2 in Appendix F). The PDA avoids native grassland and water/wetlands where possible as shown by the relatively small amount of these habitat types (5.8% and 1.5%, respectively) compared with the LAA (46.6% and 3.0%, respectively) (Table 5-13). Native grassland and water/wetland provide suitable habitat for 35 and 43 SOMCs, respectively (Table F.2 in Appendix F).

Table 5-14 Land Cover Classes within the Wildlife and Wildlife Habitat PDA and LAA

Land Cover Class	PDA		LAA	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Water/Wetland	5.7	1.5	276.1	3.0
Developed	5.3	1.4	141.7	1.5
Exposed Land/Barren	0.01	0.01	6.3	0.1
Cultivated	262.5	70.2	2,616.5	28.5
Tame Pasture/Hayland	77.9	20.8	1,210.0	13.2
Native Grassland	21.6	5.8	4,277.5	46.6
Shrubland	0.03	0.01	125.5	1.4
Broadleaf	0.6	0.2	520.2	5.7
Total	**373.7**	**100.0**	**9,173.9**	**100.0**



Stantec
BluEarth Renewables Inc

Land Cover
- Class 1 - Ephemeral Wetland
- Class 2 - Temporary Wetland
- Class 3 - Seasonal Wetland
- Class 4 - Semi-Permanent Wetland
- Class 5 - Permanent Wetland
- Drainage
- Dugout
- Agricultural
- Broadleaf
- Exposed Land / Barren
- Native Grassland
- Hayland
- Tame Pasture
- Shrubland
- Urban/Developed
- Water

- Wildlife Local Assessment Area
- Project Development Area
- Major Road
- Minor Road
- Watercourse
- Waterbody
- Township
- Section

0 1 2 Kilometres
1:65,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 13N
2. Base features used under license with the Government of Saskatchewan and the Government of Canada.
3. Project Development Area: Layout from BluEarth v3, Jan 22, 2018.
4. Land Cover: Mapped by Stantec.

Project Location
Near Coronach, SK

113253956-033 REVG
Prepared by acory on 2018-07-26
Technical Review by kskillen on 2018-07-26

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
5-4

Title
Land Cover Within the Wildlife LAA

5.4.2.3 Field Surveys

5.4.2.3.1 Raptor Nest Surveys

Fourteen stick nests suitable for nesting raptors were detected during aerial surveys in 2015 within the LAA. Of these, nine were occupied and five were unoccupied. Occupied nests consisted of:

- 5 red-tailed (*Buteo jamaicensis*) hawk nests
- 2 great-horned owl (*Bubo virginianus*) nests
- 1 Swainson's hawk (*Buteo swainsoni*) nest
- 1 ferruginous hawk nest

Ground-based raptor surveys were conducted in 2017 within the LAA to determine if any new stick nests were present. No new nests were observed and the ferruginous hawk nest found in 2015 was confirmed as still active in 2017 (see Appendix D). The location of the ferruginous hawk nest (NW-32-02-24-W2M) does not overlap the PDA. The 1 km setback around the ferruginous hawk nest overlaps the PDA but only at the location of overhead and underground collector lines. Construction activities at this location will occur outside of the activity restriction period (March 15 to July 15) and be confined to the construction workspace for those components.

5.4.2.3.2 Bat Activity Surveys

Bat activity survey results are presented in detail in the Pre-Construction Bat Monitoring Report (see Appendix F.1) with a summary presented below. Survey locations are presented in Appendix D.

During the spring monitoring period (April 29 to June 6, 2016), an average of 1.3 total and 0.3 migratory bat passes per detector night were recorded. Over the Alberta ESRD (2013b) fall monitoring period (August 1 – September 10), on average, 2.0 migratory bat passes per detector night were recorded at high detectors in 2015 and 2.4 migratory bat passes per detector night were recorded at high detectors in 2016 (Table 5-15).

Myotis species and the big brown/silver-haired bat grouping were the most common species/species grouping of bats observed during all three monitoring periods.

Topography and landscape vegetation characteristics are likely to be the main contributing factors to detected bat activity rates as higher bat activity rates were recorded at detectors located closer to the Big Muddy Valley. The forested coulees of the Big Muddy Valley may provide suitable roosting and foraging habitat for bats and the valley itself may serve as a potential migration corridor.

Table 5-15 Summary Table of Acoustic Bat Activity Survey Results

Acoustic Bat Activity Surveys	Fall 2015[1]	Spring 2016[1]	Fall 2016[1]
Total Bat Passes Per Detector Night (Aug 1 to Sep 10) (all detectors)	8.5	N/A[2]	7.1
Migratory Bat Passes Per Detector Night (Aug 1 to Sep 10) (all detectors)	3.3	N/A	2.9
Migratory Bat Passes Per Detector Night (Aug 1 to Sep 10) (high detectors only)[3]	2.0	N/A	2.4
Total Bat Passes Per Detector Night (full monitoring period) (all detectors)	6.1	1.3	7.5
Migratory Bat Passes Per Detector Night (full monitoring period) (all detectors)	2.4	0.3	3.0
Migratory Bat Passes Per Detector Night (full monitoring period) (high detectors only)	1.6	0.2	2.4

NOTES:
[1] Values represent average bat pass per detector night for all detectors, based on total bat passes per night divided by the number of nights the detectors were functional.
[2] N/A – Not applicable to spring monitoring period as these rows present data for the Alberta fall monitoring period of August 1 to September 10 only.
[3] Survey results from high detectors for the fall monitoring period of August 1 to September 10 are those compared to the Alberta Framework's bat activity threshold categories outlined in ESRD 2013b (see Section 5.4.1.3.2).

5.4.2.3.3 Bird Movement Surveys

Within the LAA (Sites 1-5 and 8), a total of 650 individuals from 41 species of birds were recorded during the spring bird movement surveys (Table 5-16) and a total of 2,240 individuals from 31 species of birds were recorded during the fall bird movement surveys (Table 5-17).

Within the LAA, Sites 3 and 5 had the most observations during spring (171 [26.3%] and 262 [40.3%] individuals, respectively) and fall (909 [40.6%] and 528 [23.6%] individuals, respectively) bird movement surveys (Table 5-16 and Table 5-17). The high number of birds at these sites was due to a large flock of horned larks (*Eremophila alpestris*) in the spring and large flocks of American crows (*Corvus brachyrhynchos*) in the fall. The majority of observations made during bird movement surveys were landbirds with 483 individuals (74.3%) in the spring (Table 5-16) and 1,842 individuals (82.2%) in the fall (Table 5-17). The second most abundant guild was waterfowl (89 individuals [13.7%] in the spring and 317 individuals [14.2%] in the fall), followed by raptors (50 individuals [7.7%] in the spring and 64 individuals [2.9%] in the fall) (Table 5-16 and Table 5-17).

During spring, the most abundant species observed in the LAA were horned lark, American crow, and red-winged blackbird (*Agelaius phoeniceus*) (250, 60, and 46 individuals, respectively); four SOMCs were detected including long-billed curlew (*Numenius americanus*), ferruginous hawk, barn swallow (*Hirundo rustica*), and Sprague's pipit (*Anthus spragueii*) (Table 5-16). During fall, the most abundant species in the LAA were American crow, Canada goose

(*Branta canadensis*), and western meadowlark (*Sturnella neglecta*) (543, 153, and 122 individuals, respectively); four SOMCs were detected including ferruginous hawk, common nighthawk, barn swallow, and lark bunting (*Calamospiza melanocorys*) (Table 5-17).

At the control sites (Sites 6 and 7), a total of 265 individuals from 28 species were recorded during the spring bird movement surveys (Table 5-16) and a total of 202 individuals from 15 species were recorded during the fall bird movement surveys (Table 5-17). Site 7 had the most observations during both spring and fall (194 and 113 individuals, respectively). In the spring, the majority of observations made during bird movement surveys were waterbirds in the spring (132 individuals, 49.8%), followed by landbirds (85 individuals, 32.1%) (Table 5-16 and Table 5-17). In the fall, the majority of observations were landbirds (140 individuals, 69.3%) (Table 5-16 and Table 5-17), followed by waterfowl (34 individuals, 16.8%) (Table 5-16 and Table 5-17).

During spring, the most abundant species at the control sites was Franklin's gull (Leucophaeus pipixcan); two SOMC were detected including ferruginous hawk and barn swallow (Table 5-16). During fall, the most abundant species were rock dove (*Columba livia*) and western meadowlark (Table 5-17).

Table 5-16 Avian Species Observed during the Spring 2016 Bird Movement Surveys

Common Name[1]	Scientific Name	No. of Individuals Observed							
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6[2]	Site 7[2]	Site 8
WATERFOWL GUILD[3]									
Tundra swan	*Cygnus columbianus*	0	0	0	0	7	0	0	0
Canada goose	*Branta canadensis*	0	0	4	2	0	0	7	0
Northern shoveler	*Spatual clypeata*	0	0	0	4	0	0	0	0
Gadwall	*Mareca strepera*	0	0	0	3	0	0	0	0
American wigeon	*Mareca americana*	0	0	0	3	0	0	0	0
Mallard	*Anas platyrhynchos*	0	0	3	21	3	3	11	0
Northern pintail	*Anas acuta*	0	0	1	8	0	0	0	0
Green-winged teal	*Anas crecca*	0	0	0	2	0	0	0	0
Duck spp.	*n/a*	0	0	21	5	2	0	0	0
Waterfowl Total		**0**	**0**	**29**	**48**	**12**	**3**	**18**	**0**
WATERBIRD GUILD[4]									
Double-crested cormorant	*Phalacrocorax auritus*	0	0	0	0	2	0	0	0
Franklin's gull	*Leucophaeus pipixcan*	0	0	0	1	0	0	130	0
Ring-billed gull	*Larus delawarensis*	0	0	0	1	0	0	0	0
California gull	*Larus californicus*	0	0	0	1	0	0	0	0

Common Name[1]	Scientific Name	No. of Individuals Observed							
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6[2]	Site 7[2]	Site 8
Tern spp.	*n/a*	0	0	0	4	0	0	2	0
Waterbird Total		**0**	**0**	**0**	**7**	**2**	**0**	**132**	**0**
SHOREBIRD GUILD[5]									
Killdeer	*Charadrius vociferus*	0	0	2	1	0	0	0	0
Long-billed curlew	***Numenius americanus***	**1**	**0**	**11**	**0**	**0**	**0**	**0**	**0**
Marbled godwit	*Limosa fedoa*	0	0	0	2	0	0	0	0
Wilson's snipe	*Gallinago delicata*	0	0	0	0	0	0	2	0
Wilson's phalarope	*Phalaropus tricolor*	0	0	0	2	0	0	0	0
Shorebird Total		**1**	**0**	**13**	**5**	**0**	**0**	**2**	**0**
RAPTOR GUILD									
Turkey vulture	*Cathartes aura*	0	1	0	0	1	2	0	0
Northern harrier	*Circus hudsonius*	3	1	0	2	3	3	0	9
Swainson's hawk	*Buteo swainsoni*	1	0	4	3	2	3	4	2
Red-tailed hawk	*Buteo jamaicensis*	0	2	2	0	0	1	0	0
Ferruginous hawk	***Buteo regalis***	**0**	**0**	**0**	**1**	**3**	**0**	**1**	**0**
Hawk spp.	*n/a*	3	0	2	0	1	1	3	1
Golden eagle	*Aquila chrysaetos*	0	0	0	0	0	1	0	0
American kestrel	*Falco sparverius*	0	0	0	0	0	4	1	0
Merlin	*Falco columbarius*	0	0	0	1	0	0	0	0
Prairie falcon	*Falco mexicanus*	0	0	0	0	0	1	0	0
Raptor spp.	*n/a*	0	0	0	0	2	0	0	0
Raptor Total		**7**	**4**	**8**	**7**	**12**	**16**	**9**	**12**
LANDBIRD GUILD[6]									
Sharp-tailed grouse	*Tympanuchus phasianellus*	1	0	0	0	1	0	0	0
Ring-necked pheasant	*Phasianus colchicus*	0	0	0	0	2	0	0	0
Mourning dove	*Zenaida macroura*	1	0	0	0	0	0	0	0
Rock pigeon	*Columba livia*	0	0	0	0	0	14	0	0
Black-billed magpie	*Pica hudsonia*	0	1	0	0	0	1	0	0
American crow	*Corvus brachyrhynchos*	0	2	57	1	0	6	0	0
Common raven	*Corvus corax*	0	1	2	0	0	1	0	1
Horned lark	*Eremophila alpestris*	3	17	9	12	205	0	7	4
Barn swallow	***Hirundo rustica***	**1**	**0**	**0**	**1**	**0**	**0**	**2**	**2**

Common Name[1]	Scientific Name	No. of Individuals Observed							
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6[2]	Site 7[2]	Site 8
American robin	*Turdus migratorius*	0	0	0	0	1	0	0	0
European starling	*Sturnus vulgaris*	0	0	2	0	0	5	0	0
Sprague's pipit	***Anthus spragueii***	**1**	**2**	**0**	**0**	**2**	**0**	**0**	**0**
Vesper sparrow	*Pooecetes gramineus*	3	1	0	0	1	0	1	0
Savannah sparrow	*Passerculus sandwichensis*	1	0	0	0	0	0	1	0
Western meadowlark	*Sturnella neglecta*	3	2	2	3	3	6	7	2
Red-winged blackbird	*Agelaius phoeniceus*	0	0	29	9	8	0	1	0
Brewer's blackbird	*Euphagus cyanocephalus*	0	8	3	2	1	3	6	0
Brown-headed cowbird	*Molothrus ater*	5	3	0	0	5	0	0	0
Blackbird spp.	*n/a*	2	2	6	4	5	7	3	1
Common grackle	*Quiscalus quiscula*	0	0	3	4	0	7	0	3
Songbird spp.	*n/a*	2	2	8	1	2	2	5	12
Landbird Total		**23**	**41**	**121**	**37**	**236**	**52**	**33**	**25**
Total		**31**	**45**	**171**	**104**	**262**	**71**	**194**	**37**

NOTES:

[1] Bold names indicate an SOMC.

[2] Control sites which are outside of the Project area.

[3] Waterfowl guild includes ducks, geese and swans.

[4] Waterbird guild includes grebes, loons, gulls, terns, herons, and pelicans.

[5] Shorebird guild includes wading species such as curlews, plovers, and sandpipers.

[6] Landbird guild includes passerines, corvids, and gamebirds.

Table 5-17 Avian Species Observed during the Fall 2016 Bird Movement Surveys

Common Name[1]	Scientific Name	No. of Individuals Observed							
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6[2]	Site 7[2]	Site 8
WATERFOWL GUILD[3]									
Canada goose	*Branta canadensis*	36	0	3	0	0	3	28	114
Goose spp.	*n/a*	0	0	0	0	0	0	0	140
Blue-winged teal	*Spatula discors*	0	0	5	0	0	0	0	0
Mallard	*Anas platyrhynchos*	0	0	0	1	0	0	0	0
Duck spp.	*n/a*	0	0	6	12	0	3	0	0
Waterfowl Total		**36**	**0**	**14**	**13**	**0**	**6**	**28**	**254**
WATERBIRD GUILD[4]									
Great blue heron	*Ardea herodias*	0	0	0	0	0	0	2	0
Franklin's gull	*Leucophaeus pipixcan*	0	0	0	0	16	0	0	0
Gull spp.	*n/a*	0	0	0	0	1	0	0	0
Waterbird Total		**0**	**0**	**0**	**0**	**17**	**0**	**2**	**0**
RAPTOR GUILD									
Turkey vulture	*Cathartes aura*	0	0	0	0	0	0	1	0
Northern harrier	*Circus hudsonius*	4	0	5	6	4	0	6	2
Sharp-shinned hawk	*Accipiter striatus*	0	1	0	0	0	0	0	0
Cooper's hawk	*Accipiter cooperii*	0	0	2	0	0	1	0	0
Swainson's hawk	*Buteo swainsoni*	8	0	1	2	1	2	0	2
Red-tailed hawk	*Buteo jamaicensis*	2	2	0	0	0	0	2	4
Ferruginous hawk	***Buteo regalis***	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**4**
Hawk spp.	*n/a*	3	0	0	1	3	3	1	0
Golden eagle	*Aquila chrysaetos*	0	0	0	0	0	0	1	0
American kestrel	*Falco sparverius*	0	1	0	0	0	0	0	0
Merlin	*Falco columbarius*	1	0	1	0	0	0	0	1
Raptor spp.	*n/a*	0	1	1	0	0	4	3	1
Raptor Total		**18**	**5**	**10**	**9**	**8**	**12**	**14**	**14**
LANDBIRD GUILD[5]									
Sharp-tailed grouse	*Tympanuchus phasianellus*	0	6	0	5	19	0	8	2
Ring-necked pheasant	*Phasianus colchicus*	0	0	0	0	1	0	0	0
Mourning dove	*Zenaida macroura*	1	0	1	0	34	0	0	8

Common Name[1]	Scientific Name	No. of Individuals Observed							
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6[2]	Site 7[2]	Site 8
Rock pigeon	*Columba livia*	0	0	0	0	0	58	0	2
Common nighthawk	***Chordeiles minor***	**0**	**0**	**5**	**0**	**1**	**0**	**0**	**0**
Northern flicker	*Colaptes auratus*	0	1	0	0	0	0	0	0
Black-billed magpie	*Pica hudsonia*	0	0	6	9	3	0	0	0
American crow	*Corvus brachyrhynchos*	0	6	380	0	156	0	2	1
Horned lark	*Eremophila alpestris*	0	6	61	20	0	0	9	4
Barn swallow	***Hirundo rustica***	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Swallow spp.	*n/a*	0	12	0	0	0	0	0	2
House wren	*Troglodytes aedon*	0	1	0	0	0	0	0	0
American robin	*Turdus migratorius*	0	57	0	0	1	0	0	0
American goldfinch	*Spinus tristis*	0	0	0	0	2	0	0	0
Clay-colored sparrow	*Spizella pallida*	0	0	9	0	0	0	0	4
Vesper sparrow	*Pooecetes gramineus*	2	0	0	0	0	0	0	0
Lark bunting	***Calamospiza melanocorys***	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Savannah sparrow	*Passerculus sandwichensis*	0	0	60	1	0	0	0	0
Western meadowlark	*Sturnella neglecta*	74	0	1	40	3	13	32	4
Red-winged blackbird	*Agelaius phoeniceus*	1	0	15	0	8	0	0	3
Blackbird spp.	*n/a*	0	42	50	0	272	0	0	11
Songbird spp.	*n/a*	0	2	297	2	3	0	18	122
Landbird Total		**79**	**133**	**885**	**77**	**503**	**71**	**69**	**165**
Total		**133**	**138**	**909**	**99**	**528**	**89**	**113**	**433**

NOTES:
[1] Bold names indicate an SOMC.
[2] Control sites which are outside of the Project area.
[3] Waterfowl guild includes ducks, geese and swans.
[4] Waterbird guild includes grebes, loons, gulls, terns, herons, and pelicans.
[5] Landbird guild includes passerines, corvids, and gamebirds.

5.4.2.3.4 Breeding Bird Surveys

A total of 1,065 individuals and 46 species were recorded during the 2016 and 2017 surveys (Table 5-18). Eight SOMC were observed in the PDA and LAA including: long-billed curlew, common nighthawk, barn swallow, Sprague's pipit, chestnut-collared longspur (*Calcarius ornatus*), Baird's sparrow (*Ammodramus bairdii*), lark bunting, and bobolink (*Dolichonyx oryzivorus*) (see Appendix D).

Table 5-18 2016 and 2017 Breeding Bird Survey Results

Common Name[1]	Scientific Name	No. of Individuals Observed per Land Cover[2]			
		Native Grassland	Cultivated	Mixed Perennial[3]	Mixed Cultivated and Perennial[4]
Blue-winged teal	*Spatula discors*	2	0	0	0
American wigeon	*Mareca americana*	4	0	0	0
Mallard	*Anas platyrhynchos*	4	0	0	2
Lesser scaup	*Aythya affinis*	1	0	0	0
Killdeer	*Charadrius vociferus*	1	1	0	9
Upland sandpiper	*Bartramia longicauda*	1	0	0	3
Long-billed curlew	***Numenius americanus***	**0**	**2**	**0**	**2**
Marbled godwit	*Limosa fedoa*	0	0	1	0
Wilson's snipe	*Gallinago delicata*	2	0	0	0
Willet	*Tringa semipalmata*	1	0	2	0
Ring-necked pheasant	*Phasianus colchicus*	0	0	0	2
Sharp-tailed grouse	*Tympanuchus phasianellus*	37	0	0	5
Mourning dove	*Zenaida macroura*	1	0	0	4
Common nighthawk	***Chordeiles minor***	**0**	**0**	**0**	**1**
Northern flicker	*Colaptes auratus*	0	0	1	1
Least flycatcher	*Empidonax minimus*	3	0	0	6
Eastern kingbird	*Tyrannus tyrannus*	4	0	0	19
Horned lark	*Eremophila alpestris*	6	6	0	73
Tree swallow	*Tachycineta bicolor*	3	0	0	1
Barn swallow	***Hirundo rustica***	**0**	**0**	**0**	**1**
House wren	*Troglodytes aedon*	1	0	0	0
American robin	*Turdus migratorius*	1	0	0	4
Gray catbird	*Dumetella carolinensis*	0	1	0	1
Brown thrasher	*Toxostoma rufum*	2	0	0	2
Sprague's pipit	***Anthus spragueii***	**34**	**0**	**4**	**11**
American goldfinch	*Spinus tristis*	4	0	1	9

Common Name[1]	Scientific Name	No. of Individuals Observed per Land Cover[2]			
		Native Grassland	Cultivated	Mixed Perennial[3]	Mixed Cultivated and Perennial[4]
Chestnut-collared longspur	***Calcarius ornatus***	**0**	**0**	**0**	**1**
Spotted towhee	*Pipilo maculatus*	2	0	0	0
Clay-colored sparrow	*Spizella pallida*	37	0	5	78
Vesper sparrow	*Pooecetes gramineus*	22	2	5	69
Lark bunting	***Calamospiza melanocorys***	**3**	**0**	**0**	**8**
Savannah sparrow	*Passerculus sandwichensis*	26	0	10	42
Grasshopper sparrow	*Ammodramus savannarum*	39	0	10	26
Baird's sparrow	***Ammodramus bairdii***	**42**	**0**	**10**	**32**
Le Conte's sparrow	*Ammodramus leconteii*	0	0	1	1
Song sparrow	*Melospiza melodia*	2	2	0	2
Bobolink	***Dolichonyx oryzivorus***	**9**	**0**	**12**	**8**
Western meadowlark	*Sturnella neglecta*	38	1	11	83
Brown-headed cowbird	*Molothrus ater*	9	0	2	27
Red-winged blackbird	*Agelaius phoeniceus*	11	1	0	18
Brewer's blackbird	*Euphagus cyanocephalus*	5	1	0	28
Ovenbird	*Seiurus aurocapilla*	0	0	0	1
Common yellowthroat	*Geothlypis trichas*	1	0	0	0
Black-and-white warbler	*Mniotilta varia*	0	0	0	1
Yellow warbler	*Setophaga petechia*	9	1	0	22
Chestnut-sided warbler	*Setophaga pensylvanica*	0	0	0	2
Total		**367**	**18**	**75**	**605**

NOTES:

[1] Bold names indicate an SOMC.

[2] To accurately document breeding birds in a grassland environment, the following BBS data was excluded from the final dataset: a) pelicans, cormorants, geese, gulls, terns, raptors, and corvids because these species have large territories or habitually feed far from their breeding territory; b) duplicate observations between the 1st and 2nd five-minute survey period to avoid double counting; c) unknown species; d) all fly-by observations; and e) observations located outside the 100 m observation radius; these observations are considered incidentals.

[3] Habitat was mixed perennial cover (i.e., native grassland, tame pasture, and/or hayland).

[4] Habitat was mixed perennial cover and cultivated (i.e., annual crop).

5.4.2.3.5 Burrowing Owl Surveys

No burrowing owls were detected during the 2016 or 2017 surveys.

5.4.2.3.6 Common Nighthawk and Short-eared Owl Surveys

A total of seven common nighthawks and one short-eared owl were detected during the 2016 surveys (see Appendix D).

5.4.2.3.7 Sharp-tailed Grouse Lek

Ten leks were observed within the LAA (see Appendix D). None of the leks overlap the PDA; however, the 400 m setback for six of the 10 leks overlaps the PDA. Two leks (SW-31-02-24-W2M, and SE-04-03-24-W2M) have a 400 m setback that overlap access roads and collector lines, and two leks (SE-35-02-25-W2M, NW-33-02-24-W2M) have setbacks that overlap collector lines only. There are two leks in SW-01-03-25-W2M and SE-02-03-24-W2M whose setback overlap access roads, collector lines and temporary workspaces around WTGs. No WTG locations are within the 400 m setback of any lek. Construction activities within the 400 m setback will occur outside of the activity restriction period (March 15 to May 15) and will be confined to the construction workspace.

5.4.2.3.8 Amphibian Surveys

A total of five breeding ponds for northern leopard frogs were detected during the 2017 surveys. The breeding ponds are not affected by the PDA; however, the 500 m setback around each breeding pond overlaps the following components of the PDA: WTGs pads, temporary workspaces, access roads, and underground and overhead collector lines. Construction activities at these locations will be confined to the construction workspace.

5.4.2.3.9 Yellow Rail Surveys

No yellow rails were detected during the 2016 surveys.

5.4.2.3.10 Incidental Wildlife SOMC Observations

A total of 11 wildlife SOMCs were detected as incidental observations in the LAA during the 2016 and 2017 targeted wildlife, vegetation community, or wetland surveys (see Table 5-19).

Table 5-19 Incidental Observations of Wildlife SOMC during 2016 and 2017 Surveys

Common Name	Scientific Name	No. of Individuals in the Wildlife and Wildlife Habitat LAA
Herptiles		
Northern leopard frog	*Lithobates pipiens*	2
Birds		
Osprey	*Pandion haliaetus*	1
Ferruginous hawk	*Buteo regalis*	1
Red-necked phalarope	*Phalaropus lobatus*	1
Long-billed curlew	*Numenius americanus*	10
Common nighthawk	*Chordeiles minor*	5
Barn swallow	*Hirundo rustica*	3
Sprague's pipit	*Anthus spragueii*	51
Baird's sparrow	*Ammodramus bairdii*	10
Bobolink	*Dolichonyx oryzivorus*	30

5.4.3 Effects Pathway and Mitigation Strategies

This section addresses the potential effects of the Project on wildlife and wildlife habitat. Potential effects may include a change in wildlife habitat availability and a change in wildlife mortality risk. The effect pathways of these two potential effects are described below.

5.4.3.1 Change in Wildlife Habitat

A change in wildlife habitat availability can occur through direct and indirect habitat loss. Direct habitat loss can occur when there is a change in land cover that converts suitable wildlife habitat (e.g., native prairie) into unsuitable wildlife habitat (e.g., developed). Indirect habitat loss can occur through sensory disturbances (e.g., noise) that cause wildlife to avoid areas that would otherwise be suitable wildlife habitat.

5.4.3.1.1 Construction

Construction activities, including site preparation (e.g., stripping of the sod and seedbank) for the WTGs, temporary workspaces, access roads, substations, and collector lines, will result in direct habitat loss.

Indirect habitat loss caused by sensory disturbances associated with construction activities such as increased vehicle traffic, heavy equipment operation, light and noise, may result in reduced habitat effectiveness and wildlife avoidance. These disturbances are temporary in nature. If construction activities occur during the spring and/or summer, the breeding and rearing success for some wildlife species may be affected (Bayne et al. 2008, Frances and Barber 2013, Habib et al. 2007). Responses are species-specific and vary but may include increased stress, loss of productivity, habitat avoidance, nest abandonment, and changes in local distribution. For example, nesting ferruginous hawks that are exposed to daily human disturbance have been observed flushing from their nest when human activities were at least within 200 m from the nest, while 33% of the disturbed nests were abandoned by the adults (White and Thurow 1985). Male sharp-tailed grouse have shown intolerance to human activities near lek sites by displacing an average of 400 m away from the lek (Baydack 1986).

5.4.3.1.2 Operation and Maintenance

Additional direct habitat loss during the operation and maintenance phase of the Project is not expected to occur. Vegetation regrowth will occur at temporary workspace locations that were disturbed during construction but habitat loss will persist within the LAA due to permanent Project infrastructure (e.g., WTGs, access roads).

Indirect habitat loss may continue to affect wildlife habitat suitability and availability during operation through sensory disturbance. Project facilities (e.g., WTGs) emit noise during operation and may result in avoidance behaviour in some wildlife. Wildlife behavioural changes associated with wind-energy facilities appear to be species- and site-specific. One study of nesting grassland birds found lower densities within 0 to 180 m of WTG with densities decreasing by more than 50% within 50 m of WTGs (Leddy et al. 1999). Another study observed displacement behaviour within 200 m of WTGs for grasshopper sparrows (*Ammodramus savannarum)* and clay-colored sparrows (*Spizella pallida*) but no changes in behaviour for western meadowlarks, chestnut-collared longspur (*Calcarius ornatus*), or killdeer (*Charadrius vociferus*) (Shaffer and Johnson 2008). A third study observed displacement behaviour in seven grassland songbird species with displacement ranging from 100 m to 300 m from WTGs (Shaffer and Buhl 2015). One study in the Prairie Pothole Region (PPR) found that the breeding densities of waterfowl in both agricultural and natural land cover was reduced by a median value of 21% within 804 m of WTGs (Loesch et al. 2013). Conversely, a different study in the PPR found no effect on shorebird or waterbirds using wetlands within 805 m of WTGs (Niemuth et al. 2013).

Disturbances associated with WTGs may also affect the quality of adjacent wetland habitat for wetland-dependent species (e.g., northern leopard frogs, yellow rails). Noise from operating WTGs may mask breeding calls for birds and amphibians and reduce overall reproductive success and increase site abandonment (Narins 1990, Habib et al. 2007).

5.4.3.1.3 Decommissioning

During decommissioning, direct habitat loss is only expected at temporary workspaces. Project infrastructure (e.g., WTGs, substation, access roads) will be decommissioned and removed allowing these previously disturbed areas to revegetate, thereby increasing the amount of wildlife habitat available.

Indirect habitat loss due to sensory disturbances is expected to be similar during decommissioning as those during construction and may result in temporary behavioural changes in wildlife. Wildlife may be displaced and/or abandon habitat due to the noise and light emitted by vehicles and heavy equipment during decommissioning.

5.4.3.2 Change in Wildlife Mortality Risk

5.4.3.2.1 Construction

Direct wildlife mortality could occur during construction due to vegetation clearing and vehicle collisions. Vegetation clearing can result in the destruction of bird nests, burrows, dens, and amphibian overwintering and breeding ponds. Ground nesting birds (e.g., Sprague's pipit, bobolink) are particularly vulnerable during construction activities and mortality may occur if the nest is damaged and/or destroyed (i.e., direct mortality) or abandoned by the adults (i.e., indirect mortality). Species with decreased mobility (e.g., young birds, small mammals, amphibians) are more susceptible to direct mortality as they may not be able to escape construction activities.

The potential for collisions due to increased equipment and vehicle traffic may result in increased wildlife mortality risk. Low-flying birds and bats may be exposed to increased mortality risk through interactions with construction equipment and vehicles during migration (Johnson et al. 2003, Machtans et al. 2013). Animals that undergo seasonal migrations and often cross roads when moving from breeding to overwintering habitat, such as amphibians, can be at greater risk of collision mortality.

Indirect mortality risk is associated with sensory disturbance on the landscape (e.g., noise) that can result in behavioural changes. Some species may move away (displacement) from the disturbance, increasing their predation risk as they leave cover. Displacement may also increase energy expenditure and reduce an individual's survival and reproductive success (Powlesland 2009), as well as decreased survivorship among the young of the year (see Section 5.4.3.1 for more details).

5.4.3.2.2 Operation and Maintenance

Direct mortality can occur during the operation and maintenance phase through collisions with Project infrastructure and vehicles. For terrestrial species like mammals and amphibians (e.g., American badger [*Taxidea taxus taxus*], northern leopard frog) changes in mortality risk are associated with maintenance vehicle traffic. The effect pathways are similar to those during the construction phase; however, the mortality risk from vehicle collisions would be lower during operations due to reduced vehicle traffic within the PDA following completion of construction.

The primary mechanism for direct wildlife mortality is collision of birds and bats with towers, nacelles, or revolving blades of WTGs. This effect pathway is described below in the context of birds and bats.

Birds

A review of 43 Canadian wind-energy facilities across a variety of landscapes found bird mortality rates that ranged from 0 to 26.9 birds/turbine/year (corrected for detection bias) with an average mortality of 8.2 ± 1.4 (95% CI) (Zimmerling et al. 2013). Within the review, five Saskatchewan wind-energy facilities averaged 10.1 birds/turbine/year and 26 Alberta facilities averaged 4.5 birds/turbine/year (Zimmerling et al. 2013). A review of mortality monitoring studies by Bird Studies Canada (BSC et al. 2017) found the average non-raptor bird mortality rate in Alberta to be 2.34 ± 0.40 birds/turbine/year.

Passerines represent the majority of bird fatalities at North American wind-energy projects (62.5%, Erickson et al. 2014; 69.8%, BSC et al. 2017). These numbers are roughly representative of the proportion of birds in North America which are passerines. Most passerine fatalities consist of nocturnal migratory songbirds (Kingsley and Whittam 2005, Erickson et al. 2014, AWWI 2014), in part because they are the most abundant species in the landscapes that host wind-energy facilities, but also because of their tendency to migrate at altitudes that may interact with the WTG rotor-swept area (National Academy of Sciences 2007). The mortality risk of wind-energy projects for grassland songbirds such as Sprague's pipit, loggerhead shrike, and chestnut-collared longspur have not been directly studied. None of these species were reported in the Bird Studies Canada (BSC et al. 2017) species list. Of the mortality monitoring data available for projects operating within the breeding range of Sprague's pipits, none have reported finding any fatalities, despite the monitoring program at Judith Gap recording the presence of Sprague's pipit during breeding bird surveys (TRC Environmental Corporation 2008). However, species which have aerial courtship displays (e.g., horned lark, vesper sparrow, bobolink) may be at a higher risk of collision if the display occurs within the rotor swept area (Kerlinger and Dowdell 2003). Indeed, horned larks represented 28.2% of all mortalities recorded in Alberta and vesper sparrows accounted for an additional 4.8% (BSC et al. 2017).

After passerines, the greatest number of bird fatalities at wind-energy facilities consist of raptors, waterbirds, and waterfowl, with shorebirds accounting for 1% of fatalities or less (Erickson et al. 2014, BSC et al. 2017). Several studies have documented avoidance of turbines by raptors, waterfowl, and shorebirds (Johnson et al. 2000, Whitfield 2010, Garvin et al. 2011, Sugimoto and Matsuda 2011). A higher rate of waterfowl fatalities has been recorded in Alberta compared to across Canada (13.5% vs. 2.7%, BSC et al. 2017); this increased rate was almost entirely due to mallards (*Anas platyrhyncos*) which accounted for 11.7% of fatalities (BSC et al. 2017). This is likely due to the fact that mallards are the most abundant duck species in North America and forage in fields, which may increase their potential interactions with turbines.

Topography and landscape features (e.g., ridges, steep slopes, valleys, shorelines) can concentrate bird movement during migration and lead to an increased level of interaction between turbines and birds (Kingsley and Whittam 2005). Generally, wind-energy facilities located within grassland landscapes have relatively lower bird and bat mortality rates than facilities located in landscapes with topographic features such as forested ridges and large rivers (Arnett et al. 2007, Arnett et al. 2008, Baerwald and Barclay 2009).

The Project is located on the southern edge of the Big Muddy Valley which is characterized by a ridge of forested coulees. Control sites for the bird movement surveys were sited along the valley in order to assess if this landscape feature could act as a corridor for migrating birds and therefore have higher number of birds than within the Project area. However, results from the bird movement surveys showed that bird movement rates at the control sites were similar to those within the Project area. Based on the data collected, it appears that the Big Muddy Valley to the north of the Project does not concentrate bird movement during migration. Furthermore, there are no other prominent features on the landscape near the Project area that could serve as a concentration site for birds (e.g., a large body of water) thereby lowering the potential for an increased level of interaction between the Project and birds.

The risk associated with indirect mortality will be similar to the construction phase and primarily related to disturbances from WTGs and maintenance activities. There may be the potential for increased predation as a result of the WTG and infrastructure (e.g., collector line poles) that may be used by perching raptors. However, indirect mortality may actually be reduced as a result of fewer predatory species in the LAA; Francis et al. (2009) reported that in areas with higher noise disturbance, predation rates of songbirds was reduced and nest success was higher because of reduced use of treatment areas by avian nest predators.

<u>Bats</u>

Bat mortality has been extensively studied at wind-energy facilities. The average bat mortality rate from wind-energy projects in Alberta 7.31 ± 1.32 bats/turbine/year (BSC et al. 2017). Zimmerling and Francis (2016) estimated bat mortality in Saskatchewan at 11.7 bats/turbine/year and Alberta at 10.9 bats/turbine/year. Across Canada, approximately 68.5% of bat fatalities are migratory bats (e.g., eastern red bat, hoary bat, silver-haired bat) (BSC et al. 2017). In Alberta, 94.4% of bat mortalities are migratory species of which 43.5% are hoary bats and 50.5% are silver-haired bats (BSC et al. 2017). Due to the devastating effects of white-nosed syndrome, there is increased concern about mortalities to susceptible resident bat populations which appear to have the less risk of mortality from collisions with wind-energy facilities than do migratory bat populations.

Environmental conditions can increase bat mortality risk. Nights with light to no wind (i.e., wind speed less than 6 m/s), when aerial insects are more active, have documented higher mortality rates (Arnett et al. 2008, Kunz et al. 2007). Horn et al. (2006) also indicated that blade rotational speed was a significant negative predictor of collisions with turbine blades, suggesting that bats may be at higher activity rate on nights with low wind speeds when turbines are typically not active, which would mitigate for mortality risk. The majority of bat fatalities across Canada occur between July and September with a peak in mid-August to early-September (BSC et al. 2017).

5.4.3.2.3 Decommissioning

During decommissioning, the effect mechanisms associated with direct and indirect mortality risk to wildlife are similar to those during the construction phase. Direct mortality may occur through vehicle collisions and indirect mortality may occur through temporary sensory disturbances associated with heavy equipment and noise.

5.4.3.3 Mitigation for Change in Wildlife Habitat

Project-specific mitigation measures, along with standard industry practices, best management practices, and avoidance measures will be implemented during the construction, operation and maintenance, and decommissioning phases to reduce the potential effects on wildlife habitat.

Direct habitat loss will be reduced through mitigation measures employed during construction to reduce the loss of native land cover types (see Section 5.3.3.2.1). Indirect habitat loss due to sensory disturbances will be mitigated by timing construction outside of the bird nesting season (April 26 to August 15) (ECCC 2017) and following any additional timing and setback restrictions as outlined in the SK MOE Activity Restriction Guidelines for Sensitive Species (SK MOE 2017b) when possible.

If construction cannot avoid the nesting season, vegetation clearing activities will take place prior to the nesting season or pre-construction surveys (e.g., nesting bird surveys) will be completed by a qualified environmental monitor prior to the start of construction activities. If an active nest is found, BluEarth will consult with the SK MOE to identify appropriate mitigation measures including species-specific setback distances and activity timing restrictions as outlined by the SK MOE (2017b).

5.4.3.4 Mitigation for Change in Wildlife Mortality Risk

Strategies to mitigate the potential for change in wildlife mortality risk associated with habitat loss are discussed in Section 5.4.3.3. Change in wildlife mortality risk will also be mitigated by establishing vehicle speed limits on access roads to reduce the potential of vehicle collisions.

Mitigations to reduce or avoid wildlife mortality risk due to collisions with Project infrastructure begins with Project siting during the planning phase. Sensitive habitat types, such as wetlands and native grassland, that are associated with wildlife SOMCs were avoided where possible during siting of Project infrastructure. Additionally, sensitive wildlife features (e.g., sharp-tailed grouse lek, ferruginous hawk nest) were identified during field surveys are avoided by the PDA and outside of the recommended activity restriction setback where possible. Where the PDA overlaps an activity restriction setback, potential effects to a feature will be mitigated through the implementation of seasonal timing restrictions for construction.

Mitigation measures to be implemented during operation will be determined through post-construction mortality monitoring and will be determined in consultation with SK MOE.

5.4.4 Summary of Residual Effects

5.4.4.1 Change in Wildlife Habitat

5.4.4.1.1 Construction

Direct habitat loss will include both permanent and temporary disturbances. Permanent habitat loss will occur at the WTG pads, permanent access roads, overhead collector line, and the substation; these components are primarily located on cultivated lands which provide less suitable habitat for wildlife SOMC. Permanent habitat loss in the PDA will be 66.2 ha (17.7%) (Table 5-20). Temporary workspaces, access roads (construction), underground collector lines, and turbine laydown areas are considered temporary disturbances as these areas will be reclaimed once construction is completed. Temporary habitat loss for the PDA will be 307.6 ha (82.3%) (Table 5-20).

Approximately 21.6 ha (5.8%) of native grassland will be affected during construction (Table 5-20). Native grassland provides suitable habitat for 35 wildlife SOMC including Sprague's pipit, chestnut-collared longspur, and smooth greensnake (see Table E.2). A further 21.3 ha (4.9%) of tame pasture will be disturbed during construction (Table 5-20). Tame pasture provides suitable habitat for 31 wildlife SOMC including bobolink, burrowing owl, and American badger (see Table E.2).

Indirect habitat loss due to sensory disturbance will occur in the PDA during construction.

Table 5-20 Area of Project Components by Land Cover Class in the PDA

Land Cover	WTG Pad (ha)	Temporary Workspace (ha)	Access Roads (Construction) (ha)	Access Roads (Operation) (ha)	Substation (ha)	Collector Lines (Underground) (ha)	Collector Lines (Overhead) (ha)	Turbine Laydown (ha)	Total (ha)
Water/Wetland	0.0	2.5	0.7	0.6	0.0	1.2	0.7	0.05	**5.7**
Developed	0.0	0.3	1.7	1.8	0.1	1.2	0.1	0.0	**5.3**
Exposed Land/Barren	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	**0.01**
Cultivated	5.3	134.1	22.3	22.0	4.0	48.9	5.2	20.8	**262.5**
Tame Pasture	0.6	12.1	2.4	2.4	0.0	2.2	1.5	0.0	**21.3**
Hayland	1.6	35.5	3.9	3.8	0.0	8.1	3.7	0.0	**56.6**
Native Grassland	0.0	0.0	3.6	3.8	0.0	5.8	8.4	0.0	**21.6**
Broadleaf	0.0	0.0	0.07	0.07	0.0	0.09	0.4	0.0	**0.6**
Shrubland	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	**0.03**
Total	**7.5**	**184.5**	**34.7**	**34.5**	**4.1**	**67.5**	**20.0**	**20.9**	**373.7**

5.4.4.1.2 Operation and Maintenance

No additional direct habitat loss is expected as a result of operation and maintenance activities. The permanent loss of habitat due to Project components such as WTG pads, access roads, and substations will persist during the operational phase.

Indirect habitat loss as a result of sensory disturbance from WTGs will continue throughout operation and maintenance. Based on the literature, the distance at which grassland songbirds experience an effect from sensory disturbance varies, but as a precautionary approach to estimate the effects of sensory disturbance a distance of 200 m was used. Assuming a lower density of birds within 200 m of WTGs, the Project may result in the reduction of habitat availability by 125.0 ha in native grassland and 149.9 ha in tame pasture/hayland. These areas represent approximately 2.9% and 12.4% of their respective land cover classes in the LAA.

5.4.4.1.3 Decommissioning

Change in wildlife habitat availability during the decommissioning phase will be minimal and temporary and the potential effects will be similar to the construction phase.

5.4.4.2 Change in Wildlife Mortality Risk

5.4.4.2.1 Construction

Overall, with the application of mitigation measures, the likelihood of an increase in wildlife mortality risk during construction is low and will not result in a measurable residual effect on wildlife populations within the LAA.

5.4.4.2.2 Operation and Maintenance

During operation and maintenance, the mortality risk to terrestrial wildlife species (e.g., northern leopard frog, American badger) due to collisions with vehicles is less than during construction due to reduced vehicle traffic. Overall, the risk of collisions would be less than the existing risk posed by residential vehicles traveling on rural roads within the Project area since Project vehicles will be limited to 25 km/hr.

Potential residual effects during operation and maintenance is primarily related to bird and bat mortality. The Project is located outside of avoidance zones identified by SK MOE (SK MOE 2017a) and WTGs were sited to avoid native grassland and sensitive wildlife features where possible (e.g., ferruginous hawk nest, sharp-tailed grouse lek) observed in the LAA. Additionally, the Project is not located within, or between, sensitive environmental features (e.g., a river valley, between IBAs) that may cause an elevated mortality risk due to increased movement rates. The Project is primarily sited in cultivated lands (70.2%) which provides less suitable habitat for SOMC.

The majority of bird observations within the LAA were landbirds (74.3% spring, 82.2% fall), followed by waterfowl (13.7% spring, 14.2% fall) and raptors (7.7% spring and 2.9% fall). The bird movement rates observed within the LAA were similar to the bird movement rates found at the control sites outside of the LAA; however, Sites 3 and 5 consistently had higher bird movement rates compared to the other sites in the LAA and the control sites (see Table 5-16 and Table 5-17). The higher abundance of birds at these sites was due to flocks of American crow and blackbird species at both sites during spring and fall, and a flock of horned lark at Site 5 in the spring (see Table 5-16 and Table 5-17). There were no clear movement corridors through the LAA.

Bat activity rates were an average of 0.2 migratory bat passes per detector night during the 2016 spring monitoring period and 2.0 migratory bat passes per detector night in 2015 and 2.4 migratory bat passes per detector night in 2016 during the fall monitoring period (August 1 to September 10) at the elevated detectors. The 2015 and 2016 fall bat activity rates fall within the moderate to high category for migratory bat fatality risk according to Alberta ESRD (2013b).

5.4.4.2.3 Decommissioning

Change in wildlife mortality risk during the decommissioning phase will be minimal and temporary and the potential effects will be similar to the construction phase.

5.5 HERITAGE RESOURCES

This section addresses heritage resources in the context of the Project. In Saskatchewan, heritage resources include Precontact period and Historic period archaeological sites, built heritage sites and structures of historical and/or architectural interest, and palaeontological sites. Heritage resources are the property of the Provincial Crown and are protected under *The Heritage Property Act*. This section outlines the methods and results of the desktop review in addition to identifying potential effect pathways, mitigation strategies, and residual effects. Heritage resources were assessed using desktop information only; no field surveys were required to quantify the existing heritage resources or sensitive lands and assess potential effects of the Project.

5.5.1 Methods

Stantec archaeologists reviewed the Project for heritage sensitivity based on the Heritage Conservation Branch's (HCB) screening criteria and Online Developers' Screening Tool. A heritage referral was then submitted to HCB for review. Since the PDA was not defined at the time of the heritage referral submission, Stantec reviewed and submitted a larger area, i.e., more quarter sections than were expected to be needed for the Project.

When the PDA location was known, Stantec archaeologists reviewed the requirements of the heritage resource review results against the PDA to determine the locations where an HRIA would be required. This determination was made based on the intersection of the PDA with native grassland or previously undisturbed portions of the quarter sections requiring HRIA. The locations where an HRIA would be required will be sent to HCB for approval prior to completing the HRIA.

The HRIA field examination will include pedestrian visual inspection augmented by test excavations. Newly discovered heritage resources will be recorded using Saskatchewan Archaeological Resource Records and assessed. Previously recorded heritage resources in conflict with the Project will be revisited and reassessed to determine current condition and potential effects to the site.

A report of the HRIA assessment will be submitted to the HCB, containing recommendations for previously and newly recorded archaeological sites in conflict with the Project. The HCB determines if further heritage requirements will be issued on a case by case basis.

5.5.2 Existing Conditions

5.5.2.1 Existing Heritage Resources

The heritage screening results determined that 85 quarter sections were considered heritage sensitive and will require an HRIA (See Appendix G for the Heritage Resource Review). Stantec's review of those results against the PDA determined that only 32 quarter section locations require an HRIA – i.e., 53 quarter sections were removed from consideration where the PDA avoided native grassland or was located on previously disturbed areas.

Eight archaeological sites (DhNh-1, 2, 15, 16, 44, 54, 55, and 56) and one palaeontological site (72H03-0003) have been previously recorded in the quarter sections proposed in the heritage referral (Appendix G). Three of the archaeological sites (DhNh-1,15, and 16) and the palaeontological site will be removed from further assessment as the PDA avoids these locations.

The quarter sections requiring an HRIA are listed in Table 5.21.

Table 5-21 Quarter Sections Requiring Heritage Resource Impact Assessments

Quarter Section	Previously Recorded Heritage Resource
SW-36-02-25-W2	
SW-04-03-24-W2	
SE-15-03-25-W2	
SW-01-03-25-W2	
NE-05-03-24-W2	
NE-11-03-25-W2	
SE-02-03-24-W2	
SW-35-02-25-W2	
SW-02-03-24-W2	
NE-10-03-25-W2	
NW-12-03-24-W2	
SW-03-03-24-W2	
NE-31-02-24-W2	
NW-09-03-25-W2	
SW-01-03-24-W2	

Quarter Section	Previously Recorded Heritage Resource
SW-12-03-24-W2	
NW-01-03-24-W2	
SE-03-03-24-W2	
NW-30-02-24-W2	
NE-09-03-25-W2	
NE-01-03-25-W2	
NW-10-03-25-W2	DhNh-2
NW-35-02-25-W2	
SE-36-02-25-W2	
NE-36-02-25-W2	
NE-08-03-24-W2	
SE-35-02-25-W2	
SE-05-03-24-W2	DhNh-54, DhNh-55, DhNh-56
NW-15-03-25-W2	DhNh-44
NW-01-03-25-W2	
NW-11-03-25-W2	
SW-11-03-24-W2	

5.5.3 Effects Pathways and Mitigation Strategies

Heritage resources are a non-renewable resource and context is vital for accurate recording and interpretation of archaeological sites. Construction activities associated with the Project have the potential to negatively affect heritage resources. The weight of heavy equipment can disturb archaeological features by crushing or displacing surficial components. Buried cultural materials such as artefacts and features can be displaced during construction activities.

Operation, maintenance and decommissioning will not interact with heritage resources as disturbance activities will occur on areas previously disturbed during construction.

Archaeologists will complete an HRIA as required by the HCB. If previously unrecorded heritage resources are discovered during the HRIA, avoidance margins will be established and adhered to by the Project, to the satisfaction of the HCB, around any potentially disturbed sites. If avoidance is unfeasible, mitigation deemed appropriate by the HCB must be conducted. Sites of a Special Nature (SSN) are offered explicit protection under Section 64 of the *Heritage Property Act*, and avoidance with appropriate margins is to be determined and executed to the satisfaction of the HCB, is the only option for mitigation.

5.5.4 Summary of Residual Effects

To fulfill the requirements of the *Heritage Property Act*, all heritage resources must be avoided or mitigated fully under the direction of the HCB. Once completed and to the HCB's satisfaction and with written approval, there will be no residual effects of the Project on heritage resources.

5.6 HUMAN ENVIRONMENT

This section addresses the human environment in the context of the Project. The human environment includes geopolitical administrative bodies (e.g., rural municipalities, towns, etc.), land uses, groundwater users, existing infrastructure, noise and visual aesthetics. This section outlines the methods and results of the desktop review in addition to identifying potential effect pathways, mitigation strategies, and residual effects. The human environment component was assessed using available online information only; no field surveys were required to assess potential effects of the Project.

5.6.1 Methods

To characterize the existing conditions of the Project area, provincial and federal databases, aerial imagery and literature sources were reviewed and relevant information summarized below. The following sources of information were reviewed:

- Land cover data from the AAFC (AAFC 2016), and desktop land cover mapping completed for this Project (see Section 5.3.2.2.1);
- Designated lands, mining, landfills, crown layer and coal disposition data from the Representative Areas Network (HabiSask 2017; Saskatchewan Ministry of Economy 2016a, 2016b and 2016c);
- National Road Network (NrCan Geobase 2016a);
- Oil and gas well information from the Vertical Wells Dataset (Saskatchewan Ministry of Economy 2016c);
- Groundwater well data from the Water Well Drillers Report Database (Water Security Agency 2016);
- Population information for the affected areas from the 2016 Community Profiles program (Statistics Canada 2016); and
- Canvec + 50K dataset (NrCan Geobase, 2016b)

The potential impact of WTG noise was assessed using the methods required by Alberta Utilities Commission Rule 012 (AUC 2017). Noise receptors were identified on the landscape, and noise modelling was completed to predict noise levels at each receptor. The Noise Impact Study demonstrates compliance with the noise level limits prescribed by AUC Rule 012.

To provide information about the potential visual impacts of the Project on the viewscape, BluEarth completed visual simulation figures from six pre-selected vantage points. Vantage points are selected based on local communities, primary roads, and points of interest. The VSMs created before and after views of the landscape where turbines locations are proposed at each of the six locations (see Appendix H). The vantage points included (distance in m to nearest turbine):

- Vantage Point 1: Hwy 15 south of Buffalo Gap (6,100 m)
- Vantage Point 2: Community of Big Beaver (8,200 m)
- Vantage Point 3: Highway 34 at point nearest to turbines (302 m)
- Vantage Point 4: along access road to Castle Butte (5,800 m)
- Vantage Point 5: along primary grid road within the Project LAA (414 m)
- Vantage Point 6: Highway 34, south of turbines adjacent to the highway (1,500 m)

Specific locations of the vantage points are found in Appendix H.

5.6.2 Existing Conditions

5.6.2.1 Rural Municipalities and Communities

Two rural municipalities (RMs) are located within the PDA including Happy Valley (RM No. 10) and Hart Butte (RM. No. 11).

Community plans and bylaws set out the policies and future physical, economic and social development of the municipal planning area. Official community plans establish development and conservation objective and policies, assign priorities and set out social and financial guidelines for a community. Zoning bylaws regulate development on individual properties, and serve as a tool to carry out the policies of the office plan.

BluEarth has engaged the RMs of Hart Butte and Happy Valley to determine the permits required for the Project. These will be obtained prior to construction commencing.

Population estimates, based on Statistics Canada (2016), are presented in Table 5-22.

Table 5-22 Population of RMs in PDA and Communities in LAA

RM and Community that intersect the PDA	Community in LAA		Population in 2016 Census
RM of Happy Valley			139
Town of Big Beaver			10
		Sub Total	**149**
RM of Hart Butte			252
	Town of Willow Bunch		272
	Town of Bengough		332
	Town of Assiniboia		2,389
		Sub Total	**2,993**
		Total	**4,037**

5.6.2.2 Land Use

Land use in the PDA and LAA have been defined based on the land cover types described in Table 5-4. The majority (70.2 %) of the PDA currently consists of cultivated land (Table 5-23). Native grassland consists of a small percentage (5.8%) of the PDA. Native grassland was avoided were possible during Project siting. This avoidance is evident when comparing the percent native vegetation in the PDA against the proportion of the land cover within the LAA (40.2%) in native vegetation (Table 5-23).

Table 5-23 Land Use within the Human Environment PDA and LAA

Land Cover Class	PDA [1]		LAA[1]	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Broadleaf	0.6	0.2	2,407.8	1.41
Cultivated	262.5	70.2	64,028.2	37.6
Drainage	0.6	0.2	38.2	0.02
Exposed Land/Barren	0.0	0.0	3,795.1	2.23
Hayland	56.6	15.1	517.8	0.3
Native Grassland	21.6	5.8	68,365.2	40.2
Pasture/Forages[2]	n/a	n/a	21,778.2	12.8
Shrubland	0.0	0.0	581.9	0.34
Tame Pasture	21.3	5.7	494.7	0.3
Urban/Developed	5.3	1.4	2,424.2	1.42
Water[2]	n/a	n/a	4,097.9	2.4
Wetlands	5.1	1.4	1,740.4	1.0
Total	**373.7**	**100.0**	**170,269.6**	**100**

[1] Land cover metrics are based on the desktop mapping.
[2] Data is based on AAFC 2016.

The PDA overlaps 4 quarter sections of leased agricultural crown land; NE-36-02-25-2, NW-31-02-24-2, NW-35-02-25-2, and SE-5-03-24-2. BluEarth will obtain a permit to construct WTGs and infrastructure on these lands from the Ministry of Agriculture.

Within the LAA of Human Environment there were 830 quarter sections of WHPA lands; however, there are no WHPA lands within the PDA. There are no quarter sections of private conservation lands within the PDA or LAA.

5.6.2.3 Groundwater

There are no groundwater wells located within the PDA. Within the LAA (800 m from the PDA), there are 3 groundwater wells. These wells include two used for domestic purposes, and one for research (water test hole) (Table 5-24).

Table 5-24 Groundwater Wells within 800 m of the PDA

Purpose	Well Use	Number of Wells	Location		Land Location
			Northing	Easting	
Research	Water Test Hole	1	5443192	480928	NE-22-002 -25 -W2
Domestic	Withdrawl	1	5446420	480941	NE-34-002 -25 -W2
Domestic	Withdrawl	1	5448794	482517	SE-12-003 -25 -W2
Source: Water Security Agency 2016					

5.6.2.4 Existing Infrastructure

Within the LAA (RMs of Hart Butte and Happy Valley), there are several types of existing infrastructure. These include the following:

- **Oil and Gas Vertical Wells**: there are 36 vertical wells in the LAA, including; 33 abandoned, two planned but cancelled wells, and one abandoned but reentered. The closest is an abandoned well, 181 m from the PDA. The one abandoned but reentered well is 4.8 km from the PDA.
- **Oil and Gas Non-Vertical Wells**: there are 22 non-vertical wells in the LAA, including; 8 planned but cancelled, 5 abandoned, 5 cased, 2 active, 1 abandoned and reentered, and 1 completed. The closest are the active wells, which are in the PDA. The next closest is an abandoned well approximately 3.3 km from the PDA.
- **Paved and gravel roads**: there are 172.4 km paved roads and 836.7 km unpaved roads in LAA.
- **Pits**: there are 6 aggregate pits within the LAA located between 22 m and 23.9 km from the PDA.

- **Mines**: the Poplar River Coal Mine is located approximately 14.5 km to the west of the PDA.
- **Landfills**: the Coronach and Happy Valley RM landfills are located approximately 14.1 and 6.5 km, respectively, from the PDA.
- **Coal Dispositions:** Within the LAA (both RMs) there are 27,493 ha of coal dispositions allocated to 5 companies. The closest coal disposition is 804 m from the PDA.
- **Oil and Gas Dispositions**: Within the LAA, there are 14,082 ha of oil and gas dispositions, with the closest being 950 m from the PDA.

There are no quarries or pipelines within the LAA.

5.6.2.5 Ambient Noise

The Noise Impact Assessment for this Project was conducted to assess the noise effects in accordance with the Alberta Utilities Commission (AUC) Rule 012; Noise Control (AUC 2017).

Project noise effects were predicted at the 13 noise receptors found within the 1.5 km cumulative boundary criteria from the turbines. The predicted cumulative sound levels at the 13 receptors were determined to be in compliance with the AUC Rule 012. The results show that cumulative noise levels including the Project will comply with Permissible Sound Level (PSL) limits at residences as calculated using AUC Rule 012 guidelines. (AUC 2017)

The detailed Noise Impact Assessment is presented in Appendix I.

5.6.2.6 Visual Aesthetics

The Project is located within the Wood Mountain Plateau and Coteau Lakes Upland landscape areas of the Mixed Grassland ecoregion. This landscape area is characterized by extensive areas of native mixed-grass prairie in association with quartzite-covered plateaus and gullied lands containing a variety of grasses and shrubs and trees in depressional areas with more moisture (Acton et al. 1998). Elevations in the Mixed Grassland Ecoreigon range from 450 m in valleys, as at Saskatchewan Landing Provincial Park, to around 1400 m at the transition point between the Mixed Grassland Ecoregion and the Cypress Upland Ecoregion (Government of Canada 2016). The Project is situated in a plateau area of transition, averaging 800 m in elevation.

There are no residences within the PDA. Thirteen (13) residences are located within the Noise LAA (Appendix G)

The PDA is primarily sited on previously disturbed lands (e.g., cultivated, hayland).

5.6.3 Effects Pathways and Mitigation Strategies

5.6.3.1 Change in Land Use

The PDA is predominately cultivated land (70.2%) used for agriculture. Construction activities could temporarily limit access or prevent the use of lands for seasonal farming operations within the PDA. Seasonal farming activities include haying (spring and/or summer) once or twice a season, baling (summer and/or fall) and grazing (seasonal movement of cattle between pastures). Soil management during construction (e.g., topsoil stripping and replacement) may change the soil capability for agriculture (see Section 5.2.3.2). The WTGs, access roads, and substation will remain on the landscape for the duration of the Project, until decommissioning, and will restrict agricultural production in the PDA for that period of time. Overhead electrical lines may provide restricted access for agricultural production during operations. The electrical collection system will remain belowground and overhead for the duration of the Project, until decommissioning. During decommissioning, the WTGs, access roads, and substation, will be removed and the associated land can be reclaimed.

Mitigation measures that will be followed to avoid or reduce the potential change to land use activities during construction and operation and maintenance will be outlined in the EMP and may include:

- Notifying all nearby residents and landowners of the Project schedule before the start of construction to prevent or reduce effects to their farming operations or activities;
- Posting appropriate signage in advance of construction, indicating access restrictions and duration of the restrictions;
- Topsoil handling will adhere to mitigation measures presented in Section 5.2.3 in order to protect agricultural land capability;
- Following mitigation measures to avoid the introduction or spread of weeds as described in Section 5.3.3.3; and,
- Completing reclamation of all disturbed agricultural lands at the end of the construction phase in temporarily disturbed areas.

5.6.3.2 Change in Groundwater

Groundwater use activities, including extraction of water from groundwater wells, occurs through the region. There are no groundwater wells located within the PDA. Within the LAA (800 m from the PDA), there are 3 groundwater wells. These wells include two used for domestic purposes, and one for research (water test hole).

During construction, groundwater dewatering at the foundation excavations may be required. Any regulatory approvals for dewatering activities will be acquired from the Water Security Agency prior to construction. Dewatering activities will be conducted using best management practices and standard industry practice to reduce or avoid any potential effects to groundwater resources in the LAA. Mitigation measures related to groundwater dewatering will be presented in the EMP.

During operations and maintenance, and decommissioning, the Project will not have any effects on groundwater resources as no water taking is anticipated during those phases of development.

5.6.3.3 Change in Existing Infrastructure

As noted in Section 5.6.2.4 there is little existing infrastructure within and close to the PDA. The existing road network will be used to transport people, equipment and materials to the PDA. However, it is expected that there will be only a minimal, short-term increase in traffic volumes during construction, operations and maintenance, and decommissioning. No damage to existing roadways is anticipated however, if damage does occur, it will be remediated to pre-construction condition. Any changes to existing infrastructure will be discussed with service providers, including the RMs, and all necessary permits will be acquired in advance of any changes or temporary modifications.

5.6.3.4 Change in Ambient Noise

Construction and decommissioning noise emissions are expected to be temporary. These interactions will be addressed through standard industry and best management practices.

The results of the predictive modelling indicate the sound levels from the Project are expected to comply with the AUC Rule 012 PSL limits at residences. The mitigation strategy to avoid noise effects during operations is to locate the turbines so as not to exceed noise thresholds.

5.6.3.5 Change in Visual Aesthetics

Alterations to the physical environment associated with the development of the Project have the potential to change the visual aesthetics of the LAA. The Project will have an effect on the viewscape of the LAA during construction and operation and maintenance. The relative visibility of the turbines depends on the particular vantage point on the landscape. Potential disruption to the visual aesthetics of the landscape was not identified as a concern by stakeholders during engagement activities completed to date.

Decommissioning would entail removal of facility components and reclaiming the land to an appropriate condition based on consultation with the landowners and regulatory requirements at that time. Decommissioning will have a positive effect on the change to the visual aesthetics of the LAA relative to operations and maintenance.

5.6.4 Summary of Residual Effects

5.6.4.1 Change in Land Use

During construction, lands within the PDA will be removed from current use. The PDA will occur on approximately 373.7 ha of land, of which 70.2% ha is currently used as cultivated land. Following reclamation at the end of construction, all temporary construction areas should be able to resume previous farming activities.

Following reclamation, the permanent Project infrastructure (i.e., WTGs, access roads, and substation) will require approximately 48.1 ha of land (See Table 5-20). Project components will be in continuous use over the life of the Project. The small area will have a negligible effect to agricultural production in the LAA.

As described in Section 2.6.3, decommissioning would entail removal of facility components and reclaiming the land to an appropriate condition based on consultation with the landowners and regulatory requirements at that time.

5.6.4.2 Change in Groundwater

There are no groundwater wells located within the PDA and only 3 within the LAA (800 m from the PDA). No residual effects to groundwater are anticipated.

5.6.4.3 Change in Existing Infrastructure

Due to the equipment and vehicles required to build the Project existing roadways will experience an increase volume in traffic during construction and the Project may temporarily alter or close existing roads during construction, restricting access to the area by local landowners. The effect is expected to be in localized areas and short-term. No residual effects on existing infrastructure are anticipated.

5.6.4.4 Change in Ambient Noise

Noise from the Project will be in compliance with the AUC Rule 012 requirements. No residual effects to noise are anticipated.

5.6.4.5 Change in Visual Aesthetics

The Project will result in the construction of WTGs which will be additional features on the landscape. Since the surrounding landscape consists of level topography, the WTGs will be visible within the LAA. Residual effects for visual aesthetics are expected during operations and maintenance.

6.0 CUMULATIVE EFFECTS ASSESSMENT

The Project residual effects in Section 5 describe the effects of the Project in the context of the current conditions on the landscape after implementation of mitigation measures. Residual effects with the potential to interact cumulatively with residual environmental effects of other physical activities within the RAA are identified in this section, and the resulting cumulative environmental effects are evaluated. The evaluation considers the interaction of the Project's residual effects with those past and present activities and resource uses and future activities with the RAA (see Section 4.6.1). Contributions of residual effects from these other projects and activities may interact with the Project and are based on publicly available information. Where residual effects from the Project could act cumulatively with those from other projects and physical activities, the cumulative effects are discussed further.

Sections 6.1 and 6.2 discuss potential biophysical and human environment cumulative effects, respectively.

6.1 BIOPHYSICAL CUMULATIVE EFFECTS

6.1.1 Project Effects with Likelihood to Interact Cumulatively

Of the Project biophysical residual effects discussed in Sections 5.2 to 5.5, three are likely to act in a cumulative manner and are discussed in Section 6.1.2. These include:

- Change in native vegetation and wetland abundance and distribution
- Change in wildlife habitat
- Change in wildlife mortality risk

These three effects are measurable for the Project and have potential to act in a cumulative manner with the effects of other existing and proposed projects. Other Project residual effects are not expected to act in a cumulative manner as mitigation measures are expected to reduce the Project's effects to levels that are unlikely to interact with those of other projects or activities.

Projects listed in Table 4-4 have previously resulted or will result in a loss of native vegetation and a corresponding amount of wildlife habitat for SOMC that inhabit this land cover, particularly during construction. As well, future activities or projects will contribute to a change in wildlife mortality risk in the RAA due to the potential for direct mortality during construction and operation. For example, the Poplar River Coal Mine and SaskPower's Outlaw Trail Transmission Interconnection project for this Project present additional mortality risk to birds (See Figure 4-1). These effects could overlap with the mortality risk for the Project.

6.1.2 Cumulative Effects Assessment and Mitigation

Each residual Project effect with potential to act in a cumulative manner is discussed below. Additional mitigation options available to manage cumulative effects are discussed, where appropriate.

6.1.2.1 Cumulative Effect Mechanisms and Mitigation for Change in Native Vegetation and Wetland Abundance and Distribution

The Project will result in a loss or disturbance of approximately 21.6 ha of native grassland (5.8% of the PDA and 0.6% of the LAA; see Table 5-6), and 5.1 ha of wetlands (1.4% of the PDA and 0.1% of the LAA; see Table 5-6). Other past and present projects in the RAA, such as land conversion for agriculture and resource extraction activities, have potential effects on native grassland and wetlands. Future projects, such as the continued expansion of the Poplar River Coal Mine and SaskPower's Outlaw Trail Transmission Interconnection project, will also result in a change in native vegetation and wetland distribution and abundance. The Poplar River Coal Mine Expansion will result in the excavation of 464 ha of native vegetation, including 230 ha of WHPA land and 8 ha of wetlands, and the loss of individuals of six species of provincially at risk plant species (SK MOE 2010). The RAA overlaps with the entire footprint of the Poplar River Coal Mine Expansion area (Figure 4-1). Due to the uncertainty of the specific siting of SaskPower's Outlaw Trail Transmission Interconnection project, the extent to which native vegetation will be affected is difficult to estimate. However, its reasonable to assume that the line will likely follow previously disturbed road allowances where possible.

Most cumulative effects on native vegetation (specifically, native grassland and wetlands) will occur during construction of these projects, with lesser effects remaining during operation. Development projects such as the Poplar River Coal Mine Expansion and SaskPower's Outlaw Trail Interconnection project will be subject to reclamation or natural recovery, as required by their respective approval conditions. The Poplar River Coal Mine project will be undertaking wetland compensation to mitigate impacts to wetlands during operation, revegetate with native species an area in compensation for the native vegetation loss, and transplant and/or collect and plant seeds at suitable sites to mitigate for the loss or rare plants (SK MOE 2010).

The total amount of native vegetation and wetlands affected by the Project and other projects and activities in the RAA is relatively small. As such, the cumulative effects on native vegetation and wetland abundance and distribution can be addressed through mitigation.

6.1.2.2 Cumulative Effect Mechanisms and Mitigation for Change in Wildlife Habitat

Cumulative effects arising from past, present, and reasonably foreseeable future projects and activities that result in a change in habitat have similar effect pathways as effects arising from the Project. Project-related changes in wildlife habitat availability relate to the loss of native vegetation (specifically, native grassland, tame pasture, and wetlands) that could be used by wildlife species and sensory disturbance associated with construction. Future projects also have the potential to result in a loss of native vegetation and wetlands affecting wildlife habitat availability in the RAA. The Poplar River Coal Mine Expansion will result in a total loss of 464 ha of native vegetation once the expansion is completed, of which 230 ha are designated as WHPA lands (SK MOE 2010). Although the location of SaskPower's Outlaw Trail Transmission Interconnection project is unknown, it is expected that it will have similar types of effects pathways related to changes in direct habitat loss as the Project's overhead collector lines. For these known projects, the loss of native vegetation and wetlands represent a small proportion of wildlife habitat available in the RAA.

During the operation and maintenance phase for the Project and future projects, no additional direct habitat loss will occur and the PDA will be reduced to 48.1 ha. Sensory disturbance is expected to occur during operations for the Project and has the potential to overlap with sensory disturbance during construction and operation of the Prairie River Coal Mine expansion. Noise associated with the mine extension however will not exceed current levels within the region as noise will be relocated from the current pits to the extension lands (AMEC 2008).

Beyond Project-specific mitigation measures outlined in Section 5.4.3, there are limited additional collaborative mitigation measure options to reduce the cumulative effect of the Project and future projects on wildlife habitat availability. Though future project construction schedules are unknown, the future projects have the potential to interact cumulatively with Project residual effects; however, given the small percentage of the RAA affected, cumulative habitat loss is not expected to have population-level effects on SOMC and wildlife in general in the RAA.

6.1.2.3 Cumulative Effect Mechanisms and Mitigation for Change in Mortality Risk

The modified landscape of the RAA has already been and continues to be a source of mortality risk to wildlife due to agricultural practices, vehicle traffic on roads, and collisions with existing transmission lines. The construction phases of the Project and future projects will contribute to a change in mortality risk from ground compaction and vegetation removal, which could result in mortality of wildlife species through vehicle collisions and destruction of nests if activities occur during the nesting period. Construction activities primarily pose a risk to less mobile species, such as amphibians, and bird nests. Assuming that the Project and future projects implement appropriate mitigation measures (e.g., vegetation clearing outside of migratory bird nesting period, pre-construction nest surveys to avoid active nests, monitoring), potential cumulative effects on mortality risk during construction will be limited.

The operation and maintenance phase of the Project and future projects (particularly SaskPower's Outlaw Trail Transmission Interconnection project) have the potential for a change in mortality risk because of the potential for wildlife (particularly birds and bats) collisions with above-ground structures (e.g., turbines, transmission lines). Wind energy projects are known to cause mortality of birds and bats, with passerines and migratory bats being the most susceptible. Transmission lines are also known to cause mortality of birds through collisions, and the species groups most commonly reported as fatalities include waterfowl, grebes, shorebirds and cranes

(Rioux et al. 2013). Transmissions lines are estimated to be among the greatest sources of mortality to birds by human activities in Canada (Calvert et al. 2013). It is expected that SaskPower's siting practices will identify an appropriate route and additional mitigation measures to reduce or avoid collision risk from SaskPower's Outlaw Trail Transmission Interconnection project.

Potential cumulative mortality from wildlife collisions with turbines and overhead lines exists for some species or guilds (e.g., waterbirds) where potential for collision exists for all types of structures (i.e., transmission lines, distribution lines and wind turbines). For other species or guilds, the potential for collision may be largely limited to turbines or transmission lines. For example, passerines account for a small proportion (~12 %; Bevanger 1998) of reported fatalities with transmission lines, despite their relative abundance compared to other bird groups, but comprise nearly two-thirds of reported fatalities from collisions with wind turbines (Zimmerling et al. 2013; Erickson et al. 2014). Large bodied birds typically represent only a small percentage (~1-2 %) of the fatalities at wind energy projects (Zimmerling et al. 2013; Erickson et al. 2014), while they are often the most susceptible to collisions with transmission lines (APLIC 2012).

Given the limited overlap in species guilds with the potential for collision with turbines and power lines, there is likely to be a small cumulative effect on change in mortality risk as a result of the Project and future projects. Overall, the contributions of future projects within the RAA, including the proposed Project, to wildlife mortality risk are not anticipated to change current wildlife abundance and diversity in the RAA.

6.1.3 Residual Cumulative Effects

Residual cumulative effects relate to a change in native vegetation and wetland abundance and distribution, as well as a change in wildlife habitat and mortality risk. In general, future projects and activities will likely use reasonable and appropriate mitigation measures; few additional mitigation measures exist for reducing cumulative effects, other than making efforts to coordinate access routes or material staging areas wherever possible for nearby projects. Given that the assessment of cumulative effects results in a low proportion of the RAA affected, cumulative loss of native vegetation, wetlands, and wildlife habitat is not expected to have population-level effects on native grassland and wildlife in the RAA.

6.2 HUMAN ENVIRONMENT CUMULATIVE EFFECTS

Of the Project human environment residual effects discussed in Section 5.6, a change in visual aesthetics is likely to act in a cumulative manner with the effects of past, present, and reasonably foreseeable future projects (see Table 4-4) and is further discussed in Section 6.2.1. Other Project human environment residual effects are not expected to act in a cumulative manner as mitigation measures are expected to reduce the Project's effects to levels that are unlikely to interact with those of other projects or activities.

6.2.1 Cumulative Effects Assessment and Mitigation

6.2.1.1 Cumulative Effect Mechanisms and Mitigation for Change in Visual Aesthetics and Land Use

SaskPower's development of SaskPower's Outlaw Trail Transmission Interconnection project, in conjunction with the Project, will result in a cumulative effect on the visual aesthetics and land use in the RAA.

The future Poplar River Coal Mine expansion is unlikely to contribute to a cumulative change in visual aesthetics because the mine is already in operation and mining activities are currently visible on the horizon. The addition of these structures will be visible to rural residents and people traveling local roads; depending on an individual's particular vantage point, their viewscape may encompass one or more of the new structures. Transmission and distribution lines already exist on the current landscape; therefore, it is expected that local residents will adapt to their presence relatively easily. Although the effects of turbines on the viewscape is an individual and subjective evaluation, the visual simulation figures indicated that turbines would be visible. Local perception of the Project was generally favourable at public open houses. As such, the cumulative effects on visual aesthetics is expected to be minor and limited to locations in proximity to future projects.

In the PDA, construction of the Project will use 373.7 ha of land; which will be reduced during operations to 48.1 ha. The Poplar River Coal Mine Expansion will also affect land use with the short-term loss of cultivated crop land and grazing pasture but reclamation of these areas will occur on an annual basis (AMEC 2008). The total amount of land use changes by the Project and other projects and activities in the RAA is relatively small.

6.2.2 Residual Cumulative Effects

In the context of the RAA, the portion of the viewscape and land use changes affected by the Project and future projects is relatively small. In addition, given the low population density, only a small portion of the local population will be affected by the change in viewscape. Taking into consideration the nature of the effects pathways and extent of overlap with other projects, the residual cumulative effects for human environment will be limited.

7.0 ENVIRONMENTAL MONITORING PROCEDURES

This section outlines the environmental monitoring commitments during the construction and operation of the Project. These commitments have been established to reduce environmental effects, reduce or avoid residual effects, and meet all regulatory requirements. All of the applicable monitoring commitments presented below will be further addressed in the EMP, to be finalized in advance of construction start.

7.1 GENERAL CONSTRUCTION MONITORING

The Project will use experienced, independent, third party environmental monitors to oversee environmental commitments and confirm compliance with regulatory requirements for the Project. The environmental monitors will provide on-site environmental support to contractors to: inform and educate on environmental concerns; ensure compliance with required mitigation measures, regulatory requirements, and permit conditions; and identify, communicate, and mitigate unexpected environmental issues.

Prior to construction, the Project-specific EMP will be developed to summarize corporate commitments and regulatory requirements. This document will ensure that all environmental commitments are summarized into one document, to be used by project managers, contractors and regulators throughout the life of the Project. The EMP will include specific mitigation and monitoring measures with reference to the regulatory requirements. Additionally, the EMP will include an Emergency Response Plan.

Prior to construction commencing, all necessary information, including a copy of the EMP and all applicable permits, will be provided to all Project personnel. Training of contractors will be required to ensure that they are aware of environmental commitments. During construction, environmental monitors will conduct regular surveys to ensure compliance with all environmental commitments. Monitors will evaluate temporary environmental effects and confirm appropriate use of mitigation measures to avoid or reduce effects. Environmental monitors will have the authority to temporarily halt activities, should any issues be identified.

To summarize, environmental monitors will:

- Supervise construction activities to ensure adherence with construction limits.
- Monitor construction equipment before and during construction to ensure it is clean and in good working condition.
- Use proactive observation and contingency planning to identify and mitigate unforeseen effects.
- Use signage, fencing or other demarcation techniques to ensure environmental features are clearly marked.

- Provide information to the Project team on all environmental issues that may arise during construction and ensure that appropriate regulators are informed.
- Ensure proper use and compliance with mitigation measures identified in this Technical Proposal.
- Evaluate the effectiveness of mitigation measures and where necessary and make recommendations for improvement, if required.

Environmental monitors will also oversee construction activities in sensitive areas including native grassland, wetlands, known locations of sensitive wildlife features (e.g., leks, ferruginous hawk nests), and areas with potential habitat to support sensitive species. Additional monitoring may be required for species at risk detected during pre-construction and construction phases. During construction, environmental monitors will:

- Inspect identified environmentally sensitive areas before, during, and after construction activities.
- Identify any new environmentally sensitive areas not previously accounted for to accommodate for seasonal and/or local variations.
- Provide guidance to BluEarth and contractors regarding site-specific mitigation procedure.
- Compile data and descriptive information pertinent to environmental mitigation for inclusion in a post-construction report.
- Communicate regularly with BluEarth's management regarding construction progress and implementation of mitigation measures. Issues and solutions will be proactively identified.

In addition to general duties of the environmental monitor listed above, specific vegetation and wildlife monitoring requirements are discussed in detail below.

7.1.1 Vegetation Monitoring

During the surveying and siting stage of construction, and throughout the remainder of the construction phase, environmental monitors will identify and flag any areas as containing weeds to make sure that construction crews are aware of these areas. Additionally, environmental monitors will make sure that contractors use additional mitigation measures to prevent the invasion/spread of weeds including: inspecting and/or cleaning vehicles such that they are clean and free of weeds before entering and leaving the PDA; stripping and storing topsoil containing noxious weeds separately to prevent mixing with the surrounding soils during re-grading and final clean-up; monitoring topsoil piles for noxious weed growth during construction; and implementing corrective measures (e.g., spraying, mowing, hand pulling) to avoid infestations when required.

7.1.2 Wildlife Monitoring

Environmental monitors will provide advice and feedback during construction regarding wildlife and wildlife habitat, and will monitor to confirm that construction activities are consistent with the activity restriction timelines and setbacks for SOMCs set out by the SK MOE (2017b). Should construction schedules occur during the nesting period for migratory birds and sensitive bird species, additional monitoring will be required.

7.2 POST-CONSTRUCTION MONITORING PROGRAM

7.2.1 Reclamation Monitoring Program

Post-construction monitoring will confirm that reclamation, weed control or other mitigation measures were effective. Reclaimed areas will be inspected post-construction to ensure the success of any reclamation efforts (i.e., germination of seeds and establishment of ground cover). Guidelines for determining reclamation success will follow those of best management practices, provincial guidance documents and other permits and regulatory requirements.

7.2.2 Mortality Monitoring Program

A post-construction mortality monitoring program that meets SK MOE requirements will be implemented. The Province of Saskatchewan finalized their Adaptive Management Guidelines for Wind Energy Projects (Guidelines) in June 2018, which provides the framework for a post-construction mortality monitoring program (SK MOE 2018b).

8.0 SUMMARY AND CONCLUSION

8.1 SUMMARY

This document is intended to fulfill the requirements of a TPP under *The Environmental Assessment Act*. This TPP has been prepared in accordance with the MOE *Technical Proposal Guidelines* document (Government of Saskatchewan, 2014). The TPP describes the Project and factors that were considered in the siting of the Project both at a regional (i.e., general location in southern Saskatchewan) and local scale (i.e., location of the layout and individual turbines and infrastructure). Data gathering, both at a local and regional scale, used both desktop sources and field surveys to better understand the potential issues at the site and within the regional context. The analysis of existing environmental conditions and potential effects of the Project on environmental components focused on issues raised by stakeholders and the SK MOE, as well as potential issues common to wind developments. The discussion also describes how efforts have been made to reduce or avoid potential effects on the environment through siting and mitigation. Residual Project and cumulative effects are also described and assessed in the document.

A summary of key findings and conclusions is presented below:

Project Development and Siting

- The Project is in compliance with SK MOE's Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects (SK MOE 2017).
- Through an iterative process to development and siting, the Project has been sited mostly on an agriculturally dominated landscape – i.e., 85.3% of the PDA consists of cultivated land or hayland.
- The Project layout avoided native grassland during siting of the turbine foundations and turbine temporary workspaces. During the siting of other permanent infrastructure, native grassland was avoided where possible. The residual effect on native grassland is anticipated to be a loss of a total of 21.6 ha of native grassland; however additional refinements to infrastructure will be made in the field prior to construction to further reduce the level of this effect. Conservatively, this assessment assumes a complete loss of vegetation along rights-of-way for the overhead collector lines. However, during operation the entire right-of-way will not be utilized, rather it will be limited to the turbine and above ground pole locations.
- Wetlands are avoided whenever possible. There are 4.15 ha of Class I-II wetlands, and 0.97 ha of Class III-IV wetlands, for a total of 5.1 ha of wetlands located within the PDA. Where avoidance is not possible, appropriate mitigation measures, as approved under the AHPP, will be implemented to reduce direct effects to wetlands. Indirect effects from

the Project are possible through changes in wetland function from sedimentation and surface runoff. Erosion control measures, specific wetland mitigation and setbacks will reduce or avoid potential effects to wetlands.

Effects on SAR and SOMC

- A total of 34 vegetation community sites were surveyed, 24 in 2016 and 10 in 2017. During the surveys, 176 vascular plant species were observed including two plant SOMC at two locations within the PDA and six plant SOMC species at 37 locations within the LAA. There were also eight noxious or nuisance weed species observed in the LAA during the surveys. No prohibited weed species were observed during the field surveys. Pre-construction rare plant surveys will confirm the locations of rare plants in the PDA. The TPP describes the process and mitigation response that will occur in the event that plant SOMC are identified.
- The Project is in compliance with the Saskatchewan Activity Restriction Guidelines for Sensitive Species (MOE 2017), with the following exceptions that will be further mitigated through detailed construction planning:
  - There is one ferruginous hawk nest whose 1 km setback overlaps the location of overhead and underground collector lines. It does not however overlap with the WTG locations or access roads. Construction activities at this location will occur outside of the activity restriction period (March 15 to July 15) and be confined to the construction workspace for those components.
  - There are six leks whose 400 m setbacks overlap the PDA. Two leks (SW-31-02-24-W2M, and SE-04-03-24-W2M) have a 400 m setback that overlap access roads and collector lines, two leks (SE-35-02-25-W2M, NW-33-02-24-W2M) have setbacks that overlap collector lines only, and two leks (SW-01-03-25-W2M and SE-02-03-24-W2M) setback overlap access roads, collector lines and temporary workspaces around WTGs. No WTG locations are within the leks' 400 m setback. Construction activities at these locations will occur outside of the activity restriction period (March 15 to May 15) and will be confined to the construction workspace.
  - A total of five breeding ponds for northern leopard frogs were detected during the field surveys. The breeding ponds are not affected by the PDA; however, the 500 m setback around each breeding pond overlaps the following components of the PDA: WTGs pads, temporary workspaces, access roads, and underground and overhead collector lines. Construction activities at these locations will be confined to the construction workspace.

Bird and Bat Occurrence and Movement Based on Project Field Data

- The Project is located on the southern edge of the Big Muddy Valley which is characterized by a ridge of forested coulees. Control sites for the bird movement surveys were sited along the valley in order to assess if this landscape feature could act as a corridor for migrating birds and therefore have higher number of birds than within the Project area. However, results from the bird movement surveys showed that bird movement rates at the control sites were similar to those within the Project area. Based on the data collected, it appears that the Big Muddy Valley, to the north of the Project, does not concentrate bird movement during migration. Furthermore, there are no other prominent features on the landscape near the Project area that could serve as a concentration site for birds (e.g., a large body of water) thereby lowering the potential for an increased level of interaction between the Project and birds.
- The Alberta ESRD (2013b) identifies categories for various levels of migratory bat activity to establish potential risk to bats. These categories are: less than 1 migratory bat passes per detector night; 1 to 2 migratory bat passes per detector night; and greater than 2 migratory bat passes per detector night. In the context of this Project, bat activity rates were 0.2 migratory bat passes per detector night during the 2016 spring monitoring period. There were 2.0 migratory bat passes per detector night in 2015 and 2.4 migratory bat passes per detector night in 2016 during the fall monitoring period (August 1 to September 10) at the elevated detectors. The 2015 and 2016 fall bat activity rates fall within the moderate to high category for migratory bat fatality risk according to Alberta ESRD (2013b).

Mitigation Commitments

- Include use of Project-specific construction mitigation to limit the size of the Project footprint and effects on native vegetation and wildlife habitats.
- Use of buffers from key wildlife and rare plant features as per the Saskatchewan Activity Restriction Guidelines for Sensitive Species (SKMOE 2017b), except for the instances described above.
- Commitment to a monitoring and EMP following MOE guidelines.

8.2 CONCLUSION

The TPP has incorporated a defensible methodology to scope potential effects pathways, acquire appropriate data (both field and desktop), analyze data, and discuss potential levels of residual effects subsequent to implementation of mitigation measures. Using this process, the TPP concluded that potential effects from the Project on the physical, biological and human environment can likely be avoided or mitigated both at a local and regional level. Most effects will be addressed through application of proven environmental design and mitigation measures, a commitment to environmental monitoring during construction and post-construction reclamation and wildlife mortality monitoring. Adaptive management responses to mortality may be required in response to results from the post-construction monitoring program.

In summary, the Project is expected to have residual effects that are manageable and allow for appropriate development of the Project to help meet SaskPower's goal of increasing the proportion of renewable energy generation in the Province of Saskatchewan.

9.0 CLOSURE

This report has been prepared by Stantec Consulting Ltd. (Stantec) for the sole benefit of BluEarth Renewables. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and the Proponent.

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The information provided in this report was compiled from existing documents, data collected during field studies carried out in support of the TPP, and data provided by BluEarth. This report represents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

Respectfully Submitted,

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Appendix A TURBINE SPECIFICATIONS BROCHURE

Vestas®

4 MW PLATFORM

Wind. It means the world to us.™

Are you looking for the maximum return on **your investment** in wind energy?

Wind energy means the world to us. And we want it to mean the world to our customers, too, by maximising your profits and strengthening the certainty of your investment in wind power.

That's why, together with our partners, we always strive to deliver cost-effective wind technologies, high quality products and first class services throughout the entire value chain. And it's why we put so much emphasis on the reliability, consistency and predictability of our technology.

We have more than 35 years' experience in wind energy. During that time, we've delivered 92 GW of installed capacity in 79 countries. That is more than anyone else in the industry. We currently monitor over 33,000 wind turbines across the globe. All tangible proof that Vestas is the right partner to help you realise the full potential of your wind site.

What is the 4 MW Platform today?
The Vestas 4 MW platform* was introduced in 2010 with the launch of the V112-3.0 MW®. Over 18 GW of the 4 MW platform has been installed all over the world onshore and offshore making it the obvious choice for customers looking for highly flexible and trustworthy turbines.

Since then the 4 MW platform was upgraded and new variants were introduced utilising untapped potential of the platform. All variants carry the same nacelle design and the hub design has been re-used to the largest extend possible. In addition, our engineers have increased the nominal power across the entire platform improving your energy production significantly.

With this expansion, the 4 MW platform covers all IEC wind classes with a variety of rotor sizes and a higher rated output power of up to 4.2 MW.

You can choose from the following turbines on the 4 MW platform:

- V105-3.45 MW™ – IEC IA
- V112-3.45 MW® – IEC IA
- V117-3.45 MW® – IEC IB/IEC IIA
- V117-4.2 MW™ – IEC IB/IEC IIA/IEC S
- V126-3.45 MW® – IEC IIB/IEC IIA
- V136-3.45 MW® – IEC IIB/IEC IIIA
- V136-4.2 MW™ – IEC IIB/IEC S
- V150-4.2 MW™ – IEC IIIB/IEC S

All variants of the 4 MW platform are based on the proven technology of the V112-3.0 MW® with a full-scale converter, providing you with superior grid performance.

Our 4 MW platform is designed for a broad range of wind and site conditions, enabling you to mix turbines across your site or portfolio of sites, delivering industry-leading reliability, serviceability and exceptional energy capture, optimising your business case.

All turbine variants are equipped with the same ergonomically designed and very spacious nacelle which makes it easier for maintenance crews to gain access, so they can reduce the time spent on service while maximizing the uptime without compromising safety. All turbines can be installed and maintained using standard installation and servicing tools and equipment further reducing the operation and maintenance costs by minimising your stock level of spare parts.

*Formerly named the Vestas 3 MW platform

+64,000

The V112-3.45 MW® and the other 4 MW variants advance the already proven technology powering over 64,000 installed Vestas turbines worldwide - more than any other supplier.

How does our technology generate **more energy?**

More power for every wind site
V112-3.45 MW®, V117-3.45 MW®, V117-4.2 MW™, V126-3.45 MW®, V136-3.45 MW®, V136-4.2 MW™ and V150-4.2 MW™ are available with several Sound Optimised Modes to meet sound level restrictions with an optimised production. The power system enables superior grid support and it is capable of maintaining production across severe drops in grid voltage, while simultaneously minimising tower and foundation loads. It also allows rapid down-rating of production to 10 per cent nominal power.

Proven technologies - from the company that invented them
The 4 MW platform is a low-risk choice. It is based on the proven technologies that underpin more than 64,000 Vestas turbines installed around the world. Using the best features from across the range, as well as some of the industry's most stringently tested components and systems, the platform's reliable design minimises downtime – helping to give you the best possible return on your investment.

With an operating range that covers all wind classes, our 4 MW platform delivers unrivalled energy production. The proven blade technology from the V112-3.0 MW® is used on the V105-3.45 MW™, the V112-3.45 MW®, V117-3.45 MW® and V117-4.2 MW™. The industry known structural shell blades are used on the V126-3.45 MW®, V136-3.45 MW®, V136-4.2 MW™ and V150-4.2 MW™- a technology which is also used on the 2 MW V110-2.0 MW®, V116-2.0 MW™ and V120-2.0 MW™ variants.

Reliable and robust
The Vestas Test Centre is unrivalled in the wind industry. We test most nacelle components using Highly Accelerated Life Testing (HALT) to ensure reliability. For critical components, HALT identifies potential failure modes and mechanisms. Specialised test rigs ensure strength and robustness for the gearbox, generator, yaw and pitch system, lubrication system and accumulators. Our quality-control system ensures that each component is manufactured to design specifications and performs at site. We systematically monitor measurement trends that are critical to quality, locating defects before they occur.

The 4 MW platform covers all wind segments enabling you to find the best turbine for your specific site.

WINDCLASSES - IEC

TURBINE TYPE	IEC III (6.0 - 7.5 m/s)	IEC II (7.5 - 8.5 m/s)	IEC I (8.5 - 10.0 m/s)
4 MW TURBINES			
V105-3.45 MW™ IEC IA			Standard IEC conditions
V112-3.45 MW® IEC IA			Standard IEC conditions
V117-3.45 MW® IEC IB/IEC IIA		Standard IEC conditions	Standard IEC conditions
V117-4.2 MW™ IEC IB/IEC IIA/IEC S		Standard IEC conditions	Standard IEC conditions
V126-3.45 MW® IEC IIA/ IEC IIB	Standard IEC conditions	Standard IEC conditions	Site dependent
V136-3.45 MW® IEC IIB/ IEC IIIA	Standard IEC conditions	Standard IEC conditions	Site dependent
V136-4.2 MW™ IEC IIB/IEC S	Standard IEC conditions	Standard IEC conditions	Site dependent
V150-4.2 MW™ IEC IIIB/IEC S	Standard IEC conditions	Site dependent	

■ Standard IEC conditions ■ Site dependent

Options available for the 4 MW platform

An option is an extra feature that can be added to the turbine to suit a project's specific needs. By adding options to the standard turbine, we can enhance the performance and adaptability of the wind power project and facilitate a shorter permitting cycle at restricted sites. The options can even be a decisive factor in realising your specific project, and the business case certainty of the investment.

Here is a list of the options available for the 4 MW platform:

- Power Optimised Modes
- Load Optimised Modes
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

Life testing

The Vestas Test Centre has the unique ability to test complete nacelles using technologies like Highly Accelerated Life Testing (HALT). This rigorous testing of new components ensures the reliability of the 4 MW platform.

Is the 4 MW platform the optimal choice for **your specific site?**

One common nacelle – six different rotor sizes
The wind conditions on a wind project site are often not identical. The 4 MW platform features a range of turbines that cover all wind classes and combined across your site they can maximise the energy output of your wind power plant.

Tip-height restrictions and strict grid requirements
With a rotor size of 105 m, the V105-3.45 MW™ IEC IA is the turbine that fits the most severe wind conditions. It has an extremely robust design for tough site conditions and is especially suited for markets with tip-height restrictions and high grid requirements.

Like all the other 4 MW turbines, the V105-3.45 MW™ is equipped with a full-scale converter ensuring full compliance with the challenging grid codes in countries like the UK and Ireland.

Cold climates
The V112-3.45 MW®, V117-3.45 MW® , V117-4.2 MW™, V126-3.45MW®, V136-3.45 MW® can be combined with Vestas De-Icing and Vestas Ice Detection ensuring optimum production in cold climates.

The Vestas De-Icing System is fully SCADA integrated and can be triggered automatically or manually depending on your de-icing strategy. Automatic control protects your investment, optimising the trigger point so the turbine only stops to de-ice when there is an expected net power production gain.

High- and medium-wind sites
The V112-3.45 MW® IEC IA is a high-wind turbine and has a very high capacity factor. Similar to the other 4 MW turbines, the V112-3.45 MW® IEC IA turbine makes efficient use of its grid compatibility and is an optimal choice for sites with MW constraints.

On medium wind-sites, the V117-3.45 MW® IEC IB/IEC IIA, V126-3.45 MW® IEC IIA/IEC IIB, V136-3.45 MW® IEC IIB/IEC IIIA and V136-4.2 MW IEC IIB/IEC S are excellent turbine choices. A combination of the variants can optimise your site layout and improve your production significantly on complex sites.

Low-wind sites
Built on the same proven technology as the V112-3.0 MW®, the V150-4.2 MW™ IEC IIIB/IEC S is our best performer on low-wind sites. The larger rotor enable greater wind capture, which in turn produces more energy to reduce levelised cost of energy (LCOE). The result is exceptional profitability in areas with low wind, and new frontiers for wind energy investment.

Large Diameter Steel Towers (LDST) support the added rotor size and rating of Vestas turbines to increase Annual Energy Production on low-wind sites. LDST is specially designed with a larger diameter in the bottom section that allows for optimal strength at high hub heights.

Maximising old permits
Although the V150-4.2 MW™ is one of the highest producing low wind turbines available, some old permits may simply be too tight to accept it. Although the V117-3.45 MW®, V126-3.45 MW®, V136-3.45 MW® and V136-4.2 MW™ are medium-wind turbines, they still deliver an excellent business case on low-wind sites.

Due to the similar electrical properties and nacelle design, it is easy to mix and match the turbines from the 4 MW platform to maximise production on heavily constrained sites.

Would you **benefit** from uninterrupted control of wind energy production?

Knowledge about wind project planning is key
Getting your wind energy project up and operating as quickly as possible is fundamental to its long-term success. One of the first and most important steps is to identify the most suitable location for your wind power plant. Vestas' SiteHunt® is an advanced analytical tool that examines a broad spectrum of wind and weather data to evaluate potential sites and establish which of them can provide optimum conditions for your project.

In addition, SiteDesign® optimises the layout of your wind power plant. SiteDesign® runs Computational Fluid Dynamics (CFD) software on our powerful in-house supercomputer Firestorm to perform simulations of the conditions on site and analyse their effects over the whole operating life of the plant. Put simply, it finds the optimal balance between the estimated ratio of annual revenue to operating costs over the lifetime of your plant, to determine your project's true potential and provide a firm basis for your investment decision.

The complexity and specific requirements of grid connections vary considerably across the globe, making the optimal design of electrical components for your wind power plant essential. By identifying grid codes early in the project phase and simulating extreme operating conditions, Electrical PreDesign provides you with an ideal way to build a grid compliant, productive and highly profitable wind power plant. It allows customised collector network cabling, substation protection and reactive power compensation, which boost the cost efficiency of your business.

Advanced monitoring and real-time plant control
All our wind turbines can benefit from VestasOnline® Business, the latest Supervisory Control and Data Acquisition (SCADA) system for modern wind power plants.

This flexible system includes an extensive range of monitoring and management functions to control your wind power plant. VestasOnline® Business enables you to optimise production levels,

+33,000

The Vestas Performance and Diagnostics Centre monitors more than 33,000 turbines worldwide. We use this information to continually develop and improve our products and services.

monitor performance and produce detailed, tailored reports from anywhere in the world. The VestasOnline® Power Plant Controller offers scalability and fast, reliable real-time control and features customisable configuration, allowing you to implement any control concept needed to meet local grid requirements.

Surveillance, maintenance and service

Operating a large wind power plant calls for efficient management strategies to ensure uninterrupted power production and to control operational expenses. We offer 24/7 monitoring, performance reporting and predictive maintenance systems to improve turbine performance and availability. Predicting faults in advance is essential, helping to avoid costly emergency repairs and unscheduled interruptions to energy production.

Our Condition Monitoring System (CMS) assesses the status of the turbines by analysing vibration signals. For example, by measuring the vibration of the drive train, it can detect faults at an early stage and monitor any damage. This information allows pre-emptive maintenance to be carried out before the component fails, reducing repair costs and production loss.

Additionally, our Active Output Management® (AOM) concept provides detailed plans and long term agreements for service and maintenance, online monitoring, optimisation and troubleshooting. It is possible to get a full scope contract, combining your turbines' state-of-the-art technology with guaranteed time or energy-based availability performance targets, thereby creating a solid base for your power plant investment. The Active Output Management® agreement provides you with long term and financial operational peace of mind for your business case.

V105-3.45 MW™ IEC IA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*Subject to different temperature options

SOUND POWER

Maximum	104.5 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	105 m
Swept area	8,659 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub height	72.5 m (IEC IA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

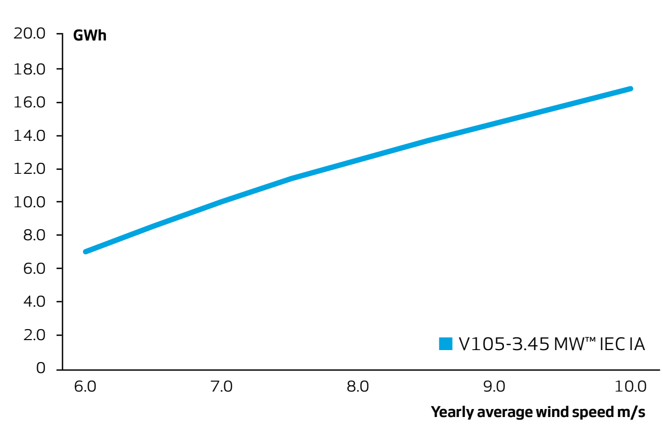
Length	51.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Low Temperature Operation to -30°C
- Fire Suppression
- Shadow Detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2,
Standard air density = 1.225, wind speed at hub height

V112-3.45 MW® IEC IA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

Maximum	105.4 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	112 m
Swept area	9,852 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub height	69 m (IEC IA) and 94 m (IEC IA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

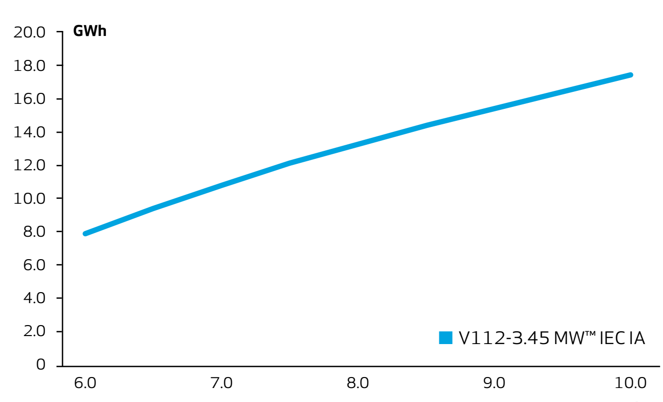
Length	54.7 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

V117-3.45 MW® IEC IB/IEC IIA Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IB/IEC IIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

Maximum	106.8 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	117 m
Swept area	10,751 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	80 m (IEC IB), 91.5 m (IEC IB) and 116.5 m (IEC IB/IEC IIA/DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

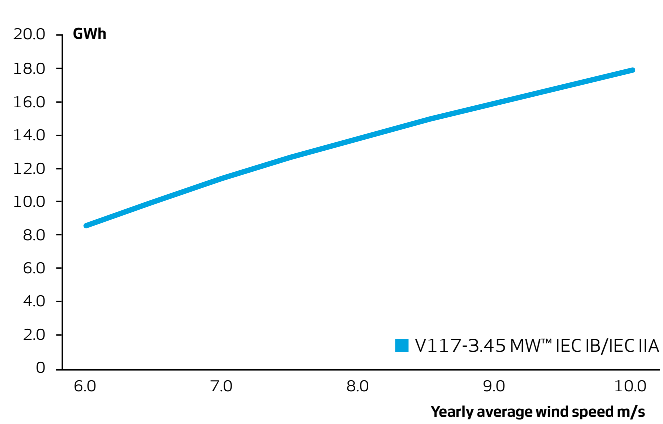
Length	57.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2, Standard air density = 1.225, wind speed at hub height

V117-4.2 MW™ IEC IB/IEC IIA/IEC S Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	4,000 kW/4,200 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IB/IEC IIA/IEC S

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000 kW)

*subject to different temperature options

SOUND POWER

Maximum	106 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	117 m
Swept area	10,751 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	91.5 m (IEC IB) 84 m (IEC IIA)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

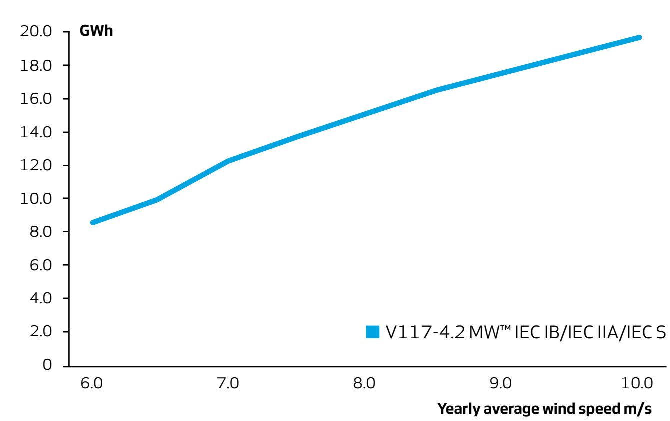
Length	57.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- 4.2 MW Power Optimised Mode (site specific)
- Load Optimised Modes down to 3.6 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight®

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2, Standard air density = 1.225, wind speed at hub height

V126-3.45 MW® IEC IIB/IEC IIA
Facts & figures

POWER REGULATION — Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIB/IEC IIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

Maximum	104.4 dB(A)**/ 107.3 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	126 m
Swept area	12,469 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights 87 m (IEC IIB/IEC IIA),117 m (IEC IIB/IECIIA/DIBtS), 137 m (IEC IIIA/DIBtS), 147 m (IEC IIIA), 149 m (DIBtS) and 166 m (DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

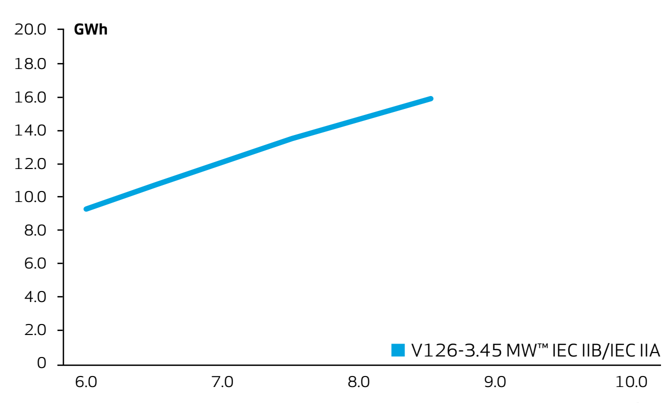
Length	61.7 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2,
Standard air density = 1.225, wind speed at hub height

V136-3.45 MW®
IEC IIB/IEC IIIA
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIB/IEC IIIA

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C

*subject to different temperature options

SOUND POWER

Maximum	105.5 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR

Rotor diameter	136 m
Swept area	14,527 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights 82 m (IEC IIB/IEC IIIA), 105 m (IEC IIIA), 112 m (IEC IIB/IEC IIIA), 132 m (IEC IIB/IEC IIIA/ DIBt2), 142 m (IEC IIIA), 149 m (DIBtS), and 166 m (DIBtS)

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

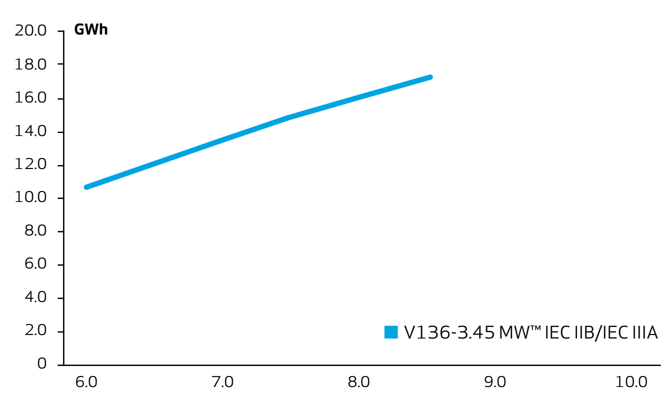
Length	66.7 m
Max. chord	4.1 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight™

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

V136-4.2 MW™ IEC IIB/IEC S Facts & figures

POWER REGULATION

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	4,000 kW/4,200 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IIB/IEC S

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000 kW)

*subject to different temperature options

SOUND POWER

Maximum	103.9 dB(A)**

**Sound Optimised modes dependent on site and country

ROTOR

Rotor diameter	136 m
Swept area	14,527 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	Site and country specific

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

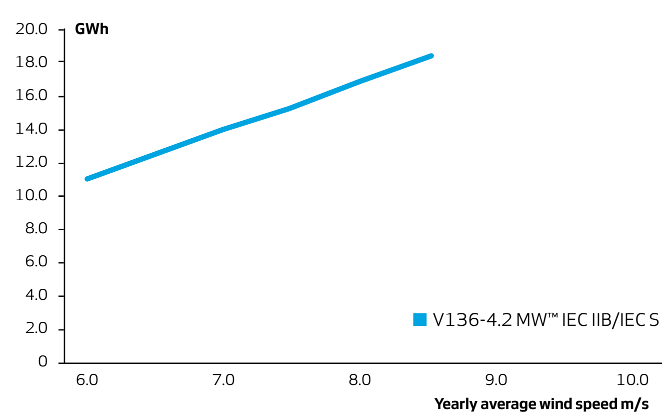
Length	66.7 m
Max. chord	4.1 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- 4.2 MW Power Optimised Mode (site specific)
- Load Optimised Modes down to 3.6 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight®

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2, Standard air density = 1.225, wind speed at hub height

V150-4.2 MW™ IEC IIIB/IEC S
Facts & figures

POWER REGULATION Pitch regulated with variable speed

OPERATING DATA

Rated power	4,000 kW/4,200 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIIB/IEC S

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000 kW)

*subject to different temperature options

SOUND POWER

Maximum	104.9 dB(A)**

**Sound Optimised modes dependent on site and country

ROTOR

Rotor diameter	150 m
Swept area	17,671 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60 Hz
Converter	full scale

GEARBOX

Type	two planetary stages and one helical stage

TOWER

Hub heights	Site and country specific

NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS

Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

BLADE DIMENSIONS

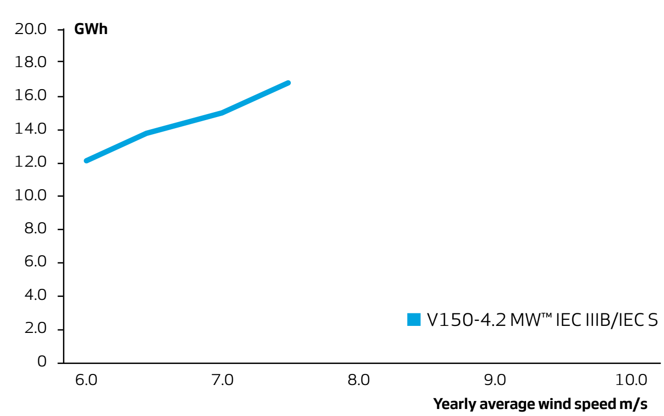
Length	73.7 m
Max. chord	4.2 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- 4.2 MW Power Optimised Mode (site specific)
- Load Optimised Modes down to 3.6 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas InteliLight®

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2,
Standard air density = 1.225, wind speed at hub height

Vestas Wind Systems A/S
Hedeager 42 . 8200 Aarhus N . Denmark
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vestas@vestas.com . **vestas.com**

09/2017-EN

Appendix B OPEN HOUSE INFORMATION

BluEarth™
RENEWABLES INC.

Community Meeting

Please sign in at the front desk and provide your contact information if you would like to receive project updates.

We invite you to walk around and look at the displays.

If you have questions or comments, please ask one of our representatives.

Thank you for attending!

The Power to Change the Future.™

BluEarth™ RENEWABLES INC.

Why now?

Electricity is the second largest source of emissions in Saskatchewan, responsible for 22% of total provincial emissions in 2013.

The Saskatchewan government is currently looking for opportunities to reduce emissions. They have committed to increasing renewable energy generation to 50% by 2030 through investments in wind, solar and geothermal technologies. BluEarth intends to bid the project into the upcoming SaskPower Request for Proposals (RFP) process, which would award long-term generation contracts for wind energy projects. If offered a contract in the RFP, and if BluEarth meets all the necessary approvals subject to the Ministry of Environment, Outlaw Trail may begin construction as early as 2018.

Outlaw Trail Wind Project

Why here?

There are several factors in choosing sites for wind projects. The Outlaw Trail site was chosen for the following reasons:

- A strong wind resource
- Close to existing power line infrastructure with enough capacity to take electricity generated from the project
- Compatible with existing land uses
- Suitable terrain
- Supportive landowners

The Power to Change the Future.™

BluEarth™ RENEWABLES INC.

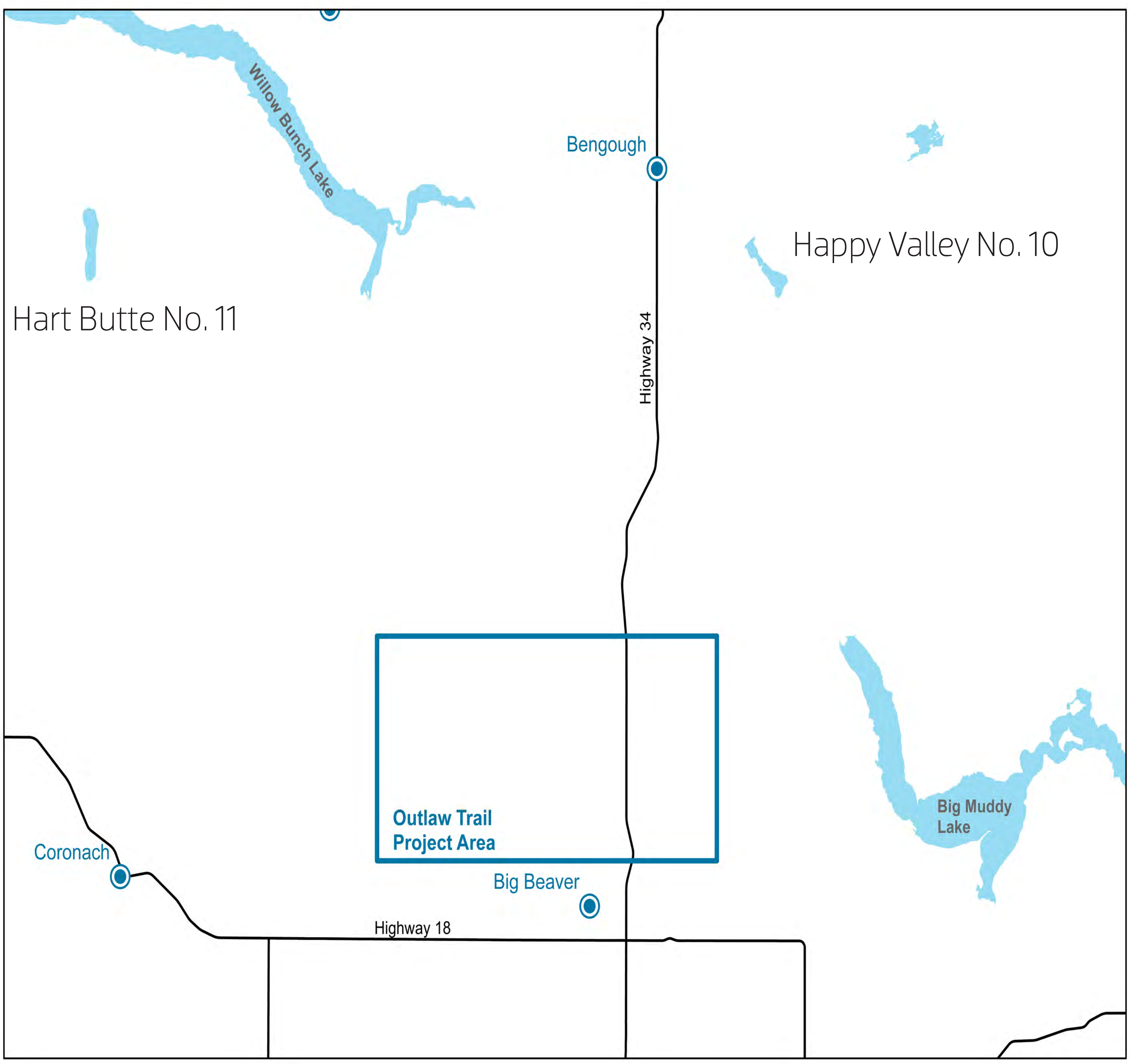
Community Benefits

- Employment. The jobs that are created during construction include: land surveying, road construction, electrical and communication networks, excavation, concrete and aggregates supply and installation, foundations, assembly of turbines, and material transportation. The project will also require permanent employees during operations
- Boosting the local economy. Construction site services, supplies, components and contractors will be sourced locally to the extent feasible, subject to meeting quality, quantity, cost, and workmanship requirements. Some workers may also require accommodations and services while working on the project
- Additional long-term tax revenue. Over the course of the project's life span, it will provide ongoing contributions to the Rural Municipality's tax base without requiring municipal services such as water and wastewater services
- Renewable energy. Renewable energy provides clean, sustainable electricity and helps to support climate change policies

BluEarth RENEWABLES INC.

Project Overview

- Proposed on both private and crown lands, the wind project is located in the Rural Municipalities of Happy Valley (No. 10) and Hart Butte (No. 11) approximately 5 Km north of Big Beaver Hamlet and 22 km south of Bengough
- This project has the potential to supply Saskatchewan's electricity grid with up to 200 megawatts (MW) of clean, renewable electricity
- The project's key components include: roads, wind turbine generators, a transformer station, and a collection system
- BluEarth is committed to consulting with and involving stakeholders in the decision-making process for proposed facilities



Environmental Studies

Pre-construction monitoring

- BluEarth has designed studies in consultation with Saskatchewan Ministry of Environment, which are currently underway
- The 2016 studies will consist of surveys for bats, birds, amphibians, snake hibernacula, wetlands, rare plants and the Heritage Resource Impact Assessment
- Future studies may include sound, visual change and shadow flicker
- Once completed, the Ministry of Environment will review the results as part of the Environmental Assessment process to ensure any potential effects have been addressed

Post-construction monitoring

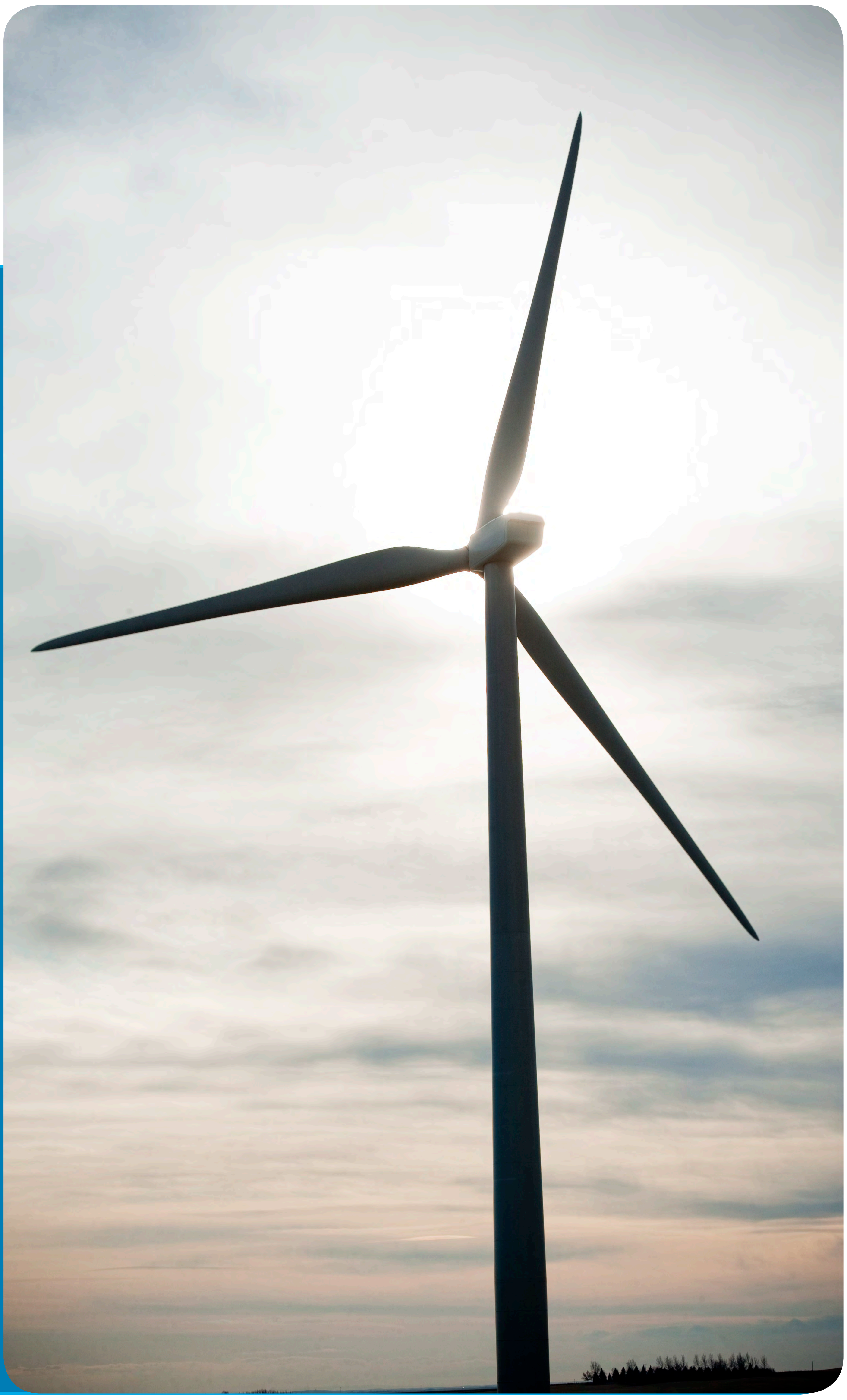
- A post-construction monitoring plan (PCMP) will be developed in consultation with the Ministry of Environment prior to project becoming operational
- The PCMP typically consists of bird and bat mortality searches and other wildlife surveys as required by regulators
- The findings of the studies will be shared with the Ministry of Environment, and if required, mitigation measures will be implemented

Outlaw Trail Wind Project

BluEarth™ RENEWABLES INC.

Thank you for joining us!

Please fill out a comment form and tell us what you think about the proposed project. If you have any additional questions that were not answered, or if you have further feedback, please include it in the comment form. Don't forget to provide your name and contact information, so we can ensure your questions are addressed.



For more information on BluEarth and the Outlaw Trail Wind Project, visit:

bluearthrenewables.com/outlawtrail

projects@bluearth.ca

1.844.214.2578

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Frequently Asked Questions

Is this project approved?

The Outlaw Trail Wind Project is not yet approved for construction. The project will have to receive the necessary environmental approvals in order to proceed. BluEarth intends to submit a technical project proposal to the Ministry of Environment for review.

When will the project be built?

If our proposal is selected and the Project is offered a contract for power, the site will be operational within two to five years, depending on the completion date required by Saskpower. Following contract award, BluEarth will be in a position to provide a development schedule on our website.

How many wind turbines will there be? Where will they be? When will you know?

BluEarth will share the site plan once all of the planning, environmental and technical work is complete. BluEarth will continue to keep landowners and stakeholders up to date with project progress through newsletters and public information sessions. Information about these public information sessions will be available in the local newspaper and on our website.

Will the turbines cause wildlife to leave the area?

There is no evidence to suggest that wind turbines cause wildlife to leave the area. In fact, we have observed both large and small wildlife utilizing resources around our operating wind facilities. BluEarth is committed to protecting the wildlife and the natural environment surrounding all of our wind facilities. Our project team works with qualified, professional consultants and government regulators to conduct environmental assessments and ensure project infrastructure is placed in areas that minimize potential impact to wildlife.

Are there any health effects to be concerned about?

There has been significant research around the effects of wind turbines on human health. In 2014, Health Canada conducted a landmark study that concluded that there was no evidence to support a direct causal link between exposure to wind turbine noise and any of the self-reported health impacts. You can read more about the study on our website here and on Health Canada's website here. You may also be interested in CanWEA's Wind Facts on Your Health.

What is stray voltage?

The term "stray voltage" is commonly used for all unwanted electrical leakage, by both the general public and utility professionals. Stray voltage is a phenomenon related to improper grounding of any electrical source. At the Project level, the Outlaw Trail Wind Project will be required to meet provincial electrical standards, and will be adequately grounded. For more information on stray voltage, please refer to CanWEA's fact sheet.

Can you put wind turbines on native grassland?

At this time, the Project is not intending to place wind turbines on native grassland.

Will turbines be placed on crown land?

Turbines may be placed on crown land for the Outlaw Trail Wind Project. BluEarth holds crown leases for the project and the land may be available for placement. BluEarth is currently working with the province to understand the conditions under which crown land would be available for the placement of turbines. This work will help inform the site plan, which will be shared on our website once available.

Will turbines have aviation obstruction lighting?

Yes, a portion of the turbines will have aviation obstruction lighting to ensure high visibility at night, as required by Transport Canada.

Will there be a local operations and maintenance centre?

Yes, an Operations and Maintenance building will be required for the facility. This may be built on site or commercial space may be rented in the community. A decision will be made as part of the detailed design work, post contract award.

How many jobs will be created? Will you employ local people?

During construction, BluEarth intends to utilize local resources and companies, whenever practicable and available, which will depend on competitive pricing, necessary experience, availability to meet the Project schedule, and other requirements. During Project operation, depending on the project size, we anticipate that four to six permanent wind technician positions will be needed to maintain the site. In addition, taxes generated by the project will contribute to long term economic support of the region.

What qualifications do you need to work at the facility?

Once the Outlaw Trail Wind Project has achieved operation, BluEarth Asset Management, a subsidiary of BluEarth Renewables, will operate and manage the facility. Operators generally possess a Wind Turbine Technician certificate, Technical Diploma or Trade Certificate in Mechanical or Electrical.

What effect do the turbines have on leased crop production?

Only a small portion of the total land area is used by the project facilities, and areas temporarily used for construction will be fully reclaimed. There is no evidence to suggest that wind turbines have any effect on crop production outside of the construction footprint.

Will BluEarth maintain the roads? Are they easy to farm around?

Project roads will be maintained by the Project, and landowners will be able to farm around the roads with ease. Project roads are designed with low ditches and a low crown, so farming equipment can easily pass over or around them.

Will the tax revenue for the RM be based on revenue from generation?

Tax revenues are generally based on commercial mill rates, which are applied against the value of certain project infrastructure. Taxes are not typically based on revenue from generation.

How much do the landowners get paid?

While all leases and agreements are confidential, participating landowners receive fair compensation for use of their land.

Are property values affected by wind turbines?

In 2012, the Municipal Property Assessment Corporation (MPAC) in Ontario did complete a study that analyzed the potential impact on property values for homes in proximity to wind energy facilities. The study concluded that "there is no statistically significant impact on sale prices of residential properties in these market areas resulting from proximity to an industrial wind turbine." (Source: https://www.mpac.ca/sites/default/files/imce/pdf/ReportWindTurbines.pdf). Should any new or updated studies specific to wind facilities become available, we will share these with interested stakeholders.

400, 214 – 11 Avenue SW
Calgary, AB T2R 0K1
T 403.668.1575
bluearth.ca

May 22, 2017

Dear Stakeholder:

RE: Outlaw Trail Wind Project

At BluEarth Renewables, we believe in keeping our neighbours and landowners informed about our projects. I'm contacting you to provide an update about the proposed Outlaw Trail Wind Project (Project) in the Regional Municipalities of Happy Valley (RM10) and Hart Butte (RM11), and invite you to attend our upcoming open house information session (details below).

Outreach efforts for the Project began last year, when we held a public meeting in June 2016. Since then, we have been consulting with stakeholders and completing technical and environmental studies in preparation of the upcoming SaskPower *Request for Proposals* (RFP) process. The RFP will award long-term generation contracts for wind energy in Saskatchewan. If offered a contract and the Project obtains the necessary approvals from the Ministry of Environment, Outlaw Trail could begin construction in early 2018.

Project Description

The proposed location of the Project is approximately 5 km north of Big Beaver Hamlet and 22 km south of Bengough**.** To fully respond to SaskPower's call for renewable energy, BluEarth will be submitting two project layouts as part of the RFP process. The first has a total generating capacity of 100 MW and the second has a total generating capacity of 200 MW. The wind facility will have a 34.5 kilovolt electrical collector system and a project substation. The collector system is to be used solely for collecting the electric energy generated by each turbine and connecting the proposed wind facility to the SaskPower electrical transmission system.

The Project would occupy lands described below:

- Sections 1, 2, 3, 4, 5, 7, 8, 9, 11 and 12 of Township 3, Range 24, West of the Second Meridian
- Sections 1, 2, 9, 10, 11, 12, 15, 21 and 22 of Township 3, Range 25, West of the Second Meridian
- Sections 22, 26, 27, 34, 35 and 36 of Township 2, Range 25, West of the Second Meridian
- Sections 5, 18, 19, 29, 30, 31, 32, 33, 34 and 35 of Township 2, Range 24, West of the Second Meridian
- Section 7 of Township 3, Range 23, West of the Second Meridian

Please refer to the enclosed maps for the proposed Project area. We are currently in the process of refining the proposed layout (turbine locations) for the Project. The Project will adhere to all setbacks and regulations (i.e. distance from roads and property lines) required by Regional Municipalities and is not expected to have any adverse effects on adjacent land usage.

Schedule

Date	Activity
August 2017	Anticipated Project approval from Ministry of Environment
September 2017	Project bid into Saskpower Request for Proposals (RFP)
December 30, 2017	RFP successful developers announced
January 2018	Earliest start of Project procurement and construction
April 30, 2020	Project is operational

Open Houses

BluEarth will be holding an open house in Big Beaver to discuss the proposed Project and respond to questions.

Date: Thursday, June 8, 2017
Time: 5:30 pm to 8:30 pm
Location: Big Beaver Hall
3 Main Street, Big Beaver, SK

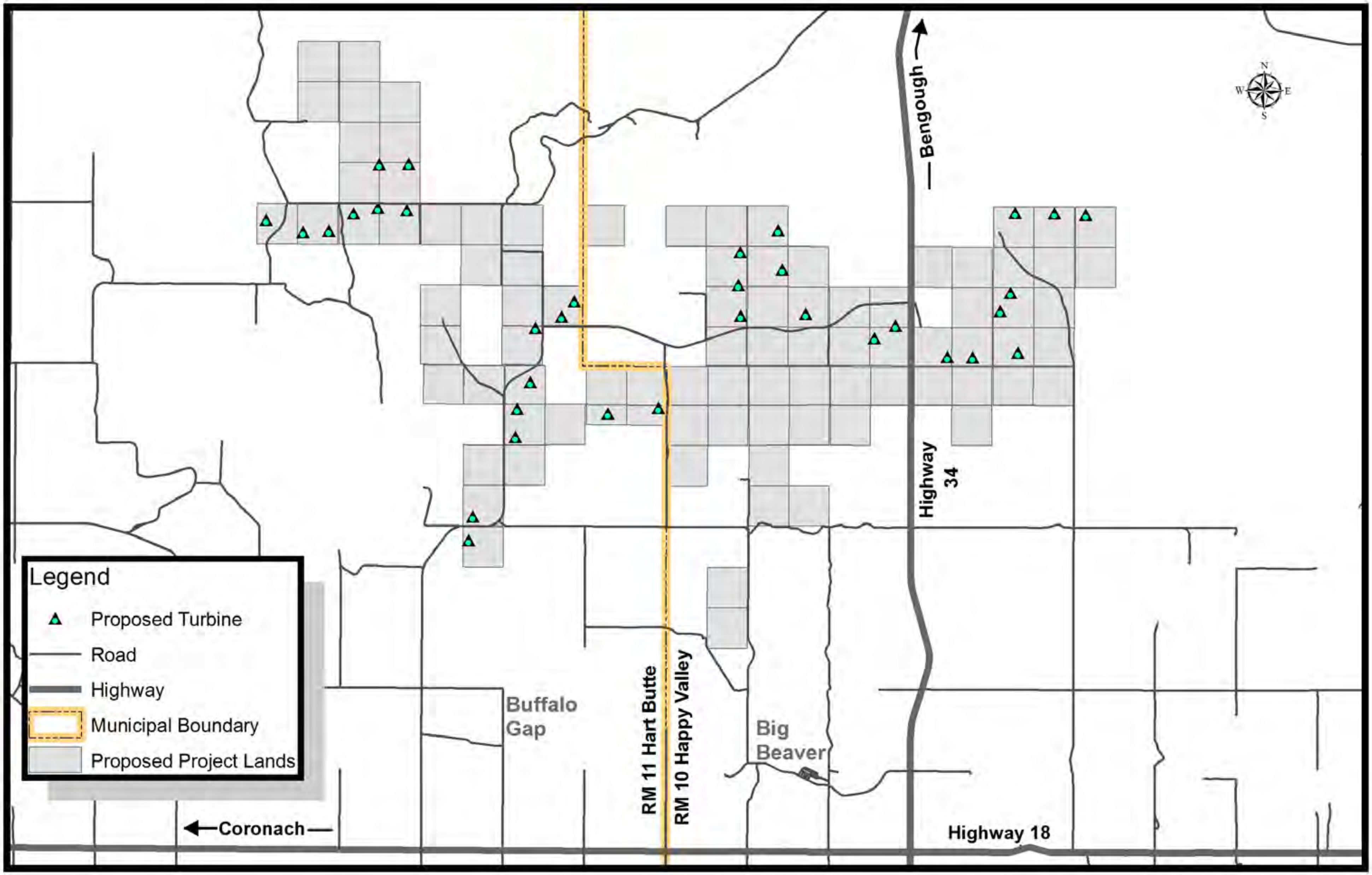
Your feedback is very important to us. Should you have any questions or comments, please feel free to contact me at 1-844-214-2578 or 403-668-1575 Ext. 426. Further information is also available on our website at www.bluearth.ca/outlawtrail.

Kind regards,

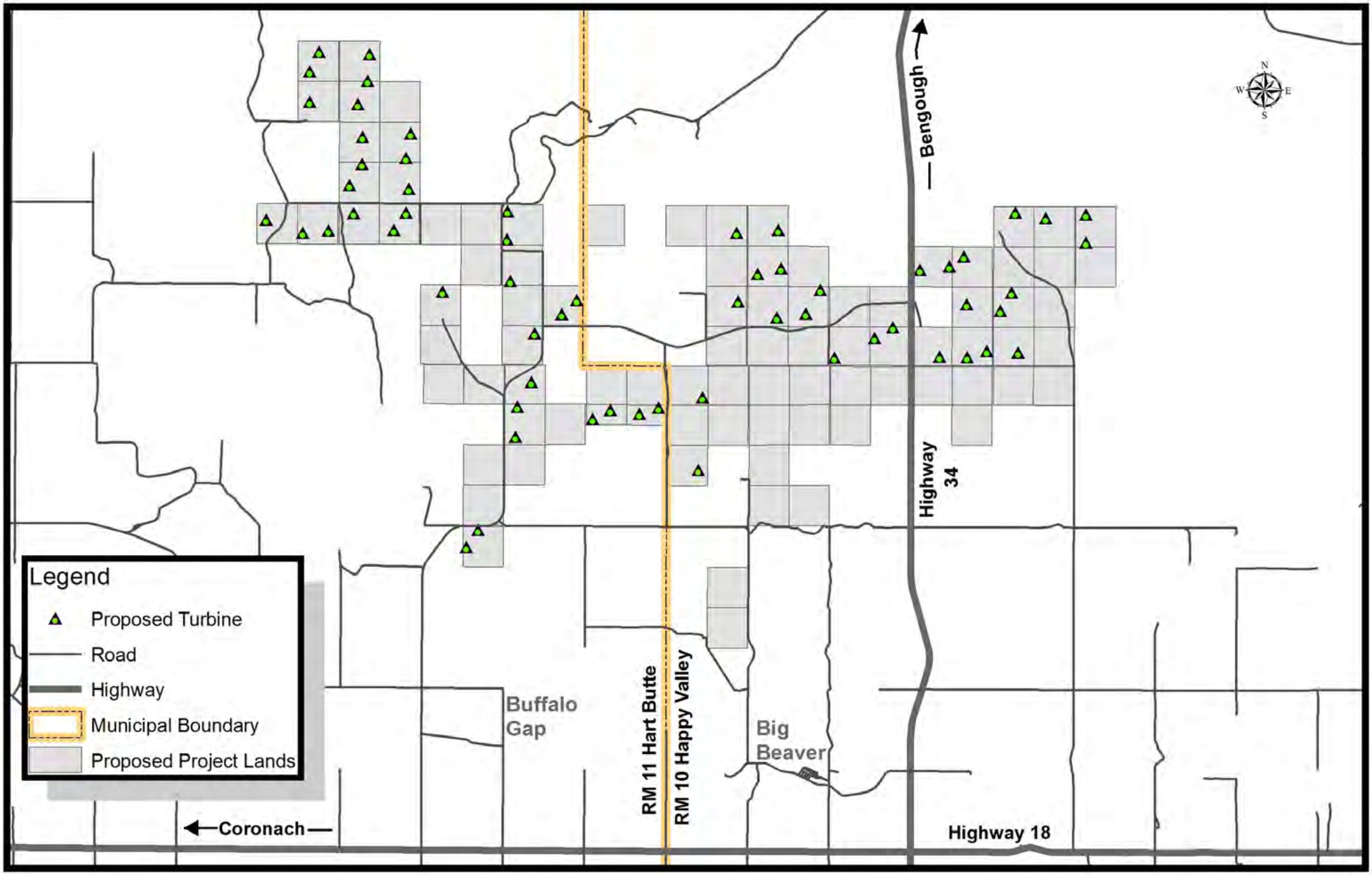
Jared Sproule
Community Liaison
jared@bluearth.ca
1-844-214-2578

Encl. Project Location Maps (100 MW and 200 MW preliminary layouts)

Outlaw Trail Wind Project Preliminary 100 MW Layout



Outlaw Trail Wind Project Preliminary 200 MW Layout



Welcome to our Open House!

Please sign in at the front desk and provide your contact information if you would like to receive project updates.

We invite you to walk around and look at the displays.

If you have questions or comments, please ask one of our representatives or fill out a comment form and we'll be in touch.

Thank you for attending!

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Background

Outreach efforts for the Outlaw Trail Wind Project began in 2016.

- Over the last year, BluEarth been consulting with stakeholders and completing technical and environmental studies.
- BluEarth plans to submit the project in the upcoming SaskPower renewable energy procurement, awarding long-term generation contracts for wind energy in Saskatchewan.
- BluEarth will be submitting two project layouts as part of the RFP process. The first has a total generating capacity of 100 MW and the second has a total generating capacity of 200 MW. Only one of these layouts could be awarded and be constructed.
- If offered a contract and the Project obtains the necessary approvals from the Ministry of Environment, Outlaw Trail could begin construction in early 2018.

Outlaw Trail Wind Project

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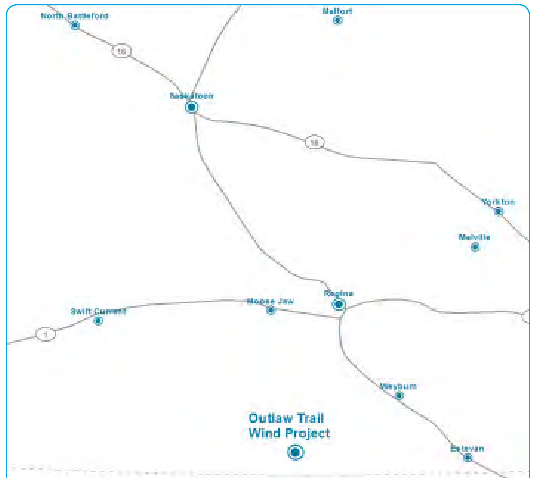
Project Description

- Facility size: up to 200 MW capacity of renewable power
- Number of turbines: up to 58 turbines
- 34.5-kilovolt electrical collector system and fibre-optic cable
- New transmission line will connect a new substation to the electricity grid
- Access roads, temporary construction roads, and an operations and maintenance building



Located approximately 5 km north of Big Beaver and 22 km south of Bengough, Alberta

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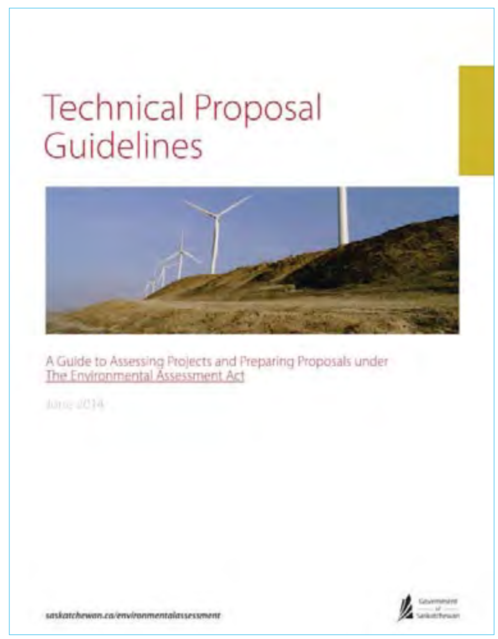
Overview of the Environmental Approval Process

The environmental approval process for a commercial wind energy facility includes completing a Technical Project Proposal (TPP) which is submitted to the Environmental Assessment Branch (EAB).

The TPP includes:

- A description of the Project and its location
- How it will be constructed
- A description of the area where it will occur (land cover, etc.)
- Public consultation results
- Results of field surveys (e.g., wildlife, plants, heritage resources, wetlands, etc.)
- The predicted effects of the Project on the environment and mitigation strategies to avoid those effects
- Description of monitoring programs to measure those effects on the landscape



Once the EAB reviews the TPP, they determine if the Project is approved or if additional steps must be taken. These may include for example, more surveys, additional mitigation or if a full environmental assessment (EA) is required.

Once approved, the Proponent may obtain their additional permits and start construction. The approval may have conditions, such as monitoring and reporting, that is completed during and after construction.

Outlaw Trail Wind Project

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Environmental Surveys Completed or Underway

To complete a TPP, Stantec Consulting has executed the following desktop assessments or field surveys to describe the Project Area and identify sensitive features or species.

- Desktop Analyses: existing databases were explored to identify historical records of rare plants, sensitive wildlife and heritage resource finds in the area.
- Land Cover: described what the land is being used for and what kind of plant communities are found on it (i.e., native grassland, cropland, hayland, pasture, wetlands, forest, etc.). Completed in 2016.
- Raptor Nests: surveyed the entire Project Area in 2015 and again in 2017 for hawk, owl, and falcon nests.
- Sharp-tailed Grouse Leks: surveyed all suitable habitat within the Project Area for grouse breeding leks in 2016 and 2017.
- Breeding Birds: communities of breeding birds were surveyed and described in the different land cover types in 2016 and will be completed again in June 2017.
- Burrowing Owls: surveyed for the nest sites of burrowing owls in 2016 and will be completed again in June 2017.
- Vegetation Communities: surveyed in areas of native grasslands were completed in 2016 and again in 2017 (June) to describe the plant communities and rangeland health.
- Breeding Amphibians: wetland areas where rare frogs and toads may breed were surveyed in 2017.
- Yellow Rails: wetlands with suitable habitat for breeding yellow rails were surveyed in 2016.
- Common Nighthawks and Short-eared Owls: Nighthawk and short-eared owl activity was surveyed in 2016.
- Bird Movements: surveys for bird movement rates were conducted within and outside the Project Area.

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Stantec Consulting Ltd.'s Role in the Process

- Stantec has been retained by BluEarth to provide regulatory guidance and complete a Technical Project Proposal for the Project to be submitted to the Saskatchewan Ministry of Environment (MOE).
- Stantec conducted a suite of desktop assessments and environmental surveys in 2015, 2016 and 2017.
- Stantec is assisting BluEarth with the public engagement process.

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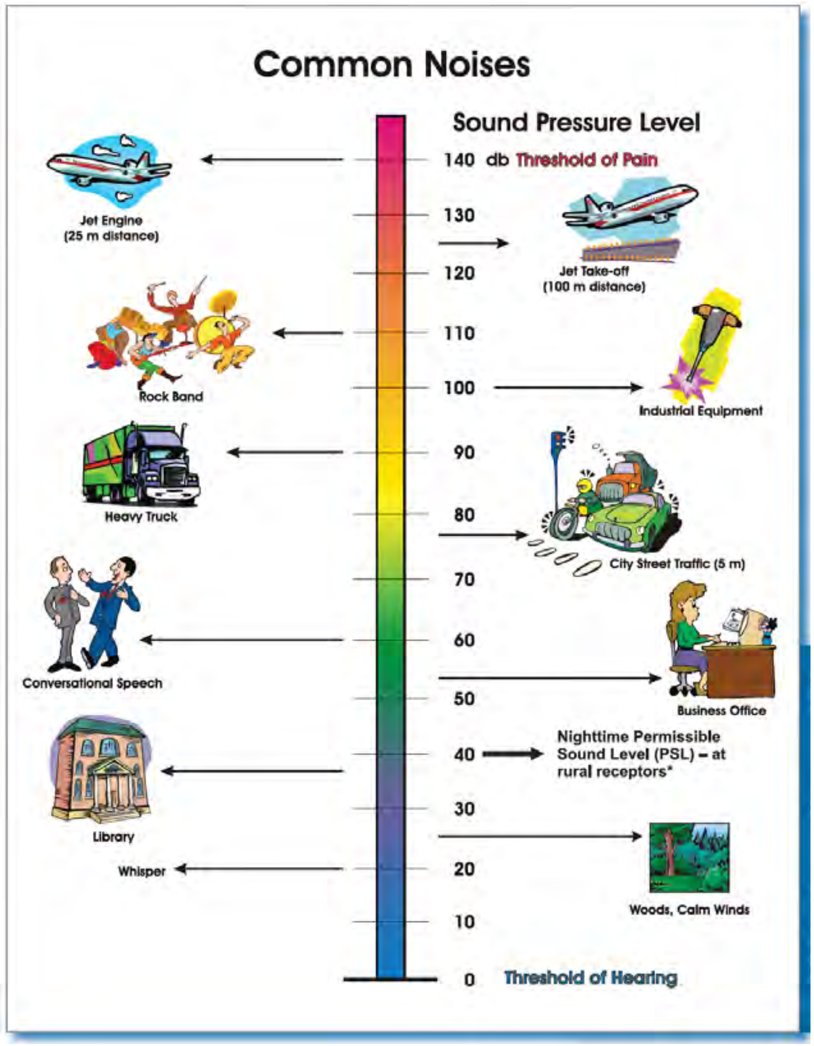
Sound

Detailed noise modelling is undertaken to ensure the sound level requirements of 40 dBA (night time) are met at all residences. The noise modelling considers:

- Topography (hills and slopes);
- Ground cover (trees, water, grass); and
- Existing noise sources (oil & gas infrastructure, highways).

Studies of the noise conditions within the Outlaw Trail Wind Project area are an important factor in selecting the final turbines for the Project.



* Permissible Sound Level (PSL) includes sound contribution from ambient (i.e., background) noise, other regulated facilities (e.g., oil and gas infrastructure, power/utilities infrastructure), and any newly proposed regulated facilities (i.e., the Project). Nighttime PSL at receptors in rural environments is 40 dBA

Outlaw Trail Wind Project

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Project Benefits

What are the benefits of wind development?

- Employment – temporary jobs during construction and permanent jobs associated with the operations and maintenance of the Project (4 to 6 full-time positions).

- New Investment – in the form of local services and supplies such as infrastructure improvements, fuel, accommodation, meals and supplies for employees, construction personnel, and contractors who will spend time in the local communities.

- Landowners and Community – wind turbines are compatible with other land uses, such as farming, and can serve as a financial boost for rural economic development.

- Municipal Tax Revenues – municipal taxes paid by wind companies to rural communities can be important, and the project does not increase demand on municipal services or public works such as sewer and water upgrades.

- Clean Energy – wind energy provides societal benefits by offsetting harmful emissions such as carbon dioxide, oxides of nitrogen, and sulphur dioxides that are created through conventional, thermal power generation.

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Outlaw Trail Wind Project

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Project Schedule

Submission to SaskPower Renewable Energy Request for Qualifications	May 2017
Application to Saskatchewan Ministry of Environment	July 2017
Ministry of Environment & Municipal Development Permit Approvals	August 2017
SaskPower Renewable Energy Procurement Contract Awarded	December 2017
Project Financing & Procurement Commencement	January 2018
Earliest Start of Project Construction	April 2018
Expected Commercial Operation	April 2020

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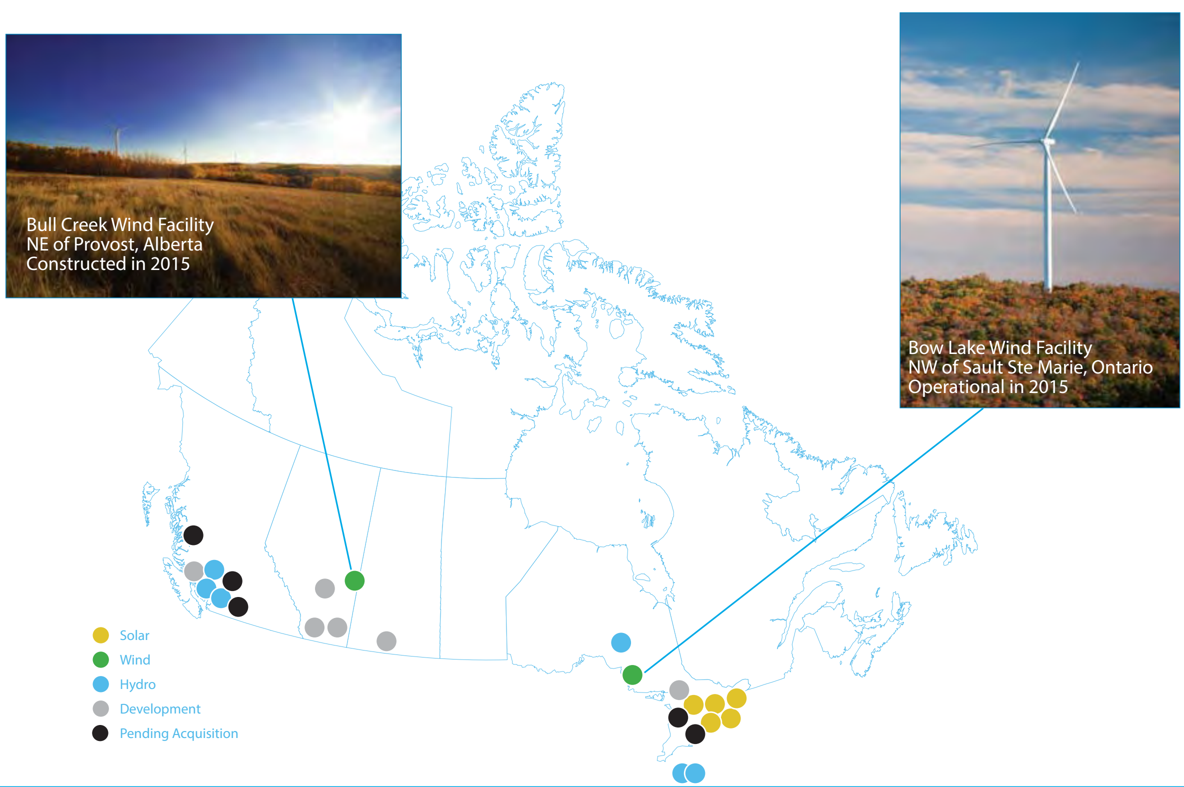
BluEarth Renewables

Headquartered in Calgary, BluEarth Renewables is a private independent renewable power producer, focused on the acquisition, development, construction and operation of wind, water, and solar projects. BluEarth's mission is to be the Canadian renewable energy leader by developing, building, and operating a portfolio that optimizes people, planet, and profit. BluEarth believes it has the power to change the future™ by demonstrating how to be sustainable and profitable, leaving the world a better place. For more information, visit **bluearth.ca**.

BluEarth has 18 operating power generation facilities



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Renewables Roadmap

Electricity generation is the second largest source of emissions in Saskatchewan, responsible for 22% of total provincial emissions in 2013.

SaskPower is taking important steps toward the development of renewable energy technology in the province. SaskPower has also set a target of having 50% of its electrical generation capacity come from renewable sources by 2030. That's double today's portfolio of 25%. This ambitious goal will be achieved by a major expansion in wind power, augmented by other renewables, such as solar, biomass, geothermal and hydro.

BluEarth intends to bid the project into the renewable energy procurement (REP) process, which would award long-term generation contracts for wind energy projects. The REP is a competitive process based on power price, so it will encourage competition among developers that will ultimately result in lower power prices from renewable energy projects.

Outlaw Trail Wind Project

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Thank you for attending!

Please take the time to fill out a comment form and tell us what you think about the project.

If you have any additional questions that were not answered, or if you have further comments or feedback, please include it on the comment form and provide us with your name and contact information.

Questions and comments can also be sent to the contact information provided on the comment form.

Comments must be received by June 23, 2017 for consideration in our decision-making process and for inclusion in our Ministry of Environment filing.

For more information on BluEarth and the Outlaw Trail Wind Project, visit:

www.bluearth.ca/outlawtrail

projects@bluearth.ca

1-844-214-2578

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Why here?

There are several factors in choosing sites for wind projects. The Outlaw Trail site was chosen for the following reasons:

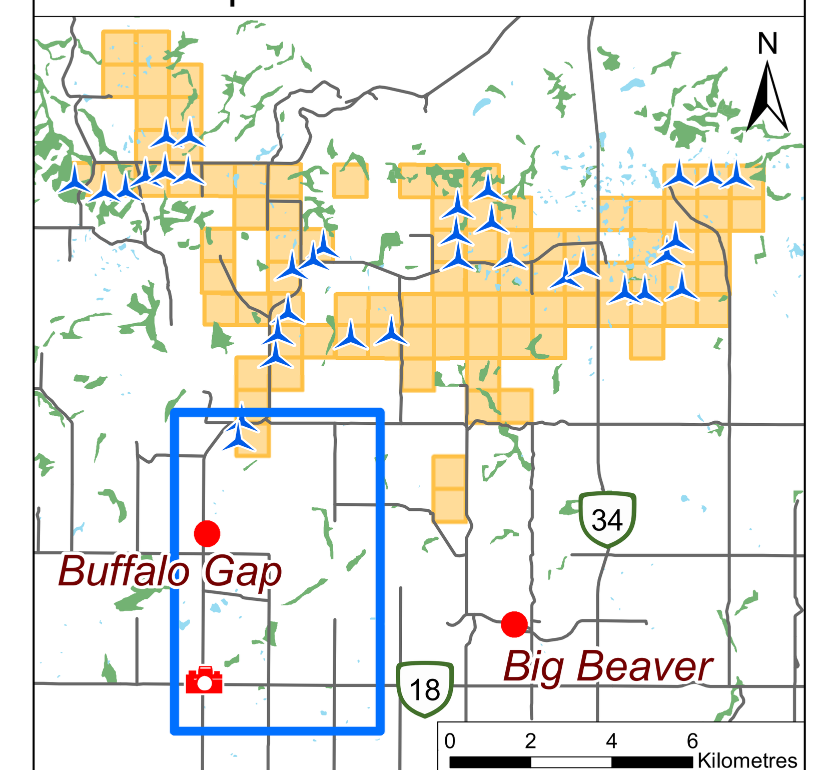
- A strong wind resource
- Close to existing power line infrastructure with enough capacity to take electricity generated from the project
- Compatible with existing land uses
- Suitable terrain
- Supportive landowners

BluEarth Renewables Inc.

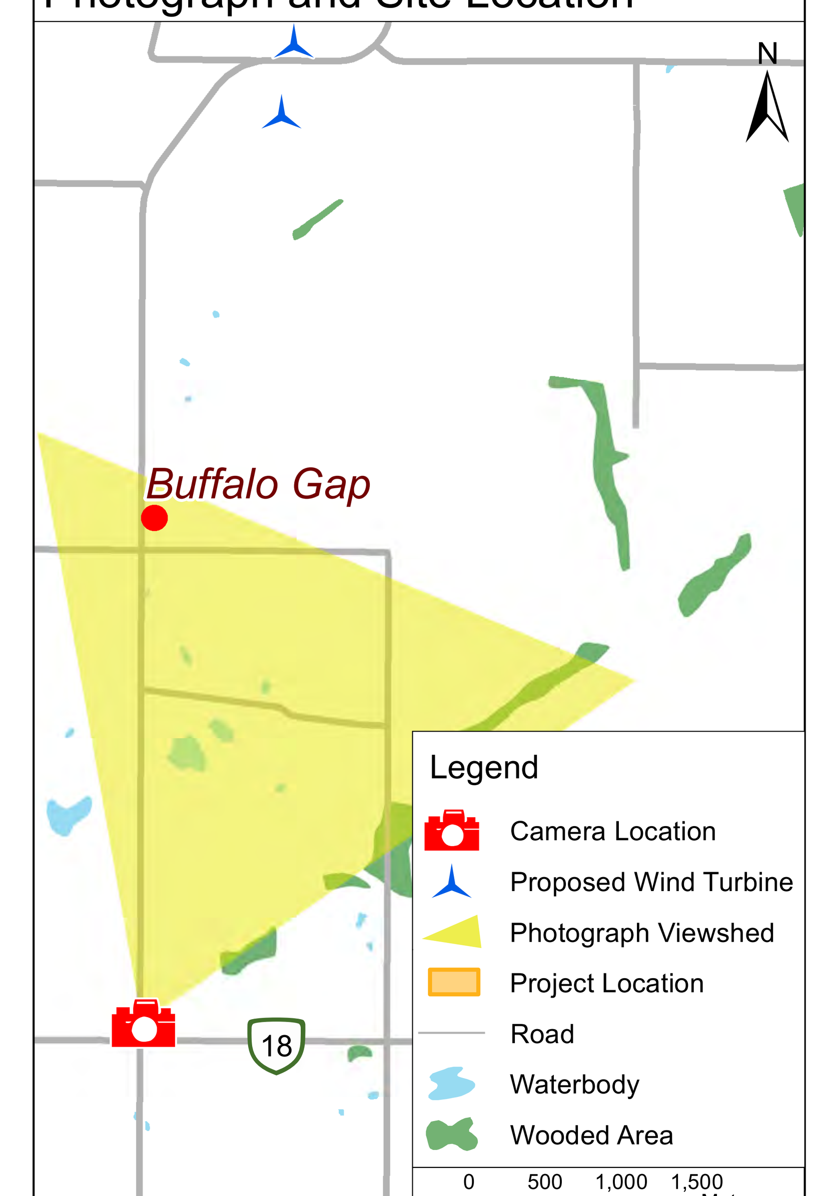
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 1 SOUTHWEST OF SITE

Index Map



Photograph and Site Location



Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 100mw - Vantage Point 1

Photomontage

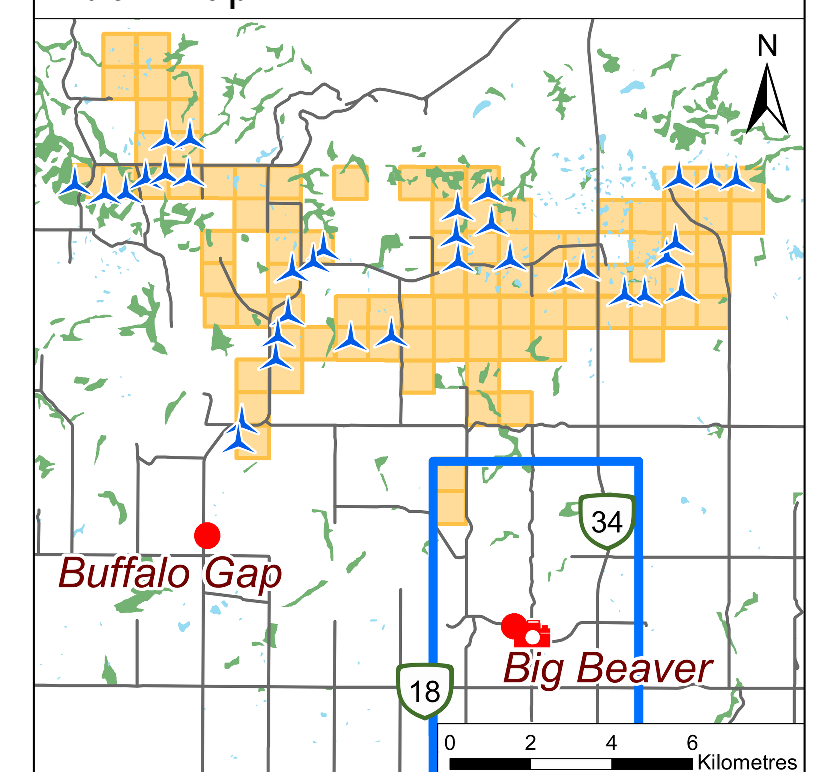
Original Photograph

BluEarth™
RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



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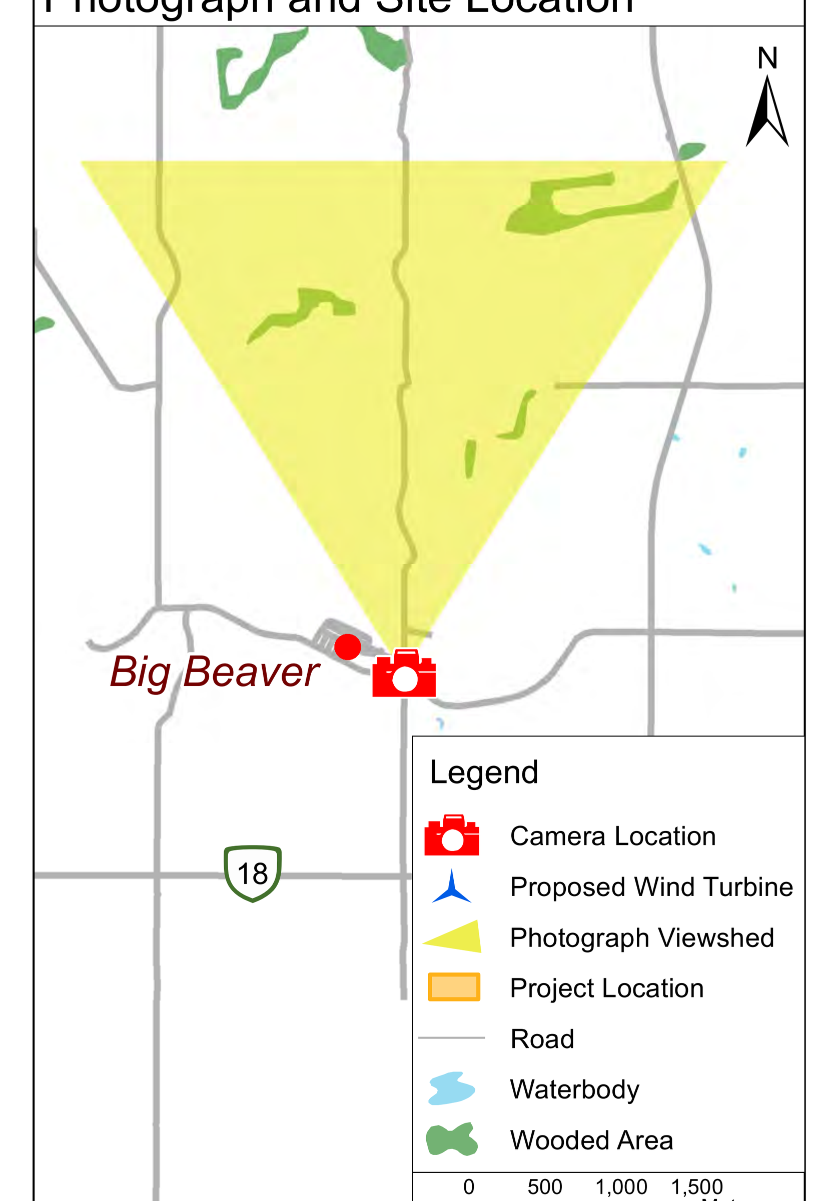

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Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 100mw - Vantage Point 2 V2

BluEarth RENEWABLES INC.

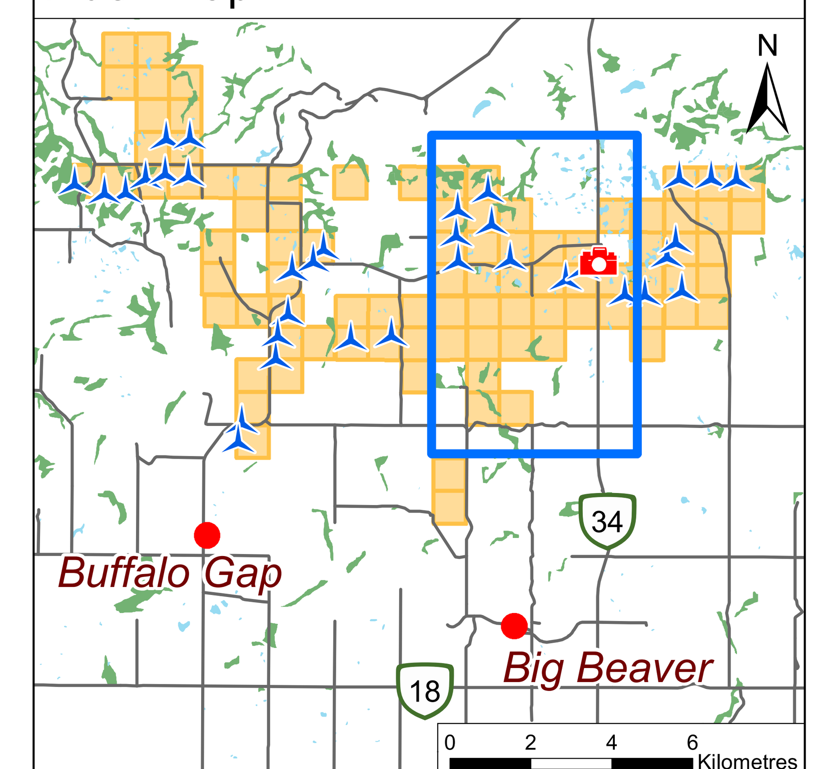
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 3 EAST OF SITE

Photomontage

Original Photograph

Index Map



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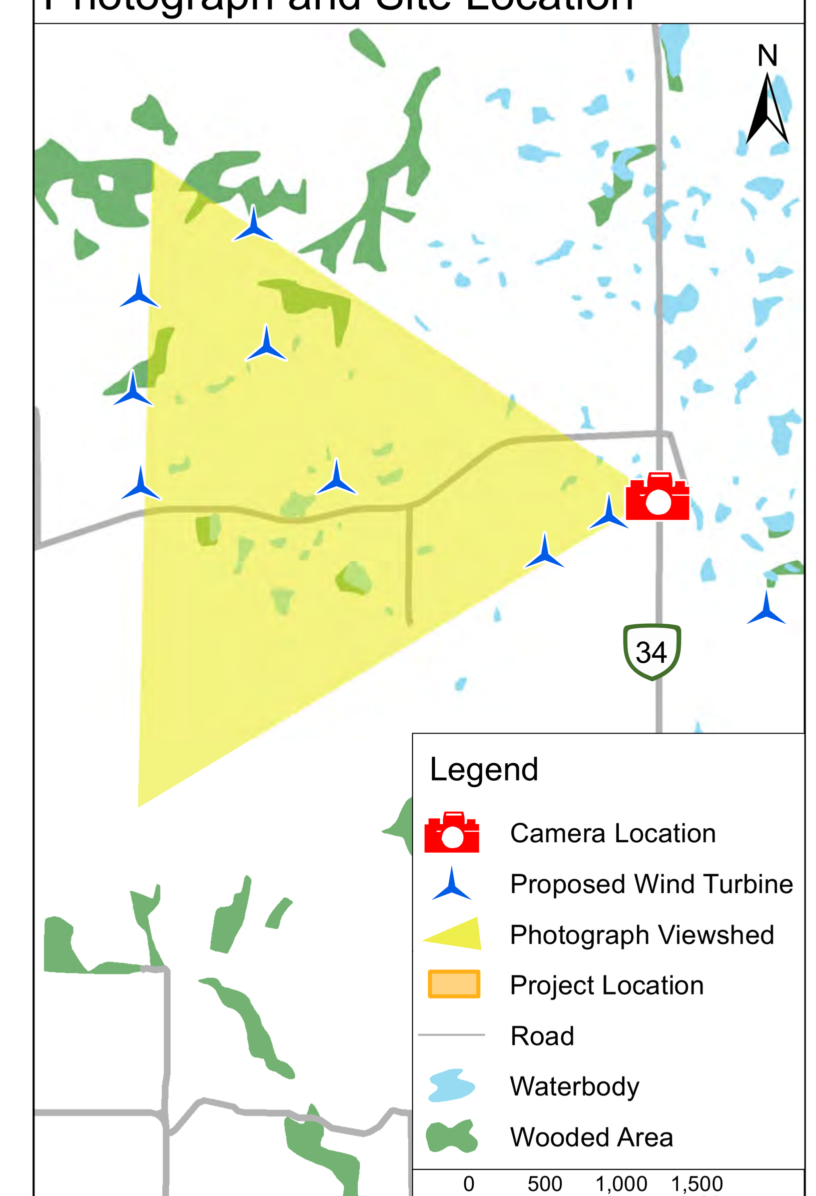

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
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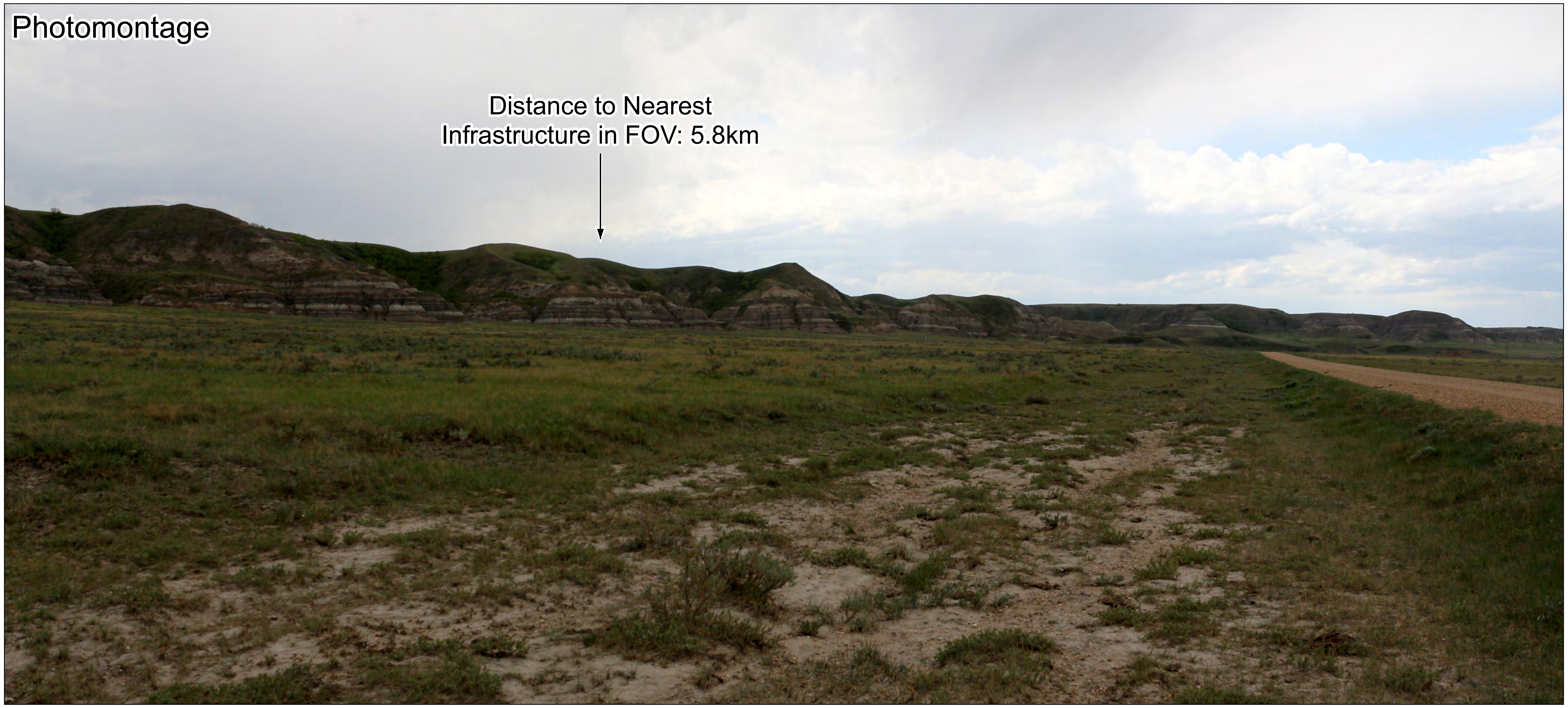
Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 100mw - Vantage Point 3

Photomontage



Original Photograph

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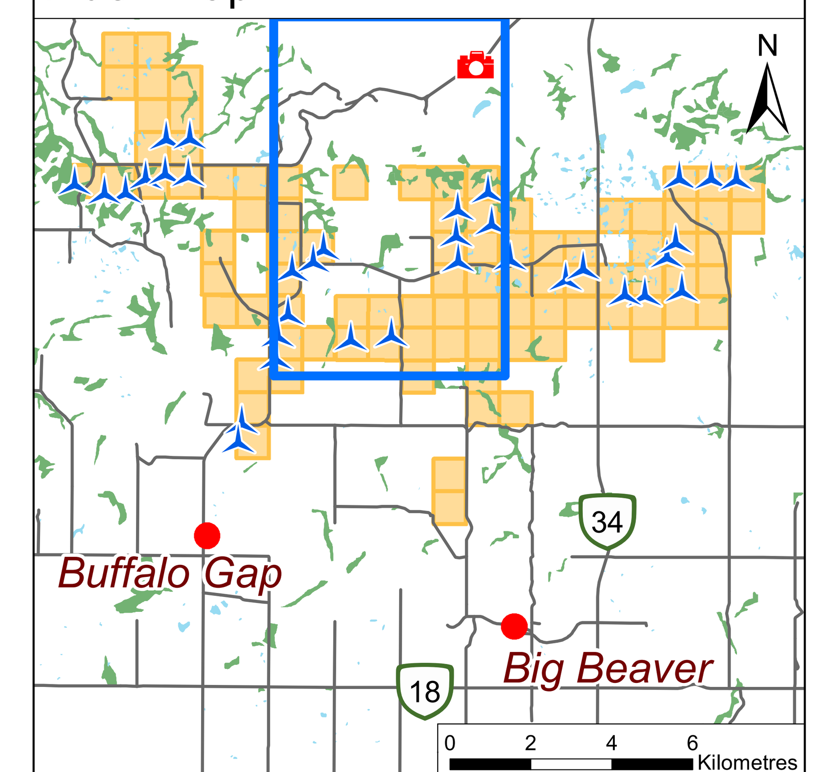
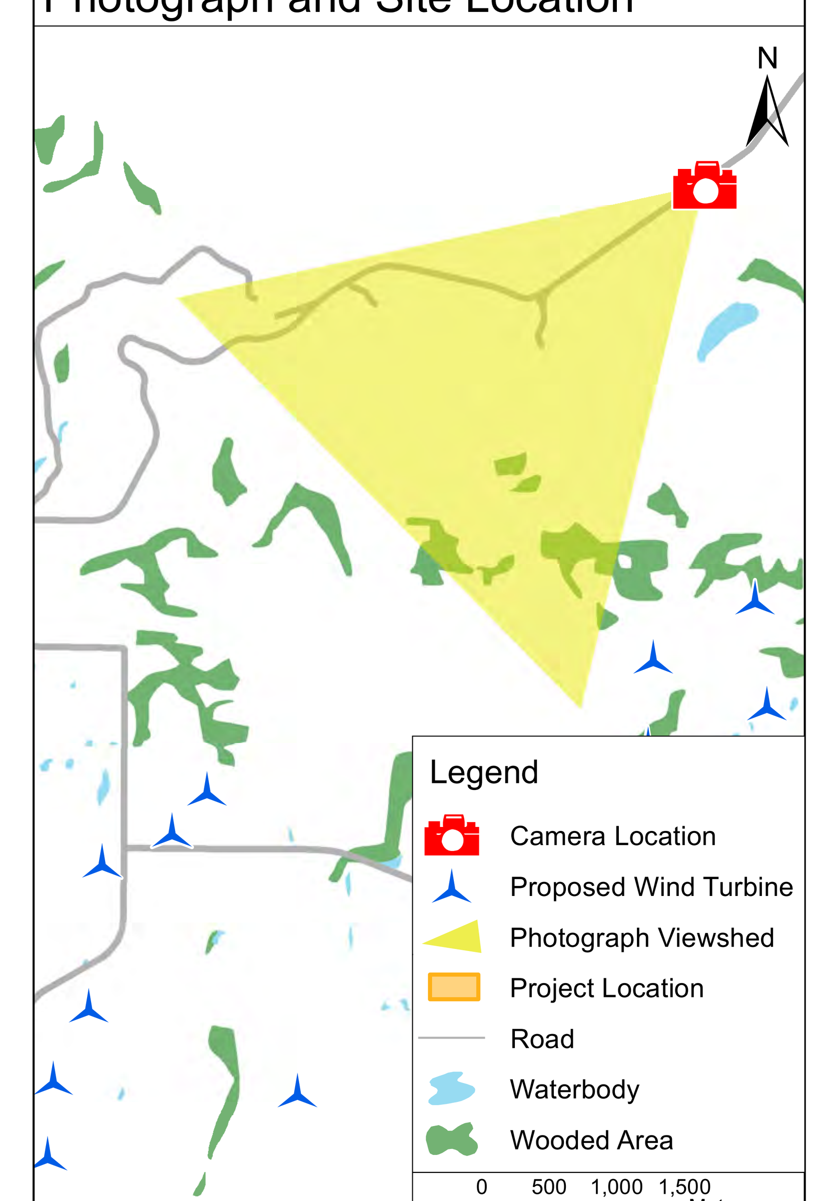
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 4 NORTH OF SITE

Index Map



Photograph and Site Location



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Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 100mw - Vantage Point 4

Photomontage

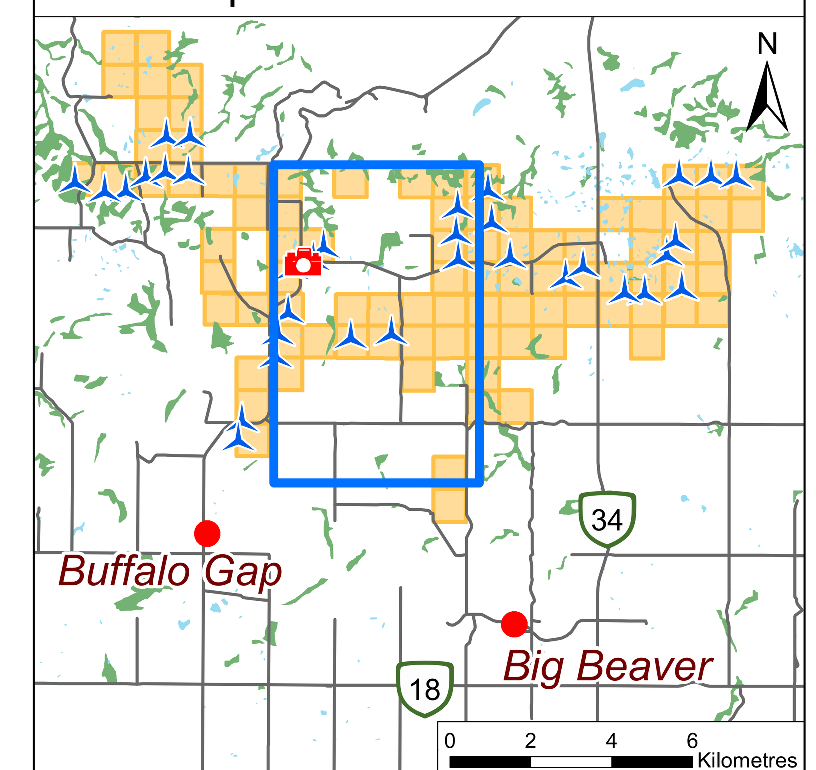
Original Photograph

BluEarth
RENEWABLES INC.

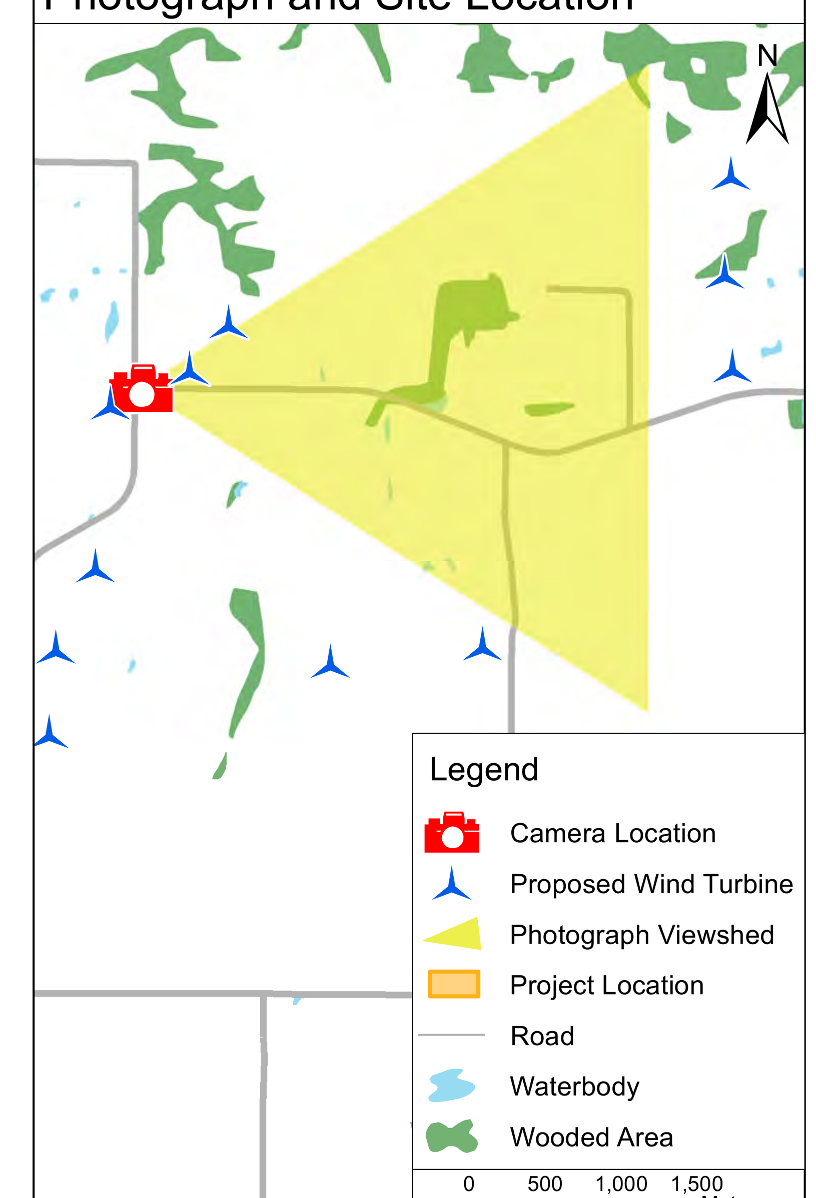
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 5 WEST OF SITE

Index Map



Photograph and Site Location



Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

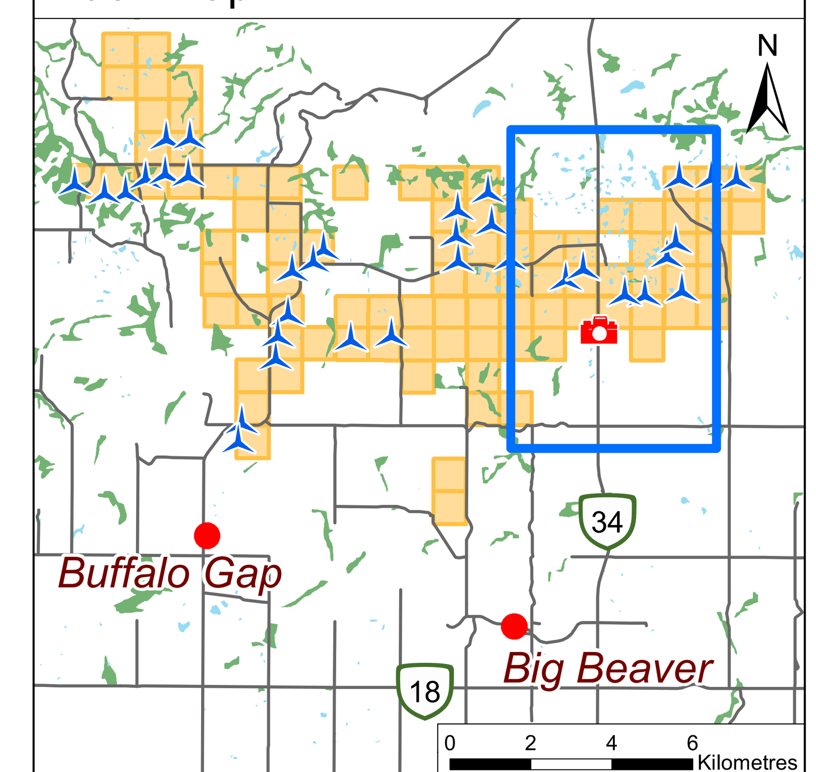
Map17-0242 - Outlaw Trails 100mw - Vantage Point 5

BluEarth RENEWABLES INC.

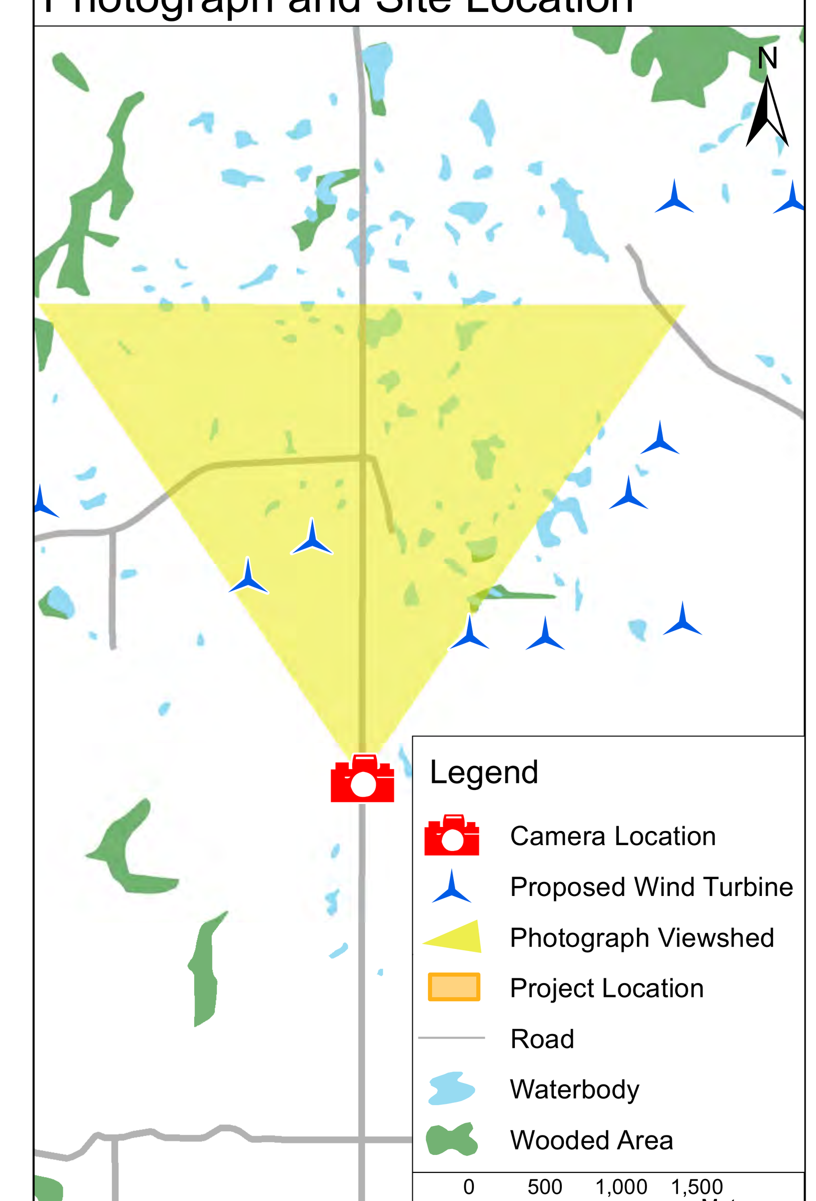
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 6 EAST OF SITE

Index Map



Photograph and Site Location



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Sources: Natural Resources Canada.

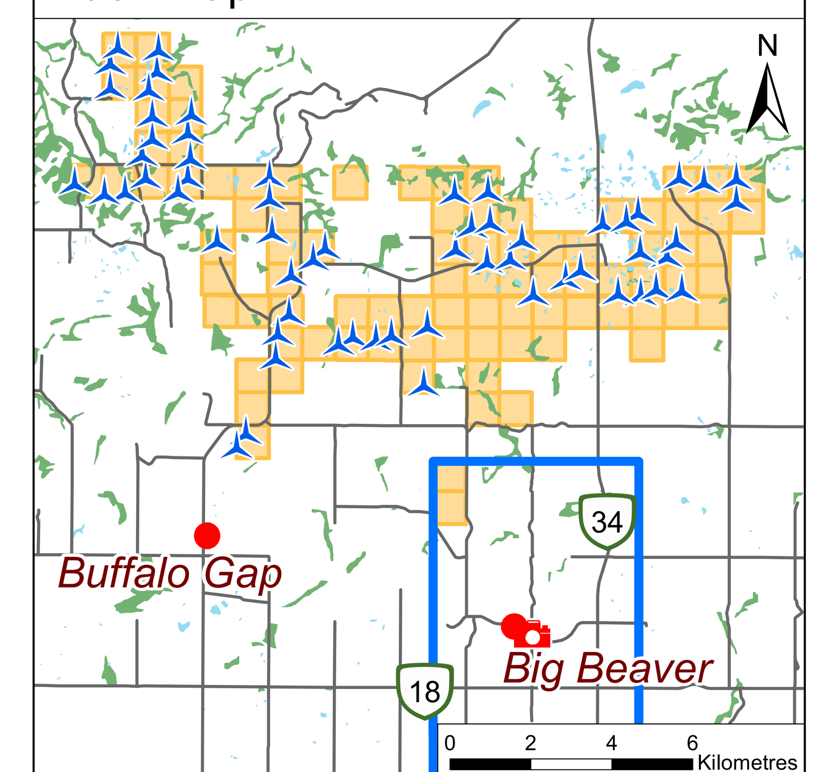
CanACRE

BluEarth RENEWABLES INC.

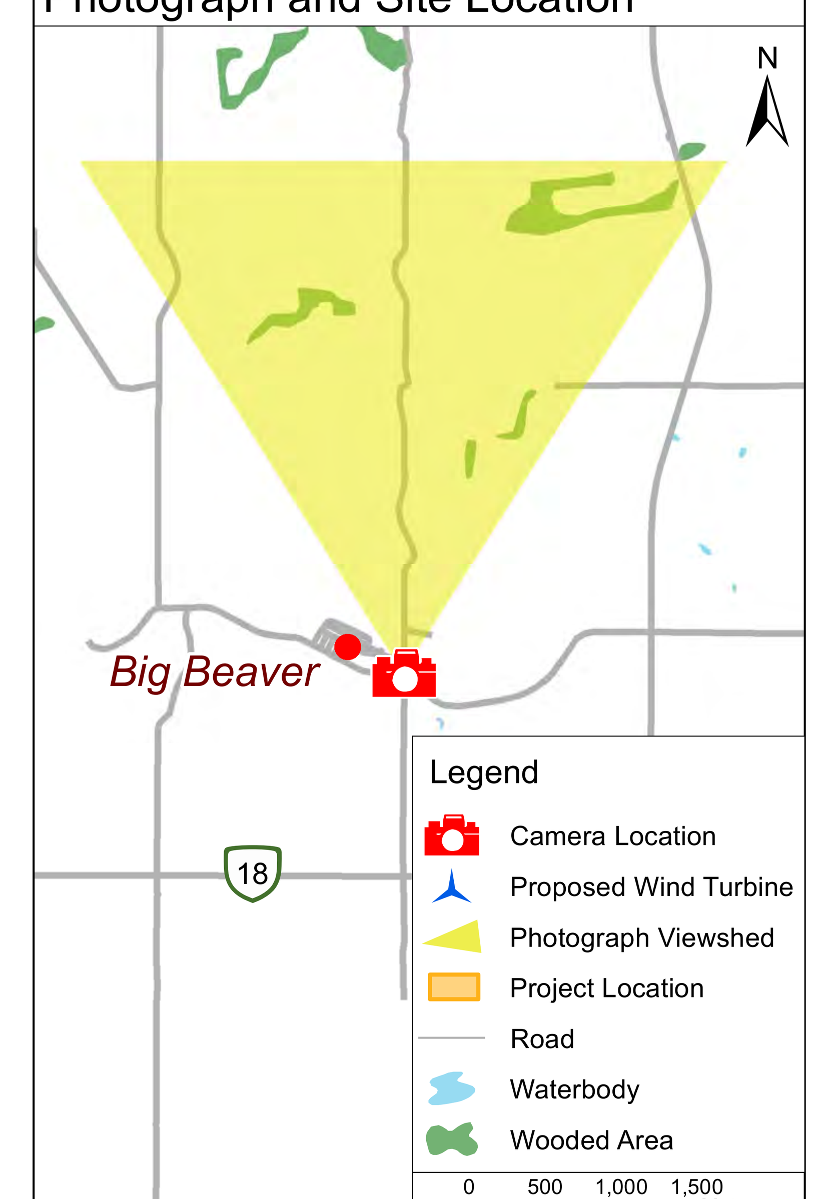
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



Photograph and Site Location



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Date: June 20, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 200mw - Vantage Point 2 V2

Photomontage

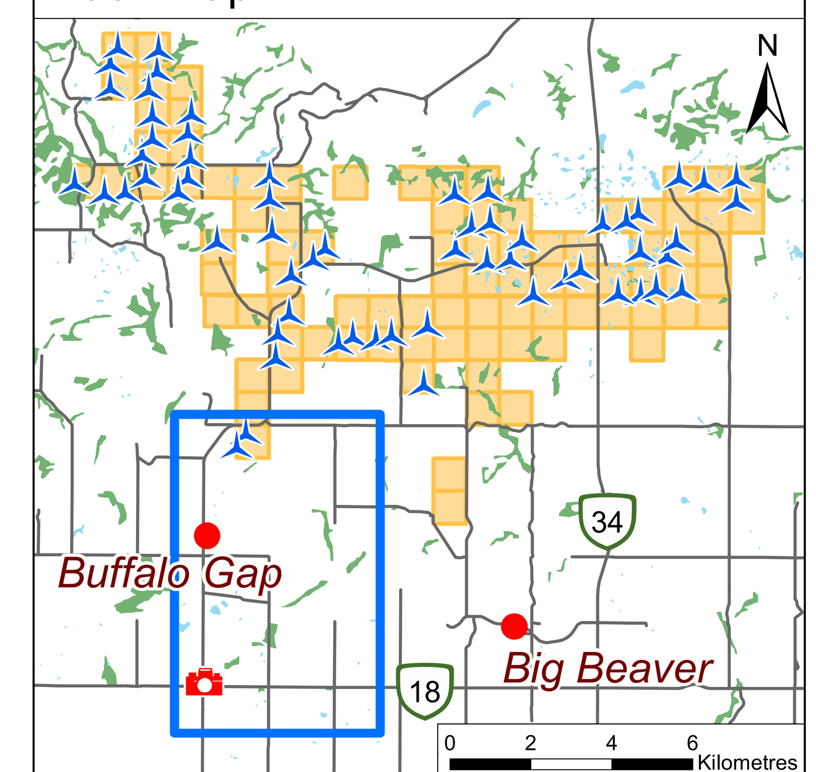
Original Photograph

BluEarth™ RENEWABLES INC.

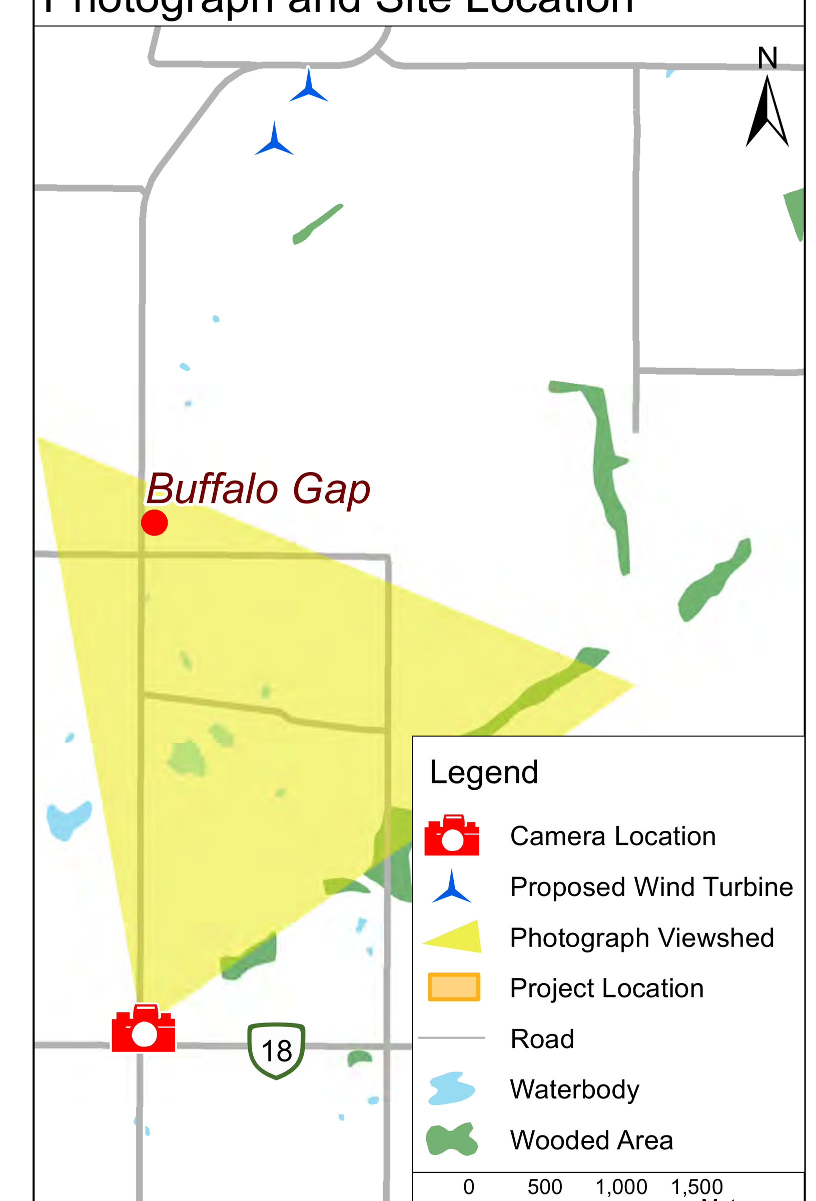
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 1 SOUTHWEST OF SITE

Index Map



Photograph and Site Location



Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

Photomontage

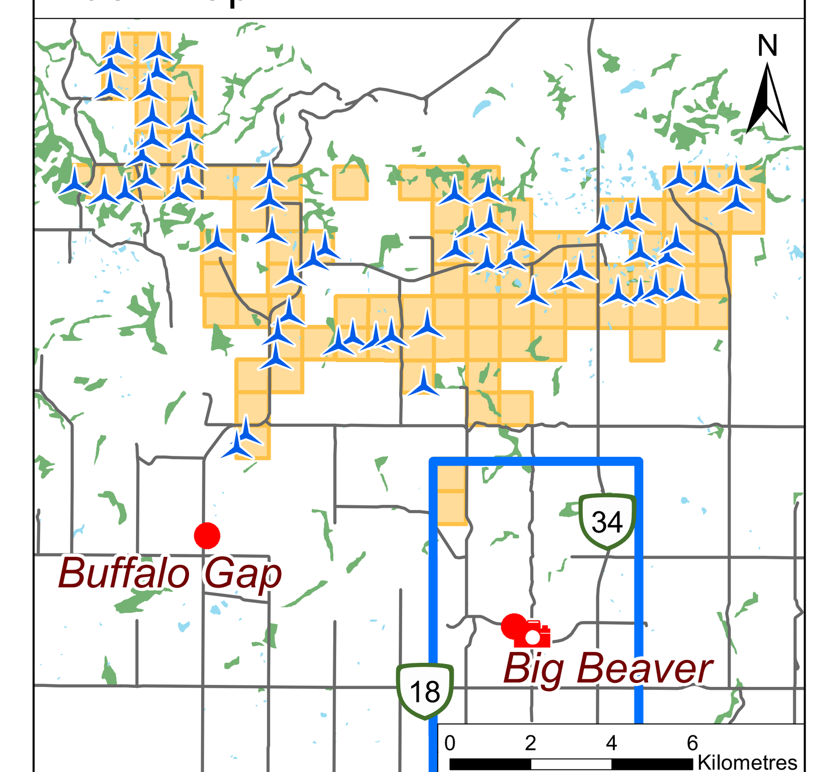
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



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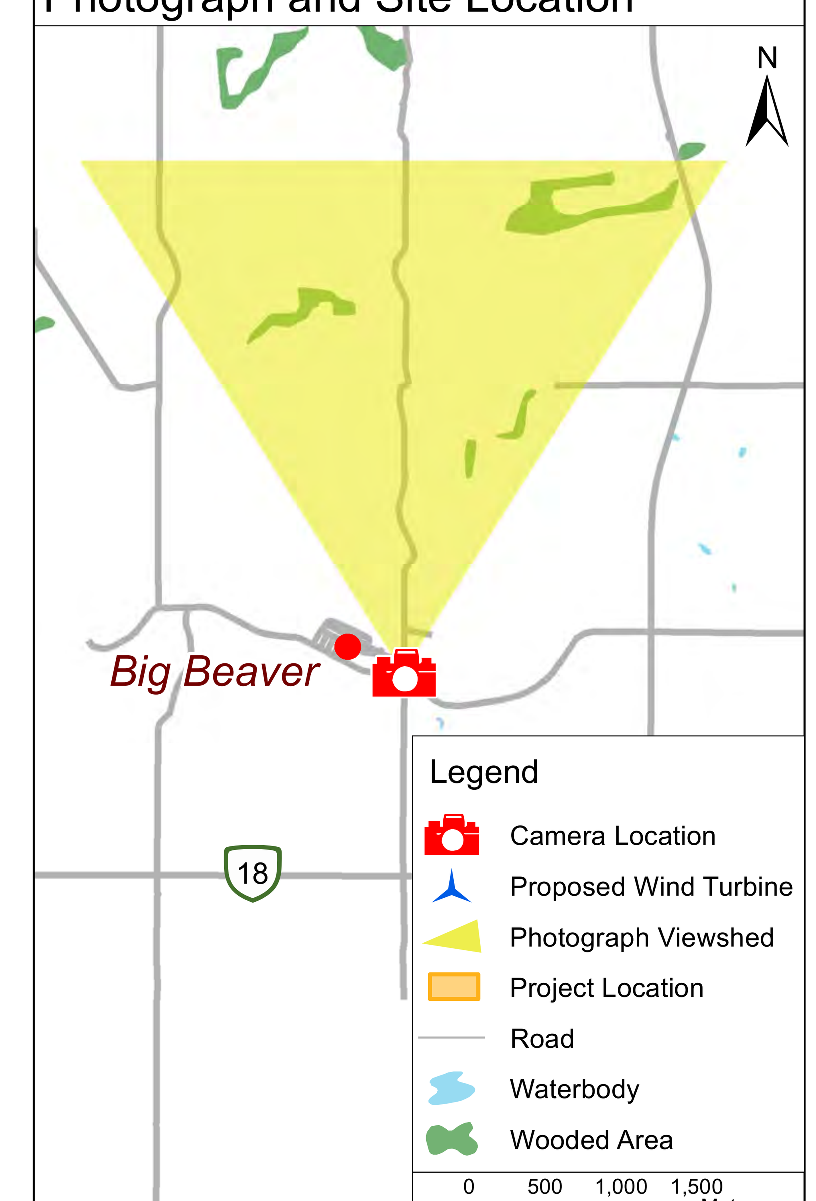


Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 20, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 200mw - Vantage Point 2 V2

BluEarth Renewables Inc.

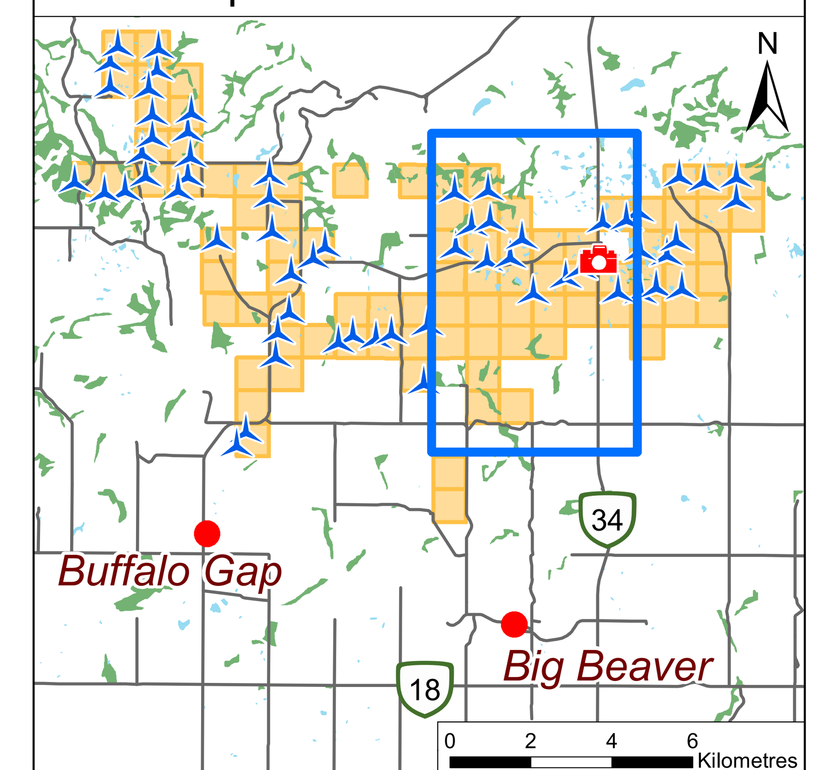
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 3 EAST OF SITE

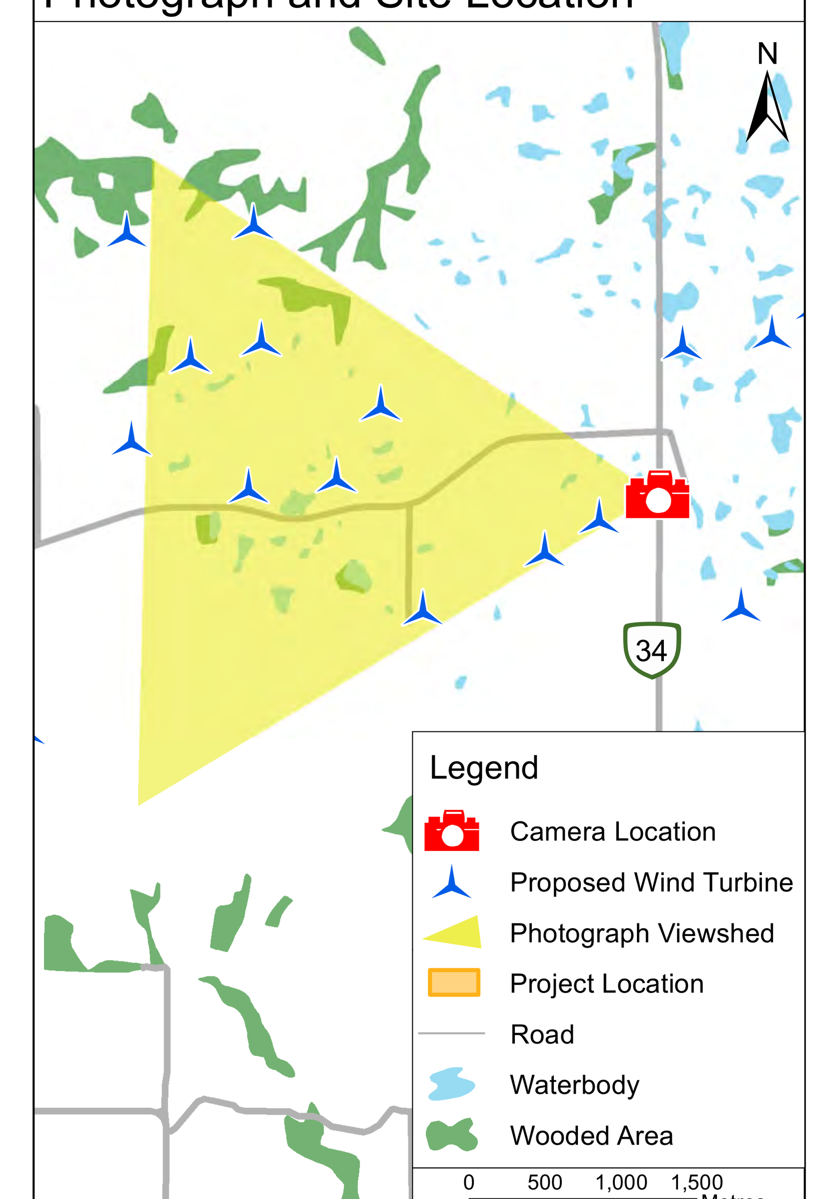
Photomontage

Original Photograph

Index Map



Photograph and Site Location



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Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

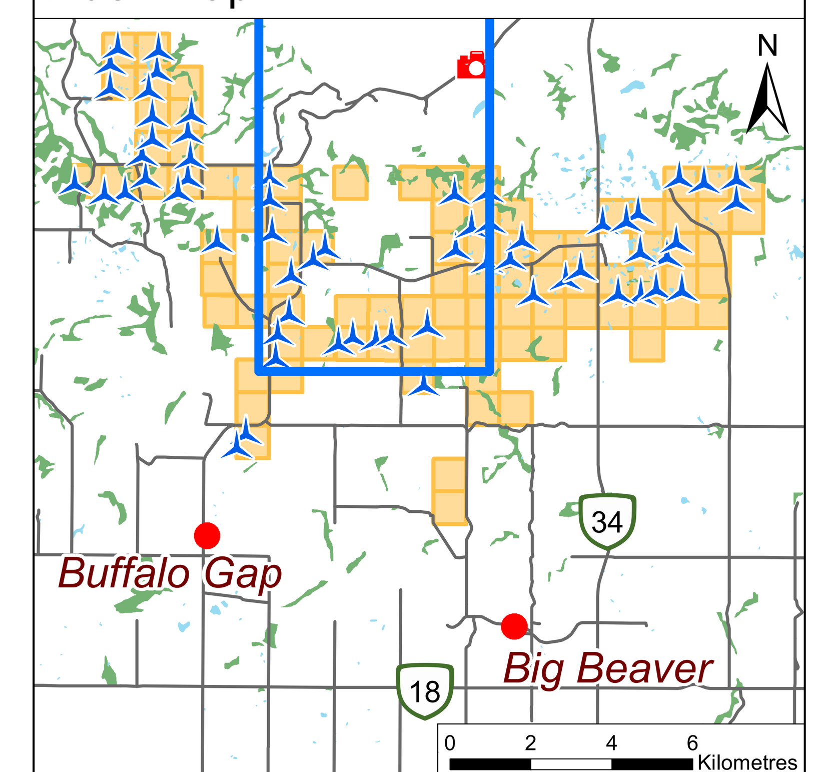
Map17-0242 - Outlaw Trails 200mw - Vantage Point 3

BluEarth™
RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 4 NORTH OF SITE

Index Map



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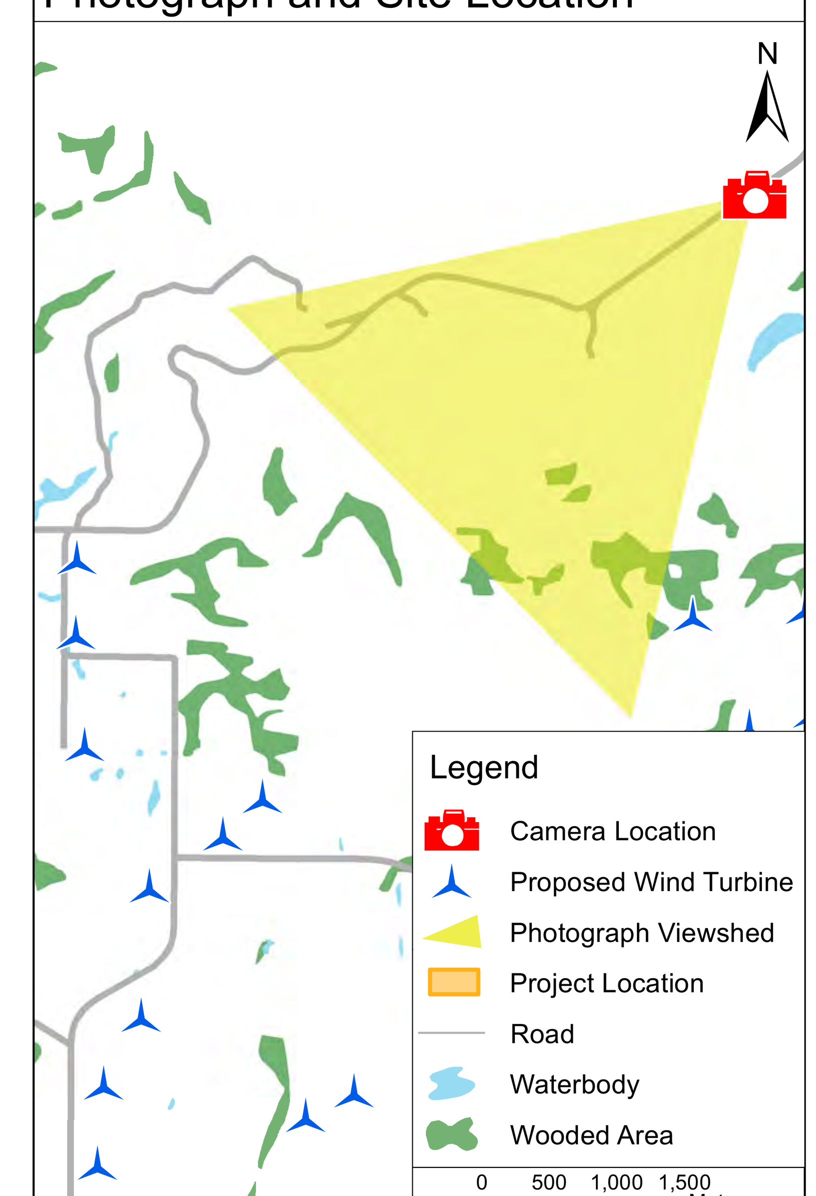

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Sources: Natural Resources Canada.

CanACRE

Map17-0242 - Outlaw Trails 200mw - Vantage Point 4

Photomontage

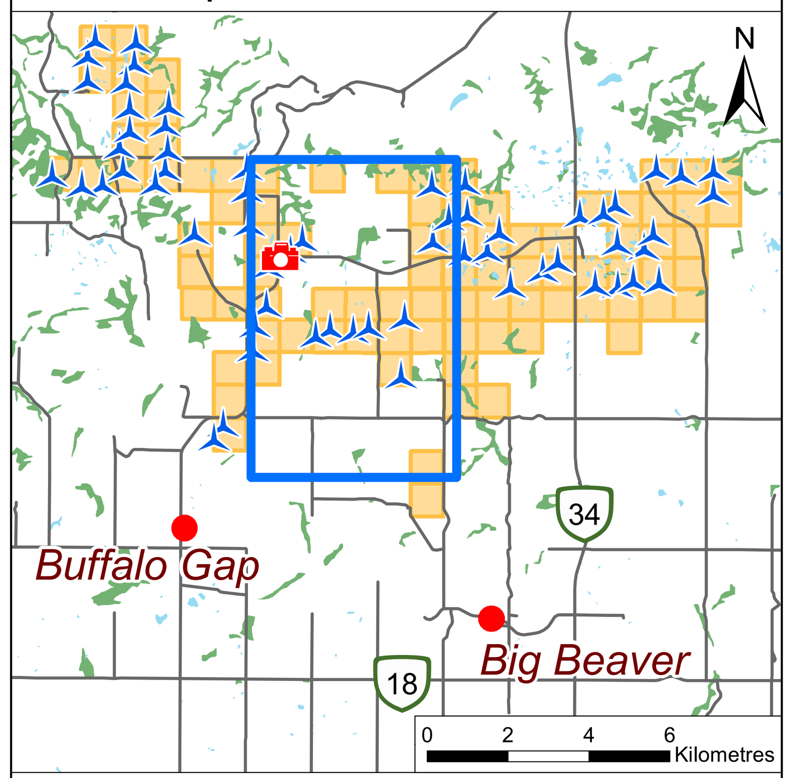
Original Photograph

BluEarth RENEWABLES INC.

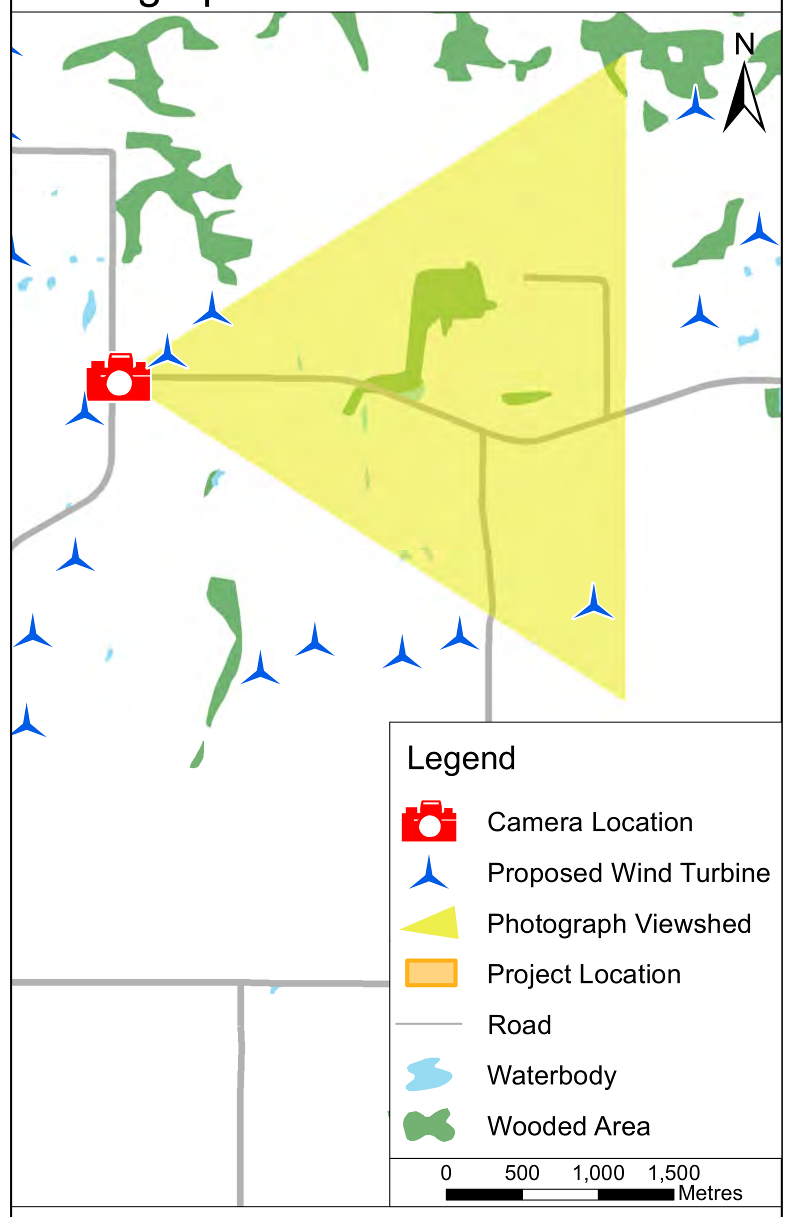
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 5 WEST OF SITE

Index Map



Photograph and Site Location



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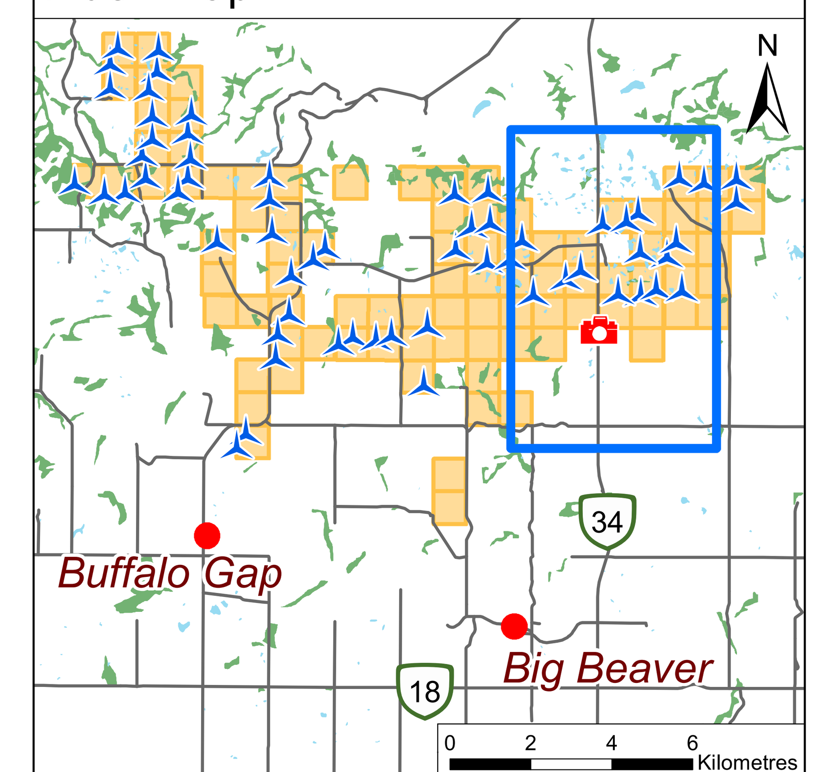
CanACRE

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 6 EAST OF SITE

Index Map



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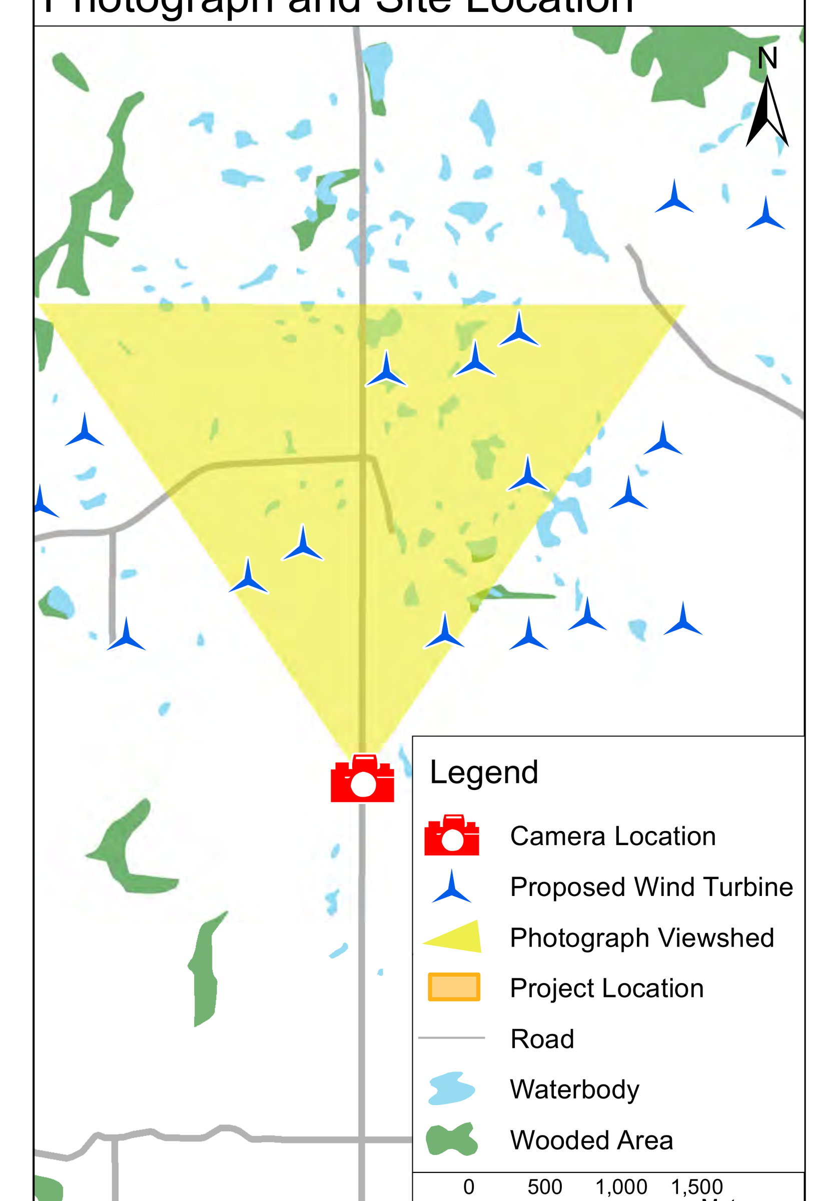

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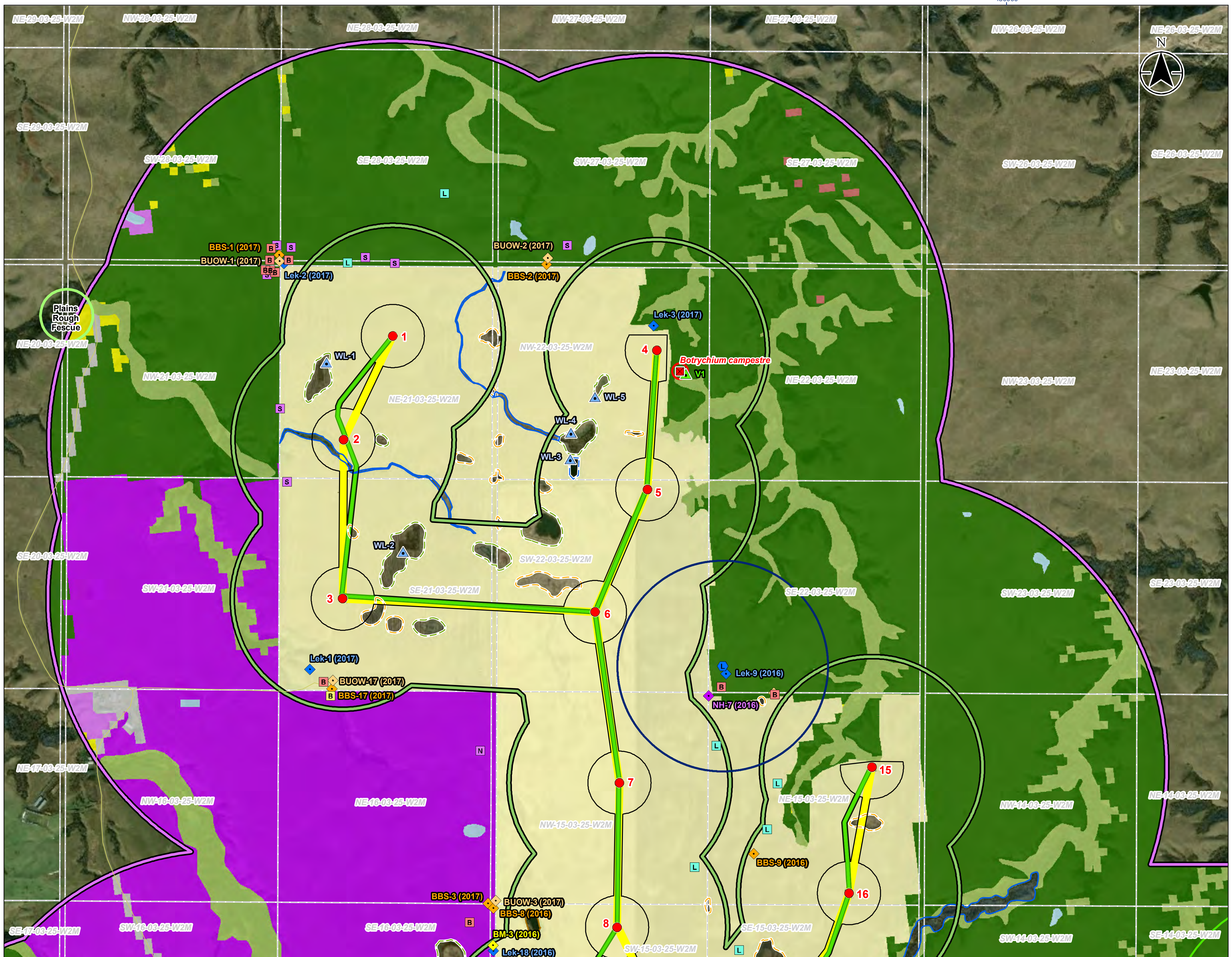
Sources: Natural Resources Canada.

Appendix C PROVINCIAL AND FEDERAL SPECIES RANKING DEFINITIONS

Category	Definition
SKCDC[1]	
S1	Critically Imperiled/Extremely Rare – at very high risk of extinction or extirpation due to extreme rarity, very steep declines, high threat level, or other factors
S2	Imperiled/Very Rare – at high risk of extinction or extirpation due to a very restricted range, very few populations, steep declines, threats or other factors.
S3	Vulnerable/Rare to Uncommon – at moderate risk of extinction or extirpation due to a restricted range, relatively few populations, recent and widespread declines, threats, or other factors.
S4	Apparently secure – uncommon, but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure/Common – demonstrably secure under present conditions; widespread and abundant; low threat level.
Modifiers for SKCDC Ranks	
A	Accidental or causal in the province, including species recorded infrequently that are far outside their range (birds or butterflies).
B	For migratory species, rank applies to the breeding population in the province.
N	For migratory species, rank applies to the non-breeding population in the province.
M	For migratory species, rank applies to the transient population.
H	Historical occurrence but without recent verification (e.g., within 20 years).
U	Status uncertain and species unrankable due to lack of information.
X	A species that is believed to be extinct or extirpated.
NA	Conservation status is not applicable to this species (e.g., exotic species).
NR	Species is not yet ranked.
?	Can be added to any rank to denote an inexact numeric rank (e.g., S1? = believed to be 5 or fewer occurrences, but some doubt exists concerning status).
SK Wildlife Act[2]	
Extirpated	A species that no longer exists in the wild in Saskatchewan but exists in the wild outside the province.
Endangered	A species facing imminent extirpation or extinction.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Vulnerable	A species of special concern because of low or declining numbers due to human activities or natural events but that is not endangered or threatened.
SARA[3]	
Extinct	A wildlife species that no longer exists.
Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.

Category	Definition
Endangered	A wildlife species that is facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern	A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
COSEWIC[4]	
Extinct	A wildlife species that no longer exists.
Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered	A wildlife species facing imminent extirpation or extinction.
Threatened	A wildlife species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern	A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.
Data Deficient	A wildlife species for which there is insufficient information to resolve a species' suitability for assessment or to permit an assessment of the species' risk of extinction.
Not At Risk	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
SOURCES: [1] SKCDC 2018. [2] Government of Saskatchewan 1998. [3] Government of Canada 2002. [4] Government of Canada 2018.	

Appendix D BIOPHYSICAL MAP ATLAS



Proposed Project Layout

- Wind Turbine Generator
- Substation
- Permenant New Access Road (Construction and Operations)
- Temporary New Access Road (Construction)
- Collector Line - Underground Feeder
- Collector Line - Overhead

Spatial Boundaries

- Project Development Area
- Vegetation Local Assessment Area
- Wildlife Local Assessment Area
- Major Road
- Minor Road
- Quarter Section

* See extended legend on the back of the page

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0 0.15 0.3 0.45 0.6 Kilometers

1:15,000 (At original document size of 11x17)

Notes

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3. Layout: BluEarth, Jan 23, 2018
4. Imagery: ESRI World Imagery, June 2013.

Area of Interest

Project Location
Near Coronach, SK

113253956-031 REVG
Prepared by acory on 2018-07-24
Technical Review by ceidem on 2018-07-24

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
Appendix D

Title
Biophysical Map Atlas

Species of Management Concern Observations

- Rare Plant
- Noxious Weed
- Ferruginous Hawk Nest
- Sharp-tailed Grouse Lek
- A American Badger
- B Baird's Sparrow
- B Barn Swallow
- B Bobolink
- C Chestnut-collared Longspur
- N Common Nighthawk
- F Ferruginous Hawk
- L Lark Bunting
- L Long-billed Curlew
- F Northern Leopard Frog
- O Osprey
- R Red-necked Phalarope
- S Short-eared Owl
- S Sprague's Pipit

Species of Management Concern Setbacks

- Rare Plant Setback (30 m)
- Ferruginous Hawk Nest Setback (1000 m, Year round)
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Biophysical Surveys

- Vegetation Community Survey Site
- Wetland Survey Site
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Historical Records (SKCDC)

- Wildlife
- Plant

Land Cover

- Class 1 - Ephemeral Wetland
- Class 2 - Temporary Wetland
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- Class 4 - Semi-Permanent Wetland
- Class 5 - Permanent Wetland
- Drainage
- Dugout
- Agricultural
- Broadleaf
- Exposed Land / Barren
- Grassland
- Hayland
- Shrubland
- Tame Pasture
- Pasture / Forages
- Urban / Developed
- Water
- Wetland

Weed Labels:

CB: Common Burdock (*Arctium minus*)
CT: Canadian Thistle (*Cirsium arvense*)

Stantec

BluEarth RENEWABLES INC.

Project Location
Near Big Beaver, SK

113253956-031 REVG
Prepared by acory on 2018-07-24
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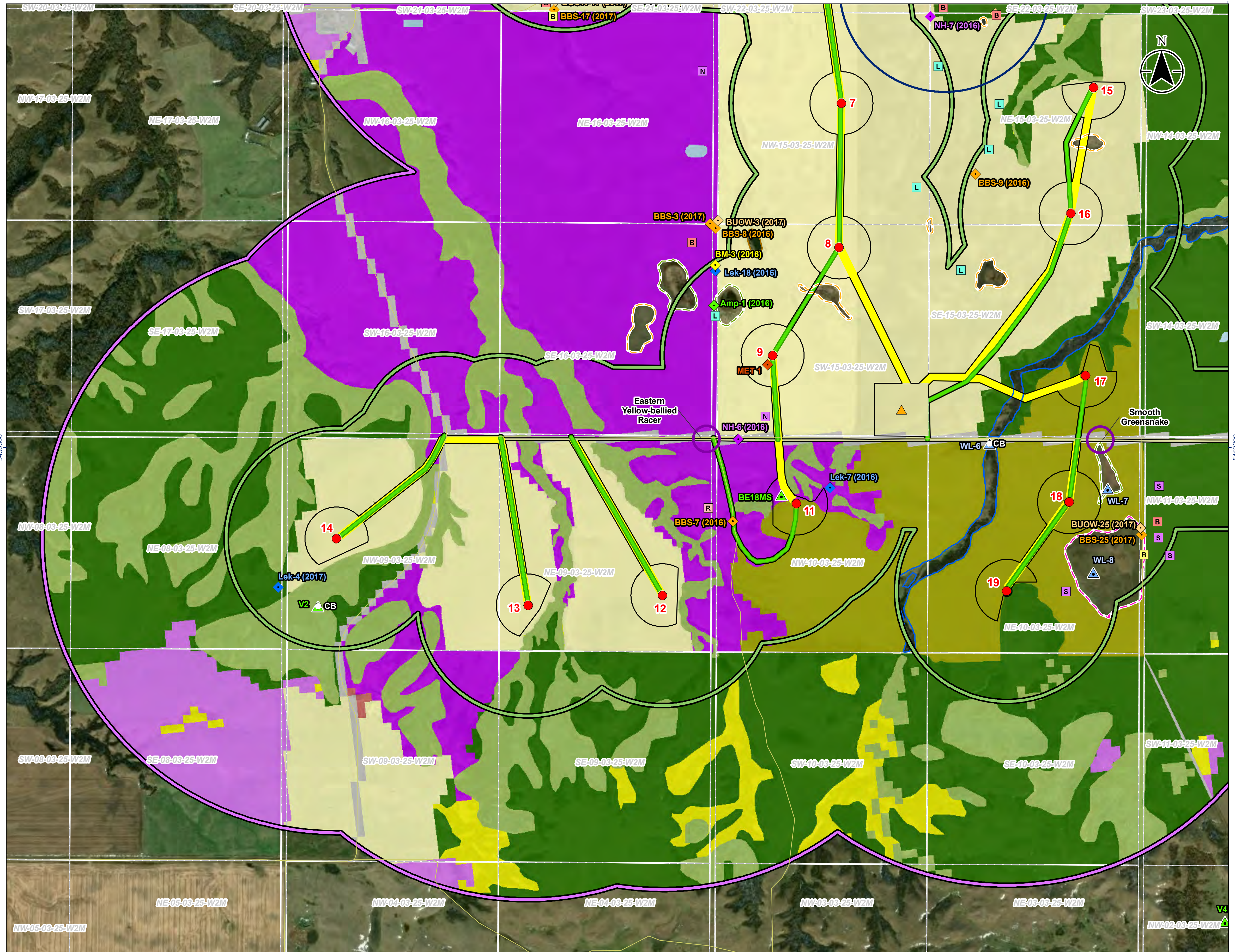

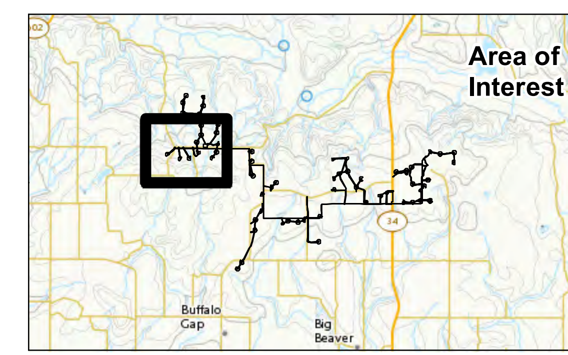

Stantec

BluEarth Renewables Inc.

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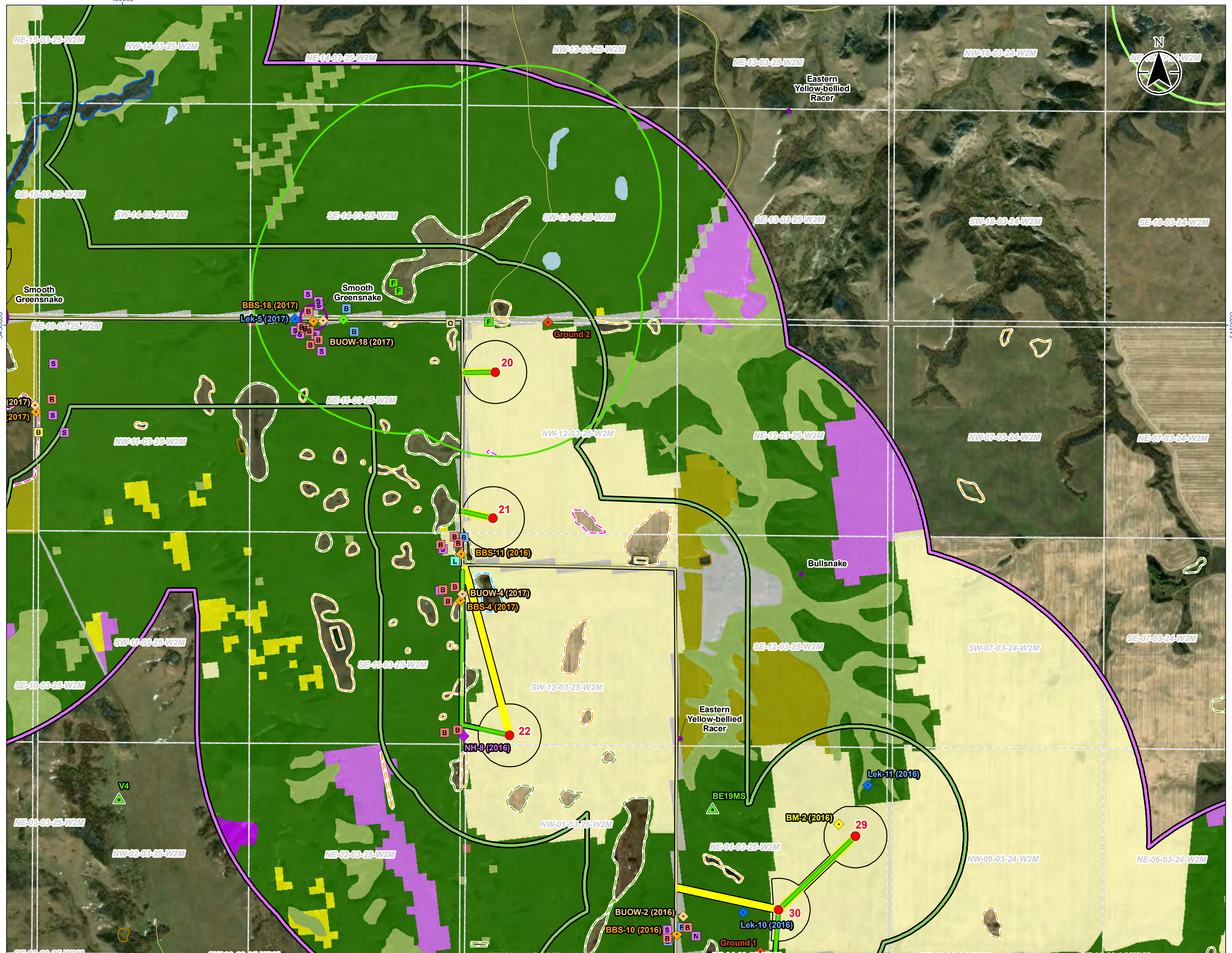

Stantec

BluEarth RENEWABLES INC.

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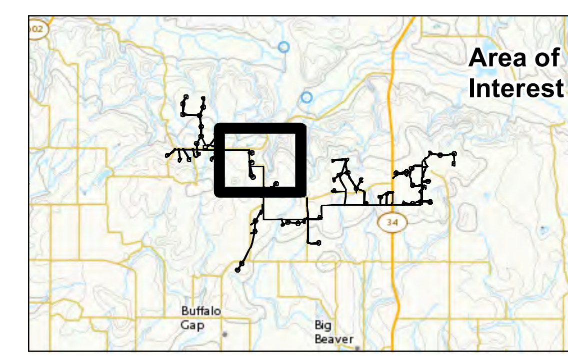

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Client/Project
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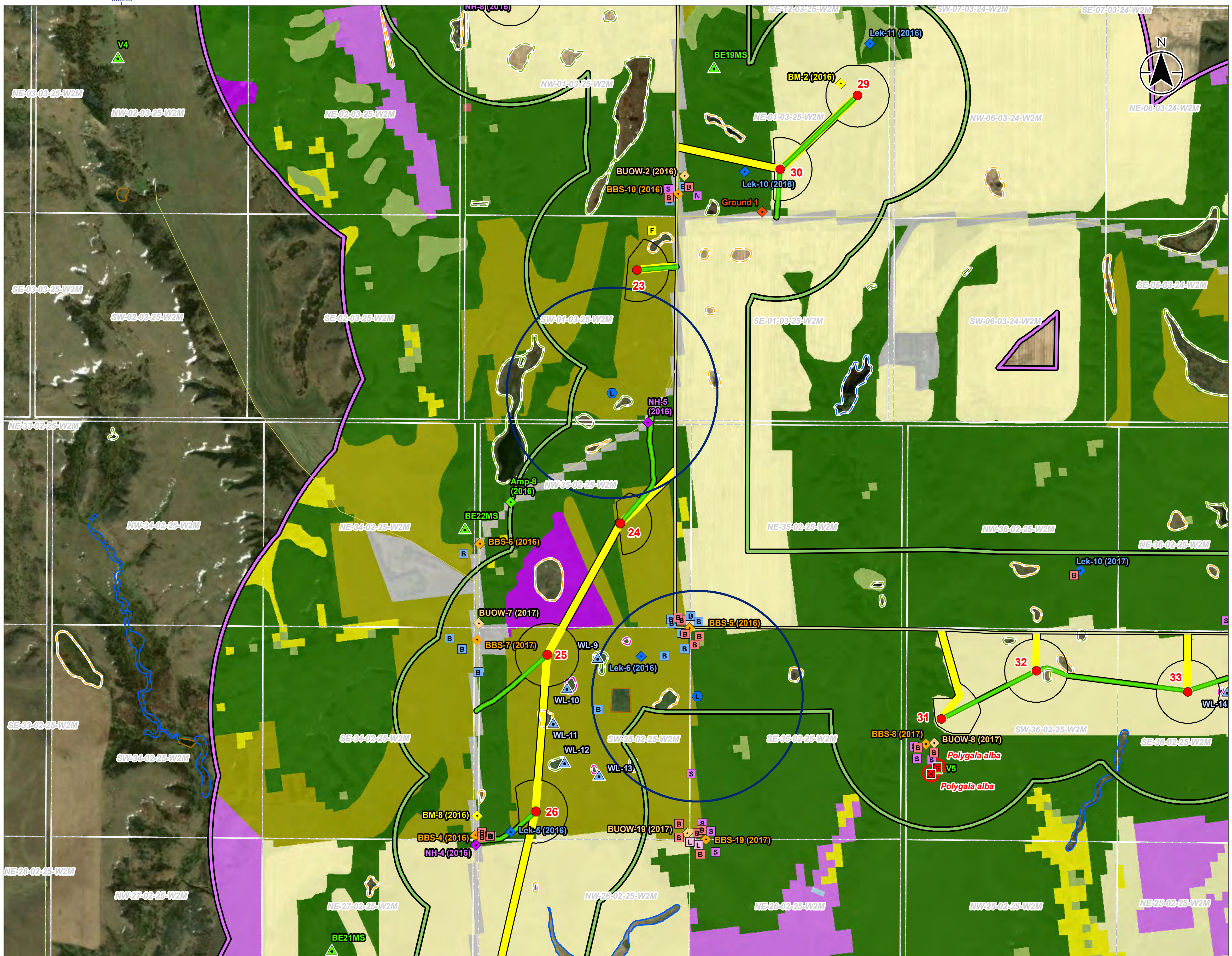

Stantec

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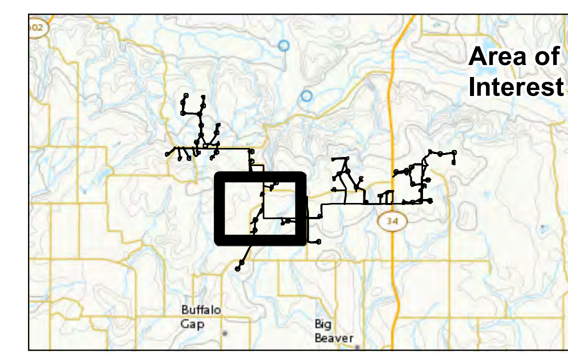

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Outlaw Trail Wind Project

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Stantec BluEarth RENEWABLES INC.

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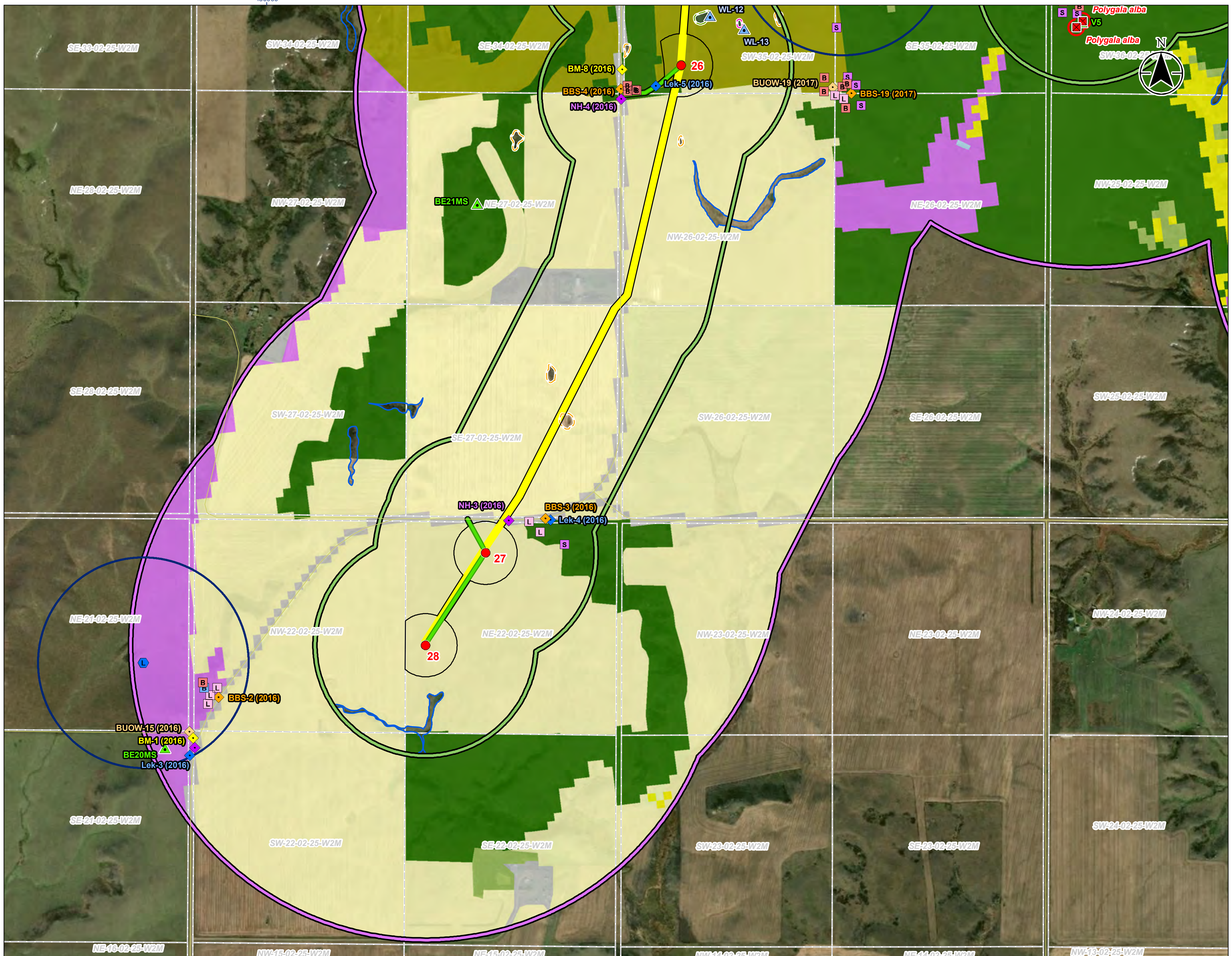

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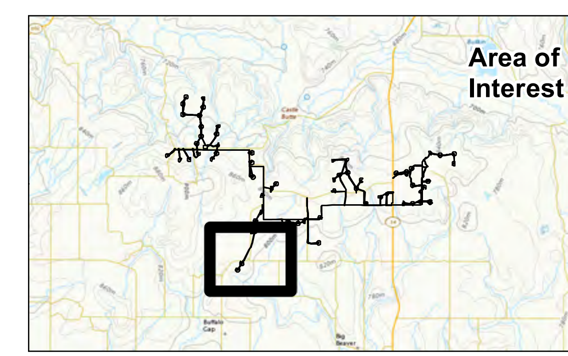

Project Location
Near Coronach, SK

113253956-031 REVG
Prepared by acory on 2018-07-24
Technical Review by ceidem on 2018-07-24

Client/Project
BluEarth Renewables Inc.
Outlaw Trail Wind Project

Figure No.
Appendix D

Title
Biophysical Map Atlas

Species of Management Concern Observations

- A Rare Plant
- Noxious Weed
- Ferruginous Hawk Nest
- Sharp-tailed Grouse Lek
- A American Badger
- B Baird's Sparrow
- B Barn Swallow
- B Bobolink
- C Chestnut-collared Longspur
- N Common Nighthawk
- F Ferruginous Hawk
- L Lark Bunting
- L Long-billed Curlew
- F Northern Leopard Frog
- O Osprey
- R Red-necked Phalarope
- S Short-eared Owl
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- Wildlife
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- Class 5 - Permanent Wetland
- Drainage
- Dugout
- Agricultural
- Broadleaf
- Exposed Land / Barren
- Grassland
- Hayland
- Shrubland
- Tame Pasture
- Pasture / Forages
- Urban / Developed
- Water
- Wetland

Weed Labels:

CB: Common Burdock (*Arctium minus*)
CT: Canadian Thistle (*Cirsium arvense*)

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BluEarth RENEWABLES INC.

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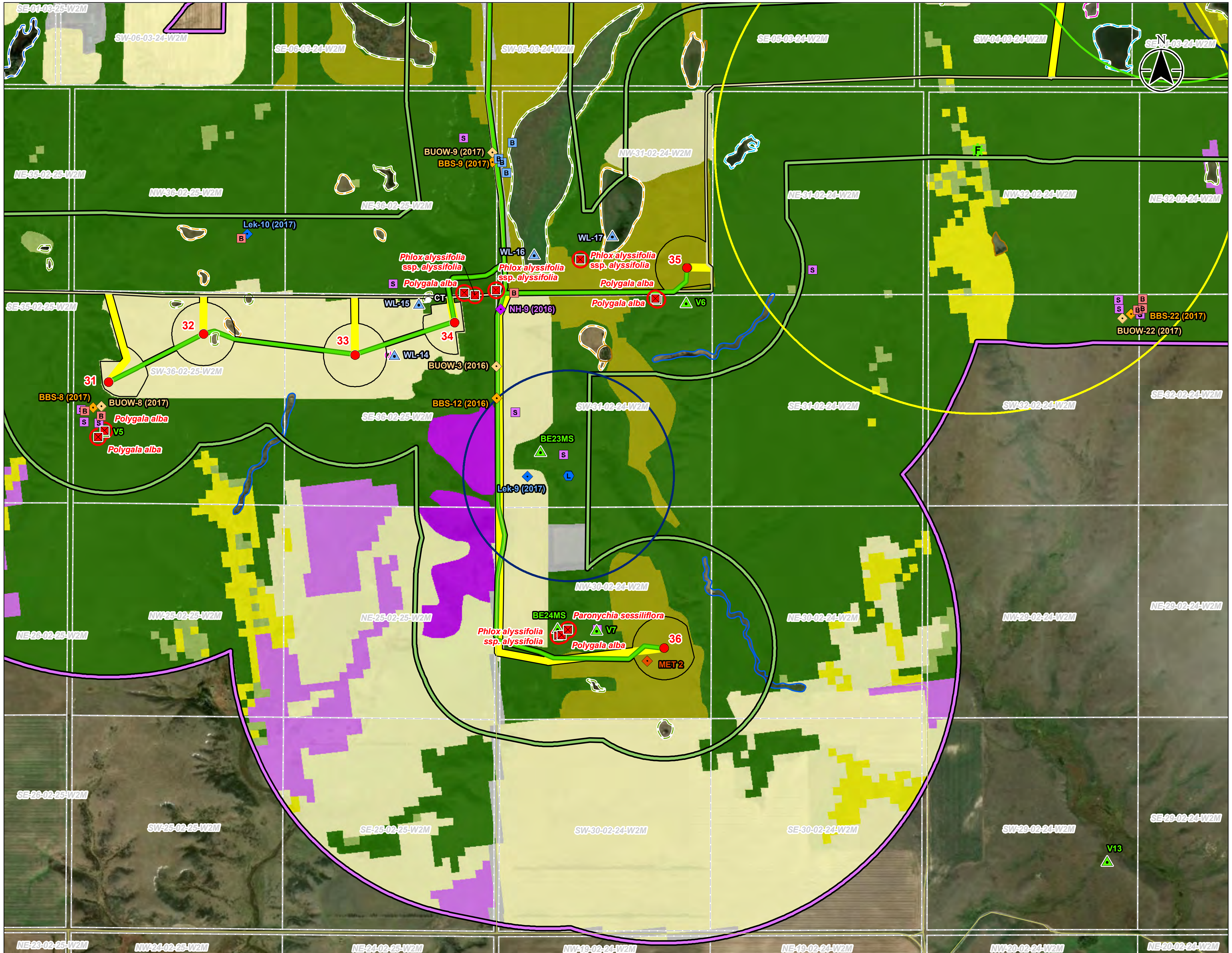

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- Substation
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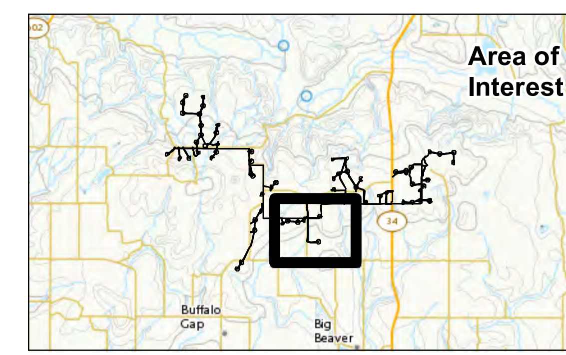

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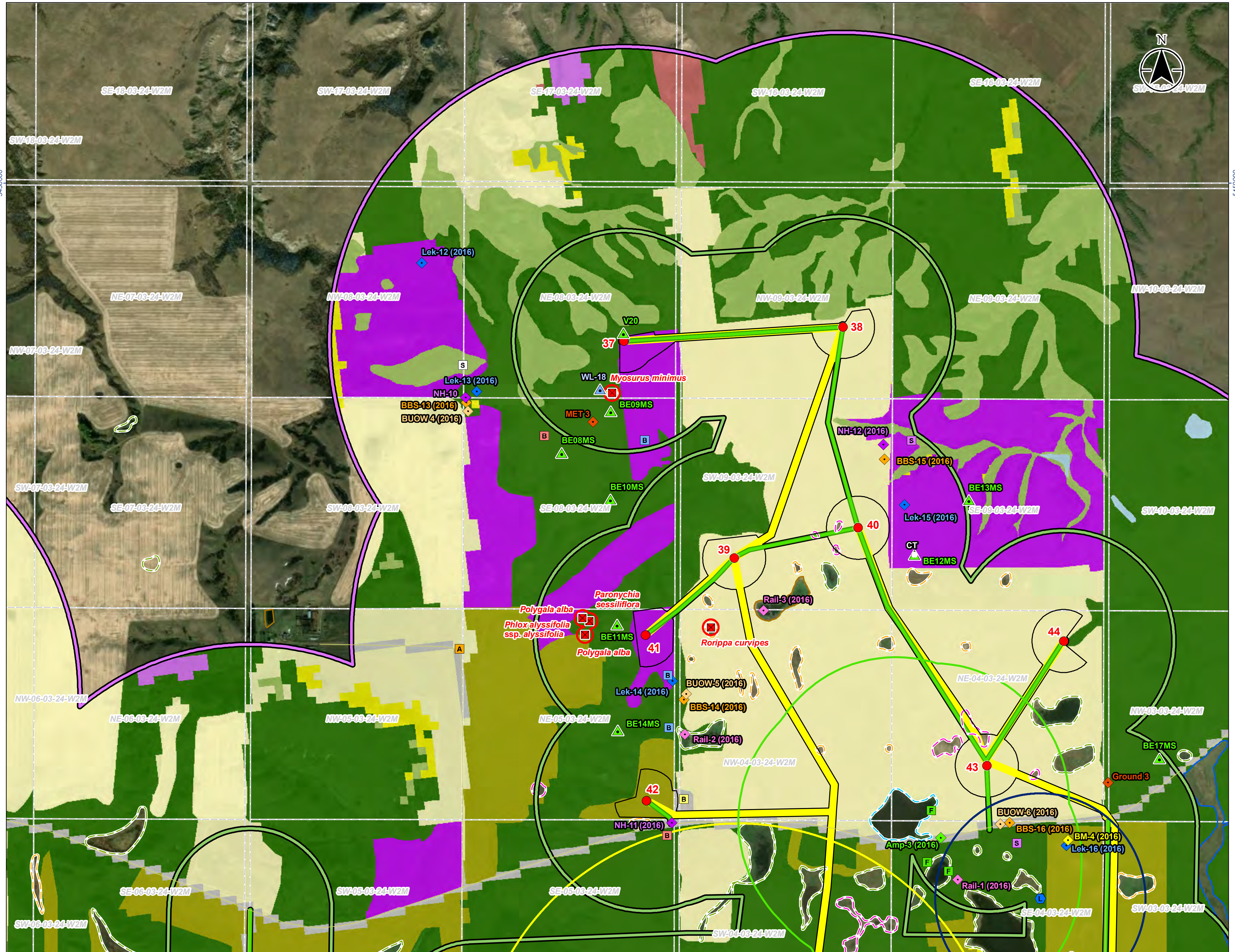

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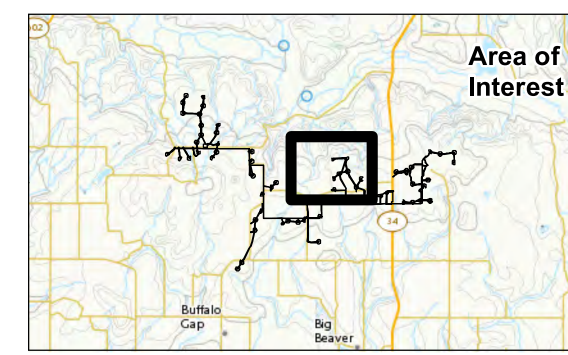

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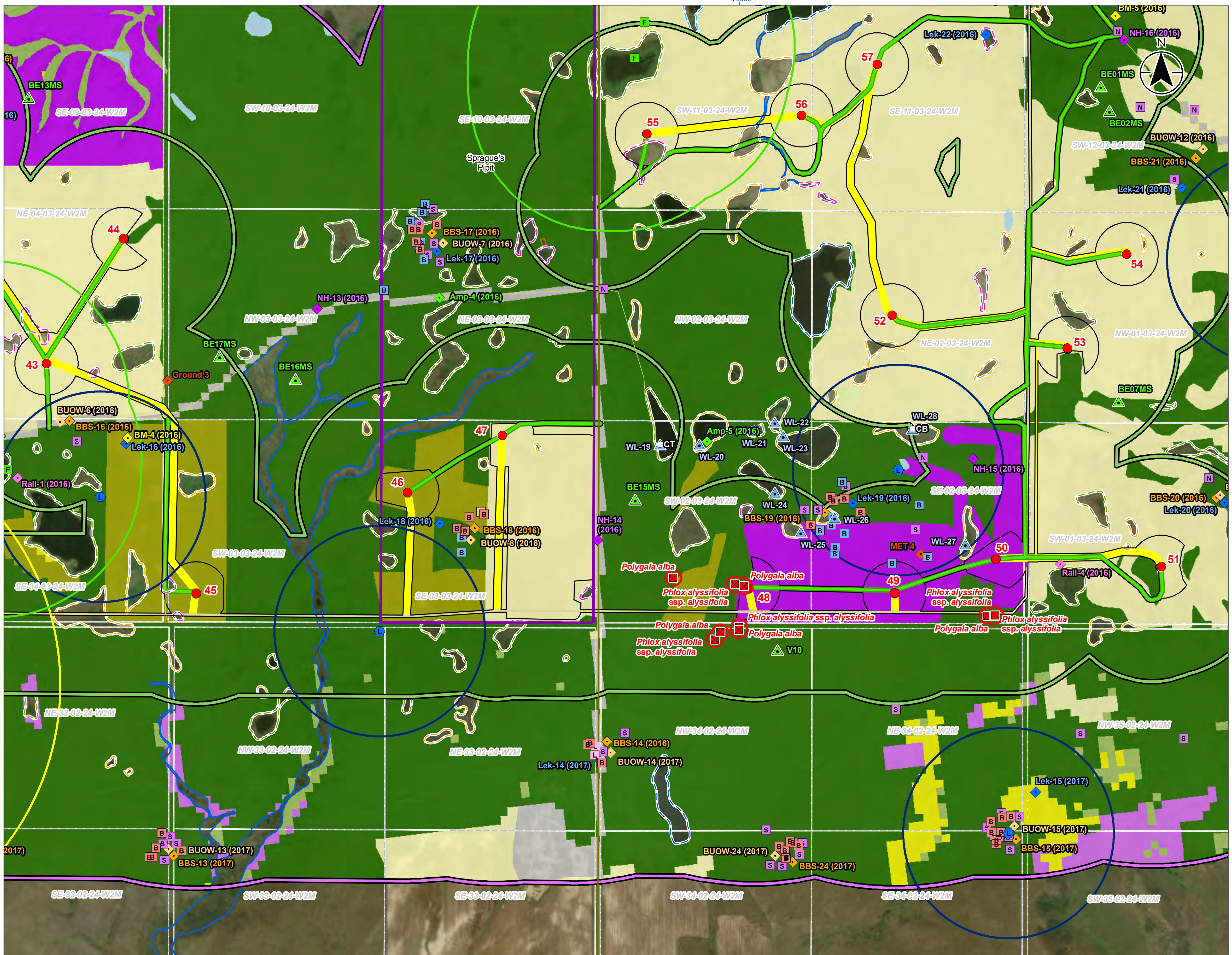

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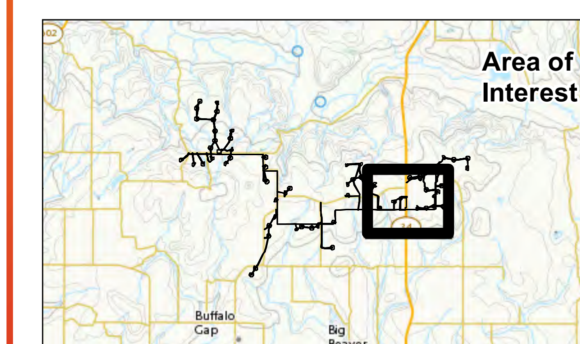

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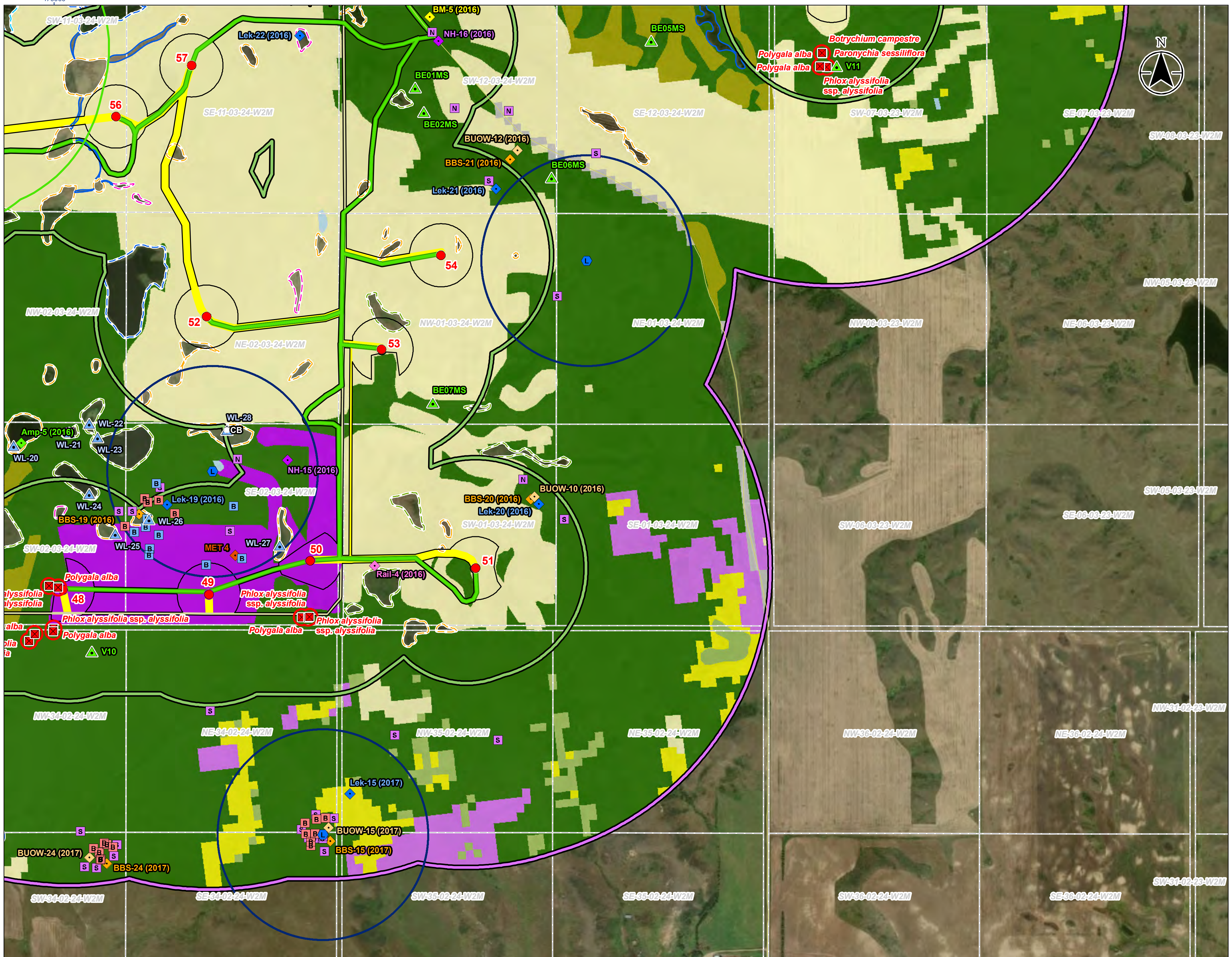

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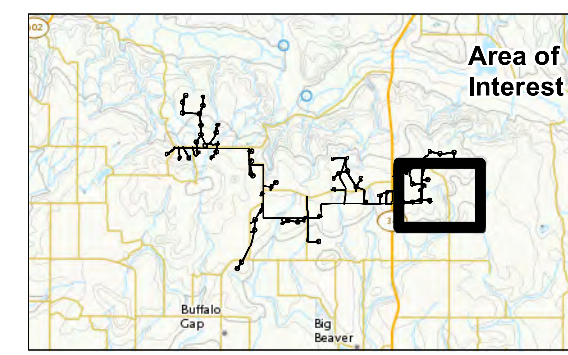

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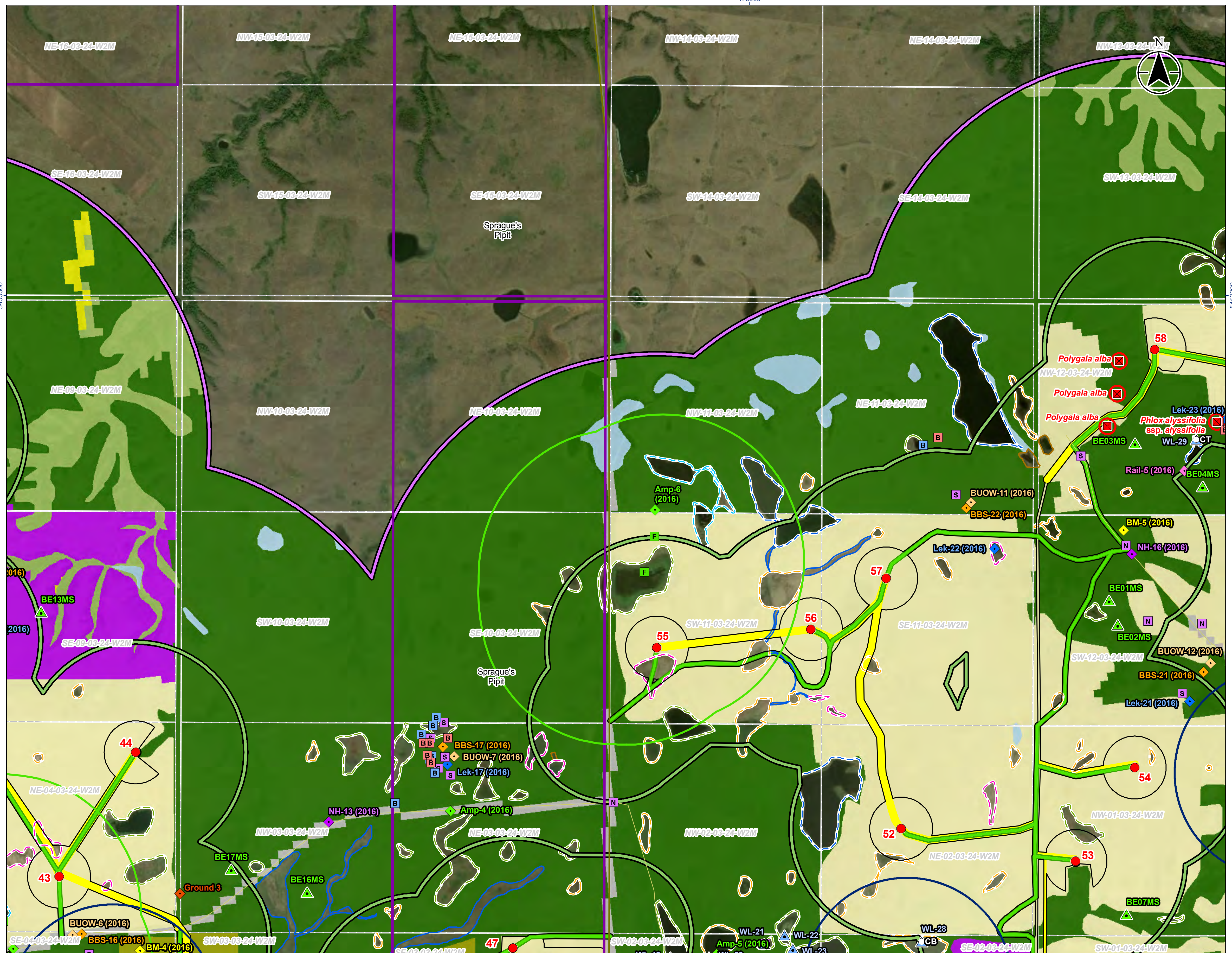

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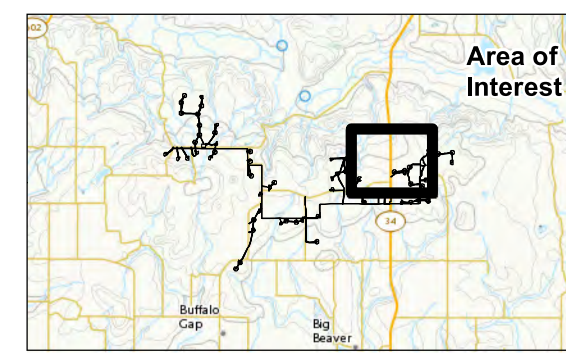

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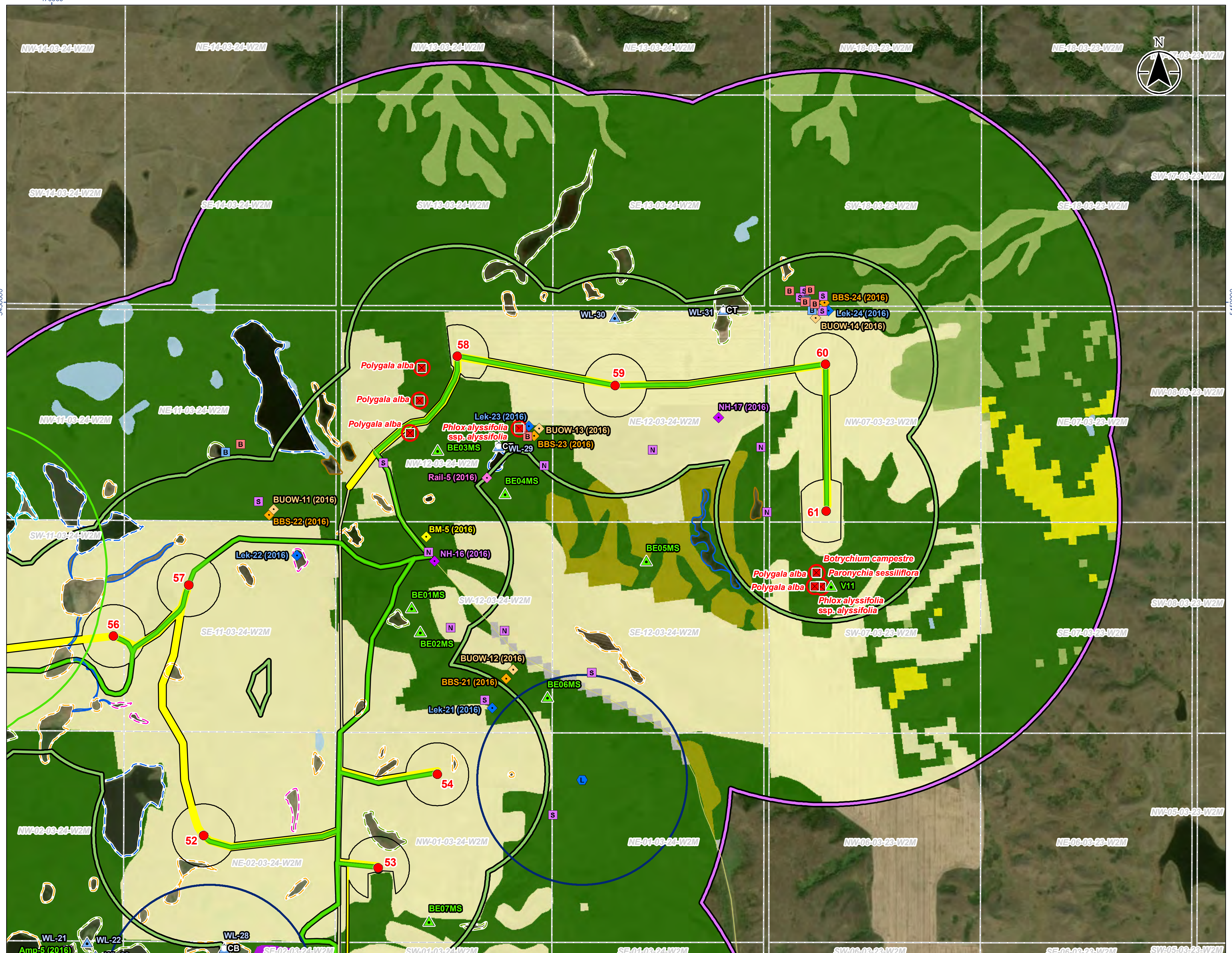

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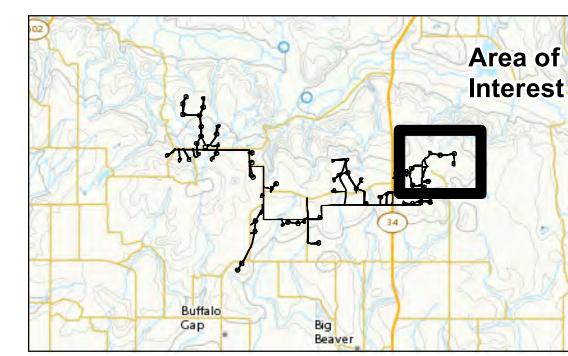

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Appendix E SUPPLEMENTARY INFORMATION – VEGETATION AND WETLANDS

E.1 STEWART AND KANTRUD (1971) WETLAND CLASSIFICATION

Wetland Class	Central Zone	Description
Class I – ephemeral ponds	low prairie zone	Ephemeral ponds occur in small swales and contain species such as Kentucky bluegrass (*Poa pratensis*).
Class II – temporary ponds	wet meadow zone	In freshwater temporary ponds, the central wet meadow zone is the deepest part of the wetland area and is usually dominated by western wheatgrass (*Pascopyrum smithii*) and foxtail barley (*Hordeum jubatum* ssp. *jubatum*).
Class III – seasonal ponds	shallow marsh zone	Seasonal ponds are wetlands with a shallow marsh zone dominating the deepest part of the wetland area. These ponds are frequently surrounded by a ring of willows with a wet center containing sedges (*Carex* spp.).
Class IV – semi-permanent ponds	deep marsh zone	In semi-permanent ponds and lakes, the deep marsh zone dominates the deepest part of the wetland area. Common cattail (*Typha latifolia*) and bulrushes (*Scirpus* spp.) are typical emergent species.
Class V – permanent ponds	permanent open water zone	The permanent open water zone dominates the deepest part of the wetland area and is devoid of emergent vegetation.
Class VI – alkali ponds	intermittent-alkali zone	The intermittent-alkali zone is the deepest part of the wetland area. This zone may be devoid of emergent vegetation or beaked ditch grass (*Ruppia maritima*) may be present.

E.2 VASCULAR PLANT SPECIES LIST FROM THE 2016 AND 2017 VEGETATION COMMUNITY SURVEYS

Scientific Name	Common Name	S-Rank
Achillea millefolium	common yarrow	S5
Agropyron cristatum ssp. *pectinatum*	crested wheatgrass	SNA
Agrostis scabra var. *scabra*	hair grass	S4
Alisma triviale	broad-leaved water plantain	S4
Alopecurus aequalis var. *aequalis*	short-awn meadow-foxtail	S4
Alopecurus pratensis	meadow foxtail	SNA
Anemone patens var. *multifida*	prairie crocus	S5
Androsace septentrionalis	pygmyflower	S5
Anemone patens var. *multifida*	prairie crocus	S5
Antennaria sp.	pussytoes	-
Antennaria microphylla	small-leaved pussy-toes	S5
Antennaria neglecta	broad-leaved pussytoes	S4
Apocynum androsaemifolium	spreading dogbane	S4
Aralia nudicaulis	wild sarsaparilla	S4
Arctium minus	common burdock	SNA
Artemisia sp.	sage species	-
Artemisia campestris	plains sagewort	S4
Artemisia dracunculus	tarragon	S4
Artemisia frigida	pasture sage	S5
Artemisia ludoviciana ssp. *ludoviciana*	prairie sage	S5
Astragalus spp.	milk-vetch	-
Astragalus gilviflorus var. *gilviflorus*	cushion milk-vetch	S5
Astragalus lotiflorus	low milk-vetch	S4
Astragalus pectinatus	narrow-leaved milk-vetch	S4
Avenula hookeri	Hooker's oat grass	S5
Beckmannia syzigachne	slough grass	S4
Boechera sp.	rockcress	-
Bouteloua gracilis	blue grama	S5
Bromus inermis	smooth brome	SNA
Calamagrostis montanensis	plains reed grass	S5
Calamovilfa longifolia var. *longifolia*	long-leaved reed grass	S5
Campanula rotundifolia	harbell	S5
Carex sp.	carex species	-
Carex atherodes	awned sedge	S4

Scientific Name	Common Name	S-Rank
Carex duriuscula	needle-leaved sedge	S5
Carex filifolia	thread-leaved sedg	S5
Carex inops ssp. *heliophila*	sun sedge	S5
Carex pellita	woolly sedge	S4
Carex sprengelii	Sprengel's sedge	S5
Cerastium arvense ssp. *strictum*	field mouse-ear chickweed	S5
Chenopodium album var. *album*	Lamb's quarter's	SNA
Chenopodium rubrum var. *rubrum*	red goosefoot	S4
Cirsium arvense	Canada thistle	SNA
Cirsium flodmanii	Flodman's thistle	S4
Comandra umbellata ssp. *pallida*	bastard toadflax	S5
Crataegus chrysocarpa	northern hawthorn	S4
Cryptantha celosioides	clustered oreocarya	S4
Coeloglossum viride var. *virescens*	long-bracted green bog orchid	S4
Dalea purpurea var. *purpurea*	purple prairie-clover	S4
Dasiphora fruticosa ssp. *floribunda*	shrubby cinquefoil	S4
Drymocallis arguta	white cinquefoil	S4
Echinochloa muricata var. *microstachya*	rough barnyard grass	S4
Elaeagnus commutata	sliverberry	S4
Eleocharis acicularis	needle spike-rush	S4
Eleocharis palustris	creeping spike-rush	S4
Elymus lanceolatus ssp. *lanceolatus*	northern wheatgrass	S5
Elymus repens	creeping wild rye	SNA
Elymus trachycaulus	slender wheatgrass	S5
Elymus trachycaulus ssp. *subsecundus*	slender wheatgrass	S5
Erigeron sp.	fleabane	-
Erigeron caespitosus	tufted fleabane	S4
Erigeron glabellus	streamside fleabane	S5
Eriogonum flavum var. *flavum*	yellow umbrella plant	S4
Erysimum sp.	wallflower	-
Erysimum asperum	western wallflower	S4
Festuca hallii	plains rough fescue	S5
Festuca saximontana var. *saximontana*	Rocky Mountain fescue	S5
Fraxinus pennsylvanica	green ash	S4
Gaillardia aristata	great-flowered gaillardia	S4
Galium boreale	northern bedstraw	S5
Geum macrophyllum var. *perincisum*	large-leaved avens	S4

Scientific Name	Common Name	S-Rank
Geum triflorum	old-man's whiskers	S5
Glyceria striata var. *striata*	fowl-manna grass	S4
Gnaphalium palustre	western marsh cudweed	S5
Grindelia hirsutula	hairy gumweed	S5
Grindelia squarrosa var. *serrulata*	tar weed	S5
Gutierrezia sarothrae	broomweed	S4
Helianthus spp.	sunflower	-
Helianthus pauciflorus ssp. *subrhomboideus*	rhombic-leaved sunflower	S4
Heracleum maximum	cow parsnip	S4
Hesperostipa sp.	needlegrass	-
Hesperostipa comata ssp. *comata*	needle-and-thread grass	S5
Hesperostipa curtiseta	porcupine grass	S5
Hesperostipa spartea	porcupine grass	S4
Heterotheca villosa var. *villosa*	hairy false golden-aster	S5
Heuchera richardsonii	alumroot	S4
Hordeum jubatum ssp. *jubatum*	fox-tail barley	S5
Juncus balticus	Baltic rush	S4
Juniperus horizontalis	creeping juniper	S5
Koeleria macrantha	June grass	S5
Krascheninnikovia lanata	winter-fat	S4
Lactuca serriola	prickly lettuce	SNA
Lathyrus ochroleucus	cream-coloured vetchling	S4
Liatris punctata	dotted blazing star	S5
Limosella aquatica	mudwort	S4
Linum lewisii var. *lewisii*	flax	S4
Lygodesmia juncea	skeleton-weed	S5
Lysimachia ciliata	fringed loosestrife	S4
Maianthemum stellatum	starflower false Solomon's-seal	S4
Medicago sativa ssp. *sativa*	alfalfa	SNA
Melilotus sp.	sweet-clover	-
Melilotus officinalis	yellow sweet-clover	SNA
Mentha arvensis	wild mint	S4
Moehringia lateriflora	blunt-leaved sandwort	S4
Monarda fistulosa var. *menthifolia*	wild bergamot	S4
Muhlenbergia cuspidata	prairie muhly	S4
Muhlenbergia richardsonis	mat muhly	S4
Myosurus minimus	least mousetail	S3

Scientific Name	Common Name	S-Rank
Nassella viridula	green needlegrass	S5
Orobanche fasciculata	clustered broom-rape	S4
Oxalis stricta	yellow wood sorrel	S4
Oxytropis spp.	locoweed	-
Oxytropis campestris var. *spicata*	northern yellow point-vetch	S4
Packera cana	silvery groundsel	S4
Paronychia sessiliflora	low whitlowwort	S3
Pascopyrum smithii	western wheatgrass	S5
Pediomelum argophyllum	silvery scurf pea	S5
Pediomelum esculentum	Indian breadroot	S4
Penstemon albidus	white beardtongue	S4
Persicaria amphibia var. *emersa*	water smartweed	S4
Phalaris arundinacea	reed canary grass	S4
Phlox hoodii ssp. *hoodii*	moss phlox	S5
Physaria spp.	bladderpod	-
Poa interior	inland blue grass	S4
Poa pratensis	Kentucky blue grass	SNA
Poa secunda	blue grass	S5
Populus balsamifera ssp. *balsamifera*	balsam poplar	S5
Populus tremuloides	trembling aspen	S5
Potentilla	cinquefoil	-
Potentilla concinna var. *concinna*	red cinquefoil	S4
Potentilla pensylvanica	prairie cinquefoil	S4
Prunus virginiana var. *virginiana*	chokecherry	S5
Ranunculus cymbalaria	seaside buttercup	S4
Ranunculus macounii	Macoun's buttercup	S4
Ratibida columnifera	prairie cone-flower	S4
Ribes oxyacanthoides ssp. *oxyacanthoides*	bristly gooseberry	S4
Rorippa curvipes	curved yellow-cress	S3
Rosa acicularis ssp. *sayi*	prickly rose	S5
Rosa arkansana	low prairie rose	S5
Rosa woodsii var. *woodsii*	Wood's rose	S5
Rubus idaeus ssp. *strigosus*	American red raspberry	S5
Rumex crispus	curled dock	SNA
Sagittaria cuneata	arum-leaved arrowhead	S4
Salsola kali	Russian-thistle	SNA
Sanicula marilandica	black snakeroot	S4

Scientific Name	Common Name	S-Rank
Schizachyrium scoparium var. *scoparium*	little bluestem	S4
Schoenoplectus acutus var. *acutus*	hard-stemmed bulrush	S4
Selaginella densa var. *densa*	dense spike-moss	S4
Setaria viridis var. *viridis*	green foxtail	SNA
Solidago gigantea	late goldenrod	S4
Solidago missouriensis	goldenrod	S5
Sonchus arvensis ssp. *arvensis*	field sow-thistle	SNA
Sonchus asper ssp. *asper*	spiny-leaved annual sow-thistle	SNA
Sphaeralcea coccinea ssp. *coccinea*	scarlet mallow	S5
Stachys pilosa var. *pilosa*	hairy hedge-nettle	S4
Symphoricarpos albus var. *albus*	snowberry	S4
Symphoricarpos occidentalis	western snowberry	S5
Symphyotrichum ericoides var. *pansum*	tufted white prairie aster	S5
Symphyotrichum laeve var. *geyeri*	Geyer's aster	S5
Taraxacum officinale ssp. *officinale*	common dandelion	SNA
Thalictrum venulosum	veiny meadow-rue	S4
Thermopsis rhombifolia	golden-bean	S5
Thlaspi arvense	stinkweed	SNA
Toxicodendron rydbergii	poison ivy	S4
Tragopogon dubius	yellow goat's-beard	SNA
Typha angustifolia	narrow-leaved cattail	SNA
Typha latifolia	common cattail	S4
Ulmus pumila	Siberian elm	SNA
Utricularia vulgaris	common bladderwort	S4
Veronica peregrina ssp. *xalapensis*	hairy speedwell	S4
Vicia americana ssp. *americana*	American purple vetch	S5
Viola spp.	violet	-
Viola adunca var. *adunca*	sand violet	S5
Viola canadensis var. *rugulosa*	Canadian white violet	S4
Xanthisma spinulosum var. *spinulosum*	spiny goldenaster	S4
Zizia aptera	heart-leaved alexanders	S4

E.3 PHOTOGRAPHS FROM THE 2016 AND 2017 VEGETATION COMMUNITY AND WETLAND SURVEYS

PHOTO 1   Prairie dunewort (*Botrychium campestre*)-S2

PHOTO 2   Least mousetail (*Myosurus minimus*) – S3

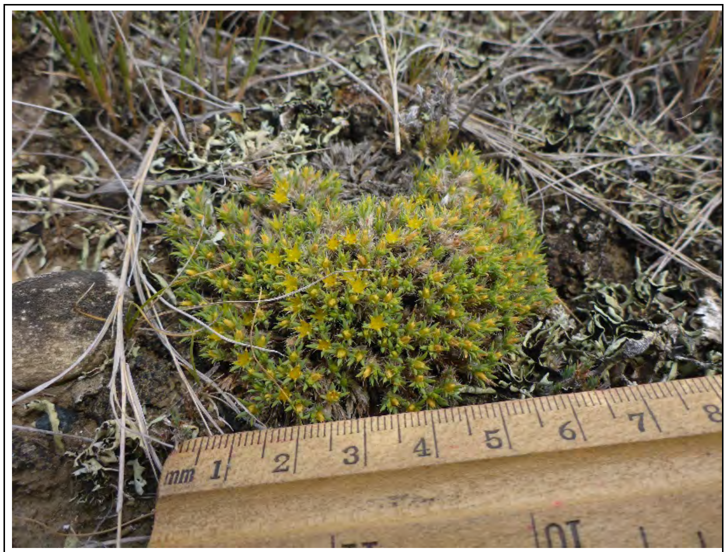


PHOTO 3   Low whitlowwort (*Paronychia sessiliflora*) – S3

PHOTO 4   Blue wild phlox (*Phlox alyssifolia* ssp. *alyssifolia*) – S3

PHOTO 5 White milkwort (*Polygala alba*) – S3

PHOTO 6 Vegetation community quadrat V6 in the SW 21-02-24 W2M

PHOTO 7 White milkwort along hillside, facing north.

PHOTO 8 Class I ephemeral pond on SW 35-02-25 W2M, facing north.

PHOTO 9 Class II temporary pond in the NE 08-02-24 W2M, facing east.

PHOTO 10 Class III seasonal pond in the NE 10-03-25 W2M, facing east.

PHOTO 11 Class VI permanent pond in the NE 12-03-24 W2M, facing south.

Appendix F SUPPLEMENTARY INFORMATION – WILDLIFE

Table F.1 Wildlife SOMC with Potential to Occur in the Wildlife RAA

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
INSECTS						
Dusky dune moth	*Copablepharon longipenne*	Endangered	Endangered		S1	none
Monarch	*Danaus plexippus*	Special Concern	Endangered		S2B	none
Pale yellow dune moth	*Copablepharon grandis*	Special Concern	Special Concern		S2	none
Rhesus skipper	*Polites rhesus*				S2	none
Verna's flower moth	*Schinia verna*	Threatened	Threatened		S1	none
Gypsy cuckoo bumble bee	*Bombus bohemicus*	No Status	Endangered		S1	none
Western bumble bee	*Bombus occidentalis*	No Status	Threatened		S4	none
Yellow-banded bumble bee	*Bombus terricola*	No Status	Special Concern		S5	none
Nine-spotted lady beetle	*Coccinella novemnotata*	No Status	Endangered		S4	none
HERPTILES						
Canadian toad	*Anaxyrus hemiophrys*		Not at Risk		S4	Breeding and overwintering habitat (90 m)
Great plains toad	*Anaxyrus cognatus*	Special Concern	Special Concern		S3	Breeding and overwintering habitat (500 m)
Plains spadefoot	*Spea bombifrons*		Not at Risk		S3	Breeding and overwintering habitat (90 m)

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
Northern leopard frog	*Lithobates pipiens*	Special Concern	Special Concern		S3	Breeding and overwintering habitat (500 m)
Western tiger salamander	*Ambystoma mavortium*	Special Concern	Special Concern		S4	none
Bullsnake	*Pituophis catenifer sayi*	No Status	Special Concern		S4	none
Smooth green snake	*Opheodrys vernalis*				S4	Hibernacula (200 m)
Plains hog-nosed snake	*Heterodon nasicus*				S3	Hibernacula (200 m)
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*	Threatened	Threatened		S2	Hibernacula (1,000 m)
UPLAND GAME BIRDS						
Sharp-tailed grouse	*Tympanuchus phasianellus*				S5	Lek (400 m)
RAPTORS						
Osprey	*Pandion haliaetus*				S2B, S2M	Nest site (1,000 m)
Bald eagle	*Haliaeetus leucocephalus*		Not at Risk		S5B,S5N,S4M	Nest site (1,000 m)
Golden eagle	*Aquila chrysaetos*		Not at Risk		S3B,S3N,S4M	Nest site (1,000 m)
Cooper's hawk	*Accipiter cooperii*		Not at Risk		S4B,S2N,S2M	Nest site (400 m)
Ferruginous hawk	*Buteo regalis*	Threatened	Threatened		S3	Nest site (1,000 m)
Peregrine falcon	*Falco peregrinus anatum*	Special Concern	Not at Risk		S1B,SNRM	Nest site (1,000 m)

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
Burrowing owl	*Athene cunicularia*	Endangered	Endangered	Endangered	S2B,S2M	Breeding bird (500 m)
Short-eared owl	*Asio flammeus*	Special Concern	Special Concern		S3B,S2N,S3M	Breeding bird (500 m)
MIGRATORY BIRDS						
Horned grebe	*Podiceps auritus*	Special Concern	Special Concern		S5B,S5M	none
Eared grebe	*Podiceps nigricollis*				S5B,S5M	Breeding grebe colony (200 m)
Western grebe	*Aechmophorus occidentalis*	Special Concern	Special Concern		S3B,S3M	Breeding grebe colony (200 m)
Double-crested cormorant	*Phalacrocorax auritus*		Not at Risk		S5B,S5M	Nesting colony (1,000 m)
American white pelican	*Pelecanus erythrorhynchos*		Not at Risk		S5B,S5M	Nesting colony (1,000 m)
American bittern	*Botaurus lentiginosus*				S5B	Breeding bird (350 m)
Black-crowned night-heron	*Nycticorax nycticorax*				S4B	Nesting colony (1,000 m)
Great blue heron	*Ardea herodias*				S5B	Nesting colony (1,000 m)
Snowy egret	*Egretta thula*				SNA	Nesting colony (1,000 m)
Cattle egret	*Bubulcus ibis*				SNA	Nesting colony (1,000 m)
Great egret	*Ardea alba*				SNA	Nesting colony (1,000 m)
Whooping crane	*Grus americana*	Endangered	Endangered	Endangered	SXB,S1M	Staging area (1,000 m)

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
Yellow rail	*Coturnicops noveboracensis*	Special Concern	Special Concern		S3B,S3M	Breeding bird (350 m)
Piping plover	*Charadrius melodus circumcinctus*	Endangered	Endangered	Endangered	S3B	High-water mark (600 m)
Snowy plover	*Charadrius nivosus nivosus*				SHB	High-water mark (600 m)
Long-billed curlew	*Numenius americanus*	Special Concern	Special Concern		S3B,S4M	Breeding bird (200 m)
Red knot	*Calidris canutus rufa*	Endangered	Endangered		S2M	Staging area (1,000 m)
Buff-breasted sandpiper	*Calidris subruficollis*	Special Concern	Special Concern		S4M	none
Red-necked phalarope	*Phalaropus lobatus*	No Status	Special Concern		S4B,S3M	none
Franklin's gull	*Leucophaeus pipixcan*				S4B,S4M	Nesting colony (400 m)
Herring gull	*Larus argentatus*				S5B,S5M	Nesting colony (400 m)
Black tern	*Chlidonias niger*		Not at Risk		S5B,S5M	Nesting colony (400 m)
Common tern	*Sterna hirundo*		Not at Risk		S5B,S5M	Nesting colony (400 m)
Forster's tern	*Sterna forsteri*		Data Deficient		S4B,S4M	Nesting colony (400 m)
Common nighthawk	*Chordeiles minor*	Threatened	Threatened		S4B,S4M	Breeding bird (200 m)
Loggerhead shrike	*Lanius ludovicianus excubitorides*	Threatened	Threatened		S2B,S2M	Breeding bird (400 m)

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
Bank swallow	*Riparia riparia*	Threatened	Threatened		S4B,S5M	none
Barn swallow	*Hirundo rustica*	Threatened	Threatened		S5B,S5M	none
Sprague's pipit	*Anthus spragueii*	Threatened	Threatened		S3B,S3M	Breeding bird (250 m)
Chestnut-collared longspur	*Calcarius ornatus*	Threatened	Threatened		S3B	Breeding bird (200 m)
McCown's longspur	*Rhynchophanes mccownii*	Special Concern	Threatened		S3B	Breeding bird (200 m)
Baird's sparrow	*Ammodramus bairdii*	Special Concern	Special Concern		S4B	none
Lark bunting	*Calamospiza melanocorys*	No Status	Threatened		S2B, S2M	none
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened		S4B,S4M	none
Rusty blackbird	*Euphagus carolinus*	Special Concern	Special Concern		S3B,SUN,S3M	Breeding bird (300 m)
MAMMALS						
American badger	*Taxidea taxus taxus*	Special Concern	Special Concern		S3	none
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered		S4	Roost/foraging site (500 m)
Long-eared myotis	*Myotis evotis*				S2	Roost/foraging site (500 m)
Western small-footed myotis	*Myotis ciliolabrum*				S2	Roost/foraging site (500 m)
Northern myotis	*Myotis septentrionalis*	Endangered	Endangered		S3	Roost/foraging site (500 m)
Big brown bat	*Eptesicus fuscus*				S5	Roost/foraging site (500 m)

Common Name	Scientific Name	SARA[1]	COSEWIC[1]	SK MOE[2]	SKCDC[3]	SK MOE Activity Restriction Feature (Setback)[4]
Silver-haired bat	*Lasionycteris noctivagans*				S5B	Roost/foraging site (500 m)
Hoary bat	*Lasiurus cinereus*				S5B	Roost/foraging site (500 m)
Eastern red bat	*Lasiurus borealis*				S4B	Roost/foraging site (500 m)

NOTES:
[1] Government of Canada 2018
[2] SK MOE 1998
[3] SKCDC 2018c, 2018d
[4] SK MOE 2017a

Table F.2 Habitat Associations for Wildlife SOMC with the Potential to Occur in the Wildlife RAA

Common Name	Scientific Name	Native Grassland	Tame Pasture	Hayland	Cultivated	Shrubland	Developed	Exposed/ barren	Water	Wetland
INSECTS[1]										
Dusky dune moth	*Copablepharon longipenne*							X		
Monarch	*Danaus plexippus*	X	X							
Pale yellow dune moth	*Copablepharon grandis*							X		
Rhesus skipper	*Polites rhesus*	X								
Verna's flower moth	*Schinia verna*	X								
Gypsy cuckoo bumble bee	*Bombus bohemicus*	X	X			X	X			
Western bumble bee	*Bombus occidentalis*	X	X	X	X	X	X			
Yellow-banded bumble bee	*Bombus terricola*	X	X	X	X	X	X			
Nine-spotted lady beetle	*Coccinella novemnotata*	X	X	X	X	X	X			
HERPTILES[2]										
Canadian toad	*Anaxyrus hemiophrys*	X	X						X	X
Great plains toad	*Anaxyrus cognatus*	X	X						X	X
Plains spadefoot	*Spea bombifrons*	X	X						X	X
Northern leopard frog	*Lithobates pipiens*	X	X						X	X
Western tiger salamander	*Ambystoma mavortium*	X	X						X	X
Bullsnake	*Pituophis catenifer sayi*	X	X							
Smooth green snake	*Opheodrys vernalis*	X	X							
Plains hog-nosed snake	*Heterodon nasicus*	X	X			X				
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*	X	X			X				
UPLAND GAME BIRDS[3]										

Common Name	Scientific Name	Native Grassland	Tame Pasture	Hayland	Cultivated	Shrubland	Developed	Exposed/ barren	Water	Wetland
Sharp-tailed grouse	*Tympanuchus phasianellus*	X	X			X				
RAPTORS[3]										
Osprey	*Pandion haliaetus*								X	
Bald eagle	*Haliaeetus leucocephalus*								X	
Golden eagle	*Aquila chrysaetos*	X	X			X		X		
Cooper's hawk	*Accipiter cooperii*					X	X			
Ferruginous hawk	*Buteo regalis*	X	X			X				
Peregrine falcon	*Falco peregrinus anatum*	X	X			X		X		
Burrowing owl	*Athene cunicularia*	X	X							
Short-eared owl	*Asio flammeus*	X	X							X
MIGRATORY BIRDS[3]										
Horned grebe	*Podiceps auritus*								X	X
Eared grebe	*Podiceps nigricollis*								X	X
Western grebe	*Aechmophorus occidentalis*								X	X
Double-crested cormorant	*Phalacrocorax auritus*								X	X
American white pelican	*Pelecanus erythrorhynchos*								X	X
American bittern	*Botaurus lentiginosus*								X	X
Black-crowned night-heron	*Nycticorax nycticorax*								X	X
Great blue heron	*Ardea herodias*								X	X
Snowy egret	*Egretta thula*								X	X
Cattle egret	*Bubulcus ibis*								X	X
Great egret	*Ardea alba*								X	X
Whooping crane	*Grus americana*				X				X	X
Yellow rail	*Coturnicops noveboracensis*								X	X
Piping plover	*Charadrius melodus circumcinctus*	X							X	X

Common Name	Scientific Name	Native Grassland	Tame Pasture	Hayland	Cultivated	Shrubland	Developed	Exposed/ barren	Water	Wetland
Snowy plover	*Charadrius nivosus nivosus*							X	X	X
Long-billed curlew	*Numenius americanus*	X								
Red knot	*Calidris canutus rufa*								X	X
Buff-breasted sandpiper	*Calidris subruficollis*								X	X
Red-necked phalarope	*Phalaropus lobatus*								X	X
Franklin's gull	*Leucophaeus pipixcan*								X	X
Herring gull	*Larus argentatus*						X		X	X
Black tern	*Chlidonias niger*								X	X
Common tern	*Sterna hirundo*								X	X
Forster's tern	*Sterna forsteri*								X	X
Common nighthawk	*Chordeiles minor*	X	X			X	X	X		
Loggerhead shrike	*Lanius ludovicianus excubitorides*	X	X			X				
Bank swallow	*Riparia riparia*							X	X	X
Barn swallow	*Hirundo rustica*	X	X				X		X	X
Sprague's pipit	*Anthus spragueii*	X	X							
Chestnut-collared longspur	*Calcarius ornatus*	X								
McCown's longspur	*Rhynchophanes mccownii*	X	X							
Baird's sparrow	*Ammodramus bairdii*	X	X							
Lark bunting	*Calamospiza melanocorys*	X	X							
Bobolink	*Dolichonyx oryzivorus*	X	X	X						
Rusty blackbird	*Euphagus carolinus*								X	X
MAMMALS[4]										

Common Name	Scientific Name	Native Grassland	Tame Pasture	Hayland	Cultivated	Shrubland	Developed	Exposed/ barren	Water	Wetland
American badger	*Taxidea taxus taxus*	X	X	X						
Little brown myotis	*Myotis lucifugus*						X		X	X
Long-eared myotis	*Myotis evotis*						X			
Northern myotis	*Myotis septentrionalis*									
Western small-footed myotis	*Myotis ciliolabrum*	X	X							X
Big brown bat	*Eptesicus fuscus*		X	X	X		X			
Silver-haired bat	*Lasionycteris noctivagans*								X	X
Hoary bat	*Lasiurus cinereus*						X			
Eastern red bat	*Lasiurus borealis*									
Total		**35**	**31**	**13**	**12**	**16**	**18**	**13**	**43**	**42**

NOTES:

[1] Government of Canada 2002

[2] Stebbins 2003

[3] Cornell Lab of Ornithology and the American Ornithologist's Union 2017

[4] Reid 2006

Table F.3 All Wildlife Species Observed During 2015, 2016, and 2017 Field Studies

Common Name	Scientific Name	SKCDC[1,2]	SARA[3]	COSEWIC[2]
HERPTIELS				
Boreal chorus frog	*Pseudacris maculata*	S5		Not at Risk
Northern leopard frog	*Lithobates pipiens*	S3	Special Concern	Special Concern
Wood frog	*Lithobates sylvaticus*	S5		
Smooth greensnake	*Opheodrys vernalis*	S4		
BIRDS				
Canada goose	*Branta canadensis*	S5B, S2N, S5M		
Tundra swan	*Cygnus columbianus*	S5M		
Blue-winged teal	*Spatula discors*	S5B, S5M		
Northern shoveler	*Spatula clypeata*	S5B, S5M		
Gadwall	*Mareca strepera*	S5B, S2N, S5M		
American wigeon	*Mareca americana*	S5B, S2N, S5M		
Mallard	*Anas platyrhynchos*	S5B, S5M		
Northern pintail	*Anas acuta*	S5B, S4N, S5M		
Green-winged teal	*Anas crecca*	S5B, S2N, S5M		
Lesser scaup	*Aythya affinis*	S5B, S3N, S5M		
Sharp-tailed grouse	*Tympanuchus phasianellus*	S5		
Rock pigeon	*Columba livia*	SNA		
Mourning dove	*Zenaida macroura*	S5B, S5M		
Common nighthawk	*Chordeiles minor*	S4B, S4M	Threatened	Threatened
Sora	*Porzana carolina*	S5B, S5M		
Double-crested cormorant	*Phalacrocorax auritus*	S5B, S5M		Not at Risk
Great blue heron	*Ardea herodias*	S5B		
Ring-necked pheasant	*Phasianus colchicus*	SNA		
Killdeer	*Charadrius vociferus*	S5B, S5M		
Upland sandpiper	*Bartramia longicauda*	S5B, S5M		
Long-billed curlew	*Numenius americanus*	S3B, S4M	Special Concern	Special Concern
Marbled godwit	*Limosa fedoa*	S4B, S4M		
Wilson's snipe	*Gallinago delicata*	S5B, S5M		
Willet	*Catoptrophorus semipalmatus*	S4B, S4M		
Wilson's phalarope	*Phalaropus tricolor*	S5B, S5M		
Red-necked phalarope	*Phalaropus lobatus*	S4B, S3M	No Status	Special Concern
Franklin's gull	*Leucophaeus pipixcan*	S4B, S4M		

Common Name	Scientific Name	SKCDC[1,2]	SARA[3]	COSEWIC[2]
Ring-billed gull	*Larus delawarensis*	S5B, S5M		
California gull	*Larus californicus*	S4B, S4M		
Turkey vulture	*Cathartes aura*	S3B, S3M		
Osprey	*Pandion haliaetus*	S2B, S2M		
Northern harrier	*Circus hudsonius*	S4B, S4M		Not at Risk
Sharp-shinned hawk	*Accipiter striatus*	S4B, S2N, S4M		Not at Risk
Cooper's hawk	*Accipiter cooperii*	S4B, S2N, S2M		Not at Risk
Swainson's hawk	*Buteo swainsoni*	S4B, S4M		
Red-tailed hawk	Buteo jamaicensis	S5B, S1N, S5M		Not at Risk
Ferruginous hawk	*Buteo regalis*	S3	Threatened	Threatened
Golden eagle	*Aquila chrysaetos*	S3B, S3N, S4M		Not at Risk
Great horned owl	*Bubo virginianus*	S4		
Short-eared owl	*Asio flammeus*	S3B, S2N, S3M	Special Concern	Special Concern
Northern flicker	*Colaptes auratus*	S5B, SUN, S5M		
American kestrel	*Falco sparverius*	S5B, S1N, S5M		
Merlin	*Falco columbarius*	S5B, S5N, S5M		Not at Risk
Prairie falcon	*Falco mexicanus*	S3B, S3N, S3M		Not at Risk
Western wood-pewee	*Contopus sordidulus*	S4B, S4M		
Least flycatcher	*Empidonax minimus*	S5B, S5M		
Western kingbird	*Tyrannus verticalis*	S5B, S5M		
Eastern kingbird	*Tyrannus tyrannus*	S5B, S5M		
Warbling vireo	*Vireo gilvus*	S5B, S5M		
Black-billed magpie	*Pica hudsonia*	S5		
American crow	*Corvus brachyrhynchos*	S5B, S4N, S5M		
Common raven	*Corvus corax*	S5		
Horned lark	*Eremophila alpestris*	S4B, S3N, SUM		
Tree swallow	*Tachycineta bicolor*	S5B, S5M		
Barn swallow	*Hirundo rustica*	S5B, S5M	Threatened	Threatened
House wren	*Troglodytes aedon*	S5B, S5M		
Mountain bluebird	*Sialia currucoides*	S4B, S4M		
American robin	*Turdus migratorius*	S5B, SUN, S5M		
Gray catbird	*Dumetella carolinensis*	S5B, S5M		
Brown thrasher	*Toxostoma rufum*	S5B, S5M		
European starling	*Sturnus vulgaris*	SNA		
Sprague's pipit	*Anthus spragueii*	S3B, S3M	Threatened	Threatened
American goldfinch	*Spinus tristis*	S5B		

Common Name	Scientific Name	SKCDC[1,2]	SARA[3]	COSEWIC[2]
Chestnut-collared longspur	*Calcarius ornatus*	S3B	Threatened	Threatened
Spotted towhee	*Pipilo maculatus*	S5B, S5M		
Clay-colored sparrow	*Spizella pallida*	S5B, S5M		
Vesper sparrow	*Pooecetes gramineus*	S5B, S5M		
Lark bunting	*Calamospiza melanocorys*	S2B, S2M	No Status	Threatened
Savannah sparrow	*Passerculus sandwichensis*	S5B, S5M		
Grasshopper sparrow	*Ammodramus savannarum*	S4B		
Baird's sparrow	*Ammodramus bairdii*	S4B	Special Concern	Special Concern
Le Conte's sparrow	*Ammodramus leconteii*	S5B, S5M		
Song sparrow	*Melospiza melodia*	S5B, S5M		
Yellow-breasted chat	*Icteria virens*	S3B, S3M		Not at Risk
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	S5B, S5M		
Bobolink	*Dolichonyx oryzivorus*	S4B, S4M	Threatened	Threatened
Western meadowlark	*Sturnella neglecta*	S4B, S4M		
Red-winged blackbird	*Agelaius phoeniceus*	S5B, SUN, S5M		
Brown-headed cowbird	*Molothrus ater*	S5B, SUN, S5M		
Brewer's blackbird	*Euphagus cyanocephalus*	S4B, SUN, S4M		
Common grackle	*Quiscalus quiscula*	S5B		
Ovenbird	*Seiurus aurocapilla*	S5B, S5M		
Common yellowthroat	*Geothlypis trichas*	S5B, S5M		
Black-and-white warbler	*Mniotilta varia*	S5B, S5M		
Yellow warbler	*Setophaga petechia*	S5B, S5M		
Chestnut-sided warbler	*Setophaga pensylvanica*	S5B, S5M		
Yellow-rumped warbler	*Setophaga coronata*	S5B, S5M		
MAMMALS				
American badger	*Taxidea taxus taxus*	S3	Special Concern	Special Concern
White-tailed deer	*Odocoileus virginianus*	S4		
Mule deer	*Odocoileus hemionus*	S4		
Moose	*Alces americanus*	S5		
Elk	*Cervus canadensis*	S4		
Coyote	*Canis latrans*	S5		
Bobcat	*Lynx rufus*	S3		

Common Name	Scientific Name	SKCDC[1,2]	SARA[3]	COSEWIC[2]
Big brown bat	*Eptesicus fuscus*	S5		
Silver-haired bat	*Lasionycteris noctivagans*	S5B		
Hoary bat	*Lasiurus cinereus*	S5B		
Eastern red bat	*Lasiurus borealis*	S4B		
Little brown myotis	*Myotis lucifugus*	S4	Endangered	Endangered
Long-eared myotis	*Myotis evotis*	S2		
Western small-footed myotis	*Myotis ciliolabrum*	S2		

NOTE:
[1] See Appendix C for provincial and federal ranking definitions.
[2] SKCDC 2018c
[3] Government of Canada 2018

F.1 BAT ACTIVITY SURVEY TECHNICAL DATA REPORT

OUTLAW TRAIL WIND ENERGY PROJECT 2015-2016 PRE-CONSTRUCTION BAT MONITORING REPORT

Prepared for:

Prepared by:

Project Number: 113253956

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

BluEarth Renewables Inc. (BluEarth) is proposing to develop a wind energy project (the Project) in the rural municipalities of Hart Butte (RM. No. 11) and Happy Valley (RM. No. 10), Saskatchewan. The Project is located approximately 20 km east of the village of Coronach, in south-central Saskatchewan, and approximately 14 km north of the US/Canada border. The Project is proposed to be up to 200 MW with a maximum of 50 wind turbine generators (WTGs). BluEarth is applying for 60 WTG locations, including 10 alternative locations. Bat mortality risk is one important regulatory concern for wind projects and a passive bat detection program was, therefore, recommended in the pre-feasibility assessment of the Project area (Stantec 2015). Passive bat detection was conducted during the fall monitoring period (July 14 to September 30) in 2015, and spring (May 1 to June 7) and fall (July 28 to September 14) in 2016 using 11 detectors. Eight detectors were placed at four meteorological (MET) Towers (four low elevation and four high elevation detectors) in the Project area, and one detector at each of three additional ground stations during each monitoring period.

The purpose of the monitoring was to estimate bat activity in the Project area during the monitoring periods as has been previously requested by Saskatchewan Ministry of Environment (MOE) for other wind energy project bat assessments. Results were also put in context of the Alberta Environment and Parks (AEP) recommended fall migration period of August 1 to September 10 for regulatory considerations (ESRD 2013) as the MOE currently does not have wind energy guidelines specific to assessing bats for wind energy projects, and therefore those established by AEP were used as a reference.

Overall, bat activity varied by species at each monitoring station. Over the Alberta AEP recommended monitoring period (August 1 – September 10), 2.0 migratory bat passes per detector night were recorded at High detectors in 2015 and 2.4 migratory bat passes per detector night were recorded at High detectors in 2016. *Myotis* species and the big brown/silver-haired bat grouping were the most common species/species grouping of bats observed during all three monitoring periods (fall 2015, spring 2016 and fall 2016). The main contributing factors to observed bat activity levels in the Project area appear to be topography and habitat.

Abbreviations

ABAT	Alberta Bat Action Team
ACA	Alberta Conservation Association
BluEarth	BluEarth Renewables Inc.
CF	Compact Flash
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
ESRD	Alberta Environment and Sustainable Resource Development (Currently Alberta Environment and Parks)
LLD	Legal Land Description
km	Kilometres
km/h	Kilometres per hour
m	Metres
ms	Millisecond
m/s	Metres per second
MET	Meteorological
MNRF	Ontario Ministry of Natural Resources and Forestry
PVC	Polyvinyl chloride
MOE	Saskatchewan Ministry of Environment
SARA	*Species at Risk Act*
SK	Saskatchewan
SRD	Alberta Sustainable Resource Development (Currently Alberta Environment and Parks)
Stantec	Stantec Consulting Ltd.
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

BluEarth Renewables Inc. (BluEarth) is proposing to develop a wind energy project (the Project) in the rural municipalities of Hart Butte (RM. No. 11) and Happy Valley (RM. No. 10), Saskatchewan. The Project is located approximately 20 km east of the village of Coronach, in south-central Saskatchewan, and approximately 14 km north of the US/Canada border (Figure 2-1). The Project is proposed to be up to 200 MW with a maximum of 50 wind turbine generators (WTGs). BluEarth is applying for 60 WTG locations, including 10 alternative locations. The Big Muddy Valley borders the Project area to the north. The proposed Project area is located on private and leased crown land consisting of native and cultivated lands.

In 2015, Stantec Consulting Ltd. (Stantec) conducted a pre-feasibility assessment identifying bat mortality as a potential Project effect. As a result, Stantec recommended acoustic bat activity surveys be conducted as part of a comprehensive pre-feasibility evaluation (Stantec 2015). Two rounds of fall and one round of spring acoustic monitoring survey were therefore conducted from 2015 to 2016. This report summarizes the results of the 2015 and 2016 bat acoustic surveys and will contribute to the assessment of potential mortality risk in the Project area.

1.1 BACKGROUND

In recent years, bat collision fatality rates at wind energy facilities, particularly for migratory tree-roosting bats, have become an increasing concern (Arnett et al. 2008, Arnett and Baerwald 2013, BSC et al. 2017, Zimmerling and Francis 2016). Fatalities occur when bats are struck by rotating turbine blades and to a lesser extent by barotrauma due to a sudden drop in air pressure around the moving blade (Baerwald et al. 2008, Cryan and Barclay 2009). Recent studies have determined barotrauma to be of less importance (approximately 10% of fatalities) than originally thought for causes of fatality (Grodsky et al. 2011, Rollins et al. 2012). Whole project and individual turbine siting in relation to bat activity levels is likely an important factor influencing potential bat fatality rates (Baerwald and Barclay 2011).

Current research shows that most bat fatalities at wind power developments occur during fall migration. In most studies, fatalities of migratory species are higher than resident species, particularly in the prairie biome (Arnett et al. 2008, Arnett and Baerwald 2013, BSC et al 2017). Few wind facilities exist in SK, and mortality monitoring reports are not available in the public domain. However, experience regarding bat and wind turbine interactions at existing wind power facilities in Alberta appear to be similar to those identified across North America, and may be representative of SK interactions. In Alberta, during the fall migration (July 15 to September 30) bat fatalities consist mainly of hoary and silver-haired bats (Baerwald et al. 2008, Lausen et al. 2010). Estimated corrected fatality rates of bats in Alberta have been determined for a variety of wind facilities averaging 7.31 ± 1.32 bats/turbine/year (BSC et al. 2017). Potential factors increasing the susceptibility of bats to collisions with turbines during migration include: abundance of individuals in flight, higher flight altitudes than resident bats, lower use of echolocation during migration, foraging differences between migrants and residents, and attractiveness of turbines to bats as potential resources for feeding, social, and mating opportunities (Cryan and Barclay 2009).

Geography may also play a role in bat activity levels, and therefore with collision fatality risk. Migration routes may be associated with the availability of suitable roosting sites (i.e., trees) and landmarks (e.g., river valleys), resulting in higher bat activity levels and fatality risk in those areas (Lausen et al. 2010). Activity levels of resident bats (Myotis species) are correlated with suitable roosting sites and prey availability; though they tend to feed at lower altitudes and are much less susceptible to collision strikes than migratory bat species.

1.2 REGULATORY CONTEXT

Bats are protected under the *Wildlife Act* of Saskatchewan, and under the *Species at Risk Act* for those species listed as endangered in Canada. As no Saskatchewan guidelines pertaining to bats exist, Alberta guidelines were used as context to the potential magnitude of effects. MOE regularly directs proponents to AEP guidance and survey protocols where none have been published in Saskatchewan, and previous experience with the MOE pertaining to assessment of effects to bats from wind developments in Saskatchewan confirms their reliance on the AEP guidance.

The *Bat Mitigation Framework for Wind Power Development* (ESRD 2013) establishes guidelines for interpreting pre-construction acoustic bat monitoring data for potential mitigation. This guidance document indicates potential fatality rates and acceptable activity levels based on bat passes per elevated (> 30 m height) detector night during the period identified in Lausen et al. (2010) for use in evaluating sites and applying mitigation. The thresholds of bat activity identified in ESRD (2013) are:

- Less than 1 migratory bat pass per detector night as potentially acceptable.
- 1 to 2 migratory bat passes per detector night as potentially requiring mitigation such as alternative siting locations and reduced turbine height or rotor length.
- Greater than 2 migratory bat passes per detector as likely requiring mitigation such as alternative turbine locations and changing cut-in speeds to reduce bat fatality.

However, the correlation used to derive these threshold guidelines was relatively weak ($r^2 = 0.31$, $P = 0.023$) and based on only five data points (Baerwald and Barclay 2009); moreover, other studies have not been able to reproduce a statistically significant relationship with greater datasets. This suggests that pre-construction survey data should be interpreted carefully.

2.0 METHODS

To design the bat activity studies for the Project, methods provided in Lausen et al. (2010) were followed. This document provides methods for acoustic bat surveys for consistent sampling, including a fall survey period from August 1 to mid-September, survey timing, and detector placement based on project scale and landscape.

The fall monitoring periods for the Project began earlier and extended later than the Alberta Guideline Period (August 1 to September 10) recommended in the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013). The longer fall monitoring periods were completed based on direction from the SK Ministry of Environment (MOE) for a previous bat activity monitoring program (MOE, Riley Schmidt, MOE, 2014, pers. comm).

Seasonality is also known to be a factor in bat activity, with higher levels of bat activity found in the fall. The 2017 final Wildlife Directive for Alberta Wind Energy Projects requires one year of spring and fall bat surveys. In addition, MOE has previously requested spring bat activity data for wind developments. Therefore, acoustic surveys during the spring monitoring period (May) were conducted to determine if seasonality is a major contributing factor in the Project area.

2.1 EQUIPMENT

A total of 11 AnaBat SD1 CF Bat Detectors (Titley Electronics) were installed at seven stations within the Project area. All detectors were powered by two HAZE or PowerKing (12 Volt 18 Ah) sealed lead acid batteries connected in parallel. To prevent exposure to the elements, the detectors were housed in an 8x8x4 cm PVC junction box enclosure, with an accompanying microphone pointing out of the junction box enclosure through a PVC elbow. To increase data collection quantity, division ratios were set to 8. Sensitivity was adjusted to the highest level, which did not produce ambient static during set up (below the squelch zone). Data were recorded and stored on compact flash (CF) cards. Detectors were programmed to record sound from 1900 hours to 0700 hours each night.

The bat call data was downloaded from the CF cards using CFC read storage ZCAIM interface (version 4.4u). The data collected were transcribed using the latest available software (AnalookW Version 4.2g).

2.2 MONITORING STATIONS

Two detectors were installed on each of the Project's four Meteorological Towers (MET) Towers; one at a low elevation (Low detector) (2 m) and one at a high elevation (High detector) (45-49 m) as listed in Table 2-1and shown on Figure 2-1. High detectors were installed with a pulley system developed by Stantec; heights were verified using a range finder. The power cable connecting High detectors to the battery source was secured to rope using zip ties and attached at the tower's base near the weather-proof battery container. High detectors were installed to provide information on bat activity within the likely turbine rotor-swept altitude, as ground (i.e., Low) detectors only reliably collect data on bats travelling from ground level up to approximately 30 m height (Titley Scientific 2015).

Ground level detectors (Ground 1, 2, and 3) were installed at three additional ground stations (Figure 2-1, Table 2-1 Site Information and Photos of the Outlaw Trail Bat Monitoring Stations) to better understand the spatial distribution of bat activity of the Project area and to further inform turbine siting. To maintain consistency in data collection and allow data comparison, the three ground detectors were installed using the same parameters (i.e., height, orientation and detector settings) as the four MET Low detectors. The ground stations were sited between MET Towers to provide even coverage of the Project area in locations similar to where turbines might be constructed (Figure 2-1). In 2016, Detector Ground 2 was relocated to provide a better coverage following changes in to the Project target lands; all other detector locations did not change during the three rounds of surveys.

Based on data from the Moose Jaw airport, prevailing winds in the region originate from the northwest (Aviador 2016). In the spring, bats are expected to migrate from the south, and in the fall, the north, but taking into account the prevailing wind direction, and for consistency, all detectors were oriented to the southeast in the spring and northeast in the fall. Orienting the microphones perpendicular to the prevailing wind direction, and assumed bat migration direction, provides a balance that increases potential bat detections while reducing interfering noise caused by prevailing winds.

Table 2-1 Site Information and Photos of the Outlaw Trail Bat Monitoring Stations

Monitoring Station	Location (LLD, UTM)	Site / Setup Description	Land Cover	Photo
Ground 1	NE-1-3-25-W2M; NAD 83, 13U, 482435, 5447608	Attached to a fence line with temporary PVC pipe at a height of approximately 2 m. Located north of road.	Native prairie to northwest. Cultivation to east and south. Treed coulee 700 m to north and extends 2 km north into badlands. Farmstead and treed wetland 700 m to southeast.	Photo orientation: facing west 

Monitoring Station	Location (LLD, UTM)	Site / Setup Description	Land Cover	Photo
Ground 2 (2015)	NW-30-02-24-W2M; NAD 83, 13U, 481625, 5450009	Attached to a fence line with temporary PVC pipe at a height of approximately 2 m. Located on south side of road.	Cultivated grain to south and native prairie to north. Treed coulees approximately 300 m to southeast, extensive coulees and badlands beginning 800 m to east. Wetland 400 m to northwest.	Photo Orientation: facing west 
Ground 2 (2016)	NE22-2-25-W2MNAD 83, 13U, 480534, 5443504	Attached to a fence line with temporary PVC pipe at a height of approximately 2 m. Located 50 m south of road.	Surrounded by cultivation, a small patch of trees approximately 1 km to southwest.	Photo Orientation: facing north 
Ground 3	NW-3-3-24-W2M; NAD 83, 13U, 487828, 5447719	Attached to a fence line with temporary PVC pipe at a height of approximately 2 m. Located 50 m south of road.	Native prairie to east, cultivated flax to west and south. A few small patches of shrubs approximately 500 m to north. Wetlands approximately 250 m to northwest and 600 m to southwest.	Photo Orientation: facing north 

Monitoring Station	Location (LLD, UTM)	Site / Setup Description	Land Cover	Photo
MET 1 (Met 1 High and Met 1 Low) MET Tower 3012	SW-15-03-25-W2M; NAD 83, 13U, 478248, 5450315	2 detectors were attached to the MET Tower: approximately 2 m and 45 m above ground	Located within cultivated field. Wetlands approximately 200 m to northwest. Treed coulees approximately 700 m to southwest. Patches of trees 350 m to southeast.	Photo Orientation: facing north 
MET 2 (Met 2 High and MET 2 Low) MET Tower 3010	NW-30-02-24-W2M; NAD 83, 13U, 485163, 5444624	2 detectors were attached to the MET Tower: approximately 2 m and 47 m above ground	Located within cultivated field. Slopes with native prairie approximately 200 m to east. Shrub shelter belt 400 m to north and treed shelterbelt 800 m to south.	Photo Orientation: facing east 
MET 3 (Met 3 High and Met 3 Low) MET Tower 3008	SE-8-3-24-W2M; NAD 83, 13U, 485869, 5449091	2 detectors were attached to the MET Tower: approximately 2 m and 49 m above ground	Located within native prairie, treed coulee 200 m to north, extends to badlands 900 m to north. Shrubby coulee approximately 400 m to south, cultivated field to the east.	Photo Orientation: facing west 

Monitoring Station	Location (LLD, UTM)	Site / Setup Description	Land Cover	Photo
MET 4 (Met 4 High and Met 4 Low) MET Tower 3011	SW-2-3-24-W2M; NAD 83, 13U, 490688, 5447060	2 detectors were attached to the MET Tower: approximately 2 m and 49 m above ground	Located within hay / tame pasture field. Native prairie approximately 200 m to north and south. Wetlands 500 m to northwest.	Photo Orientation: facing west 

2.2.1 Equipment Status Visits and Monitoring Issues

Electronic monitoring equipment can experience malfunctions and other technical issues. While maintenance visits were executed every two weeks to verify equipment function and replace batteries, malfunctions and partial data loss may occur during the interval between maintenance visits. These malfunctions are typically attributed to the following events:

- Lightning strikes: MET towers are susceptible to lightning strikes and detectors mounted to MET towers also become subject to frequent lightning strikes. These events usually result in a system shutdown of the detectors and possibly to data loss in the memory cards. This is the most common source of technical issues with acoustic bat detectors.
- Battery failure: battery maintenance and predictions of charge capacity of batteries used to power the detectors helps to prevent battery failure. However, moisture, extreme temperatures and other environmental conditions may cause premature battery fatigue. If batteries fall below a minimum charge capacity, detectors may fail to record for a period of time.
- Detector failure: technical issues with detectors, such as moisture or short-circuiting, may cause detector units to fail.
- Memory card capacity: while maximum capacity memory cards are used in the detectors, ambient noise may sometimes cause sound recording and fill memory cards, thus limiting the period when data may be collected.

The following summarizes the equipment data visits and any technical issues encountered during the three monitoring periods.

Fall 2015

Five stations (seven detectors) began collecting data on July 14, 2015 at 1900 hours (Ground 1, 2, and 3, MET 1 High, MET 1 Low, MET 2 High, and MET 2 Low), and the remainder on July 15, 2015 at 1900 hours (MET 3 High, MET 3 Low, MET 4 High, MET 4 Low). Equipment status checks were performed on July 30, August 12, September 1, and September 16, 2015. During these visits the CF cards and HAZE batteries were exchanged for empty cards and charged batteries. Data were retrieved from the cards and stored for interpretation at a future date. All detectors were removed on October 1, 2015.

Detectors Ground 2, Ground 3, MET 1 Low, MET 3 Low, MET 4 Low and MET 4 High were in operation for the entire monitoring period and complete datasets were collected. Five detectors malfunctioned during the fall 2015 monitoring period, accounting for approximately 8% of the total dataset. Malfunctions are summarized below and in Appendix A:

- Ground 1 did not collect data for 15 nights from September 1 to 15 due to card malfunctions
- MET 2 Low did not collect data for 14 nights from September 2 to 15 due to card malfunctions
- MET 1 High did not collect data for 23 nights from July 27 to 30, Aug 5 to 11, August 31, or September 4 to 14. due to unknown causes
- MET 2 High did not collect data for 14 nights from July 28 to 30 and August 13 to 23 due to unknown causes (possibly lighting)
- MET 3 High did not collect data for three nights from July 27 to 29 due to unknown causes (possibly lightning)

It is unknown as to why some of these detectors malfunctioned, but is likely due to lightning strikes. Some data malfunctions occurred during peak activity periods, particularly for MET 1 High and MET 2 High. However, the overall bat activity is calculated as bat passes per detector night, based on the number of operational nights during the monitoring period, and would not be biased by these malfunctions. Though this resulted in reduced sample size, with 11 stations, ample data were collected for the Project area despite the malfunctions.

Spring 2016

Three stations (four detectors) began collecting data on April 29, 2016 at 1900 hours (Ground 1, Ground 2, MET 1 High, and MET 1 Low), and the remainder on April 30, 2016 at 1900 hours (Ground 3, MET 2 High, MET 2 Low, MET 3 High, MET 3 Low, MET 4 High, and MET 4 Low). Equipment status checks were performed on May 15. During this visit the CF cards and HAZE batteries were exchanged for empty cards and charged batteries. Data was retrieved from the cards and stored for interpretation at a future date. Detectors MET 4 High and MET 4 Low were removed on June 6. Ground 1, Ground 2, Ground 3, MET 2 Low and MET 2 High were removed on June 7, and MET 1 High, MET 1 Low, MET 3 High and MET 3 Low were removed on June 9.

Detectors Ground 1, Ground 2, Ground 3, MET 1 Low, MET 1 High, Met 2 High, MET 3 Low, MET 3 High, and Met 4 High were in operation for the entire monitoring period and complete datasets were collected. Two detectors malfunctioned during the spring 2016 monitoring period, accounting for approximately 6% of the total dataset. Malfunctions are summarized below and in Appendix A:

- MET 2 Low did not collect data for 13 nights from May 3 to 15, due to water leakage damaging the HAZE batteries
- MET 3 Low did not collect data for 6 nights from May 10 to 15 due to water leakage damaging the HAZE batteries

Though these two malfunctions resulted in reduced sample size at two locations, with 11 stations ample data were collected for the Project area despite the malfunctions.

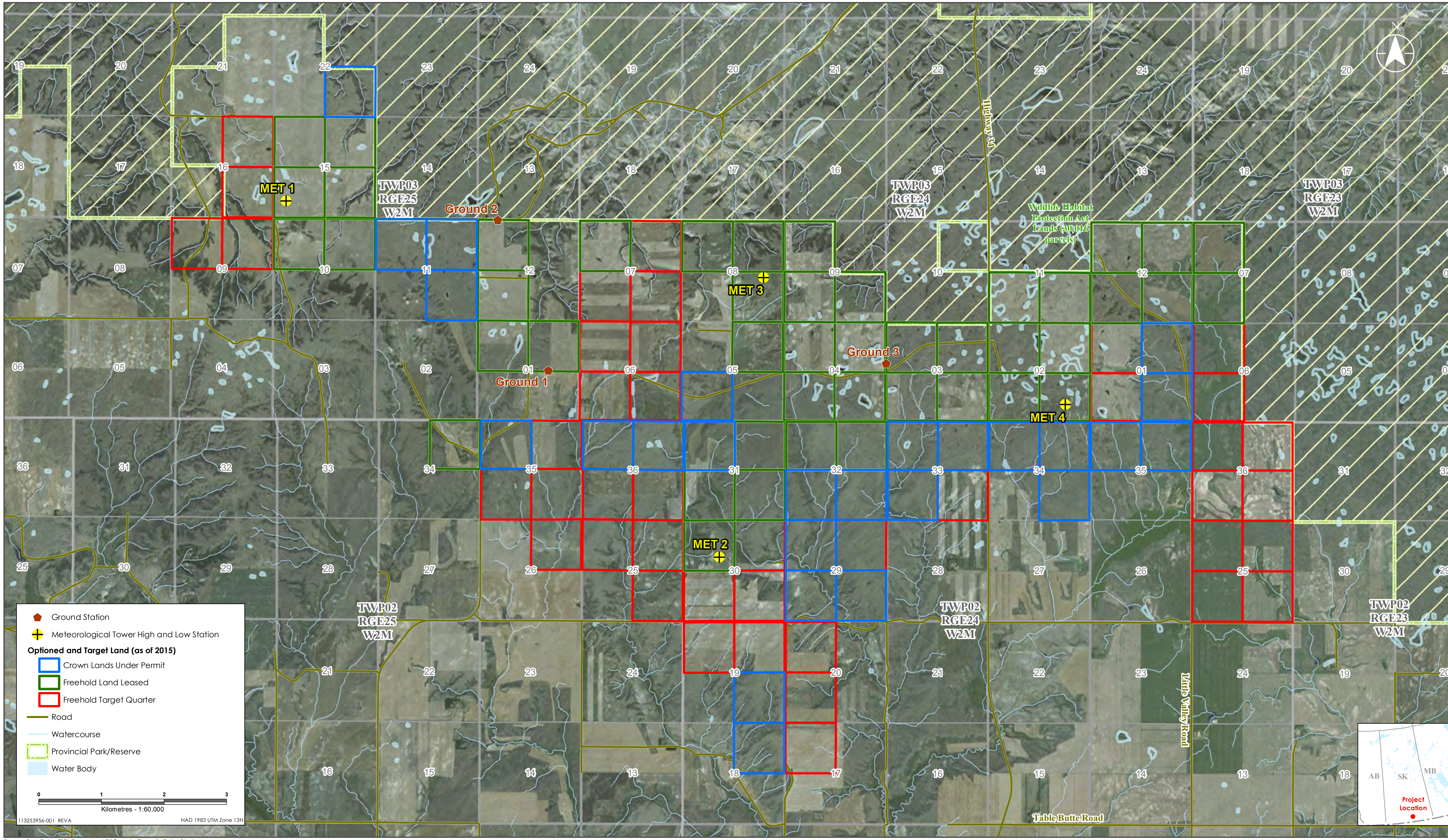
Fall 2016

All seven stations (eleven detectors) began collecting data on July 28, 2016 at 1900 hours. Equipment status checks were performed on August 18 and August 31. During these visits the CF cards and HAZE batteries were exchanged for empty cards and charged batteries. Data was retrieved from the cards and stored for interpretation at a future date. All detectors were removed on September 13, 2016.

Detectors Ground 1, Ground 2, Ground 3, MET 1 Low, MET 2 Low, and Met 3 Low were in operation for the entire monitoring period and complete datasets were collected. Five detectors malfunctioned during the fall 2015 monitoring period, accounting for approximately 16% of the total dataset. Malfunctions are summarized below and in Appendix A:

- MET 1 High did not collect data for 23 nights from August 7 to 17, August 23 to 30 and September 10 to 13 due to lighting strikes.
- MET 2 High did not collect data for 19 nights from August 7 to 17 and August 23 to 30 due to lighting strikes.
- MET 3 High did not collect data for 14 nights from August 8 to 17 and September 10 to 13 due to lighting strikes.
- MET 4 Low did not collect data for 8 nights from August 8 to 17 due to card malfunctions.
- MET 4 High did not collect data for 20 nights, from August 7 to 17 and September 5 to 13 due to power failure, possibly due to lightning strikes.

Some data malfunctions occurred during peak activity periods, particularly for the four high detectors. However, activity is relatively constant during the peak migration period, so using the average of the data from that period, regardless of the gaps due to malfunctions, will be representative of the activity levels.



Sources: Base Data - ESRI; Government Of Canada; Thematic Data - Stantec

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Stantec

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Bat Acoustic Monitoring Station Locations

Figure 2-1

2.3 ANALYSIS

2.3.1 Bat Echolocation Analysis

The unit of measure selected for analysis is a bat call sequence, which is expressed as a bat pass and can be used as a relative measure of bat activity. Bat passes per detector night is used as the relative measure of bat activity and is the primary measurement for reporting activity rates. A limitation to using bat passes as a metric is that it is unknown if multiple passes are attributed to one or several active bats in the area (i.e., one individual making multiple passes near the detector). However, standard practice is to use ≥ 2 seconds between call sequences to define a bat pass (Loeb et al. 2015). Echolocation analysis to determine the number of bat passes and identify passes to species was conducted using AnalookW (version 4.1 t). Data were compiled using Microsoft Excel and outputs modeled using R (version 3.2.2). Site-specific data for sunrise and sunset were generated using Anasun (version 1.0a). Bat calls and passes were visually distinguished using reference data from:

- Acoustics Workshop: Analysis of AnaBat files (Cori Lausen 2008, pers. comm.)
- Acoustics Techniques Course: Reference Bat Calls (Cori Lausen 2011, pers. comm.)
- Published literature
- Stantec bat call identification key

While automatic bat identification algorithms (e.g. Kaleidoscope Pro) exist and, in some cases, provide a more precise identification than manual identification, previous experience has indicated that these types of software do not completely analyze an entire dataset, and have a tendency to not recognize low quality calls and duplicate bat passes. Manual identification using AnalookW was therefore used to ensure a complete analysis of the dataset.

Where possible bats were identified to species, or grouping based on several parameters: frequency (minimum), duration, slope, and shape. Considerable regional variation can occur with the calls of a species based on habitat and other bat species in the area (Cori Lausen, 2008, pers. comm.); therefore, parameters from western Canada records were relied upon more heavily.

Though detector setup methods such as microphone orientation and sensitivity reduce extraneous noise collected (see Section 2.1), large quantities of unwanted noise data can be collected by the detectors. Due to similarities between species echolocation parameters and/or degraded call quality from extraneous noise, some bats cannot be conclusively identified to species and were therefore grouped together. Due to the potential for call similarities, there is some uncertainty in differentiating calls of big brown and silver-haired bats, eastern red and little brown myotis, and bat species in the *Myotis* genus. In most cases, these groupings were not identified to species conclusively.

Considering the bat species in Saskatchewan (see Section 3.1) and the inability to identify all bat passes to species due to call quality and overlapping call parameters between species, the following five groupings were used for species classification in this study when individual species classification was not possible:

- **Low frequency bat**: includes big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*) and hoary bat (*Lasiurus cinereus*)
- **High frequency bat**: includes eastern red bat (*Lasiurus borealis*), long-eared bat (*Myotis evotis*), little brown myotis (*Myotis lucifugus*) and western small-footed bat (*Myotis ciliolabrum*)
- **Big brown bat or silver-haired bat**
- **Eastern red bat or little brown myotis**
- ***Myotis* species**: includes long-eared bat, little brown myotis, and western small-footed bat

Based on comparisons of echolocation results and fatality search results at a number of wind development projects in southern Alberta by Baerwald et al. (2008) and Baerwald and Barclay (2009), bat passes identified into the big brown/silver-haired grouping are likely to be mainly silver-haired bats. Likewise, the low frequency bat grouping is expected to be predominantly silver-haired and hoary bats.

The majority of bat fatalities at wind energy development sites in North America involve migratory species (Arnett and Baerwald 2013, Zimmerling and Francis 2016); therefore, migratory bats were considered as an additional grouping for this assessment. Three bat species known to occur within the Project area are considered migratory: hoary, eastern red and silver-haired bats. As such, the migratory bat grouping includes the three migratory bat species and all individuals within the low frequency bat, big brown/silver-haired bat, and eastern red/little brown myotis groupings. Grouping migratory bats in this manner provides the most conservative estimate of the maximum potential migratory bat activity within the Project area.

3.0 RESULTS AND DISCUSSION

3.1 BAT SPECIES IN THE PROJECT AREA

Eight species of bat are known to occur in Saskatchewan, seven of which have the potential to occur within the Project area (Table 3-1). The distribution data for Saskatchewan's bats indicate that the northern myotis, a non-migratory species of bat, is not expected to occur in the Project area (Caceres and Barclay 2000, BCI 2012). All seven of the possible bat species may potentially breed within the Project area as suitable terrain and vegetation is present.

All seven bat species potentially occurring in the Project area were identified by call, and therefore confirmed as occurring in the Project area. Species identified using manual identification are: eastern red bat, hoary bat, silver-haired bat, little brown myotis, long-eared myotis, western small footed myotis. Big brown bat was confirmed during the fall 2015 analysis.

Little brown myotis are the most abundant and widespread bat species in North America (COSEWIC 2013) and likely make up the majority of the Myotis species grouping observations. While little brown myotis are currently abundant in Saskatchewan, the species is listed as Endangered under the *SARA* (ECCC 2016) due to white-nose syndrome, which is currently decimating populations in eastern North American.

Table 3-1 Bat Species With Potential to Occur in the Project Area

Common Name	Scientific Name	*SRank[1]	Widlife Act[2]	COSEWIC Status[3]	SARA Status[4]	Expected to Breed in the Project area	Migratory Bat
Big brown bat	*Eptesicus fuscus*	**S5**	N/A	N/A	N/A	Yes (roosts in buildings, tree cavities, rock crevices)	No
Silver-haired bat	*Lasionycteris noctivagans*	**S5B**	N/A	N/A	N/A	Yes (roosts in foliage)	Yes
Eastern red bat	*Lasiurus borealis*	**S4B**	N/A	N/A	N/A	Yes (roosts in foliage)	Yes
Hoary bat	*Lasiurus cinereus*	**S5B**	N/A	N/A	N/A	Yes (roosts in tree cavities)	Yes
Western small-footed bat	*Myotis ciliolabrum*	**S2S3**	N/A	N/A	N/A	Yes (roosts in rock crevices; associated with badlands along river valleys)	No
Little brown myotis	*Myotis lucifugus*	**S4**	N/A	Endangered	Endangered (Schedule1)	Yes (roosts in buildings, tree cavities, rock crevices)	No
Long-eared bat	*Myotis evotis*	**S2**	N/A	N/A	N/A	Yes (roosts in buildings, tree cavities, rock crevices)	No

SOURCES:
[1] NatureServe (2012), [2]MOE (2016), [3] COSEWIC (2016), [4] ECCC (2016)
S Rank Identifies subnational conservation rank (for Saskatchewan): S1: critically imperiled, S2: imperiled, S3: vulnerable, S4: Apparently Secure; S5: Secure; 2 ranks (S2S3) indicates a possible range of status; B refers to the Saskatchewan breeding population only.

3.2 BAT ACTIVITY LEVELS

Although this study uses Alberta's guidelines (AEP 2016), which states that pre-construction migratory bat activity is positively correlated to post-construction mortality rates, the American Wind Wildlife Institute reports that the ability to predict collision risk for birds and bats from activity recorded by radar and acoustic detectors, respectively, remains elusive (AWWI 2015). To date studies have not been able to develop a quantitative model enabling reasonably accurate prediction of collision risk from pre-construction acoustic surveys (e.g., Hein et al. 2013).

3.2.1 Monitoring Summary

Fall 2015

During the 2015 fall monitoring period, migratory bat activity rates for all detectors during the full monitoring period (July 14 – September 30) ranged from 0.8 to 5.2 migratory bat passes per detector night, with an average of 2.4 migratory bat passes per detector night. During this same monitoring period, total bat activity rates for all bats in the Project area from all detectors combined ranged from 0.8 to 12.7 bat passes per detector night, with an average of 6.1 bat passes per detector night (Table 2-1).

During the Alberta Guideline period the migratory bat activity rate was recorded as 2.0 passes per detector night at elevated detectors, while non-migratory bats was only 0.3 (Table 2-1). Generally, non-migratory bat species showed higher activity at low detectors compared to migratory bat species, which is consistent with known foraging behavior of these species.

Although there was higher total bat activity recorded at the low detectors, the higher proportion of migratory bat activity at the high detectors (Figure 3-1) in the potential rotor-swept area supports observations that most bat fatalities at wind projects are migratory bats, as non-migratory bats are more active at lower altitude (Arnett et al. 2008), as observed for this Project.

Overall, Ground 2 recorded the highest levels of both total and migratory bat activity in the Project area (Figure 3-1), with 18.0 total bat and 6.6 migratory bat passes per detector night during the Alberta Guideline Period (August 1 – September 10) and 12.7 total bat and 5.2 migratory bat passes per detector night during the full monitoring period. This was likely due to the proximity to the adjacent forested coulees (Figure 2-1). In comparison, MET 2 High had the lowest levels of both total and migratory bat activity, both being 1.2 passes per detector night (total and migratory) for the Alberta Guideline period, and 0.8 passes per detector night (total and migratory) for the full monitoring period (Figure 3-1). Migratory bat activity peaked on several nights between July 28 and August 28, 2015, for all detectors combined. The highest level of activity was observed on the night of August 21 with 13.3 migratory bat passes per detector night (Figure 3-1, Appendix B). Total bat activity was also highest on the night of August 21 with 19.7 bat passes per detector night (Figure 3-1, Appendix B).

Table 3-2 Summary of Bat Activity at Each Monitoring Station During the Fall 2015 Monitoring Period

	Ground 1	Ground 2[1]	Ground 3	MET 1 Low	MET 1 High	MET 2 Low	MET 2 High	MET 3 Low	MET 3 High	MET 4 Low	MET 4 High	Total
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	11
Detector Height Above Ground (m)	2	2	2	2	45	2	47	2	49	2	49	N/A
Number of Nights of Operation	64	79	79	79	56	65	67	78	75	78	78	798
Alberta Guideline Period Nights of Operation Aug 1 to Sep 10	31	41	41	41	26	32	31	41	41	41	41	407
Number of Detector Hours	768	948	948	672	948	804	780	900	936	936	936	9,576
Number of Raw Data Files	8,566	5,026	1,615	3,225	5,566	55,745	3,114	32,541	16,613	17,690	2,112	151,813
Number of Recorded Total Bat Passes	585	1,003	646	486	137	321	56	571	222	686	116	4,829
Number of Recorded Migratory Bat Passes	235	413	185	120	115	154	55	199	203	194	81	1,954
Alberta Guideline Period Number of Recorded Total Bat Passes (Aug 1 to Sep 10)	384	736	511	358	82	248	38	313	170	526	96	3,462
Alberta Guideline Period Number of Recorded Migratory Bat Passes (Aug 1 to Sep 10)	184	270	123	66	81	122	37	156	97	143	67	1,346
Alberta Guideline Period Migratory Bat Passes Per Detector Night (Aug 1 to Sep 10)	5.9	6.6	3.0	1.6	3.1	3.8	1.2	3.8	2.4	3.5	1.6	3.3 2.0[2]
Alberta Guideline Period Total Bat Passes Per Detector Night (Aug 1 to Sep 10)	12.4	18.0	12.5	8.7	3.2	7.8	1.2	7.6	4.1	12.8	2.3	8.5
Migratory Bat Passes Per Detector Night	3.7	5.2	2.3	1.5	2.1	2.4	0.8	2.6	2.7	2.5	1.0	2.4 1.6[2]
Total Bat Passes Per Detector Night	9.1	12.7	8.2	6.2	2.4	4.9	0.8	7.3	3.0	8.8	1.5	6.1

NOTES:
1- Detector Ground 2 was relocated during the 2016 surveys (Figure 2-1)
2- Average based on high detectors

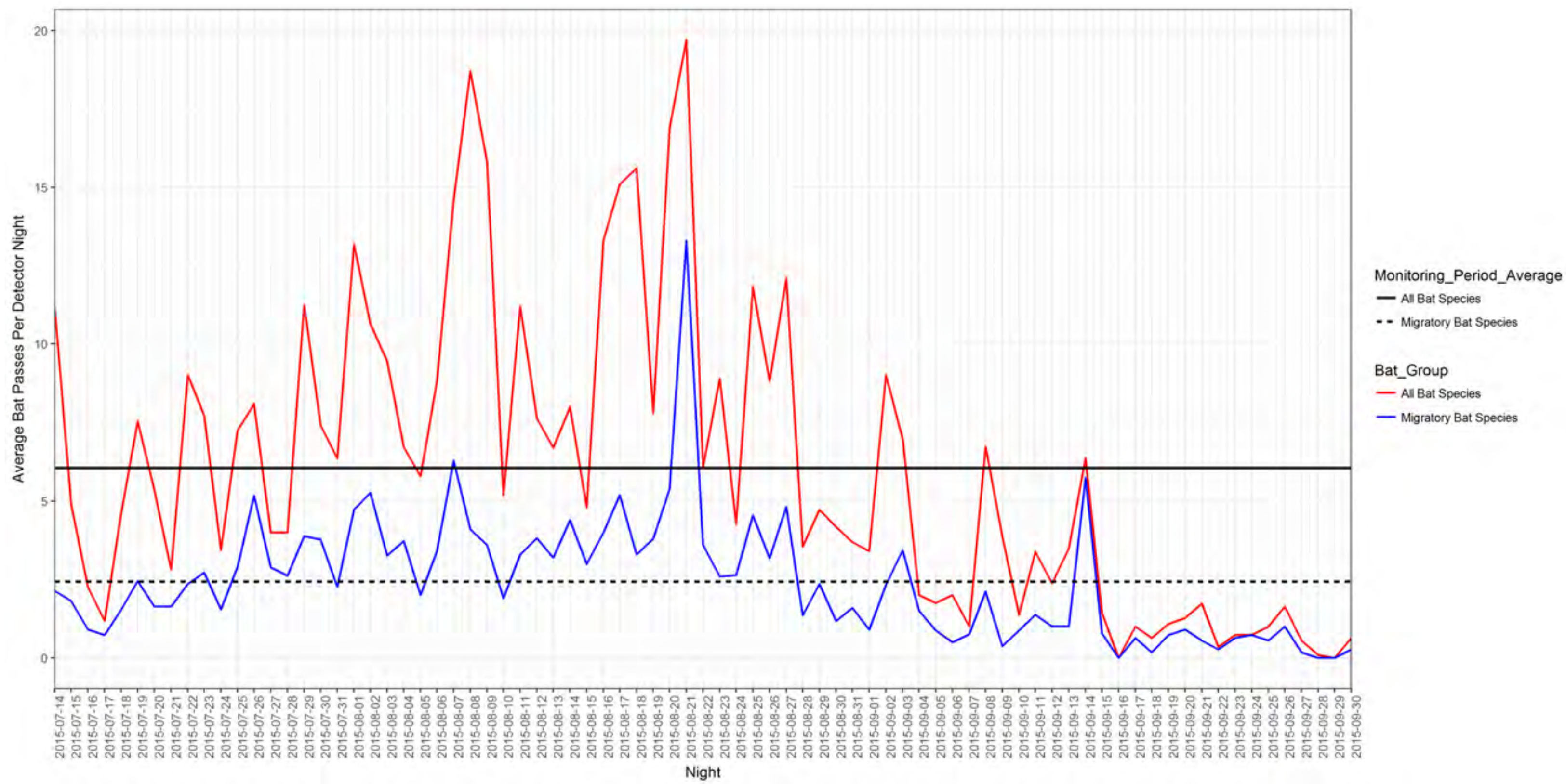

Figure 3-1 Bat Passes per Detector Night (Migratory and Total) During the 2015 Fall Monitoring Period

Spring 2016

During the 2016 spring monitoring period, migratory bat activity rates for all detectors ranged from 0.1 to 0.7 migratory bat passes per detector night, with an average of 0.3 migratory bat passes per detector night. Total bat activity in the spring ranged from 0.1 to 6.5 bat passes per detector night, with an average of 1.4 bat passes per detector night (Table 3-3). Generally, non-migratory bat species showed higher activity at low detectors (1.8 passes per detector night) compared to elevated detectors where a rate of 0.01 passes per detector night was recorded.

Overall, MET 3 Low recorded the highest levels of both total and migratory bat activity in the Project area (Figure 3-2), with 6.5 total bat and 0.7 migratory bat passes per detector night observed during the 2016 Spring monitoring period. This is possibly due to its proximity to treed coulees.

Migratory bat activity peaked on several nights over the spring monitoring period with the highest level of activity observed on the night of June 4 with 1.2 migratory bat passes per detector night (Figure 3-2,Appendix A). Total bat activity was also highest on the night of June 4 with 4.5 bat passes per detector night (Figure 3-2,Appendix A).

Table 3-3 Summary of Bat Activity at Each Monitoring Station During the Spring 2016 Monitoring Period

	Ground 1	Ground 2[1]	Ground 3	MET 1 Low	MET 1 High	MET 2 Low	MET 2 High	MET 3 Low	MET 3 High	MET 4 Low	MET 4 High	Total
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	11
Detector Height Above Ground (m)	2	2	2	2	45	2	47	2	49	2	49	N/A
Number of Nights of Operation	39	39	38	40	40	25	38	33	39	37	37	405
Number of Detector Hours	468	468	456	480	480	300	456	396	468	444	444	4,860
Number of Raw Data Files	771	2525	3887	6780	4608	3442	2635	1968	6504	12320	5798	51,238
Number of Recorded Total Bat Passes	34	9	91	73	10	8	3	213	13	109	4	567
Number of Recorded Migratory Bat Passes	17	7	11	16	8	5	3	24	13	9	4	117
Migratory Bat Passes Per Detector Night	0.4	0.2	0.3	0.4	0.2	0.2	0.1	0.7	0.3	0.2	0.1	0.3 0.2[2]
Total Bat Passes Per Detector Night	0.9	0.2	2.4	1.8	0.2	0.3	0.1	6.5	0.3	2.9	0.1	1.4

NOTES:
1- Detector Ground 2 was relocated during the 2016 surveys (Figure 2-1)
2- Average based on high detectors

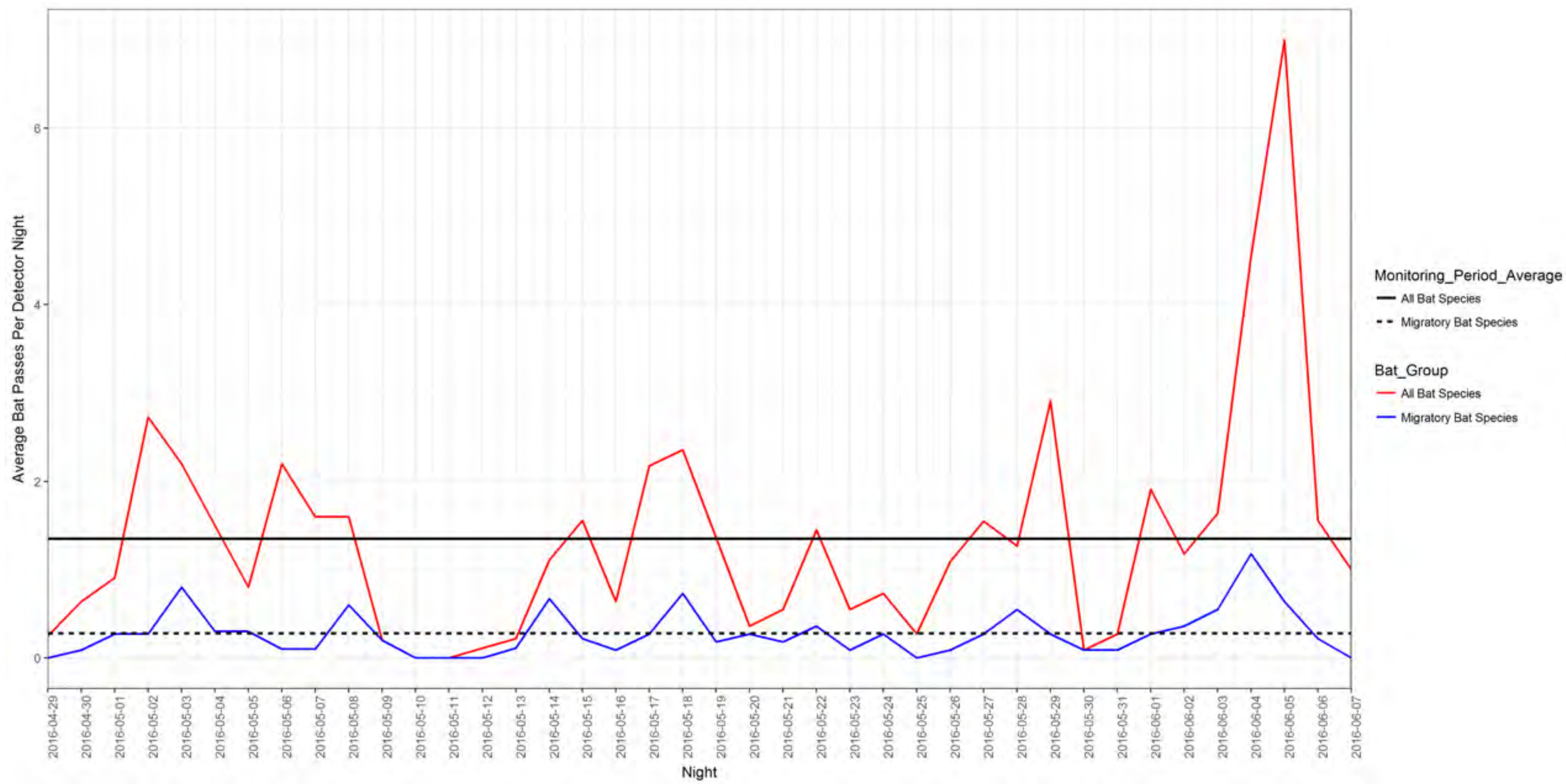

Figure 3-2 Bat Passes per Detector Night (Migratory and Total) During the 2016 Spring Monitoring Period

Fall 2016

During the 2016 fall monitoring period, migratory bat activity rates for all detectors during the full monitoring period (July 28 – September 1) ranged from 1.1 to 3.8 migratory bat passes per detector night, with an average of 3.0 migratory bat passes per detector night. Total bat activity rates for fall 2016 ranged from 1.1 to 18.9 bat passes per detector night, with an average of 7.5 bat passes per detector night (Table 3-4).

During the Alberta Guideline period the migratory bat activity rate was recorded as 2.4 passes per detector night at elevated detectors, while non-migratory bats had rates of 0.5 passes per detector night (Table 3-4, Figure 3-3). Generally, non-migratory bat species had activity rates 18x higher at low detectors compared to elevated detectors, which is consistent with known foraging behavior of these species.

Although there was higher total bat activity recorded at the low detectors, there was a higher proportion of migratory bat activity at the high detectors (Figure 3-3) in the potential rotor-swept area, which supports observations that most bat fatalities at wind projects are migratory bats, as non-migratory bats are more active at lower altitude (Arnett et al. 2008).

Table 3-4 Summary of Bat Activity at Each Monitoring Station During the Fall 2016 Monitoring Period

	Ground 1	Ground 2[1]	Ground 3	MET 1 Low	MET 1 High	MET 2 Low	MET 2 High	MET 3 Low	MET 3 High	MET 4 Low	MET 4 High	Total
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	11
Detector Height Above Ground (m)	2	2	2	2	45	2	47	2	49	2	49	N/A
Number of Nights of Operation	48	48	48	48	25	48	29	48	34	40	28	444
Alberta Guideline Period Nights of Operation Aug 1 to Sep 10	43	43	43	43	22	43	24	43	31	35	25	395
Number of Detector Hours	576	576	576	576	300	576	348	576	408	480	336	5,328
Number of Raw Data Files	5,939	7,534	3,652	79,248	5,332	5,491	3,947	7,404	8,176	83,027	321	210,071
Number of Recorded Total Bat Passes	376	156	360	905	94	223	33	568	148	409	64	3,336
Number of Recorded Migratory Bat Passes	174	103	129	156	66	129	31	241	128	116	51	1,324
Alberta Guideline Period Number of Recorded Total Bat Passes (Aug 1 to Sep 10)	312	138	229	817	78	205	28	489	128	341	58	2,823
Alberta Guideline Period Number of Recorded Migratory Bat Passes (Aug 1 to Sep 10)	151	89	102	138	57	120	26	211	113	98	46	1,151
Alberta Guideline Period Migratory Bat Passes Per Detector Night (Aug 1 to Sep 10)	3.5	2.1	2.4	3.2	2.6	2.8	1.1	4.9	3.6	2.8	1.8	2.9 2.4[2]
Alberta Guideline Period Total Bat Passes Per Detector Night (Aug 1 to Sep 10)	7.3	3.2	5.3	19	3.5	4.8	1.2	11.4	4.1	9.7	2.3	7.1
Migratory Bat Passes Per Detector Night	3.6	2.1	2.7	3.2	2.6	2.7	1.1	5	3.8	2.9	1.8	3.0 2.4[2]
Total Bat Passes Per Detector Night	7.8	3.2	7.5	18.9	3.8	4.6	1.1	11.8	4.4	10.2	2.3	7.5

NOTES:
1- Detector Ground 2 was relocated during the 2016 surveys (Figure 2-1)
2- 2-Average based on high detectors

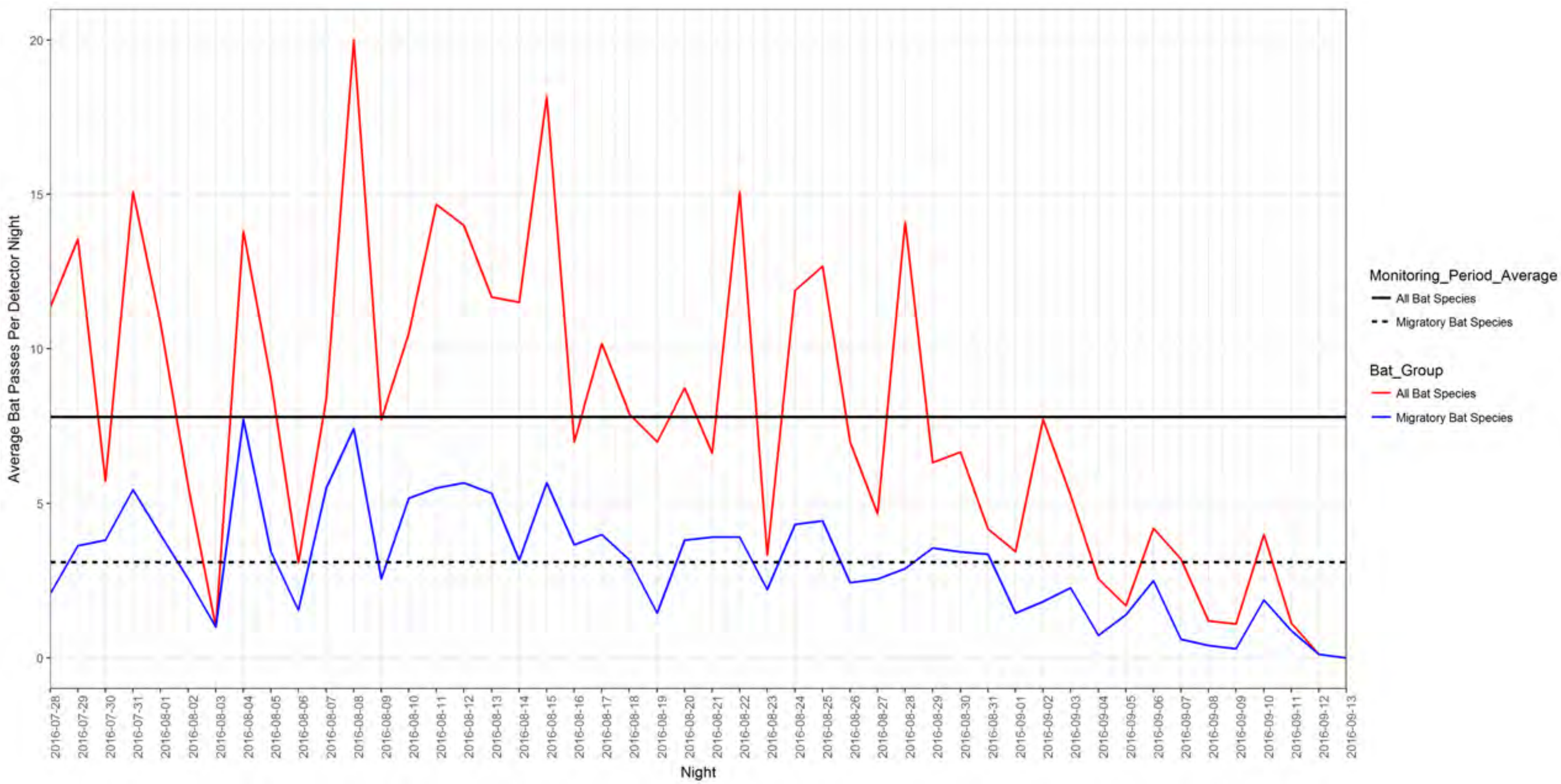

Figure 3-3 Bat Passes per Detector Night (Migratory and Total) During the 2016 Fall Monitoring Period

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3.2.2 Nightly Bat Activity Levels

Fall 2015

The highest levels of bat activity were recorded between 0300 and 0359 hours, with a total of 644 bat passes recorded, though bat activity was relatively even over the evenings between 2100 and 0459 hours (Figure 3-4). Both migratory and non-migratory activity was also relatively consistent between 2100 and 0459 hours (Figure 3-4).

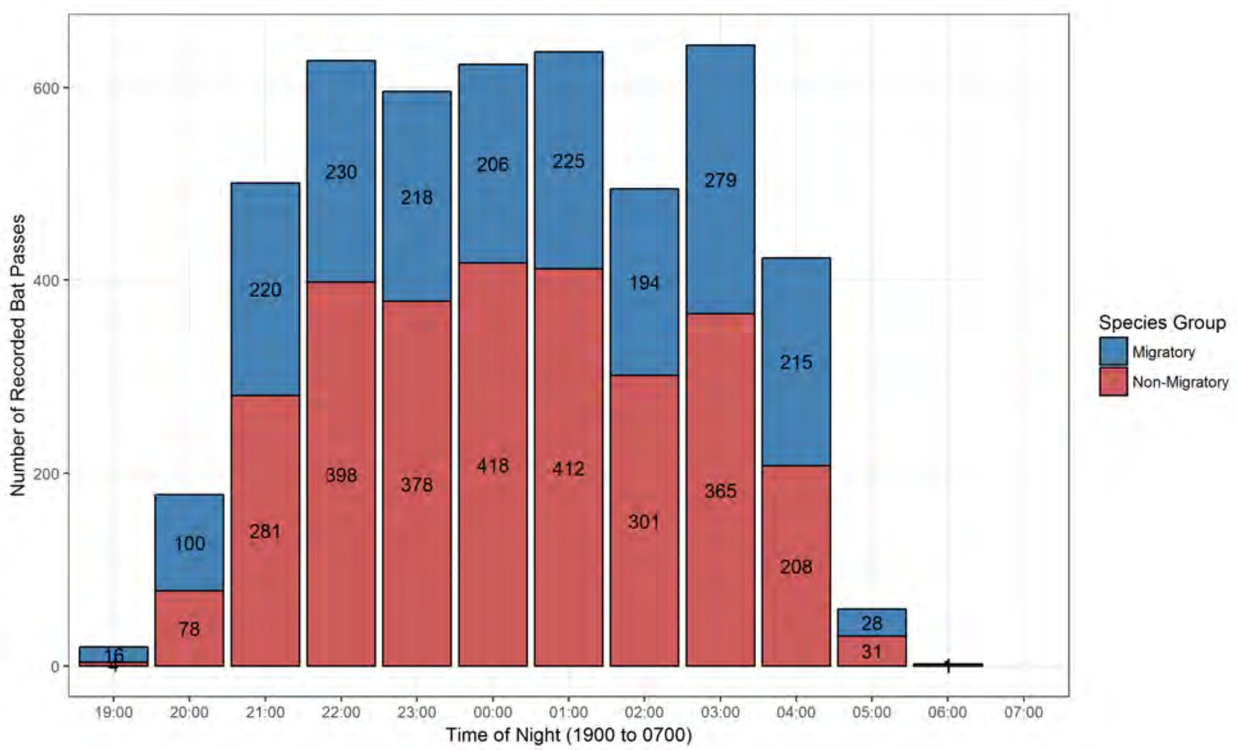

Figure 3-4 Distribution of Hourly Bat Activity for Migratory and Non-migratory Bats During the Fall 2015 Monitoring Period

Spring 2016

The highest levels of bat activity were recorded between 2200 and 2259 hours, with a total of 126 bat passes recorded. Most activity occurred between 2100 and 0359 hours (Figure 3-5).

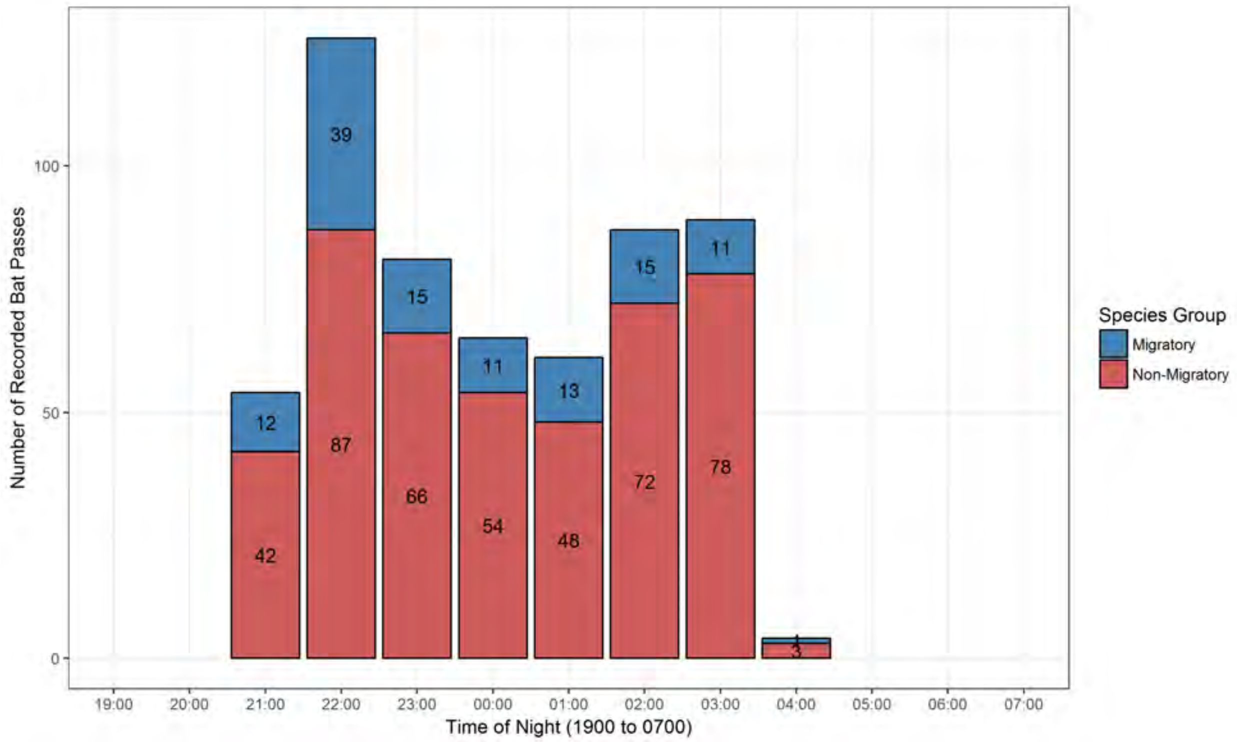

Figure 3-5 Distribution of Hourly Bat Activity for Migratory and Non-migratory Bats During the Spring 2016 Monitoring Period

Fall 2016

The highest levels of bat activity were recorded between 2200 and 2259 hours, with a total of 455 bat passes recorded, though bat activity was relatively even over the nights between 2100 and 0459 hours (Figure 3-6). Both migratory and non-migratory activity was also relatively consistent between 2100 and 0459 hours (Figure 3-6).

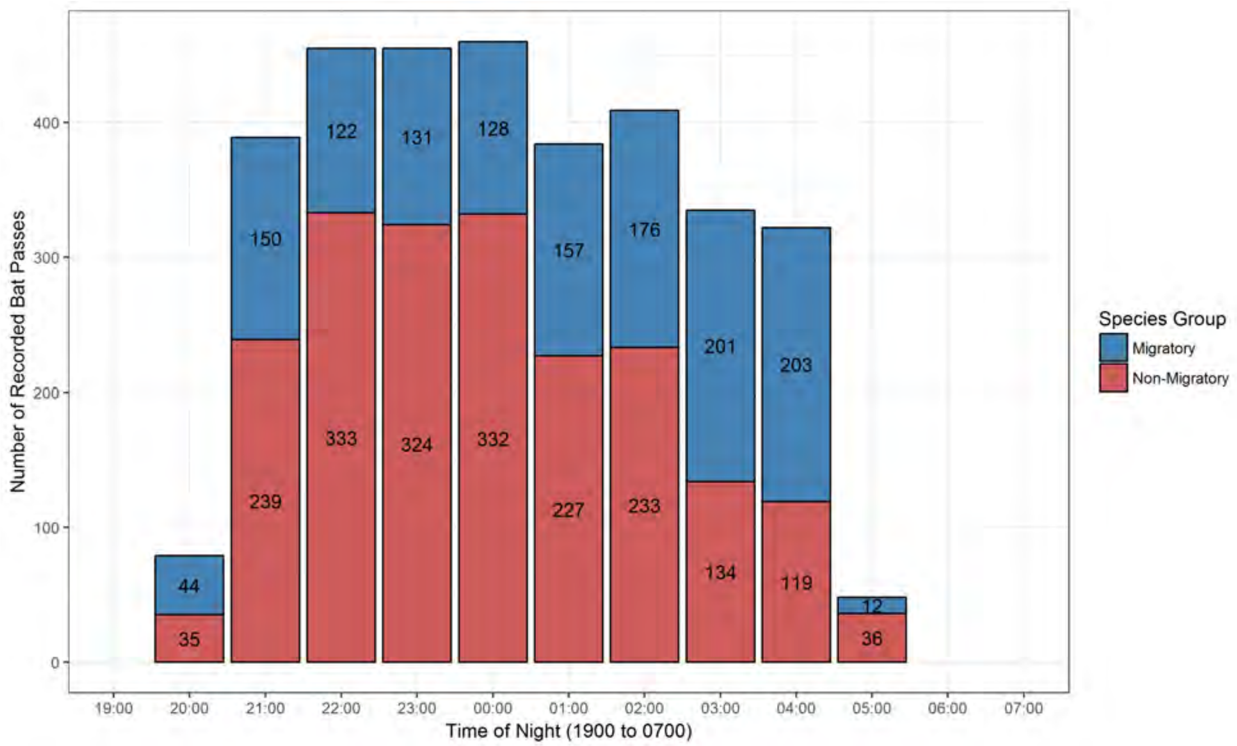

Figure 3-6 Distribution of Hourly Bat Activity for Migratory and Non-migratory Bats During the Fall 2016 Monitoring Period

3.2.3 Annual Fall Bat Activity

Between the 2015 and 2016 fall monitoring period, bat activity was relatively similar. During the Alberta Guideline Period, the average migratory bat activity at the high detectors was 2.0 passes per detector night in 2015 and 2.4 passes per detector night in 2016. The differences in activity rates between the two years of fall monitoring likely represents potential year-to-year variation in activity rates.

The three migratory species recorded in the Project area, eastern red bat, hoary bat, and silver-haired bat displayed similar patterns of activity between the two years of fall monitoring (Appendix B). Eastern red bat peak activity occurred on August 1 in 2015 and July 30 in 2016. Hoary bat activity peaked on August 6 in 2015 and August 4 in 2016. Bats identified as silver-haired bats were infrequently recorded over the fall monitoring periods, as this species is difficult to differentiate from the big brown bat. The big brown / silver-haired bat species grouping is likely mostly made up of silver-haired bats (Baerwald et al. 2008, Baerwald and Barclay 2009) and was the mostly commonly reported migratory species / grouping during both years of fall monitoring. Big brown / silver-haired bat activity was highest on August 21 in 2015 and August 31 in 2016, but also peaked on August 22. Consistent annual pattern of fall activity reflects those of migratory species that are spending the summer north of the Project area and only passing through on migration, as their activity is regulated more by seasonality and less by weather conditions.

3.3 ENVIRONMENTAL FACTORS

3.3.1 Sunrise and Sunset

Between the first (July 14) and last (September 30) night of monitoring in fall 2015, sunset and sunrise times varied by 4 hours and 8 minutes with a maximum darkness period of 12 hours and 16 minutes. Between the first and last night of monitoring in spring 2016, sunset and sunrise times varied by 1 hour and 34 minutes, with a maximum darkness period of 9 hours and 27 minutes. Between the first (July 28) and last (September 13) night of monitoring in fall 2016, sunset and sunrise times varied by 2 hours and 34 minutes with a maximum darkness period of 11 hours and 17 minutes. Because of this variation, it is not possible to accurately display nightly data in relation to both sunset and sunrise simultaneously. As such, nightly activity for the Project area is most effectively displayed in reference to the beginning of darkness (i.e., sunset), and the sunrise period accounts for the entire variation in the number of hours of darkness between the start and end of the monitoring period. No bat passes were recorded prior to sunset and activity rates increased considerably one hour after sunset (Figure 3-7, Figure 3-8, and Figure 3-9). Nightly activity varied by detector and by monitoring period (Figure 3-7, Figure 3-8, and Figure 3-9).

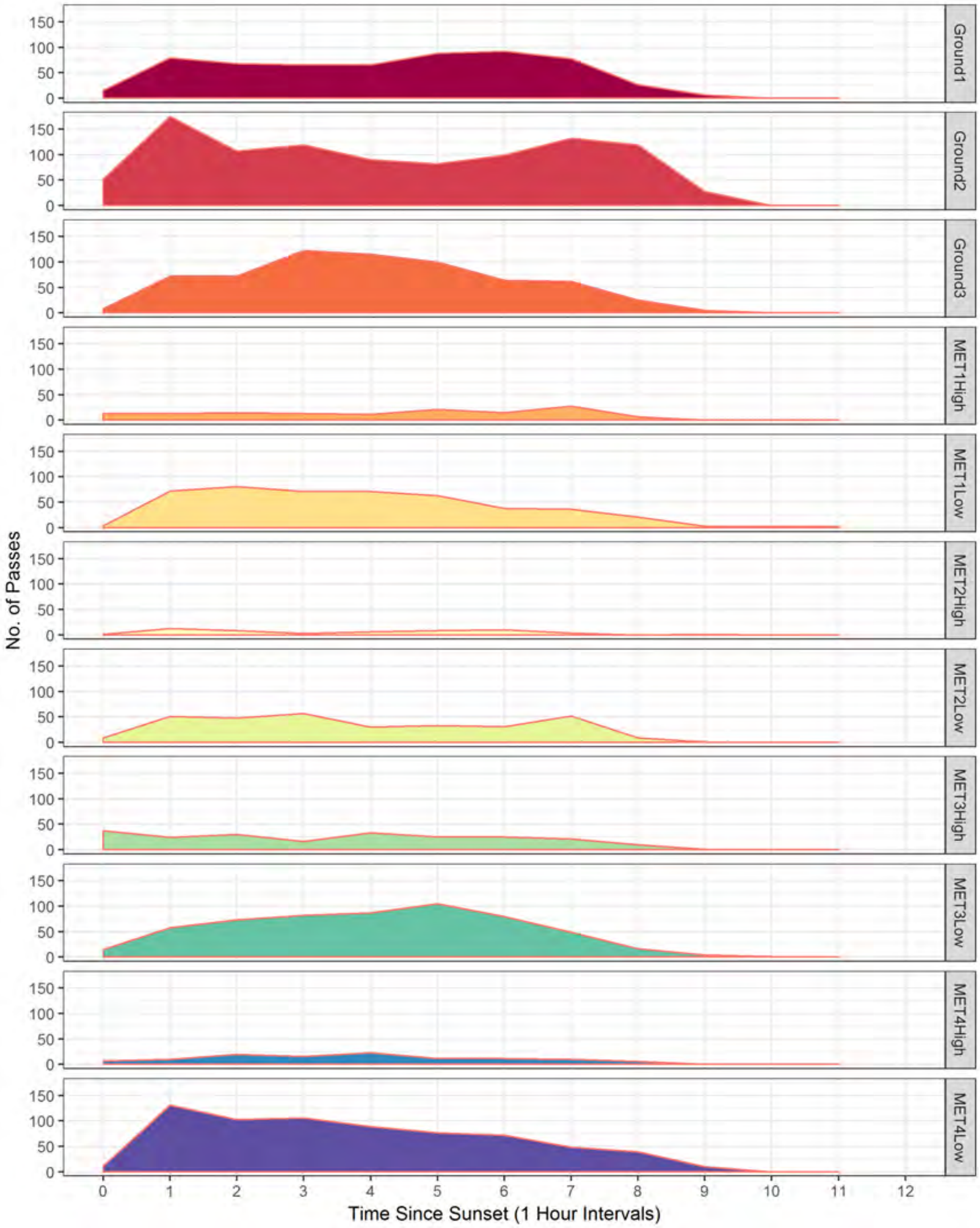

Figure 3-7 Distribution of Nightly Bat Activity by Detector During the Fall 2015 Monitoring Period

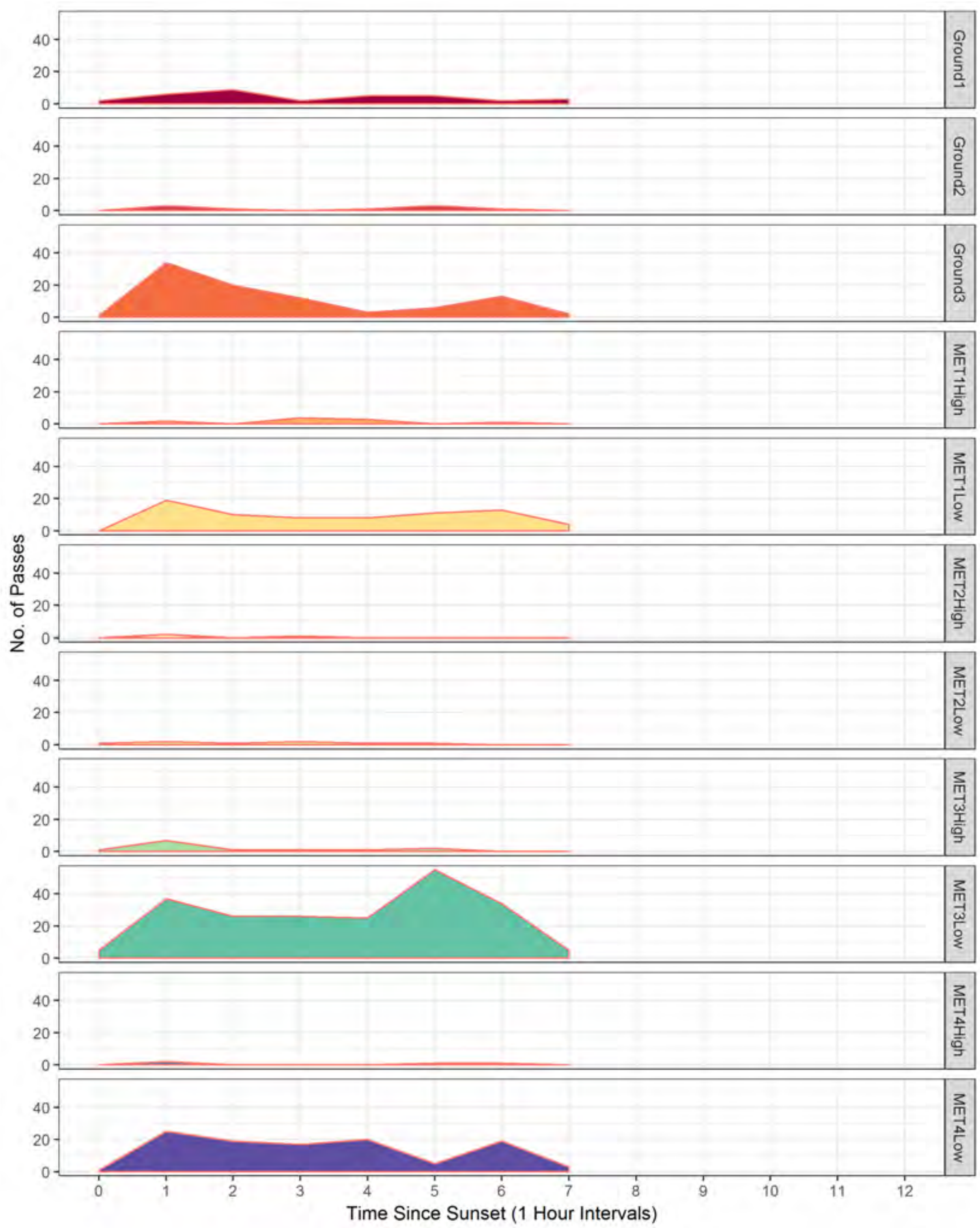

Figure 3-8 Distribution of Nightly Bat Activity by Detector During the Spring 2016 Monitoring Period

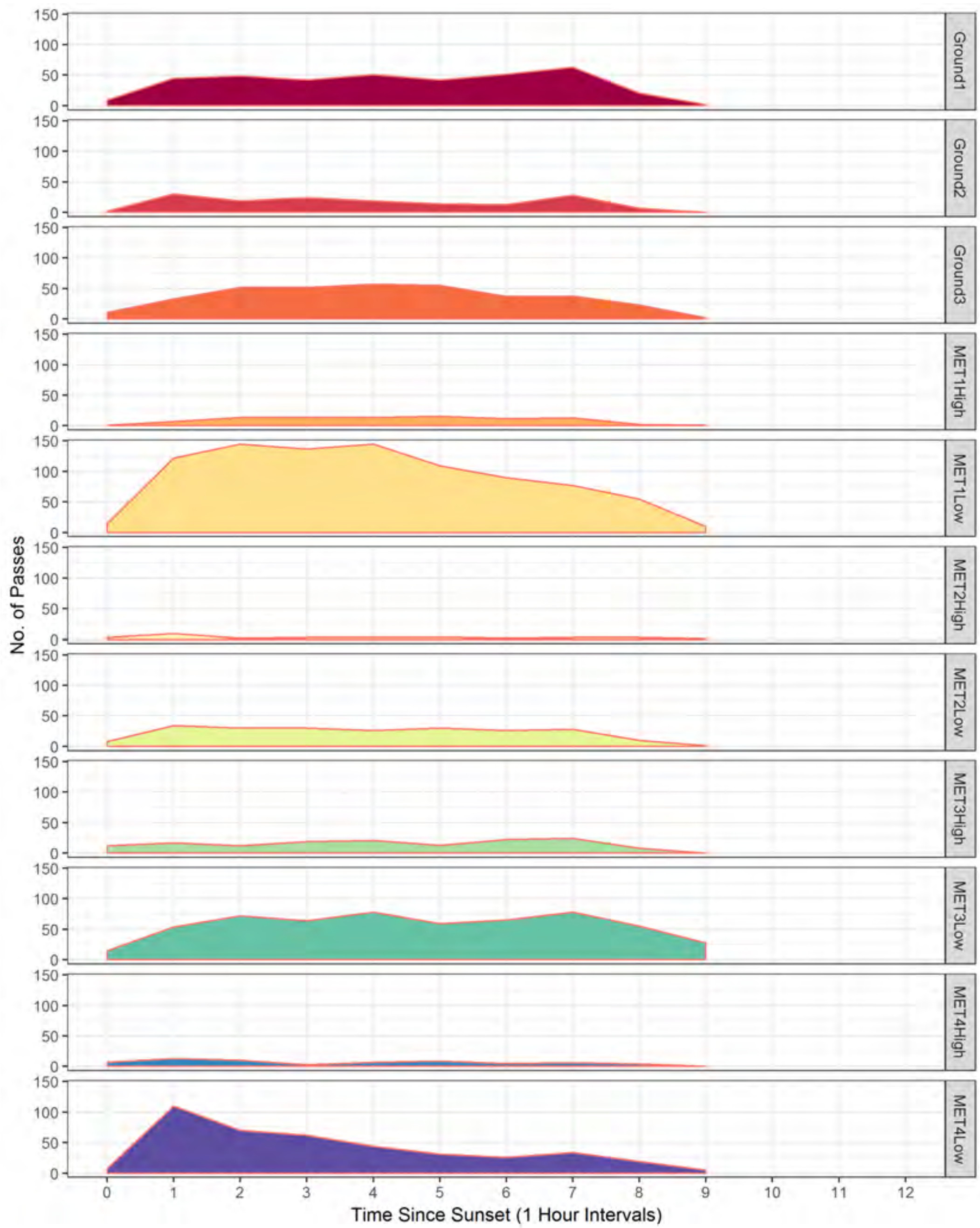

Figure 3-9 Distribution of Nightly Bat Activity by Detector During the Fall 2016 Monitoring Period

3.4 BAT ACTIVITY BY SPECIES OR SPECIES GROUPING

The number of passes for each bat species and bat grouping recorded during the monitoring period is provided in Appendix B. The most common species or species grouping in the Project area during all three monitoring periods was *Myotis* species, followed by the big brown/silver-haired grouping (Figures 3-10, 3-11 and 3-12). In general, *Myotis* species activity was more variable throughout the three monitoring periods, with no consistent pattern.

The most common migratory species or species grouping was the big brown/silver-haired bat species grouping. During the spring monitoring period, bat observations were relatively sparse with the highest periods of activity recorded during the nights of June 3, 4 and 5, with relatively consistent activity occurring from early May to Early June.

During the fall monitoring period in 2015, big brown/silver-haired bat began increasing from the beginning of the monitoring period on July 14, peaking on August 21, and decreasing to very little activity by mid-September. During the fall monitoring period in 2016, big brown/silver-haired bat activity peaked on July 29 and 30, and was relatively low until mid-August, peaking on August 31, and decreasing until the end of the monitoring period (September 12) (Appendix B).

Other migratory bat species and species groupings, including silver-haired bat, eastern red bat, hoary bat and low frequency bats displayed similar patterns of activity to the big brown / silver-haired bat species grouping during both the spring and fall monitoring periods.

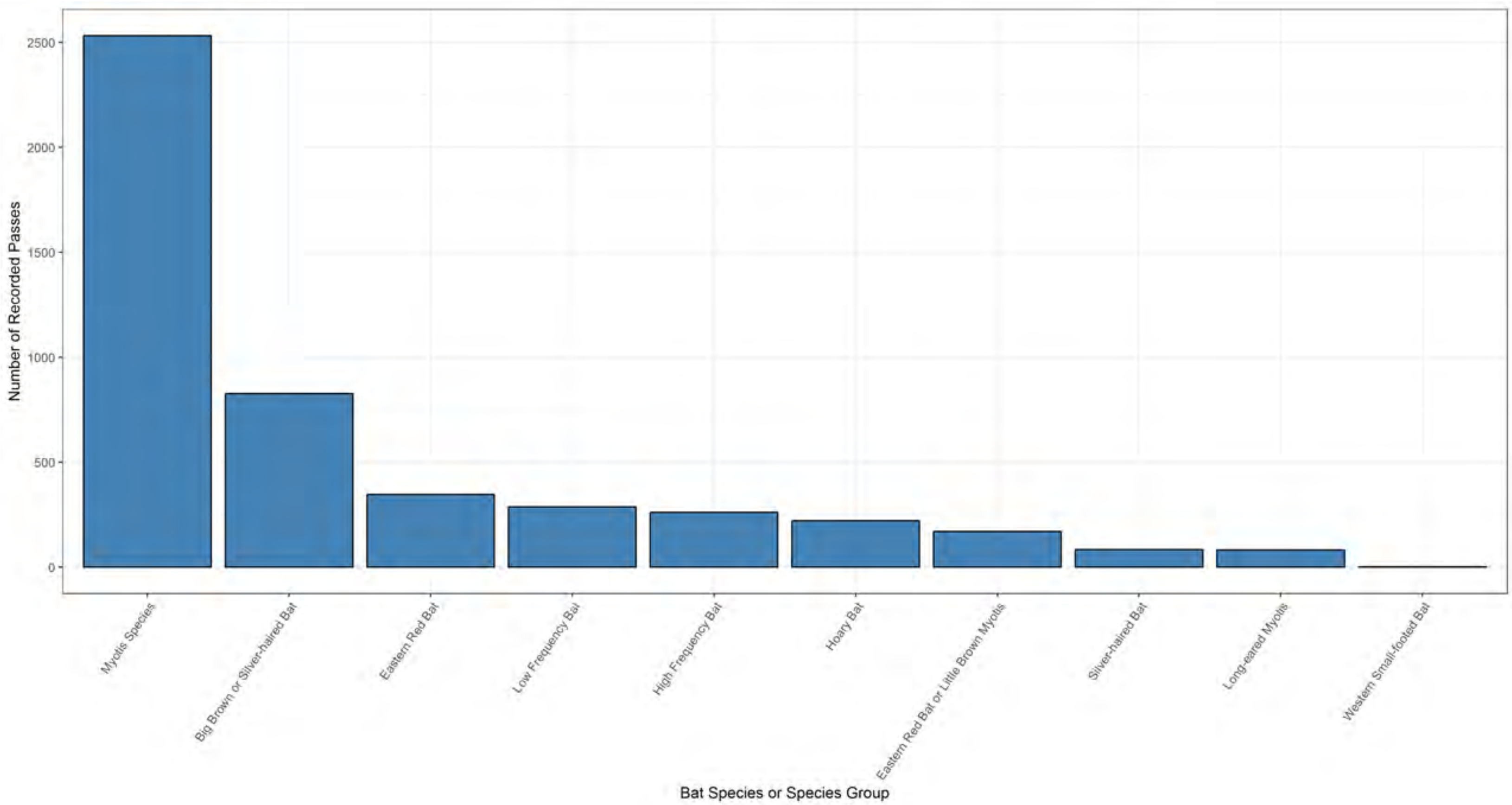

Figure 3-10 Total Bat Passes per Species or Species Grouping During the Fall 2015 Monitoring Period

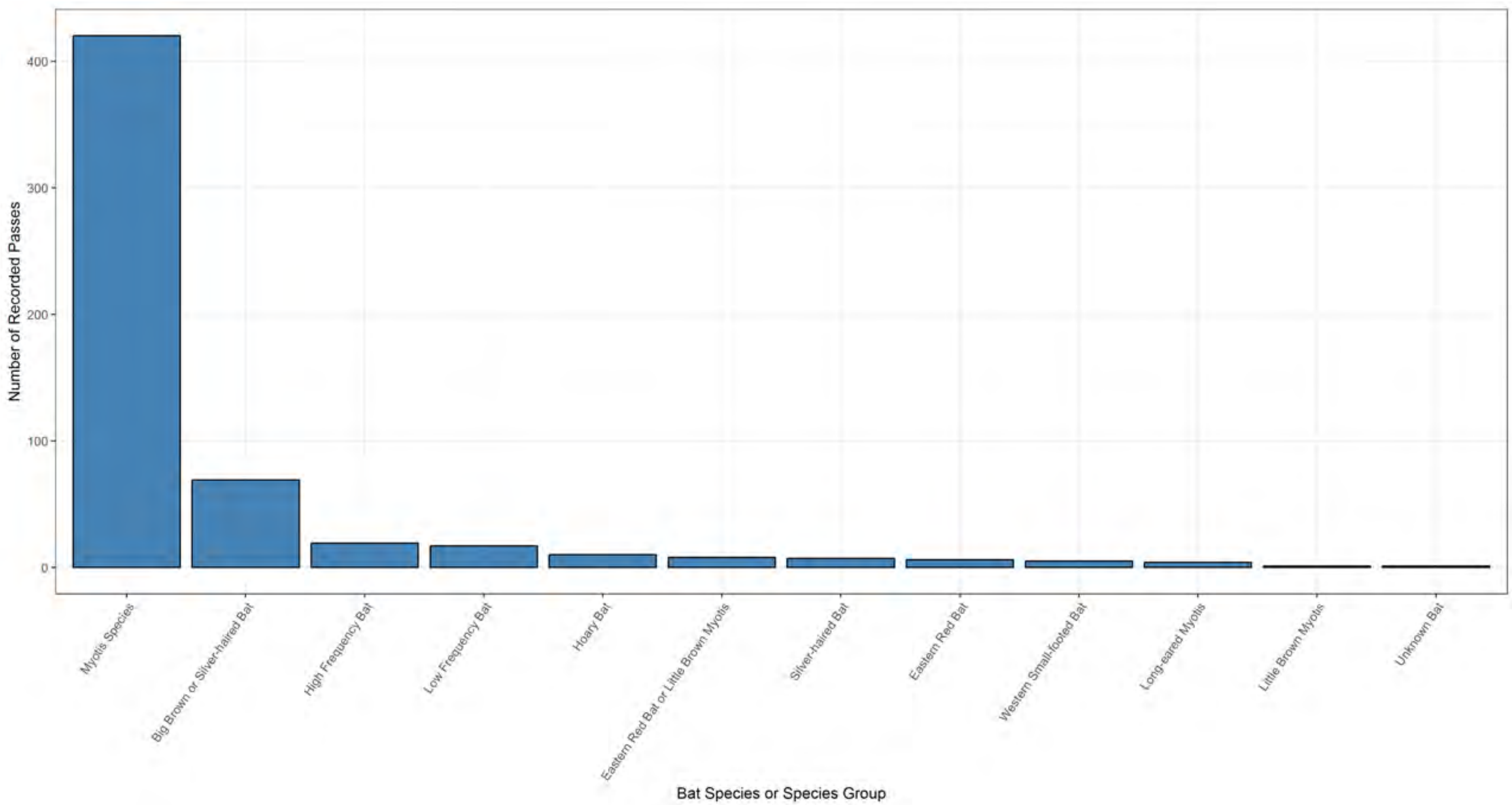

Figure 3-11 Total Bat Passes per Species or Species Grouping During the Spring 2016 Monitoring Period

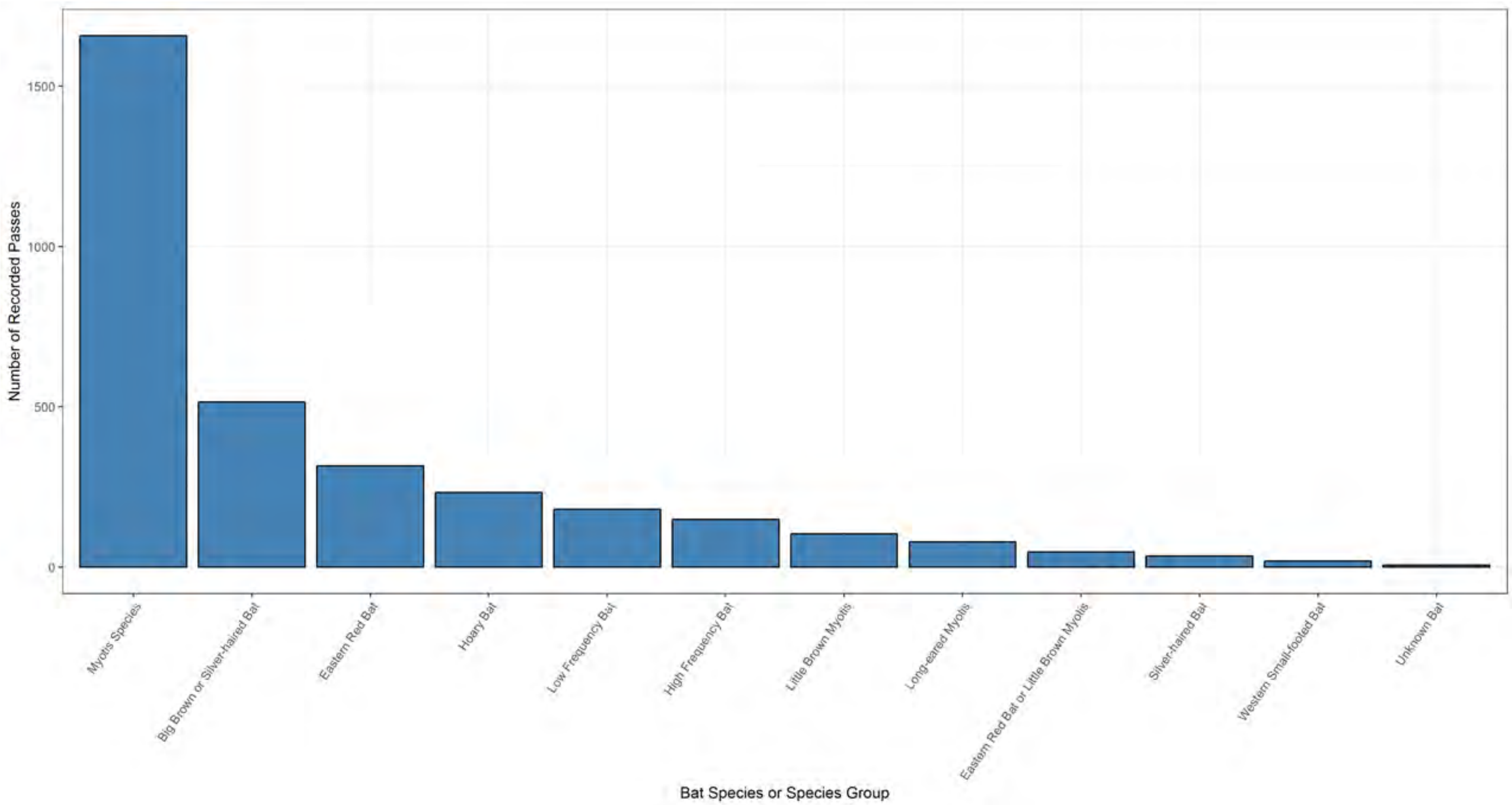

Figure 3-12 Total Bat Passes per Species or Species Grouping During the Fall 2016 Monitoring Period

4.0 SUMMARY

The average activity rate for migratory bats at high detectors during the Alberta Guideline period (August 1 to September 10) was 2.0 migratory bat passes per detector night in 2015 and 2.4 migratory bat passes per detector night in 2016. Based on the AEP guidance related to bat activity and wind developments (ESRD 2013), greater than two migratory bat passes per detector night during this period indicates that there is a potentially high risk of bat fatalities for an area. Although this study is using Alberta's guidelines (ESRD 2013), which states that pre-construction bat activity is correlated to post-construction mortality rates, the ability to predict collision risk for birds and bats from activity recorded by radar and acoustic detectors, respectively, remains elusive as the correlations between activity rates and fatality rates are not strong (AWWI 2015). To date studies have not been able to develop a quantitative model enabling reasonably accurate prediction of collision risk from these surveys (e.g., Hein et al. 2013). Key findings of the passive acoustic bat surveys include:

- 6.1 total and 2.4 migratory bat passes per detector night were recorded over the fall 2015 monitoring period (July 14 to September 30) for all detectors.
- 1.4 total and 0.3 migratory bat passes per detector night were recorded over the spring 2016 monitoring period (April 29 to June 6) for all detectors.
- 7.5 total and 3.0 migratory bat passes per detector night were recorded over the fall 2016 monitoring period (July 28 to September 13) for all detectors.
- During the Alberta Guideline monitoring period (August 1st to September 10th) activity rates for total bats and migratory bats were 8.5 and 2.4 in 2015 and 7.1 and 2.9 in 2016, respectively.
- A potential migratory corridor was identified following the Big Muddy Valley to the north of the Project Area; turbines are not sited within the Big Muddy Valley
- The most common species grouping of bats was the big/brown silver-haired bat species grouping.
- At the MET High detectors, the most recorded activity was that of migratory bat species.

Bat activity rates varied considerably between the spring and fall monitoring periods. There were approximately 5 times as many total bat passes per detector observed during the fall monitoring periods as during the spring monitoring period, and 8 to 11 times as many migratory bat passes per detector night. This is consistent with results of previous studies where the highest rates of bat mortality at wind projects in North America were consistently found during August and September (Arnett et al. 2008).

While non-migratory bats made up most recorded bat passes during all three monitoring periods, migratory bats consisted of 85, 93, and 81% of all high detector passes during the fall 2015, spring 2016 and fall 2016 monitoring periods respectively. The higher proportion of migratory bat activity at the high detector in the potential rotor-swept area for the Project supports observations that most bat fatalities at wind projects are migratory bats (94.4% in Alberta, 71.2 to 74% in Canada), as non-migratory bats are more active at lower altitude (BSC et al 2017, Zimmerling and Francis 2016). The potential for fatality of non-migratory bats is expected to be low as *Myotis* species tend to travel and forage below the rotor swept area (Arnett et al. 2008). Based on these results, the fatality risk for little brown myotis, which is listed on Schedule 1 (endangered) of the *SARA*, is predicted to be low.

5.0 CLOSURE

This report was prepared on behalf of BluEarth. The report may not be relied upon by any other person or entity without the express written consent of Stantec and BluEarth.

Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgment of Stantec based on the data obtained from the work and on the site conditions encountered at the time the work was performed at the specific sampling, testing, and/or observation locations.

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Appendix A BAT PASSES RECORDED IN THE OUTLAW TRAIL PROJECT STUDY AREA

Table A- 1 Total Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (All Bats)
14-Jul-15	33	19	17	5	3	1	0	N/A	N/A	N/A	N/A	78	7	11.1
15-Jul-15	17	11	3	0	3	2	0	10	3	5	0	54	11	4.9
16-Jul-15	1	5	3	0	0	0	0	13	2	1	0	25	11	2.3
17-Jul-15	1	3	1	0	0	2	0	5	1	0	0	13	11	1.2
18-Jul-15	9	4	6	1	1	3	0	12	1	14	0	51	11	4.6
19-Jul-15	14	12	9	6	0	3	0	19	3	16	1	83	11	7.5
20-Jul-15	13	13	2	2	1	3	0	15	0	10	0	59	11	5.4
21-Jul-15	5	9	5	1	0	0	1	6	1	3	0	31	11	2.8
22-Jul-15	9	18	15	6	2	9	1	24	1	14	0	99	11	9
23-Jul-15	13	5	8	8	4	5	1	23	2	16	0	85	11	7.7
24-Jul-15	8	8	3	1	1	3	1	1	2	9	1	38	11	3.5
25-Jul-15	7	9	13	3	3	7	1	22	4	11	0	80	11	7.3
26-Jul-15	8	15	2	11	6	7	4	15	6	9	6	89	11	8.1
27-Jul-15	4	4	7	2	---	6	0	10	---	1	2	36	9	4
28-Jul-15	6	4	1	0	---	4	---	8	---	8	1	32	8	4
29-Jul-15	16	36	4	1	---	4	---	24	---	3	2	90	8	11.3
30-Jul-15	9	18	6	2	---	4	---	16	6	3	3	67	9	7.4
31-Jul-15	16	10	10	3	3	4	1	11	4	7	1	70	11	6.4
1-Aug-15	31	21	12	7	7	6	1	40	3	16	1	145	11	13.2

Table A- 1 Total Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (All Bats)
2-Aug-15	19	4	11	12	1	5	5	40	8	10	2	117	11	10.6
3-Aug-15	12	30	22	1	3	8	1	11	2	12	2	104	11	9.5
4-Aug-15	9	50	2	1	0	3	2	1	0	5	1	74	11	6.7
5-Aug-15	7	7	21	2	---	7	1	0	4	6	3	58	10	5.8
6-Aug-15	14	7	21	4	---	2	1	16	3	20	0	88	10	8.8
7-Aug-15	20	15	15	7	---	4	4	24	8	43	6	146	10	14.6
8-Aug-15	19	26	66	11	---	7	2	36	11	9	0	187	10	18.7
9-Aug-15	10	13	88	7	---	6	3	13	6	9	3	158	10	15.8
10-Aug-15	5	11	6	0	---	5	6	8	0	9	2	52	10	5.2
11-Aug-15	17	11	32	6	---	9	4	8	0	22	3	112	10	11.2
12-Aug-15	11	10	3	11	7	10	0	13	5	14	0	84	11	7.6
13-Aug-15	11	11	5	1	4	7	---	5	5	16	2	67	10	6.7
14-Aug-15	23	19	6	4	6	5	---	7	4	3	3	80	10	8
15-Aug-15	7	9	0	4	1	8	---	3	7	5	4	48	10	4.8
16-Aug-15	9	27	12	17	6	12	---	11	4	31	4	133	10	13.3
17-Aug-15	18	23	23	19	4	9	---	11	11	24	9	151	10	15.1
18-Aug-15	14	29	22	24	6	7	---	12	3	36	3	156	10	15.6
19-Aug-15	10	15	7	7	8	5	---	6	7	11	2	78	10	7.8
20-Aug-15	15	89	16	9	1	10	---	2	8	15	4	169	10	16.9
21-Aug-15	18	33	10	18	18	36	---	2	18	26	18	197	10	19.7
22-Aug-15	17	8	5	4	2	6	---	6	1	12	0	61	10	6.1

Table A- 1 Total Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (All Bats)
23-Aug-15	8	33	12	8	1	1	0	5	8	10	3	89	11	8.1
24-Aug-15	5	2	6	2	3	9	0	2	4	12	2	47	11	4.3
25-Aug-15	13	47	12	13	5	11	0	4	2	21	2	130	11	11.8
26-Aug-15	4	42	10	5	2	6	0	2	10	16	0	97	11	8.8
27-Aug-15	14	23	28	15	10	14	0	5	0	20	4	133	11	12.1
28-Aug-15	5	6	6	2	2	7	0	3	1	7	0	39	11	3.5
29-Aug-15	6	20	2	2	1	7	0	0	3	8	3	52	11	4.7
30-Aug-15	11	8	1	4	0	10	0	3	3	6	0	46	11	4.2
31-Aug-15	2	12	2	3	---	6	0	0	4	8	0	37	10	3.7
1-Sep-15	---	9	2	5	2	0	2	4	0	10	0	56	10	5.6
2-Sep-15	---	22	2	25	3	---	2	1	2	23	1	81	9	9
3-Sep-15	---	13	3	32	2	---	0	2	3	5	3	63	9	7
4-Sep-15	---	6	2	3	---	---	0	0	5	0	0	16	8	2
5-Sep-15	---	4	1	5	---	---	1	0	1	2	0	14	8	1.8
6-Sep-15	---	2	3	2	---	---	0	0	0	6	3	16	8	2
7-Sep-15	---	1	1	0	---	---	0	1	0	4	1	8	8	1
8-Sep-15	---	15	7	14	---	---	1	3	4	10	0	54	8	6.8
9-Sep-15	---	1	5	16	---	---	0	3	1	3	2	31	8	3.9
10-Sep-15	---	2	1	4	---	---	2	0	1	1	0	11	8	1.4
11-Sep-15	---	13	2	5	---	---	3	2	1	1	0	27	8	3.4
12-Sep-15	---	6	3	1	---	---	1	2	1	5	0	19	8	2.4

Table A- 1 Total Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (All Bats)
13-Sep-15	---	13	2	6	---	---	0	2	0	5	0	28	8	3.5
14-Sep-15	---	6	5	27	---	---	3	0	3	6	1	51	8	6.4
15-Sep-15	---	1	0	5	0	---	0	0	0	7	0	13	9	1.4
16-Sep-15	0	0	0	0	0	0	0	0	0	0	0	0	11	0
17-Sep-15	2	0	0	3	0	1	0	1	2	2	0	11	11	1
18-Sep-15	3	0	1	1	0	0	0	2	0	0	0	7	11	0.6
19-Sep-15	2	2	0	2	1	0	0	3	1	1	0	12	11	1.1
20-Sep-15	0	2	4	1	0	1	1	3	1	1	0	14	11	1.3
21-Sep-15	3	3	1	7	0	1	0	1	2	1	0	19	11	1.7
22-Sep-15	0	0	0	2	0	2	0	0	0	0	0	4	11	0.4
23-Sep-15	1	3	1	0	0	0	0	1	0	0	2	8	11	0.7
24-Sep-15	0	3	0	1	1	0	0	1	2	0	0	8	11	0.7
25-Sep-15	0	4	0	4	0	0	0	2	0	1	0	11	11	1
26-Sep-15	1	4	1	7	1	1	0	0	3	0	0	18	11	1.6
27-Sep-15	0	3	0	1	0	0	0	2	0	0	0	6	11	0.5
28-Sep-15	0	0	0	1	0	0	0	0	0	0	0	1	11	0.1
29-Sep-15	0	0	0	0	0	0	0	0	0	0	0	0	11	0
30-Sep-15	0	1	0	2	2	0	0	2	0	0	0	7	11	0.6
Total	585	1,003	646	464	137	321	56	571	222	686	116	4,807	N/A	6.0
Total # of Nights Per Detector	64	79	79	79	56	65	67	78	75	78	78	N/A	798	N/A

Table A- 1 Total Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (All Bats)
# of Total Bat Passes Per Detector Night	9.1	12.7	8.2	5.9	2.5	4.94	0.8	7.3	3.0	8.8	1.5	6.0	N/A	N/A

--- indicates night of detector malfunction
N/A indicates night is outside of survey period or field is not applicable

Table A- 2 Migratory Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
14-Jul-15	2	5	5	0	3	0	0	N/A	N/A	N/A	N/A	15	7	2.1
15-Jul-15	2	7	3	0	3	0	0	2	3	0	0	20	11	1.8
16-Jul-15	0	3	2	0	0	0	0	3	2	0	0	10	11	0.9
17-Jul-15	1	2	1	0	0	0	0	3	1	0	0	8	11	0.7
18-Jul-15	1	3	3	1	1	0	0	3	1	4	0	17	11	1.5
19-Jul-15	2	6	5	1	0	1	0	8	2	2	0	27	11	2.5
20-Jul-15	0	6	0	0	0	2	0	9	0	1	0	18	11	1.6
21-Jul-15	0	8	2	0	0	0	1	5	1	1	0	18	11	1.6
22-Jul-15	4	8	3	0	1	1	1	7	1	0	0	26	11	2.4

Table A- 2 Migratory Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
23-Jul-15	1	4	3	0	4	4	1	9	2	2	0	30	11	2.7
24-Jul-15	4	3	0	0	0	1	1	1	2	4	1	17	11	1.5
25-Jul-15	5	4	5	0	3	2	1	4	3	5	0	32	11	2.9
26-Jul-15	5	12	1	1	6	4	4	9	6	6	3	57	11	5.2
27-Jul-15	3	3	4	0	---	5	0	9	---	0	2	26	9	2.9
28-Jul-15	4	1	1	0	---	3	---	6	---	6	0	21	8	2.6
29-Jul-15	3	17	3	0	---	2	---	4	---	1	1	31	8	3.9
30-Jul-15	3	12	3	0	---	3	---	3	5	2	3	34	9	3.8
31-Jul-15	5	2	4	0	2	0	1	5	3	2	1	25	11	2.3
1-Aug-15	13	5	7	1	4	5	1	7	2	7	0	52	11	4.7
2-Aug-15	12	3	8	1	1	4	5	12	8	2	2	58	11	5.3
3-Aug-15	4	14	3	1	2	2	1	2	2	4	1	36	11	3.3
4-Aug-15	6	26	1	1	0	0	2	0	0	4	1	41	11	3.7
5-Aug-15	3	4	3	1	---	2	1	0	3	1	2	20	10	2
6-Aug-15	7	2	3	0	---	1	1	8	3	9	0	34	10	3.4
7-Aug-15	11	6	5	0	---	1	4	14	8	12	2	63	10	6.3
8-Aug-15	2	8	6	1	---	3	2	9	10	0	0	41	10	4.1
9-Aug-15	2	5	5	2	---	4	3	5	6	1	3	36	10	3.6
10-Aug-15	2	3	3	0	---	1	5	3	0	0	2	19	10	1.9

Table A- 2 Migratory Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
11-Aug-15	8	7	2	0	---	4	4	2	0	3	3	33	10	3.3
12-Aug-15	7	5	0	1	7	3	0	7	5	7	0	42	11	3.8
13-Aug-15	5	5	3	0	4	2	---	2	4	5	2	32	10	3.2
14-Aug-15	16	8	4	1	6	0	---	1	4	1	3	44	10	4.4
15-Aug-15	4	2	0	2	1	5	---	3	7	3	3	30	10	3
16-Aug-15	2	6	3	1	6	4	---	5	3	6	4	40	10	4
17-Aug-15	4	9	5	2	4	6	---	1	11	6	4	52	10	5.2
18-Aug-15	6	5	8	4	3	1	---	1	2	3	0	33	10	3.3
19-Aug-15	2	12	2	0	8	3	---	1	7	1	2	38	10	3.8
20-Aug-15	5	22	3	1	1	7	---	0	8	3	4	54	10	5.4
21-Aug-15	17	11	8	4	17	31	---	1	17	15	12	133	10	13.3
22-Aug-15	13	1	5	0	1	5	---	4	1	6	0	36	10	3.6
23-Aug-15	0	9	3	1	1	0	0	1	6	3	2	26	11	2.4
24-Aug-15	4	2	3	1	3	7	0	0	3	4	2	29	11	2.6
25-Aug-15	6	19	6	1	2	4	0	2	1	7	2	50	11	4.5
26-Aug-15	3	12	6	0	2	3	0	0	8	1	0	35	11	3.2
27-Aug-15	7	7	6	2	10	7	0	2	0	10	2	53	11	4.8
28-Aug-15	1	2	3	1	2	3	0	0	1	2	0	15	11	1.4
29-Aug-15	4	7	1	2	1	2	0	0	3	4	2	26	11	2.4

Table A- 2 Migratory Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
30-Aug-15	6	3	0	0	0	1	0	0	3	0	0	13	11	1.2
31-Aug-15	2	6	1	1	---	1	0	0	4	1	0	16	10	1.6
1-Sep-15	---	3	0	0	1	0	2	1	0	2	0	9	10	0.9
2-Sep-15	---	6	1	5	1	---	2	0	2	3	1	21	9	2.3
3-Sep-15	---	8	2	9	1	---	0	2	3	3	3	31	9	3.4
4-Sep-15	---	5	1	1	---	---	0	0	5	0	0	12	8	1.5
5-Sep-15	---	2	1	1	---	---	1	0	1	1	0	7	8	0.9
6-Sep-15	---	1	0	1	---	---	0	0	0	0	2	4	8	0.5
7-Sep-15	---	1	0	0	---	---	0	1	0	3	1	6	8	0.8
8-Sep-15	---	7	0	6	---	---	1	0	3	0	0	17	8	2.1
9-Sep-15	---	0	1	1	---	---	0	0	1	0	0	3	8	0.4
10-Sep-15	---	1	1	2	---	---	2	0	1	0	0	7	8	0.9
11-Sep-15	---	3	2	0	---	---	3	2	1	0	0	11	8	1.4
12-Sep-15	---	3	1	0	---	---	1	1	1	1	0	8	8	1
13-Sep-15	---	6	0	1	---	---	0	1	0	0	0	8	8	1
14-Sep-15	---	5	5	23	---	---	3	0	3	6	1	46	8	5.8
15-Sep-15	---	0	0	1	0	---	0	0	0	6	0	7	9	0.8
16-Sep-15	0	0	0	0	0	0	0	0	0	0	0	0	11	0
17-Sep-15	2	0	0	1	0	1	0	0	2	1	0	7	11	0.6

Table A- 2 Migratory Bat Passes Recorded in the Project Area During the Fall 2015 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
18-Sep-15	0	0	1	0	0	0	0	1	0	0	0	2	11	0.2
19-Sep-15	2	2	0	0	1	0	0	1	1	1	0	8	11	0.7
20-Sep-15	0	2	3	1	0	0	1	2	1	0	0	10	11	0.9
21-Sep-15	1	3	0	0	0	1	0	0	1	0	0	6	11	0.5
22-Sep-15	0	0	0	1	0	2	0	0	0	0	0	3	11	0.3
23-Sep-15	1	2	1	0	0	0	0	1	0	0	2	7	11	0.6
24-Sep-15	0	3	0	1	1	0	0	1	2	0	0	8	11	0.7
25-Sep-15	0	3	0	2	0	0	0	1	0	0	0	6	11	0.5
26-Sep-15	0	3	1	4	0	0	0	0	3	0	0	11	11	1
27-Sep-15	0	1	0	0	0	0	0	1	0	0	0	2	11	0.2
28-Sep-15	0	0	0	0	0	0	0	0	0	0	0	0	11	0
29-Sep-15	0	0	0	0	0	0	0	0	0	0	0	0	11	0
30-Sep-15	0	1	0	1	1	0	0	0	0	0	0	3	11	0.3
Total	235	413	185	98	115	154	55	199	203	194	81	1,932	N/A	2.4
Total # of Nights Per Detector	64	79	79	79	56	65	67	78	75	78	78	N/A	798	N/A
# of Migratory Bat Passes Per Detector Night	3.7	5.2	2.3	1.2	2.1	2.4	0.8	2.6	2.7	2.5	1.0	2.4	N/A	N/A

--- indicates night of detector malfunction

N/A indicates night is outside of survey period or field is not applicable

Appendix A Bat Passes Recorded in the Outlaw trail Project Study Area

Table A- 3 Total Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
29-Apr-16	0	0	N/A	1	0	N/A	N/A	N/A	N/A	N/A	N/A	1	4	0.3
30-Apr-16	0	0	3	1	1	0	0	2	0	0	0	7	11	0.6
1-May-16	0	0	2	1	0	0	0	5	1	1	0	10	11	0.9
2-May-16	1	0	6	2	2	0	0	11	0	8	0	30	11	2.7
3-May-16	2	0	4	2	0	---	0	4	0	9	1	22	10	2.2
4-May-16	3	0	2	1	0	---	0	3	2	4	0	15	10	1.5
5-May-16	1	0	1	4	0	---	0	2	0	0	0	8	10	0.8
6-May-16	0	0	2	8	0	---	0	7	0	5	0	22	10	2.2
7-May-16	1	1	4	3	0	---	0	6	0	1	0	16	10	1.6
8-May-16	0	1	1	3	0	---	0	6	0	5	0	16	10	1.6
9-May-16	0	0	0	0	0	---	0	2	0	0	0	2	10	0.2
10-May-16	0	0	0	0	0	---	0	0	0	---	0	0	9	0.0
11-May-16	0	0	0	0	0	---	0	0	0	---	0	0	9	0.0
12-May-16	0	1	0	0	0	---	0	0	0	---	0	1	9	0.1
13-May-16	0	0	0	2	0	---	0	0	0	---	0	2	9	0.2
14-May-16	0	0	3	1	0	---	0	0	1	3	2	10	9	1.1
15-May-16	0	0	5	2	0	---	0	0	1	6	0	14	9	1.6
16-May-16	0	0	0	0	1	0	0	2	1	3	0	7	11	0.6
17-May-16	1	0	9	3	0	0	0	9	0	2	0	24	11	2.2
18-May-16	2	0	3	3	1	1	0	10	2	3	1	26	11	2.4
19-May-16	1	1	0	1	0	0	0	7	0	5	0	15	11	1.4
20-May-16	1	1	0	0	0	0	0	1	1	0	0	4	11	0.4
21-May-16	2	0	1	0	0	0	0	3	0	0	0	6	11	0.6

Table A- 3 Total Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
22-May-16	1	0	1	1	1	0	1	6	0	5	0	16	11	1.5
23-May-16	0	1	1	0	0	0	0	2	0	2	0	6	11	0.6
24-May-16	1	2	0	0	0	0	0	5	0	0	0	8	11	0.7
25-May-16	0	0	0	0	0	0	0	1	0	2	0	3	11	0.3
26-May-16	1	0	0	3	0	0	0	6	0	2	0	12	11	1.1
27-May-16	1	0	2	1	1	1	0	3	0	8	0	17	11	1.6
28-May-16	0	0	1	3	0	1	1	4	2	2	0	14	11	1.3
29-May-16	3	0	7	6	0	1	0	8	0	7	0	32	11	2.9
30-May-16	0	0	0	0	1	0	0	0	0	0	0	1	11	0.1
31-May-16	0	0	0	0	0	1	0	1	0	1	0	3	11	0.3
1-Jun-16	3	0	8	1	1	1	0	2	0	5	0	21	11	1.9
2-Jun-16	1	0	3	0	0	0	1	5	0	3	0	13	11	1.2
3-Jun-16	0	1	5	5	0	0	0	4	0	3	0	18	11	1.6
4-Jun-16	5	0	9	5	0	0	0	22	2	7	0	50	11	4.6
5-Jun-16	1	0	6	5	1	2	0	55	0	7	0	77	11	7.0
6-Jun-16	2	0	2	4	0	0	0	6	0	N/A	N/A	14	9	1.6
7-Jun-16	N/A	N/A	N/A	1	0	N/A	N/A	3	0	N/A	N/A	4	4	1.0
Total	34	9	91	73	10	8	3	213	13	109	4	567	N/A	N/A
Total # of Nights Per Detector	39	39	38	40	40	25	38	33	39	37	37	N/A	405	N/A
# of Total Bat Passes Per Detector Night	0.9	0.2	2.4	1.8	0.2	0.3	0.1	6.5	0.3	2.9	0.1	1.3	N/A	N/A
--- indicates night of detector malfunction														

Appendix A Bat Passes Recorded in the Outlaw trail Project Study Area

Table A- 3 Total Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
N/A indicates night is outside of survey period or field is not applicable														

Table A- 4 Migratory Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
29-Apr-16	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	4	0.0
30-Apr-16	0	0	0	0	1	0	0	0	0	0	0	1	11	0.1
1-May-16	0	0	2	0	0	0	0	0	1	0	0	3	11	0.3
2-May-16	0	0	1	0	1	0	0	0	0	1	0	3	11	0.3
3-May-16	2	0	3	1	0	---	0	0	0	1	1	8	10	0.8
4-May-16	1	0	0	0	0	---	0	0	2	0	0	3	10	0.3
5-May-16	0	0	0	1	0	---	0	2	0	0	0	3	10	0.3
6-May-16	0	0	0	0	0	---	0	1	0	0	0	1	10	0.1
7-May-16	0	1	0	0	0	---	0	0	0	0	0	1	10	0.1
8-May-16	0	1	0	1	0	---	0	3	0	1	0	6	10	0.6
9-May-16	0	0	0	0	0	---	0	2	0	0	0	2	10	0.2
10-May-16	0	0	0	0	0	---	0	0	0	---	0	0	9	0.0

Table A- 4 Migratory Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
11-May-16	0	0	0	0	0	---	0	0	0	---	0	0	9	0.0
12-May-16	0	0	0	0	0	---	0	0	0	---	0	0	9	0.0
13-May-16	0	0	0	1	0	---	0	0	0	---	0	1	9	0.1
14-May-16	0	0	1	0	0	---	0	0	1	2	2	6	9	0.7
15-May-16	0	0	0	1	0	---	0	0	1	0	0	2	9	0.2
16-May-16	0	0	0	0	0	0	0	0	1	0	0	1	11	0.1
17-May-16	1	0	0	2	0	0	0	0	0	0	0	3	11	0.3
18-May-16	2	0	0	0	1	0	0	2	2	0	1	8	11	0.7
19-May-16	1	0	0	0	0	0	0	0	0	1	0	2	11	0.2
20-May-16	0	1	0	0	0	0	0	1	1	0	0	3	11	0.3
21-May-16	1	0	0	0	0	0	0	1	0	0	0	2	11	0.2
22-May-16	1	0	0	0	1	0	1	1	0	0	0	4	11	0.4
23-May-16	0	1	0	0	0	0	0	0	0	0	0	1	11	0.1
24-May-16	0	2	0	0	0	0	0	1	0	0	0	3	11	0.3
25-May-16	0	0	0	0	0	0	0	0	0	0	0	0	11	0.0
26-May-16	0	0	0	0	0	0	0	1	0	0	0	1	11	0.1
27-May-16	1	0	0	0	1	1	0	0	0	0	0	3	11	0.3
28-May-16	0	0	0	1	0	1	1	1	2	0	0	6	11	0.6

Table A- 4 Migratory Bat Passes Recorded in the Project Area During the Spring 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
29-May-16	1	0	0	1	0	1	0	0	0	0	0	3	11	0.3
30-May-16	0	0	0	0	1	0	0	0	0	0	0	1	11	0.1
31-May-16	0	0	0	0	0	1	0	0	0	0	0	1	11	0.1
1-Jun-16	1	0	1	0	1	0	0	0	0	0	0	3	11	0.3
2-Jun-16	0	0	0	0	0	0	1	3	0	0	0	4	11	0.4
3-Jun-16	0	1	1	2	0	0	0	1	0	1	0	6	11	0.6
4-Jun-16	4	0	1	3	0	0	0	3	2	0	0	13	11	1.2
5-Jun-16	0	0	1	1	1	1	0	1	0	2	0	7	11	0.6
6-Jun-16	1	0	0	1	0	0	0	0	0	0	0	2	9	0.2
7-Jun-16	0	0	0	0	0	0	0	0	0	0	0	0	4	0.0
Total	17	7	11	16	8	5	3	24	13	9	4	117	N/A	N/A
Total # of Nights Per Detector	39	39	38	40	40	25	38	33	39	37	37	N/A	405	N/A
# of Migratory Bat Passes Per Detector Night	0.4	0.2	0.3	0.4	0.2	0.2	0.1	0.7	0.3	0.2	0.1	0.3	N/A	N/A

Table A- 5 Total Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
28-Jul-16	11	1	50	10	2	2	1	20	5	23	0	125	11	11.4
29-Jul-16	15	5	52	27	5	5	1	23	3	9	4	149	11	13.6
30-Jul-16	8	4	17	10	2	2	2	7	4	5	2	63	11	5.7
31-Jul-16	28	7	12	37	7	8	0	28	8	31	0	166	11	15.1
1-Aug-16	15	4	14	34	5	4	1	16	2	23	1	119	11	10.8
2-Aug-16	4	4	4	15	2	4	2	8	3	13	2	61	11	5.6
3-Aug-16	1	0	0	2	3	0	0	4	1	0	0	11	11	1.0
4-Aug-16	13	4	14	13	7	11	3	24	33	30	0	152	11	13.8
5-Aug-16	9	6	2	23	8	7	3	15	7	19	0	99	11	9.0
6-Aug-16	5	5	2	7	0	1	0	7	3	4	0	34	11	3.1
7-Aug-16	8	1	7	14	---	11	---	17	7	2	---	67	8	8.4
8-Aug-16	14	11	12	45	---	17	---	25	---	16	---	140	7	20.0
9-Aug-16	4	4	4	19	---	6	---	9	---	8	---	54	7	7.7
10-Aug-16	11	2	11	17	---	5	---	17	---	---	---	63	6	10.5
11-Aug-16	13	4	9	30	---	8	---	24	---	---	---	88	6	14.7
12-Aug-16	18	5	7	30	---	5	---	19	---	---	---	84	6	14.0
13-Aug-16	7	10	13	21	---	4	---	15	---	---	---	70	6	11.7
14-Aug-16	6	6	6	27	---	7	---	17	---	---	---	69	6	11.5
15-Aug-16	9	7	11	55	---	16	---	11	---	---	---	109	6	18.2
16-Aug-16	8	7	4	3	---	9	---	11	---	---	---	42	6	7.0
17-Aug-16	8	3	3	27	---	4	---	16	---	---	---	61	6	10.2

Table A- 5 Total Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
18-Aug-16	11	4	4	39	2	2	3	10	4	6	2	87	11	7.9
19-Aug-16	8	1	8	23	6	2	0	16	1	10	2	77	11	7.0
20-Aug-16	7	6	5	19	3	7	2	18	3	21	5	96	11	8.7
21-Aug-16	12	7	8	10	5	12	1	10	0	5	3	73	11	6.6
22-Aug-16	14	3	6	63	7	3	2	15	5	39	9	166	11	15.1
23-Aug-16	5	0	2	8	---	1	---	4	4	6	0	30	9	3.3
24-Aug-16	20	2	6	28	---	1	---	28	5	15	2	107	9	11.9
25-Aug-16	8	3	18	27	---	3	---	35	3	9	8	114	9	12.7
26-Aug-16	1	3	5	10	---	3	---	22	0	17	2	63	9	7.0
27-Aug-16	5	0	6	1	---	3	---	5	7	9	6	42	9	4.7
28-Aug-16	24	4	2	51	---	1	---	13	1	30	1	127	9	14.1
29-Aug-16	6	3	2	15	---	10	---	3	7	8	3	57	9	6.3
30-Aug-16	3	4	6	13	---	12	---	8	5	8	1	60	9	6.7
31-Aug-16	3	1	2	7	7	3	2	4	8	3	6	46	11	4.2
1-Sep-16	4	0	7	11	3	4	2	1	0	3	3	38	11	3.5
2-Sep-16	10	1	3	46	2	3	1	11	1	7	0	85	11	7.7
3-Sep-16	4	2	3	20	1	4	3	6	8	7	0	58	11	5.3
4-Sep-16	2	0	1	12	1	1	0	3	3	3	2	28	11	2.6
5-Sep-16	2	2	0	2	5	1	2	1	1	1	---	17	10	1.7
6-Sep-16	6	3	2	5	2	7	1	7	4	5	---	42	10	4.2
7-Sep-16	2	1	2	9	6	0	0	1	2	9	---	32	10	3.2

Table A- 5 Total Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
8-Sep-16	0	0	1	7	3	0	0	1	0	0	---	12	10	1.2
9-Sep-16	1	2	1	2	0	0	0	5	0	0	---	11	10	1.1
10-Sep-16	1	3	6	7	---	3	0	7	---	5	---	32	8	4.0
11-Sep-16	2	1	0	3	---	1	1	1	---	0	---	9	8	1.1
12-Sep-16	0	0	0	1	---	0	0	0	---	0	---	1	8	0.1
13-Sep-16	0	0	0	0	---	0	0	0	---	0	---	0	8	0.0
Total	376	156	360	905	94	223	33	568	148	409	64	3,336	N/A	N/A
Total # of Nights Per Detector	48	48	48	48	25	48	29	48	34	40	28	N/A	444	N/A
# of Total Bat Passes Per Detector Night	7.8	3.2	7.5	18.9	3.8	4.6	1.1	11.8	4.4	10.2	2.3	7.5	N/A	N/A

--- indicates night of detector malfunction
N/A indicates night is outside of survey period or field is not applicable

Table A- 6 Migratory Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
28-Jul-16	0	1	2	4	2	1	1	7	4	1	0	23	11	2.1
29-Jul-16	5	2	5	5	3	2	1	9	2	2	4	40	11	3.6
30-Jul-16	6	4	12	4	1	2	2	4	4	2	1	42	11	3.8
31-Jul-16	10	6	8	3	3	3	0	9	5	13	0	60	11	5.5
1-Aug-16	5	3	5	2	2	3	1	7	2	13	1	44	11	4.0
2-Aug-16	2	2	2	9	1	3	2	2	3	0	2	28	11	2.6
3-Aug-16	1	0	0	2	3	0	0	4	1	0	0	11	11	1.0
4-Aug-16	5	4	4	3	5	8	3	18	33	2	0	85	11	7.7
5-Aug-16	1	4	0	4	8	2	3	8	7	1	0	38	11	3.5
6-Aug-16	2	5	0	2	0	1	0	2	3	2	0	17	11	1.6
7-Aug-16	4	0	5	9	---	9	---	10	6	1	---	44	8	5.5
8-Aug-16	11	6	2	9	---	10	---	10	---	4	---	52	7	7.4
9-Aug-16	2	3	4	1	---	3	---	5	---	0	---	18	7	2.6
10-Aug-16	3	1	4	7	---	3	---	13	---	---	---	31	6	5.2
11-Aug-16	7	1	6	6	---	3	---	10	---	---	---	33	6	5.5
12-Aug-16	8	4	5	6	---	3	---	8	---	---	---	34	6	5.7
13-Aug-16	4	8	4	5	---	3	---	8	---	---	---	32	6	5.3
14-Aug-16	3	3	3	1	---	2	---	7	---	---	---	19	6	3.2

Table A- 6 Migratory Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
15-Aug-16	3	4	5	7	---	12	---	3	---	---	---	34	6	5.7
16-Aug-16	4	5	2	1	---	6	---	4	---	---	---	22	6	3.7
17-Aug-16	6	1	1	3	---	3	---	10	---	---	---	24	6	4.0
18-Aug-16	7	3	3	5	2	0	3	4	4	4	0	35	11	3.2
19-Aug-16	3	0	1	1	5	0	0	2	0	2	2	16	11	1.5
20-Aug-16	1	2	2	3	2	4	2	9	3	9	5	42	11	3.8
21-Aug-16	9	4	5	1	5	10	1	3	0	2	3	43	11	3.9
22-Aug-16	6	2	3	5	2	1	1	6	3	11	3	43	11	3.9
23-Aug-16	4	0	1	0	---	1	---	4	4	6	0	20	9	2.2
24-Aug-16	8	1	5	0	---	1	---	14	5	3	2	39	9	4.3
25-Aug-16	4	2	8	8	---	2	---	5	3	1	7	40	9	4.4
26-Aug-16	0	3	1	2	---	2	---	10	0	2	2	22	9	2.4
27-Aug-16	3	0	3	0	---	3	---	1	5	2	6	23	9	2.6
28-Aug-16	12	2	0	3	---	0	---	1	1	7	0	26	9	2.9
29-Aug-16	3	2	1	4	---	6	---	3	6	4	3	32	9	3.6
30-Aug-16	2	2	1	4	---	5	---	6	5	5	1	31	9	3.4
31-Aug-16	3	1	2	2	7	1	2	2	8	3	6	37	11	3.4
1-Sep-16	3	0	3	3	3	1	1	0	0	0	2	16	11	1.5

Table A- 6 Migratory Bat Passes Recorded in the Project Area During the Fall 2016 Monitoring Period

Night	Ground 1	Ground 2	Ground 3	Met 1 Low	Met 1 High	Met 2 Low	Met 2 High	Met 3 Low	Met 3 High	Met 4 Low	Met 4 High	Total Bat Passes Per Night	Number of Detector Nights	Bat Passes Per Detector Night (Migratory Bats)
2-Sep-16	3	0	2	5	0	1	1	3	1	4	0	20	11	1.8
3-Sep-16	2	1	1	5	1	1	3	3	6	2	0	25	11	2.3
4-Sep-16	1	0	1	2	1	1	0	1	0	0	1	8	11	0.7
5-Sep-16	2	2	0	2	5	0	2	0	1	0	---	14	10	1.4
6-Sep-16	1	3	2	5	2	4	1	1	3	3	---	25	10	2.5
7-Sep-16	1	1	0	0	1	0	0	0	0	3	---	6	10	0.6
8-Sep-16	0	0	1	0	2	0	0	1	0	0	---	4	10	0.4
9-Sep-16	1	1	0	0	0	0	0	1	0	0	---	3	10	0.3
10-Sep-16	1	3	4	1	---	2	0	2	---	2	---	15	8	1.9
11-Sep-16	2	1	0	1	---	1	1	1	---	0	---	7	8	0.9
12-Sep-16	0	0	0	1	---	0	0	0	---	0	---	1	8	0.1
13-Sep-16	0	0	0	0	---	0	0	0	---	0	---	0	8	0.0
Total	174	103	129	156	66	129	31	241	128	116	51	1,324	N/A	N/A
Total # of Nights Per Detector	48	48	48	48	25	48	29	48	34	40	28	N/A	444	N/A
# of Migratory Bat Passes Per Detector Night	3.6	2.1	2.7	3.2	2.6	2.7	1.1	5	3.8	2.9	1.8	3.5	N/A	N/A

--- indicates night of detector malfunction
N/A indicates night is outside of survey period or field is not applicable

Appendix B BAT PASSES BY SPECIES OR SPECIES GROUPING RECORDED IN THE OUTLAW TRAIL PROJECT AREA

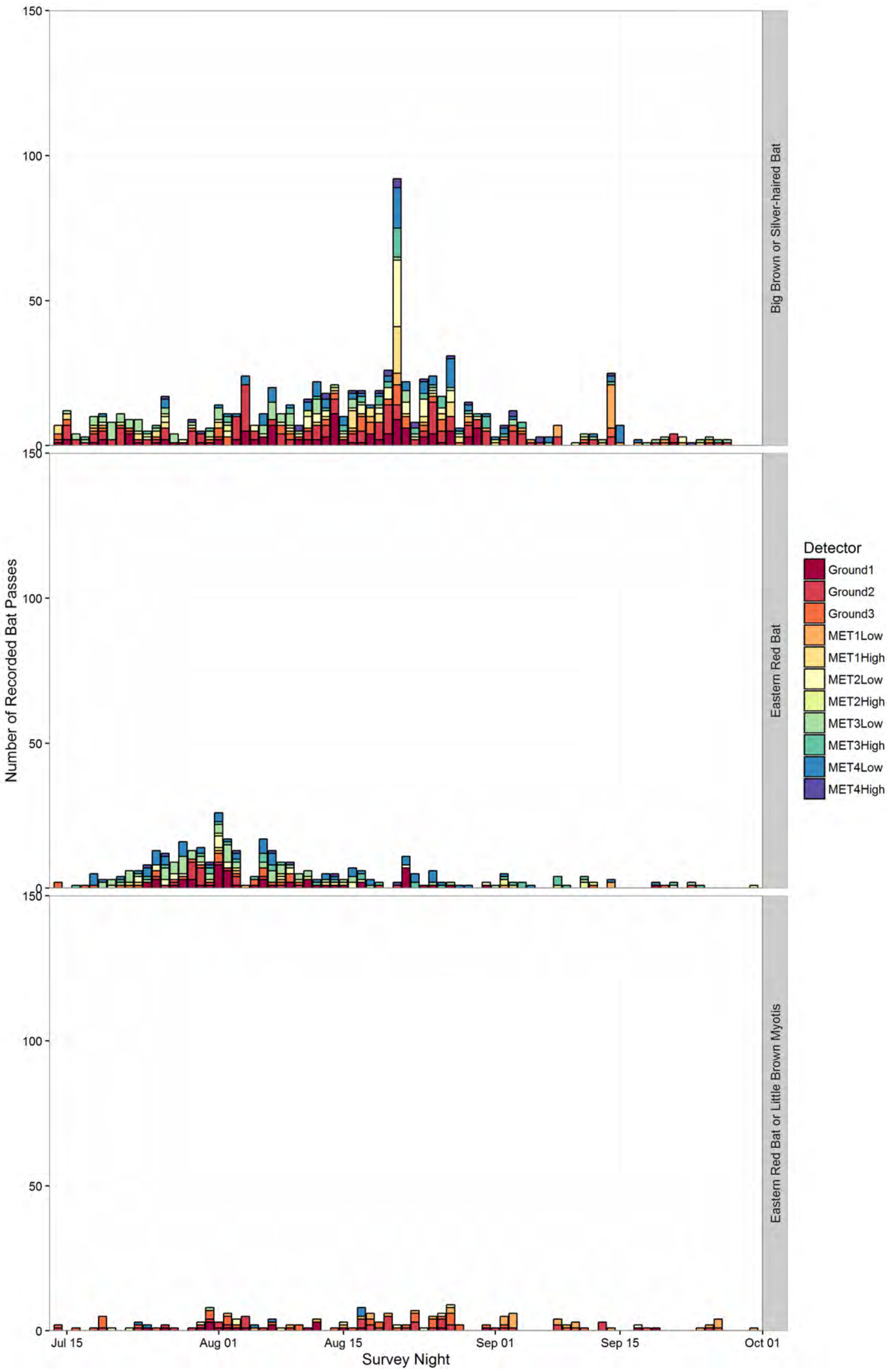


Figure B- 1 Bat Passes per Species by Detector During the 2015 Fall Monitoring Period

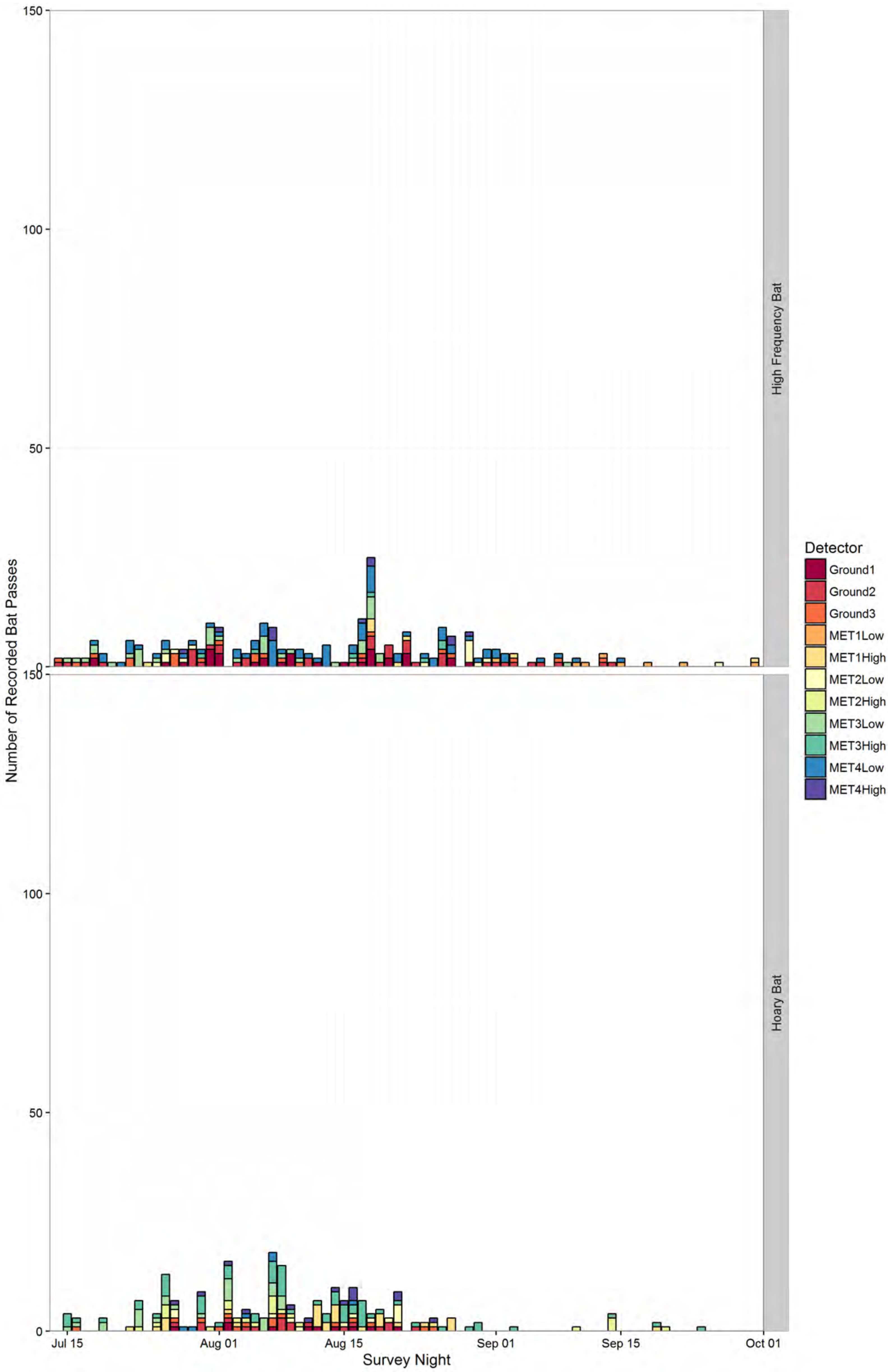


Figure B-1 (Continued)

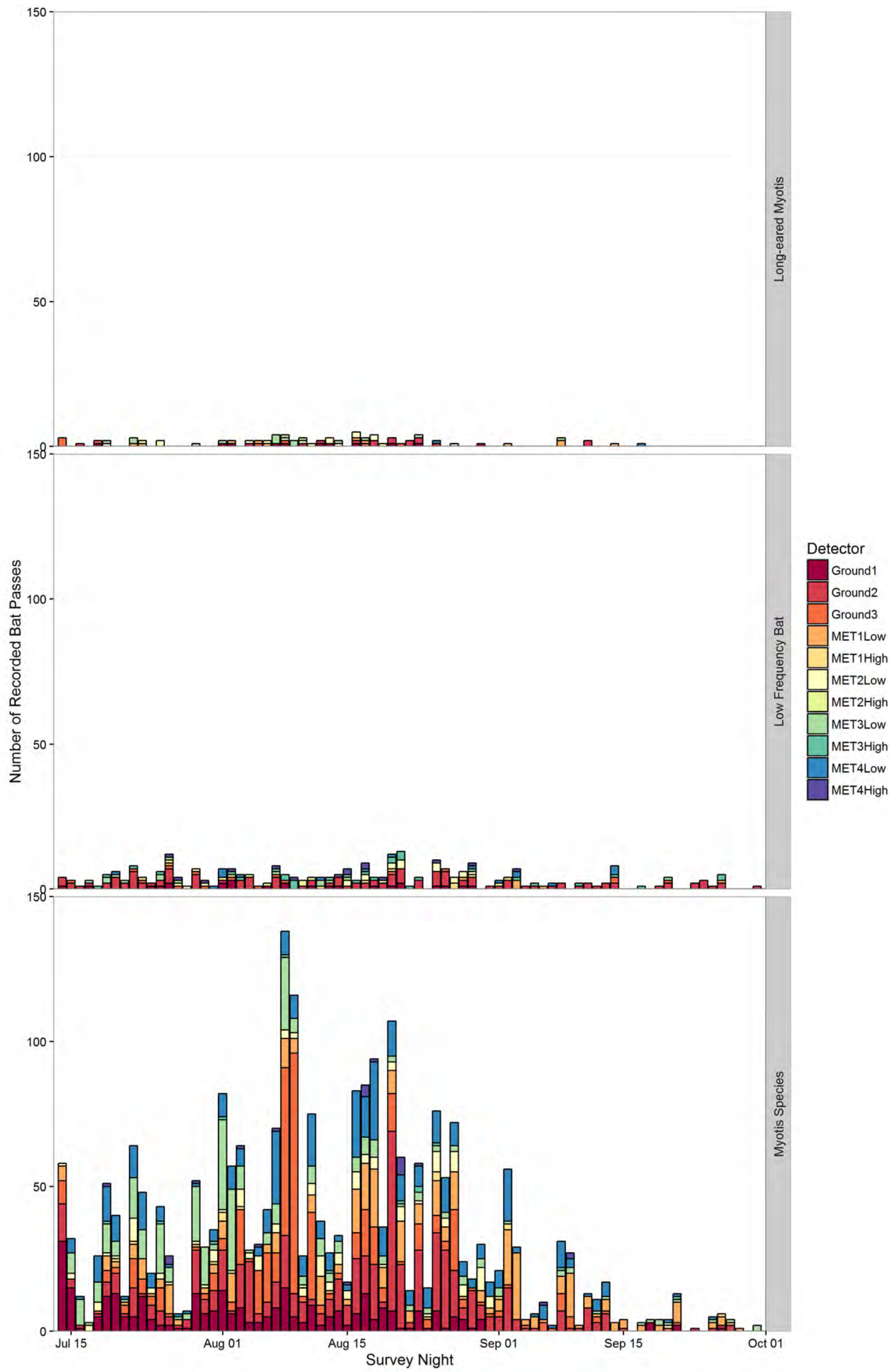


Figure B-1 (Continued)

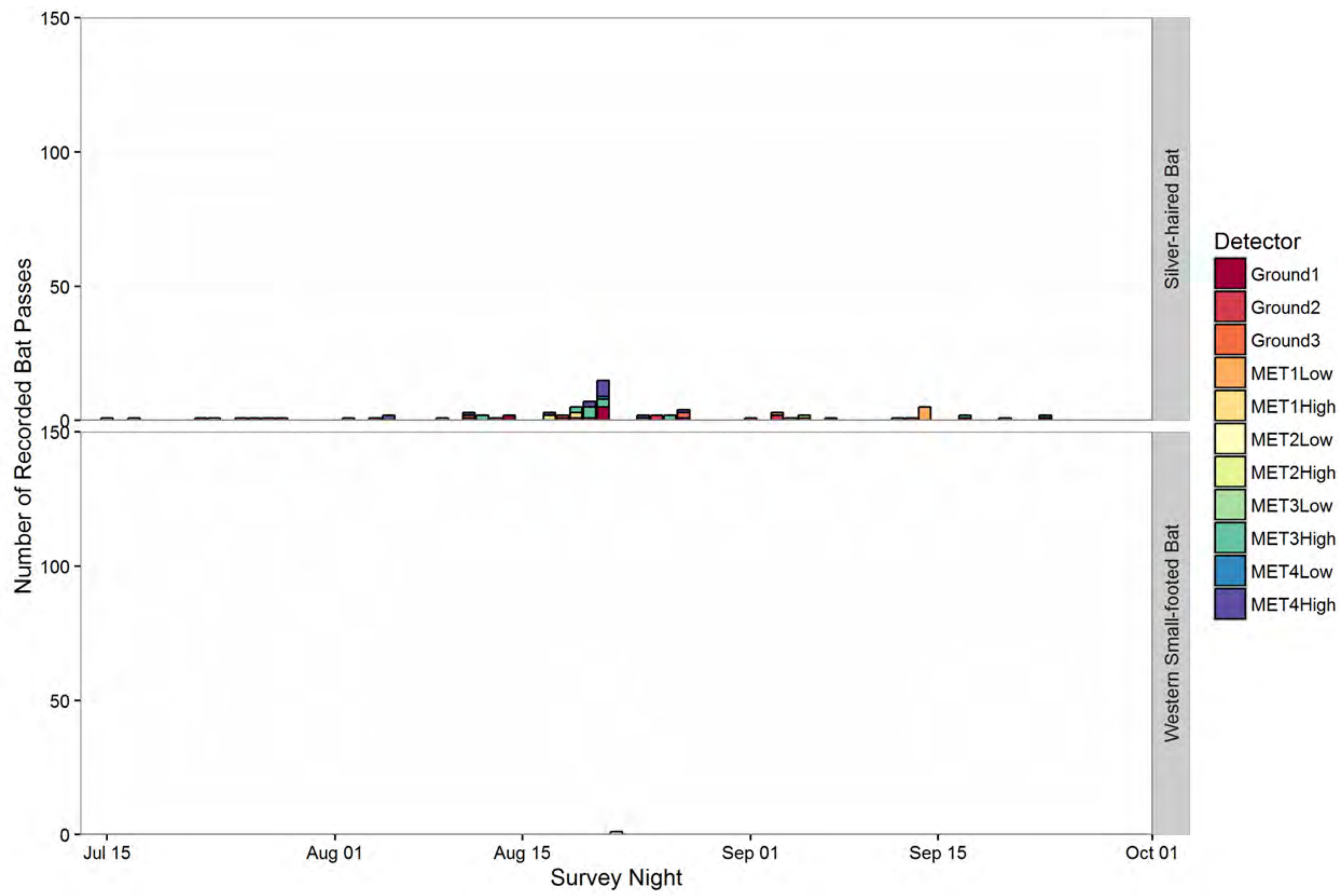


Figure B-1 (Continued)

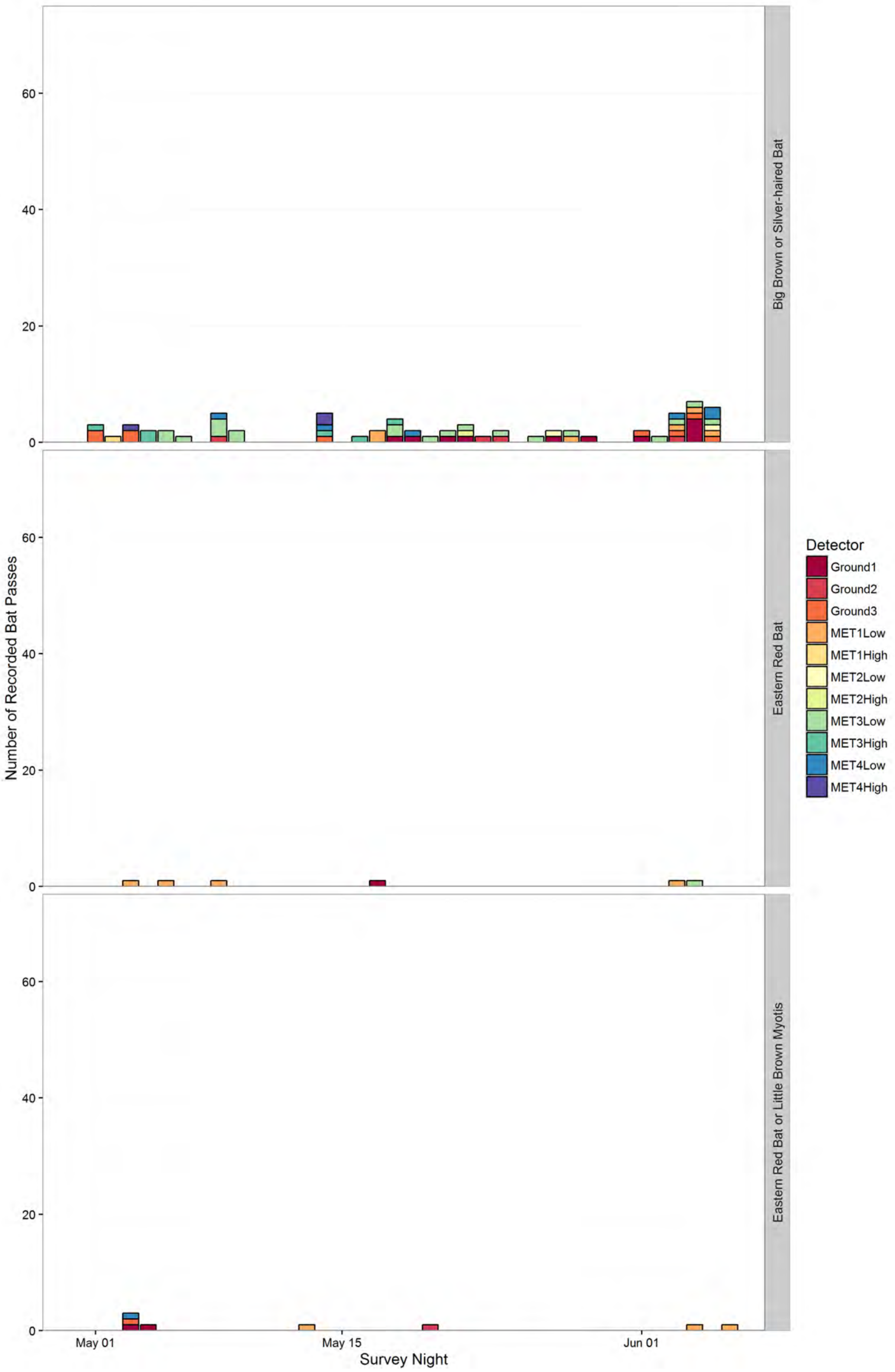


Figure B- 2 Bat Passes per Species by Detector During the 2016 Spring Monitoring Period

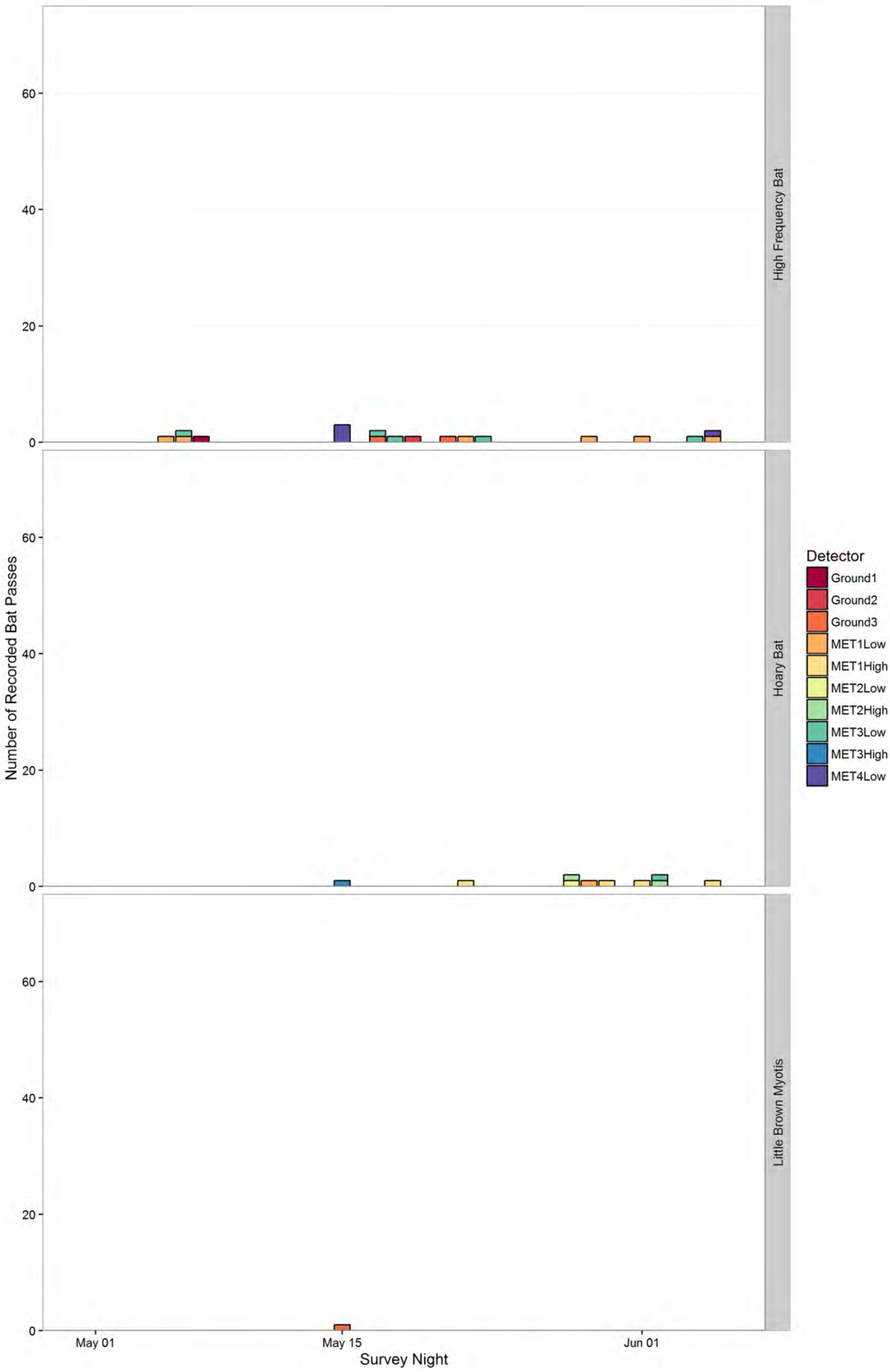


Figure B-2 (Continued)

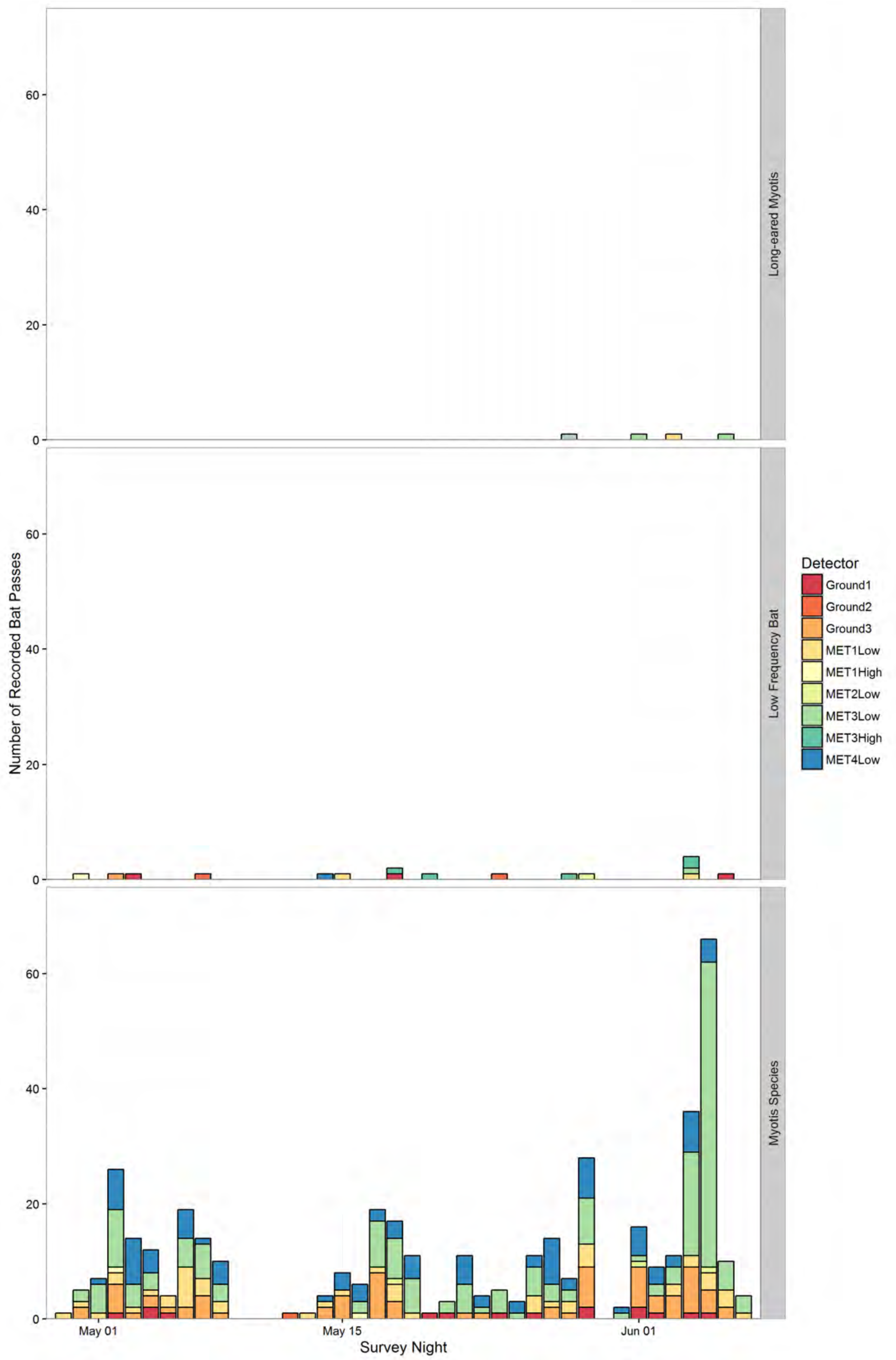


Figure B-2 (Continued)

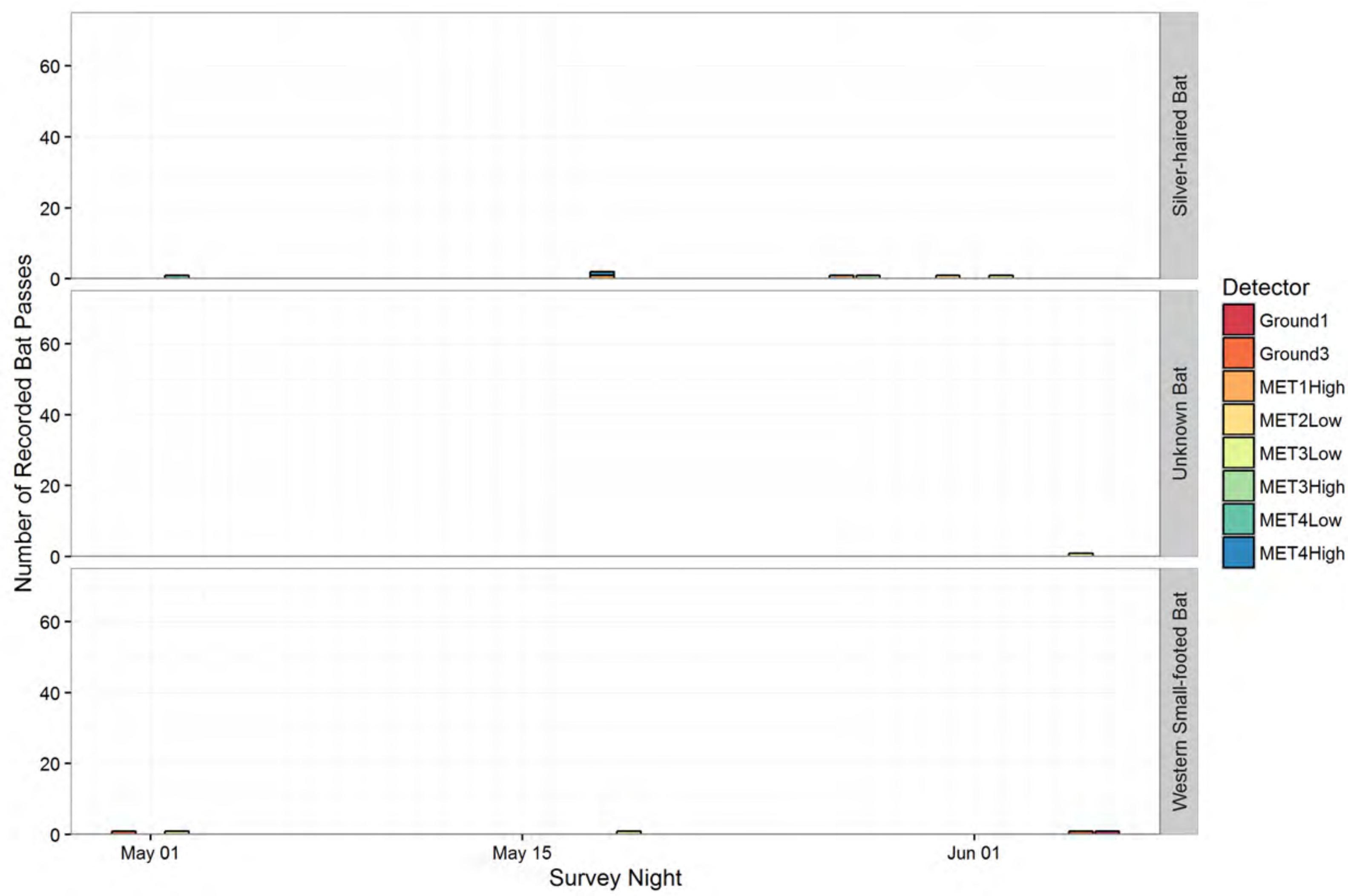


Figure B-2 (Continued)

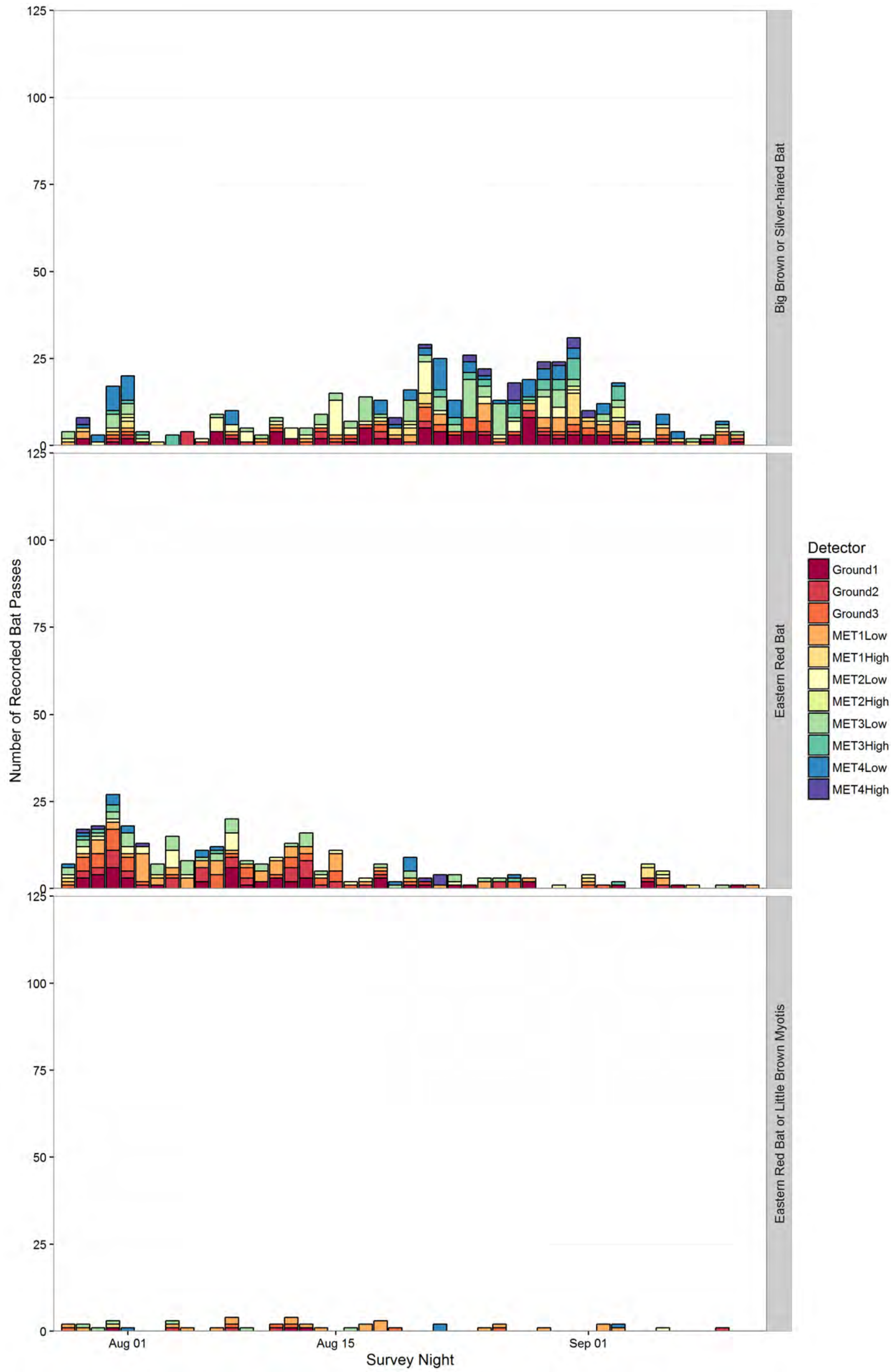


Figure B- 3 Bat Passes per Species by Detector During the 2016 Fall Monitoring Period

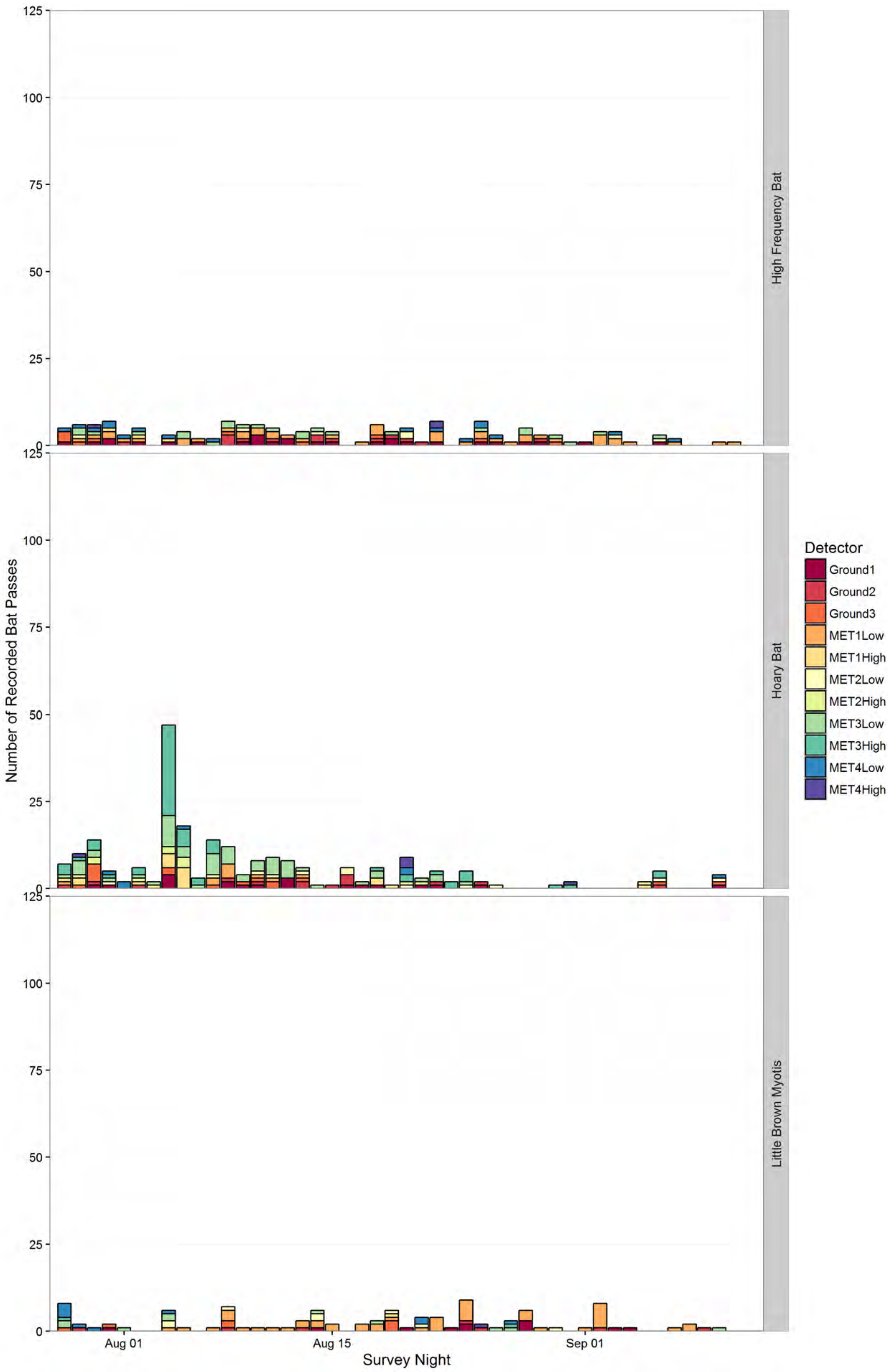


Figure B-3 (Continued)

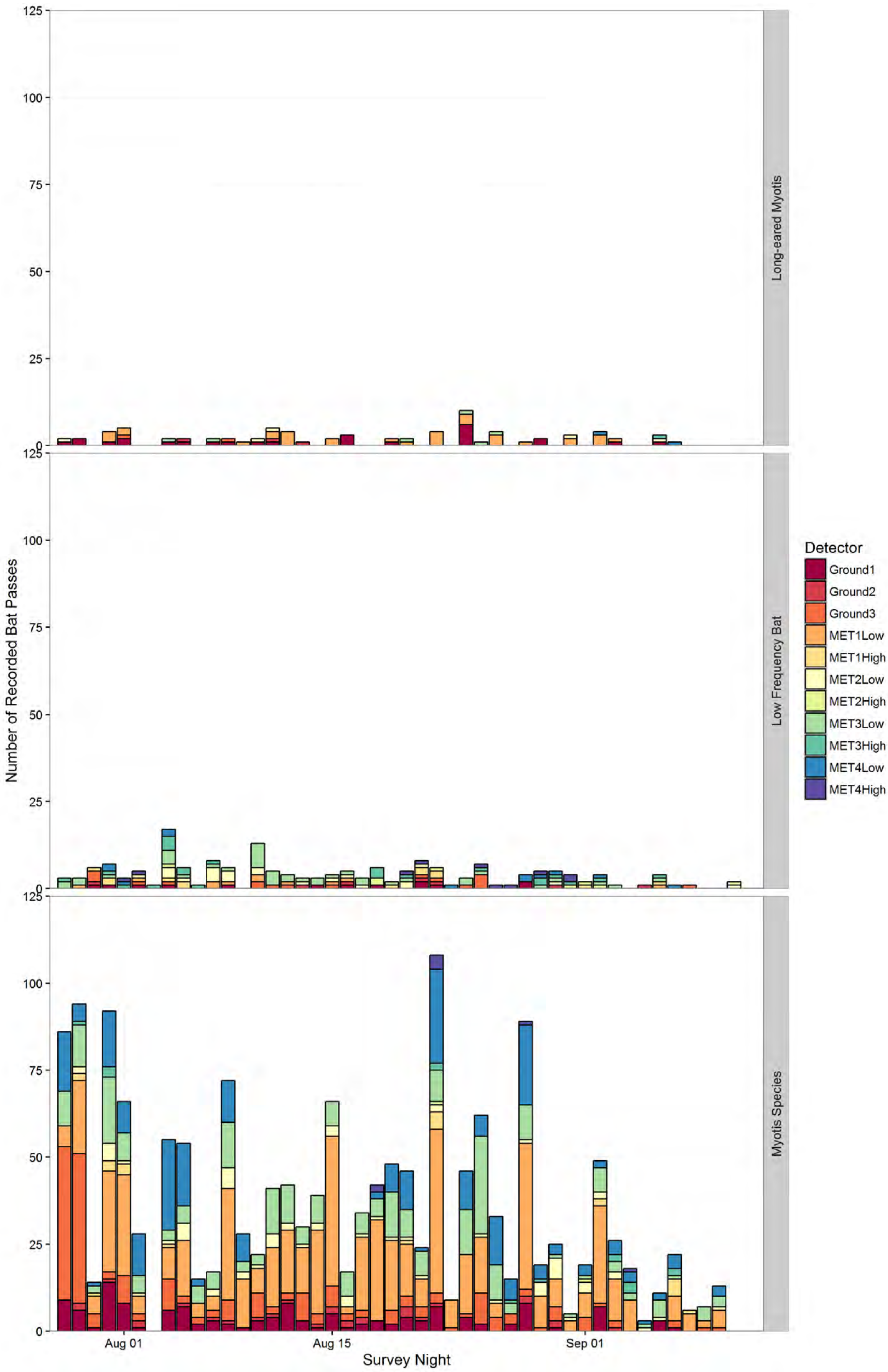


Figure B-3 (Continued)

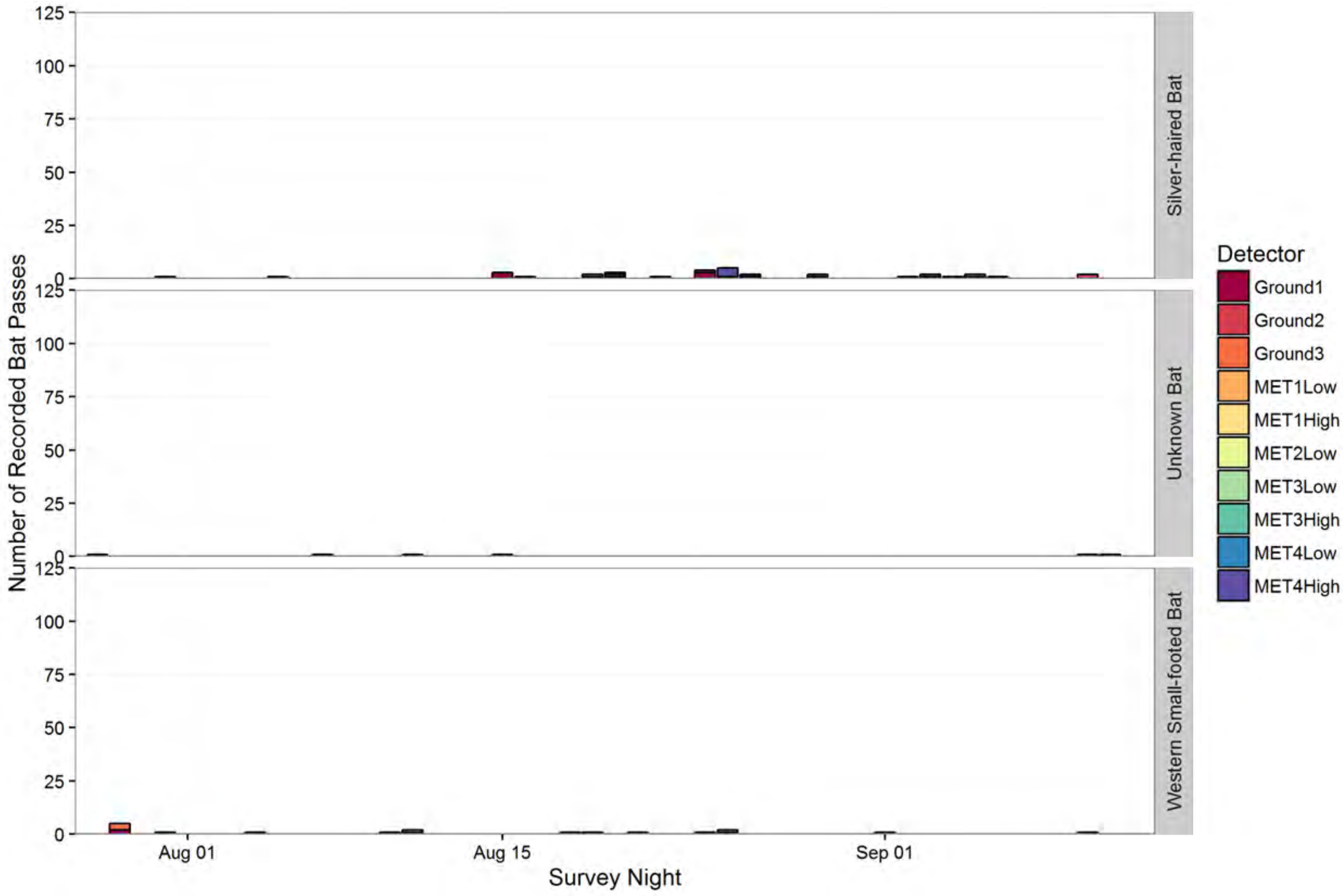


Figure B-3 (Continued)

Appendix C PHOTOS

Photo C- 1 Gentle Coulees with Native Prairie and Patches of Trees Looking South from MET 3 Station

Photo C- 2 Gentle Coulees with Native Prairie and Deciduous Forest Looking North from the top of the Big Muddy Valley at MET 3 Station.

Appendix G HERITAGE RESOURCES REVIEW LETTER

Government
of
Saskatchewan

Ministry of Parks Culture and Sport

Heritage Conservation Branch
2nd Floor, 3211 Albert Street
Regina, Canada S4S 5W6

Phone: 306-787-5774
Tom.richards@gov.sk.ca

March 27, 2018

Our file: 18-324

ORIGINAL E-MAILED
Mar. 27/18

Ms. Lauren Stead
Stantec Consulting Ltd.
Agent for: **BluEarth Renewables Inc.**
100 – 75 24th Street E
SASKATOON SK S7K 0K3
Email: lauren.stead@stantec.com

Dear Ms. Stead:

**RE: BluEarth Renewables Inc. – Outlaw Trail Wind Energy Project:
See Table 1 for 87 Locations;
HERITAGE RESOURCE REVIEW**

Thank you for referring this project for heritage resource review.

In determining the need for, and scope of, Heritage Resource Impact Assessment (HRIA) pursuant to s.63 of *The Heritage Property Act*, the following factors were considered: the presence of previously recorded heritage sites, the area's overall heritage resource potential, the extent of previous land disturbance, and the scope of new proposed land development.

The proposed project is located on both cultivated land and undisturbed hummocky native prairie near seasonal water sources and drainage coulees south of the Big Muddy Valley and Castle Butte. The latter is a terrain type considered to have moderate to high potential for containing archaeological sites. Eight archaeological sites (DhNh-1, 2, 15, 16, 44, 54, 55 and 56) and one palaeontological site (72H03-0003) are in direct conflict with the development, and there are a number of sites recorded nearby including Sites of a Special Nature (SSN). As heritage resources may be adversely affected by this wind farm development, an HRIA study is required for those areas specified in Table 1.

Although one palaeontological site (72H03-0003) is within the development area, a palaeontological HRIA is not required at this time provided the site area and surrounding exposures are avoided. The palaeontological site is located in NW-2-3-25-W2M and was found within the Ravenscrag Formation exposures present here. The site consists of one almost complete crocodile-like Champsosaurus skeleton. If the exposures cannot be avoided, the palaeontologists from the Royal Saskatchewan Museum (RSM) must be contacted to assess the potential disturbance area. There are also a number of other exposure areas within the rest of the development area. If fortuitous discovery of fossils occurs (either in the planning or construction phase), then the palaeontologists at the RSM must also be contacted for assessment.

...2

The HRIA, including systematic surface survey and sub-surface test exploration, is a proponent responsibility. The study will first establish the presence of heritage sites within the project area and where suitable site avoidance measures (including right-of-way relocation) may be implemented. If heritage sites are located in unavoidable conflict with development, the study must also establish the content, structure and significance of those sites, and, on that basis, recommend both the need for and scope of any further study (including archaeological salvage excavation or other conservation action).

The HRIA must be carried out by qualified personnel under an approved investigation permit issued through this office. Normally, two days are required to process a heritage contractor's permit application.

If you have any questions regarding these heritage regulatory requirements, please contact Kim Cloutier at the above address or by calling 787-2848. Thank you again for referring this proposed development and for your cooperation in protecting the province's cultural heritage.

Sincerely,

Thomas Richards

Dr. Thomas Richards
Senior Archaeologist

cc: Kim Cloutier, Archaeologist, Heritage Conservation Branch, Ministry of Parks, Culture and Sport

Table 1: HRIA Requirements for 87 Heritage Sensitive Quarter Sections

Quarter Section	HCB Requirement(s)	HCB Comments
SW-36-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation adjacent to coulee drainages.
NW-36-02-25-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to seasonal water sources and coulee drainages.
NW-03-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation and road infrastructure adjacent to coulee drainages and seasonal water

		sources.
SW-04-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation and road infrastructure adjacent to seasonal water sources.
NE-27-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation and an existing yard site.
SE-15-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact a small portion of native prairie along the edge of a coulee drainage and areas disturbed by cultivation.
NE-34-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, road infrastructure and an existing yard site.
NE-32-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and possibly areas disturbed by cultivation, adjacent to seasonal water sources and drainages.
SW-09-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, adjacent to coulee drainages.
SW-01-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, adjacent to seasonal water sources.
SE-11-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, adjacent to seasonal water sources.
NE-05-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation.
NE-11-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and possibly areas disturbed by cultivation, adjacent to seasonal water sources.
SE-08-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, adjacent to coulee drainages.
NW-35-02-24-W2M	**HRIA Required for**	No sites in conflict. Development may impact

	native prairie portions only	hummocky native prairie and areas disturbed by cultivation, adjacent to coulee drainages.
SE-02-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation, adjacent to seasonal water sources and coulee drainages.
SE-04-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and areas disturbed by cultivation and road infrastructure, adjacent to seasonal water sources.
NW-34-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages.
SW-35-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to seasonal water sources and areas disturbed by cultivation.
SW-02-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to seasonal water sources and areas disturbed by cultivation and road infrastructure.
NE-10-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and coulee drainages, and areas disturbed by cultivation.
NW-12-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to seasonal water sources, and areas disturbed by cultivation and road infrastructure.
SE-12-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and coulee drainages, and areas disturbed by cultivation and road infrastructure.
SW-03-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie and coulee drainages, and areas disturbed by cultivation.
NW-31-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to seasonal water sources, and areas disturbed by cultivation.
NW-34-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by road infrastructure.

NE-31-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas possibly disturbed by cultivation.
NW-09-03-25-W2M	**HRIA Required for native prairie portions**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure.
NE-03-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to seasonal water sources, and areas disturbed by cultivation and road infrastructure.
NW-09-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
SW-29-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure.
NE-35-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NW-22-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NE-33-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to seasonal water sources, and areas disturbed by gravel activities in SE corner.
SE-29-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
SW-01-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to seasonal water sources and coulee drainages, and areas disturbed by cultivation.
SW-33-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
SW-12-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to seasonal water sources, and areas disturbed by cultivation, road infrastructure and gravel activities.
NW-01-03-24-W2M	**HRIA Required for**	No sites in conflict. Development may impact

	native prairie portions only	native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
SE-22-03-25-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
SE-19-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
NW-29-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
NW-33-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
NE-12-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
SE-03-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NW-04-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie along the western boundary of the quarter section adjacent to seasonal water sources, and areas disturbed by cultivation, road infrastructure, and an existing yard site.
NW-07-03-23-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
SE-21-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a coulee drainages, and areas disturbed by cultivation and road infrastructure.
SW-32-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to coulee drainages.
SE-11-03-25-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to seasonal water sources.
NW-32-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to coulee drainages.
NW-30-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation, road infrastructure and a yard site.

NE-09-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NE-02-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to seasonal water sources, and areas disturbed by cultivation.
SE-31-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to coulee drainages.
NW-08-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
SW-22-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a coulee drainage in the NE corner, and areas disturbed by cultivation.
SW-07-03-23-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a coulee drainage, and areas disturbed by cultivation.
NE-04-03-24-W2M	No further concerns	No sites in conflict. Development will impact areas disturbed by cultivation and road infrastructure with minimal amounts of native prairie adjacent to seasonal water sources.
NE-18-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
NE-01-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NE-34-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to coulee drainages.
NW-10-03-25-W2M	**HRIA Required for native prairie portions and assessment of DhNh-2**	DhNh-2 (artifact/feature combo) in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure.
NW-35-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to water sources, and areas disturbed by cultivation and road infrastructure.
SE-36-02-25-W2M	**HRIA Required for native prairie**	No sites in conflict. Development may impact native prairie adjacent to coulee drainages, and

	portions only	areas disturbed by cultivation.
NE-36-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure.
NE-01-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure.
NE-08-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NW-02-03-25-W2M	**HRIA Required for native prairie portions only and avoidance of exposures around site 72H03-0003 recommended**	One palaeontology site (72H03-0003) in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation. Avoid exposures of Ravenscrag Formation. If avoidance of exposures is not feasible, a palaeontology HRIA may be required.
SE-35-02-25-W2M	**HRIA Required**	No sites in conflict. Development will impact hummocky native prairie adjacent to coulee drainages.
NE-15-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a coulee drainage, and areas disturbed by cultivation.
SE-09-03-24-W2M	**HRIA Required for native prairie portions and assessments of DhNh-1, 15, and 16**	DhNh-1 (artifact/feature combo), DhNh-15 (single feature), and DhNh-16 (recurrent feature) in conflict. Development may impact hummocky native prairie adjacent to coulee drainages, and areas disturbed by cultivation.
NW-26-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a drainage, and areas disturbed by cultivation.
SE-05-03-24-W2M	**HRIA Required if potential impact to DhNh-55**	DhNh-54 (artifact find), DhNh-55 (single feature) and DhNh-56 (artifact find) are in conflict, but DhNh-54 and 56 have no further work recommended. Development may impact native prairie adjacent to coulee drainages, and areas disturbed by cultivation and road infrastructure. This entire quarter section was previously surveyed (permit 17-197).
NW-15-03-25-W2M	**HRIA Required for**	DhNh-44 (recurrent feature) in conflict.

	assessment of DhNh-44	Development will impact areas disturbed by cultivation.
NE-21-03-25-W2M	No further concerns	No sites in conflict. Development will impact areas disturbed by cultivation with only a small amount of native prairie within the drainage coulee.
NW-01-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to water sources, and areas disturbed by cultivation.
NW-12-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to drainage coulees, and areas disturbed by cultivation.
NE-22-02-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie and areas disturbed by cultivation.
SW-31-02-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to seasonal water sources, and areas disturbed by cultivation.
SE-34-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to drainage coulees.
SE-01-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to drainage coulees, and areas disturbed by cultivation and road infrastructure.
SE-32-02-24-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to drainage coulees.
NW-11-03-25-W2M	**HRIA Required**	No sites in conflict. Development will impact native prairie adjacent to seasonal water sources and a drainage coulee.
SW-02-03-25-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to a drainage coulee, and areas disturbed by cultivation and road infrastructure.
SW-11-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact areas disturbed by cultivation with only a small portion of native prairie in the SW corner.
NW-07-03-24-W2M	**HRIA Required for native prairie portions only**	No sites in conflict. Development may impact native prairie adjacent to drainage coulees, and areas disturbed by cultivation.

Appendix H VISUAL SIMULATION FIGURES

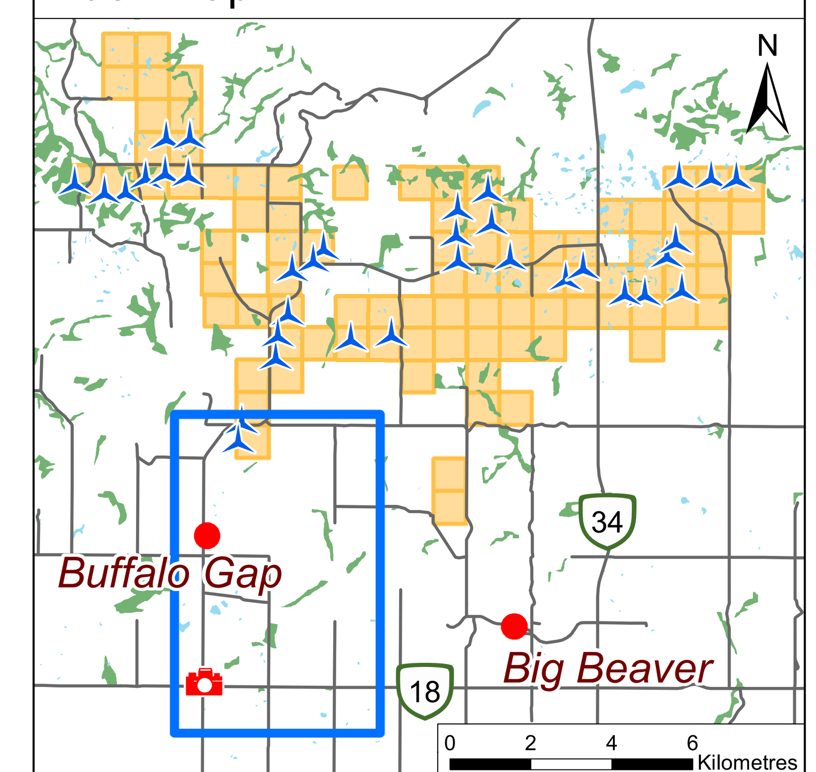
Photomontage

Original Photograph

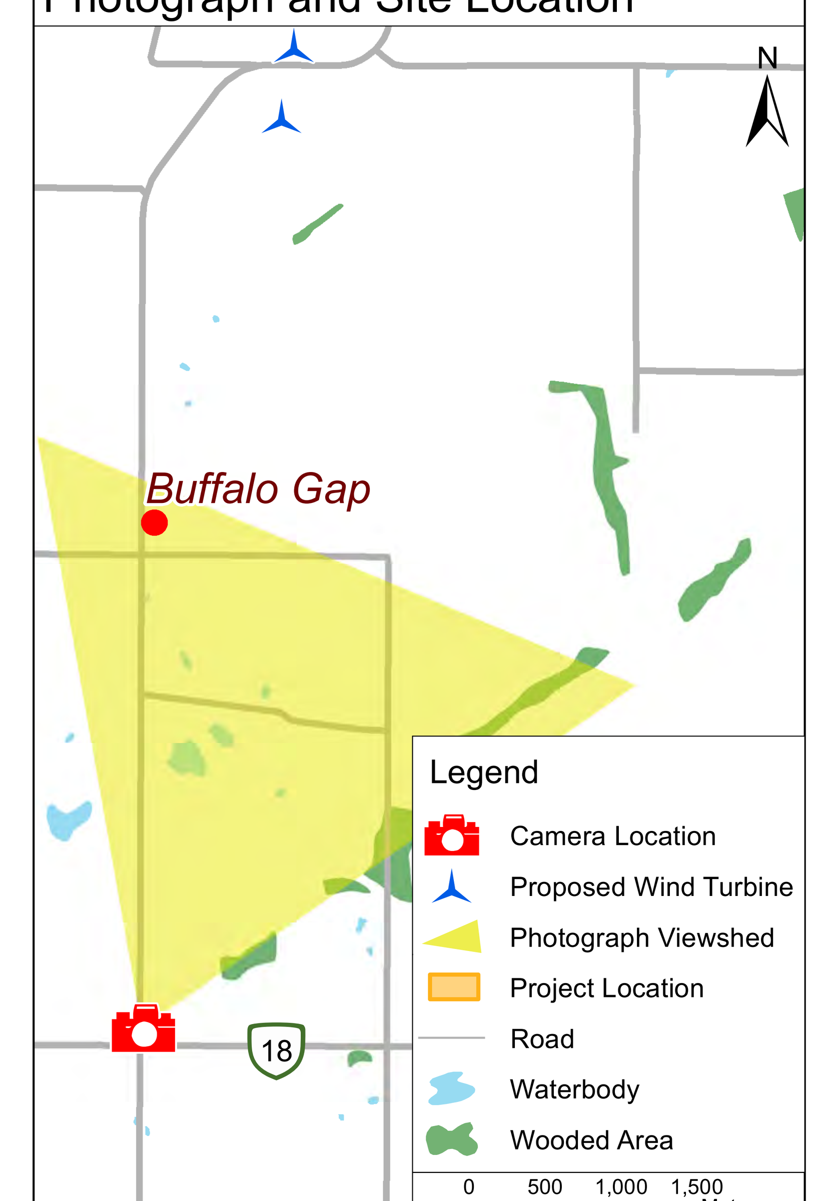
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 1 SOUTHWEST OF SITE

Index Map



Photograph and Site Location



Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

Photomontage

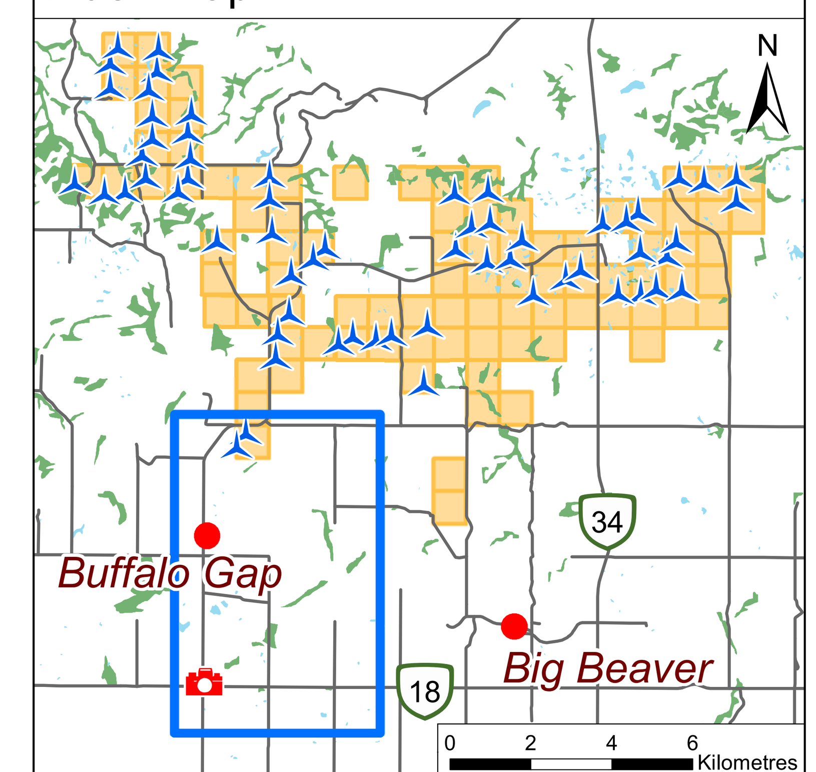
Original Photograph

BluEarth™
RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 1 SOUTHWEST OF SITE

Index Map



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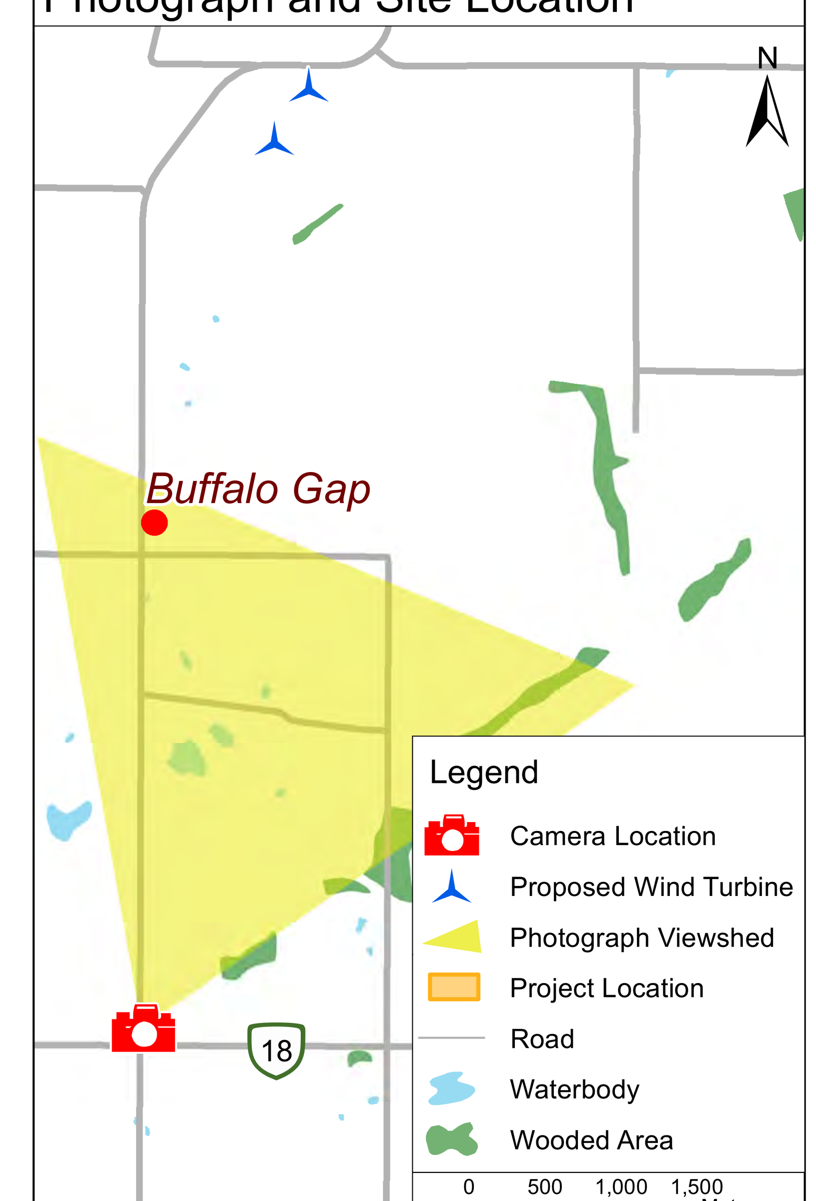

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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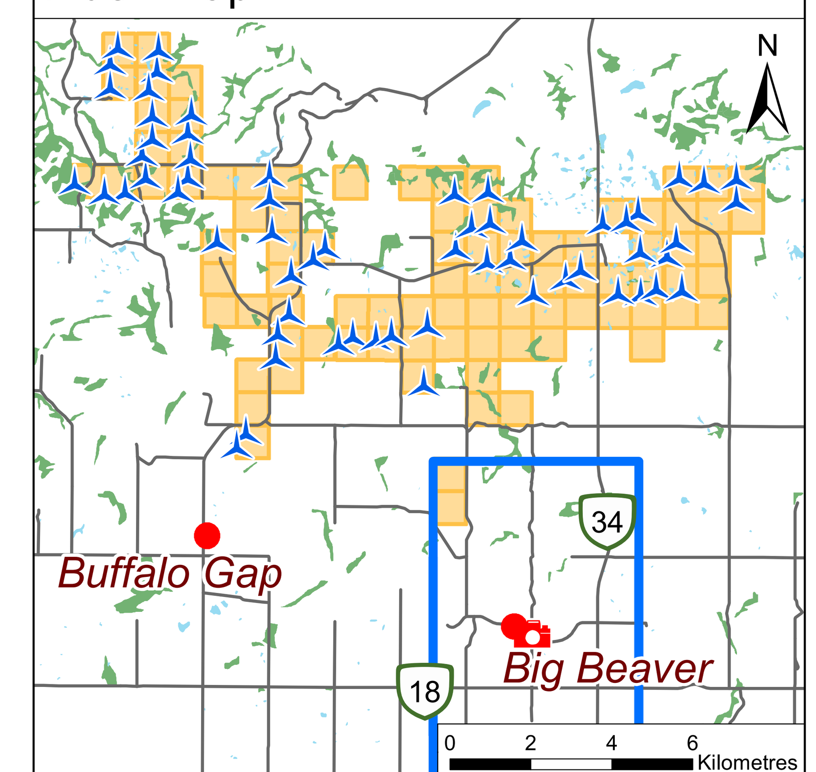
BluEarth Renewables Inc.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



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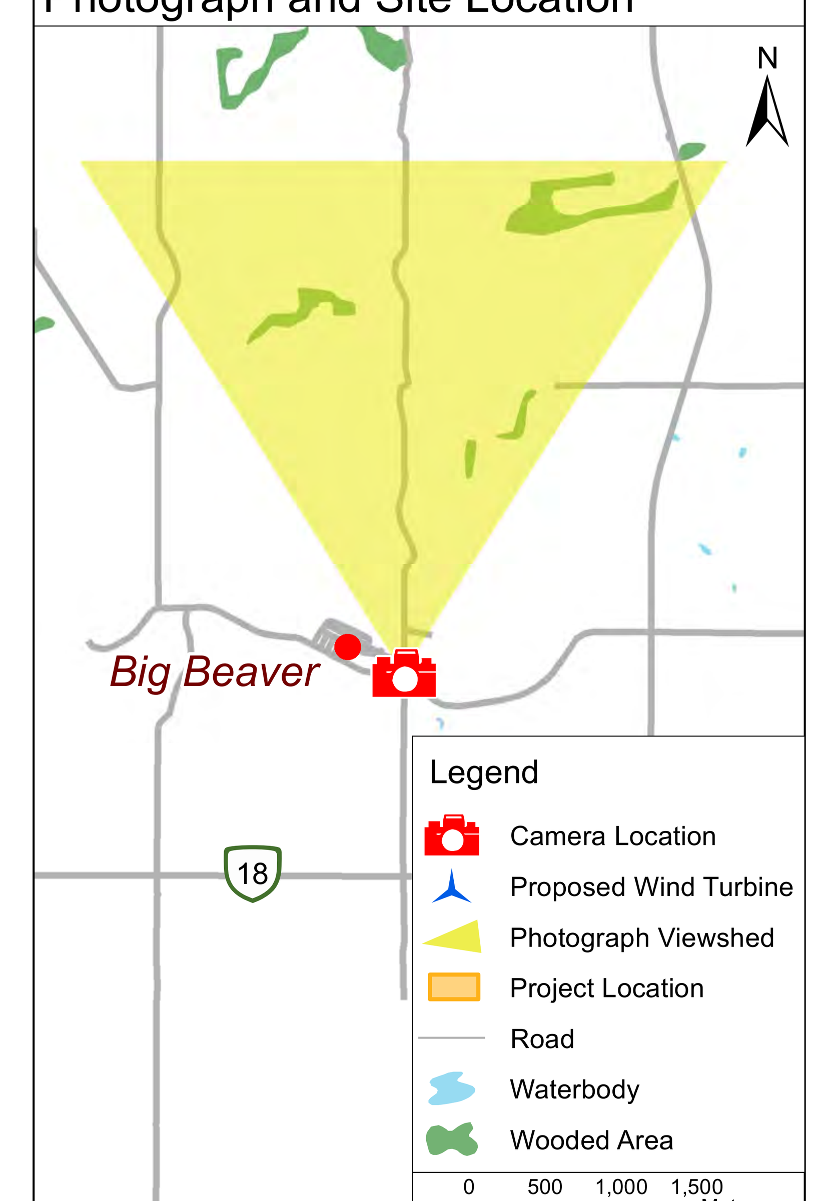

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 20, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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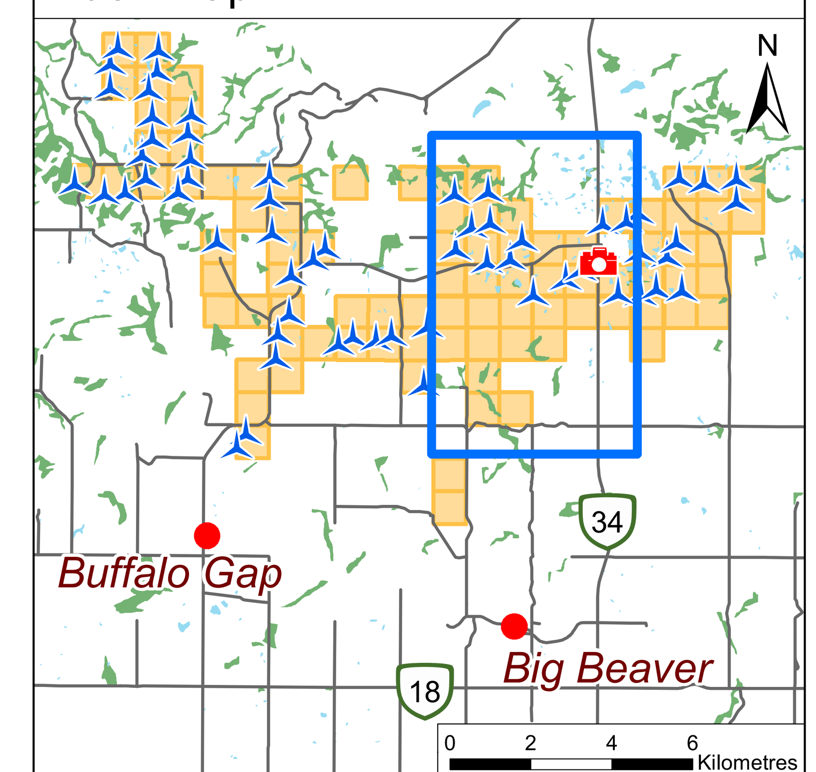
Map17-0242 - Outlaw Trails 200mw - Vantage Point 2 V2

BluEarth Renewables Inc.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 3 EAST OF SITE

Index Map



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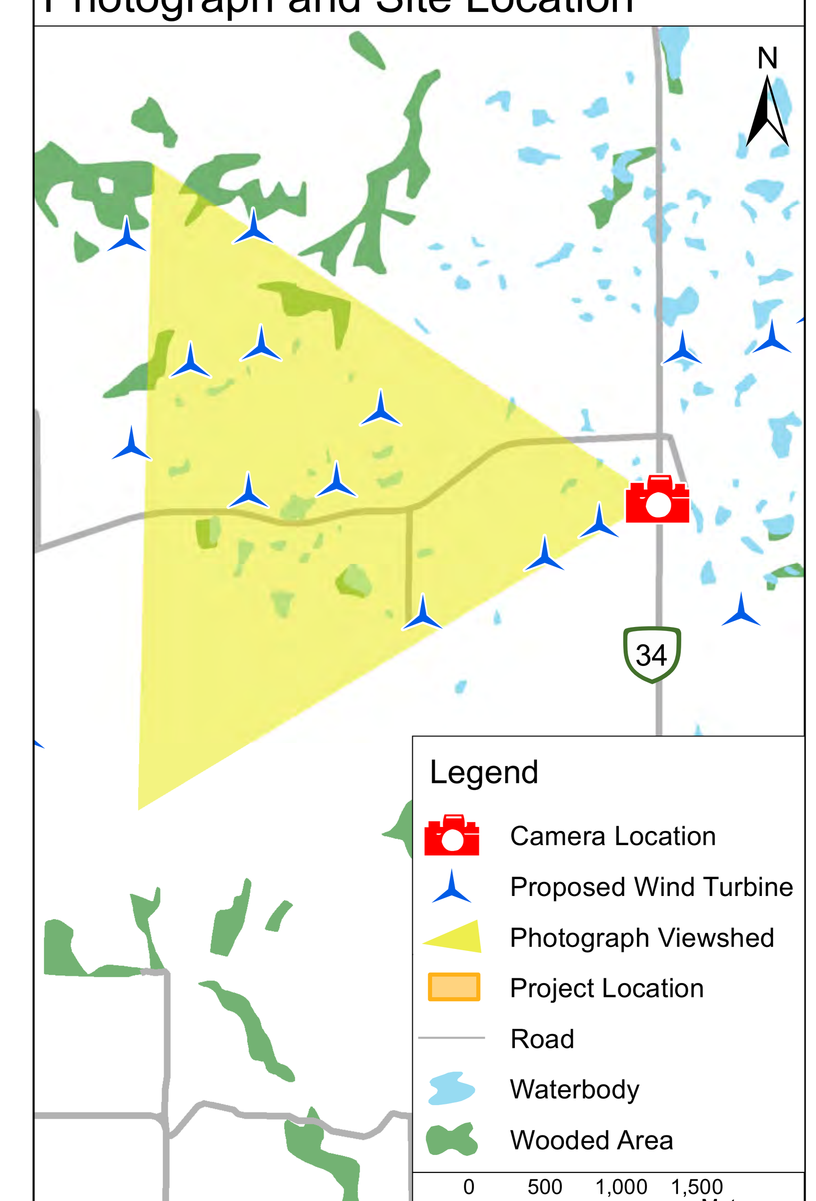

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Map17-0242 - Outlaw Trails 200mw - Vantage Point 3

Photomontage

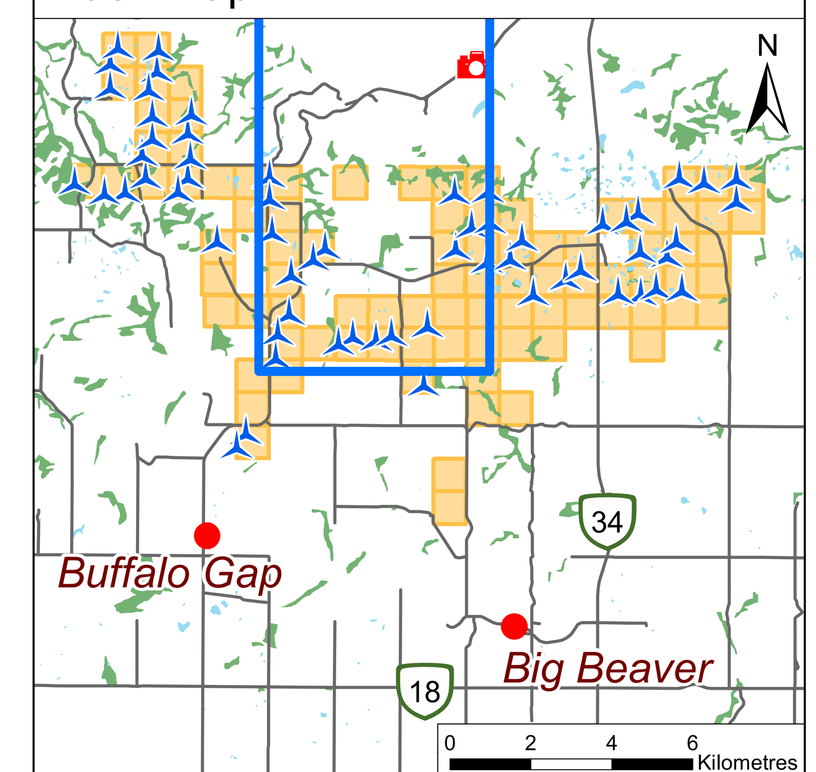
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 4 NORTH OF SITE

Index Map



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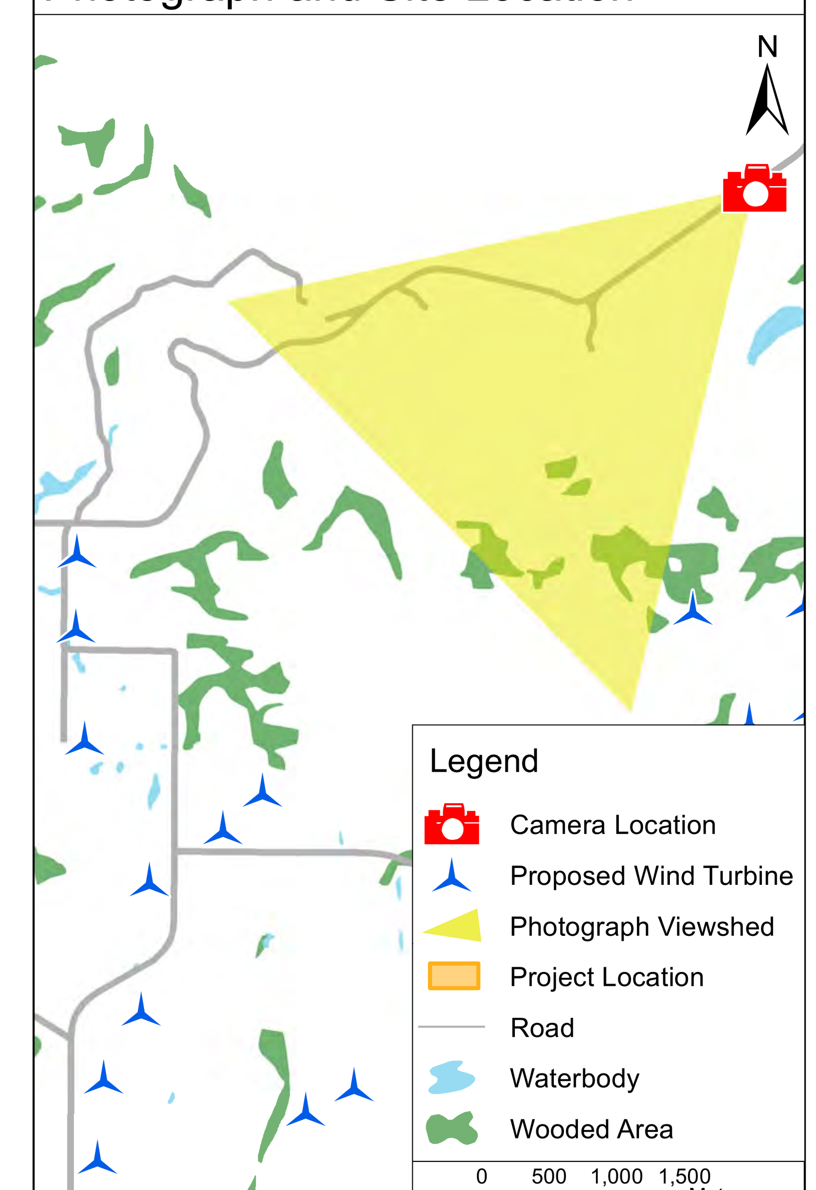


Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

CanACRE

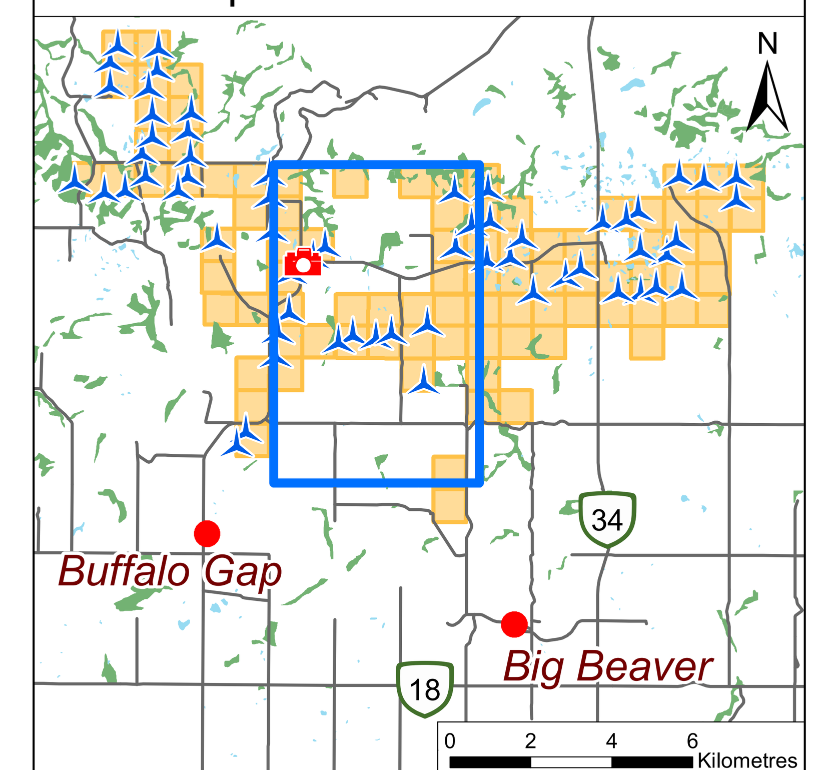
Map17-0242 - Outlaw Trails 200mw - Vantage Point 4

BluEarth
RENEWABLES INC.

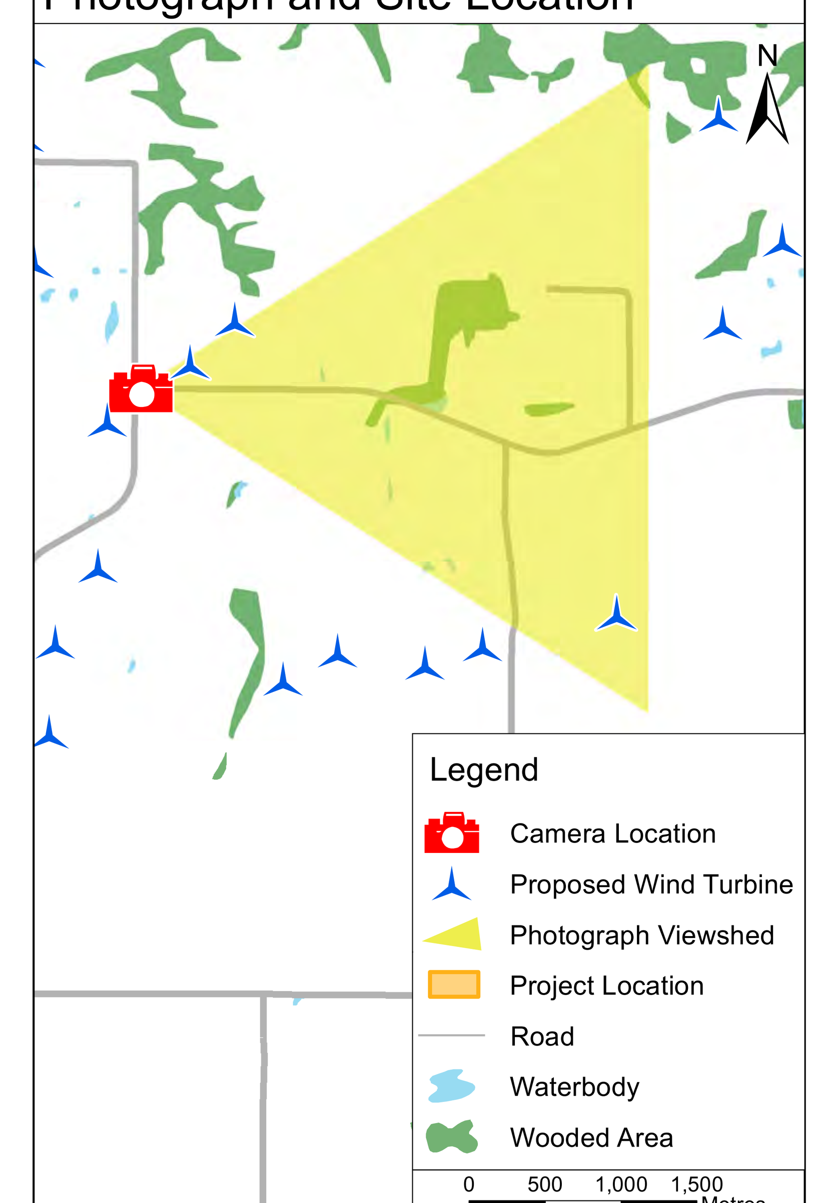
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 5 WEST OF SITE

Index Map



Photograph and Site Location



Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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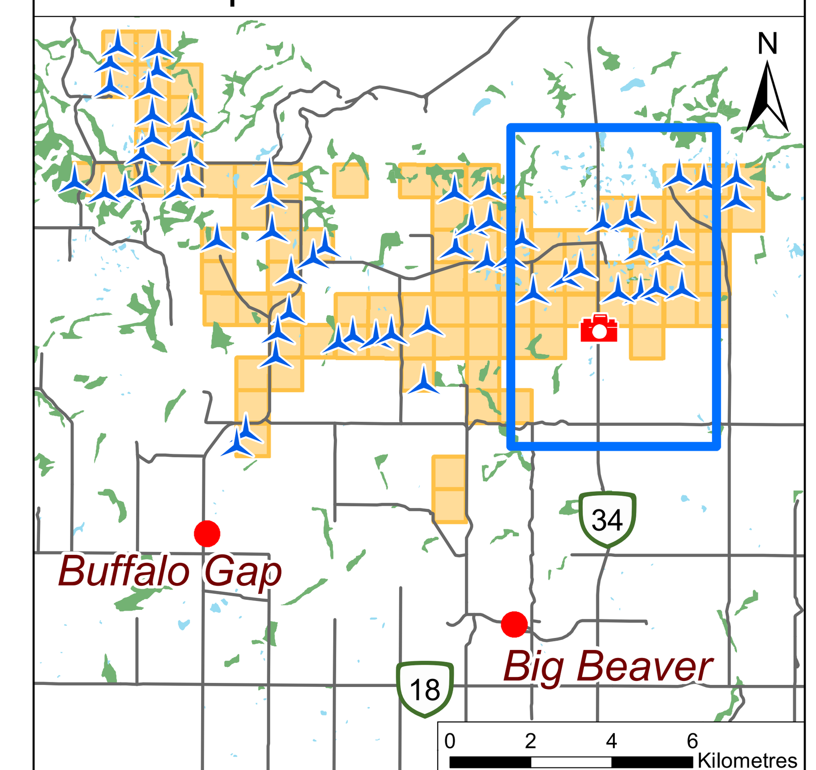
BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 6 EAST OF SITE

Index Map



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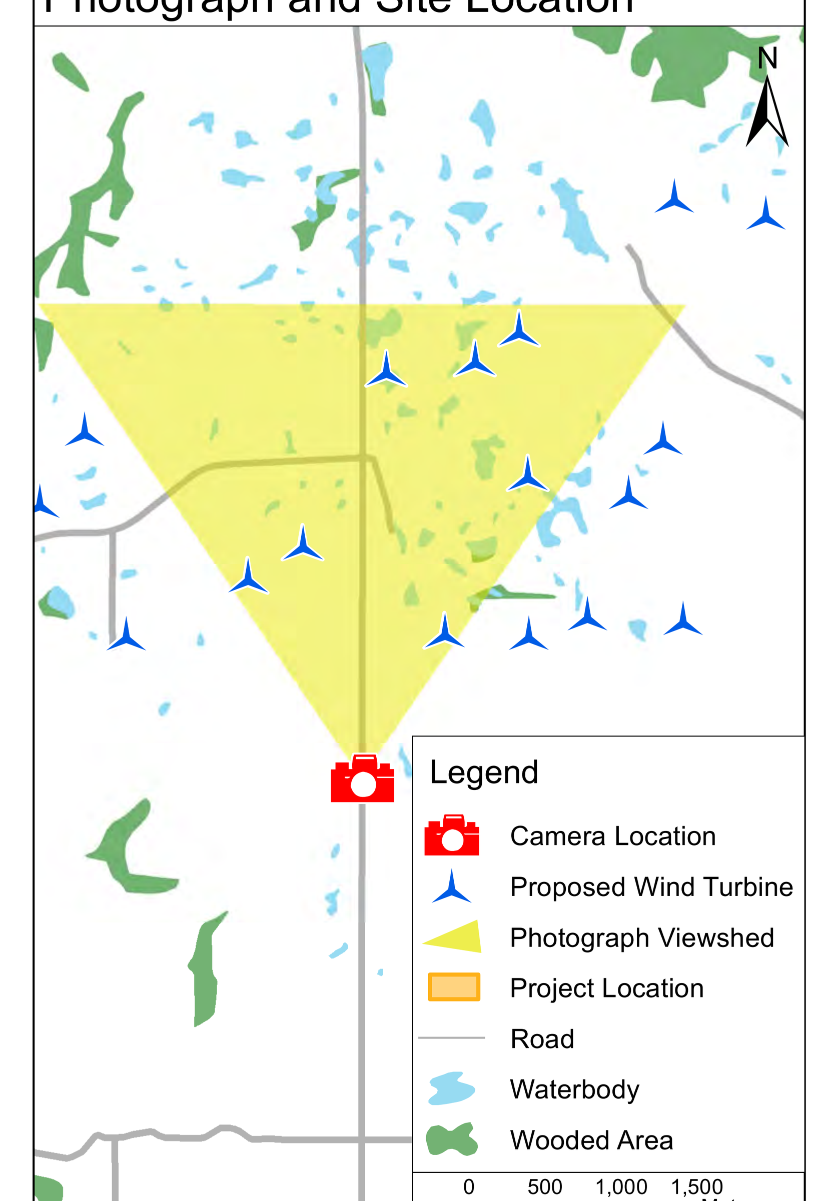

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Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Map17-0242 - Outlaw Trails 200mw - Vantage Point 6

Photomontage

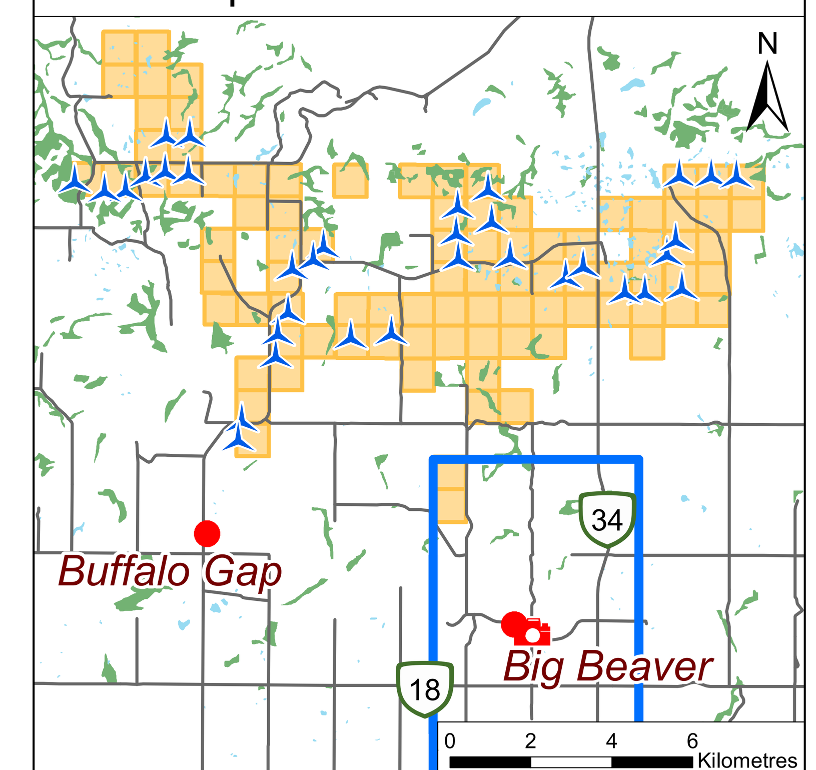
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



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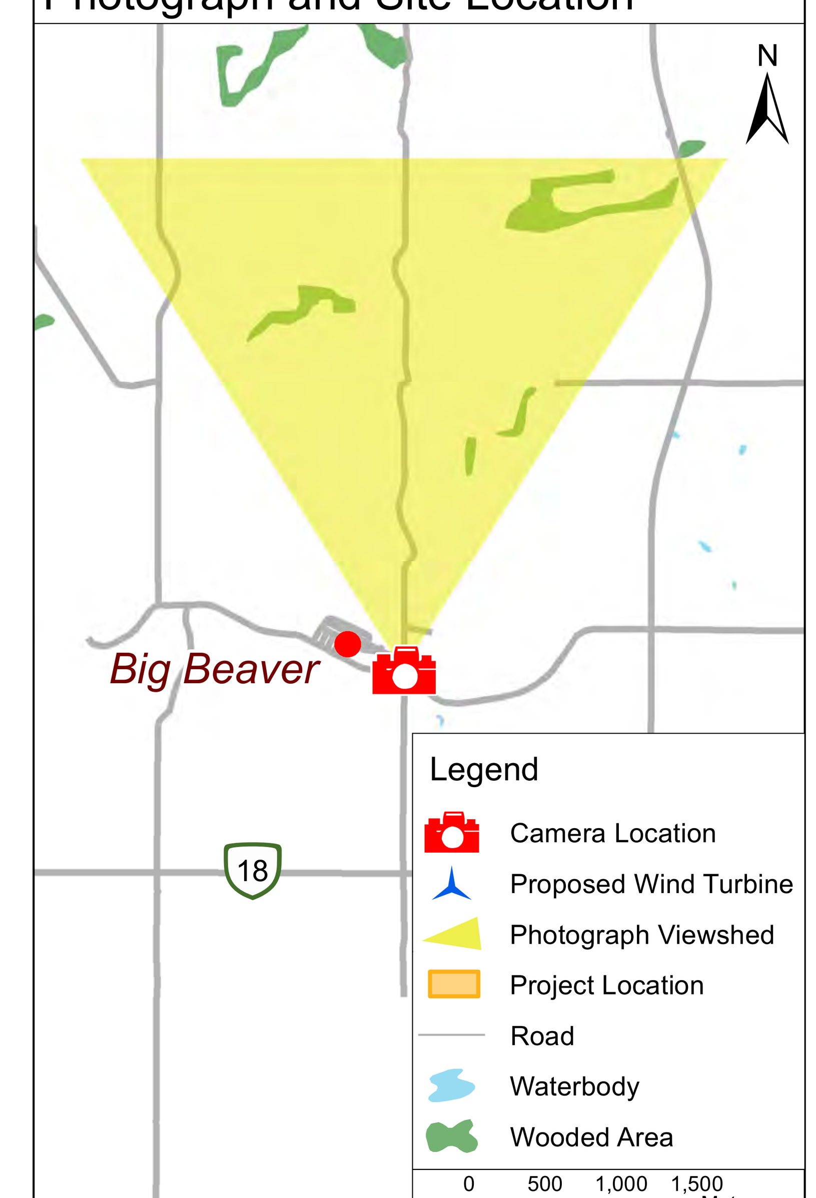

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 20, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Map17-0242 - Outlaw Trails 100mw - Vantage Point 2 V2

Photomontage

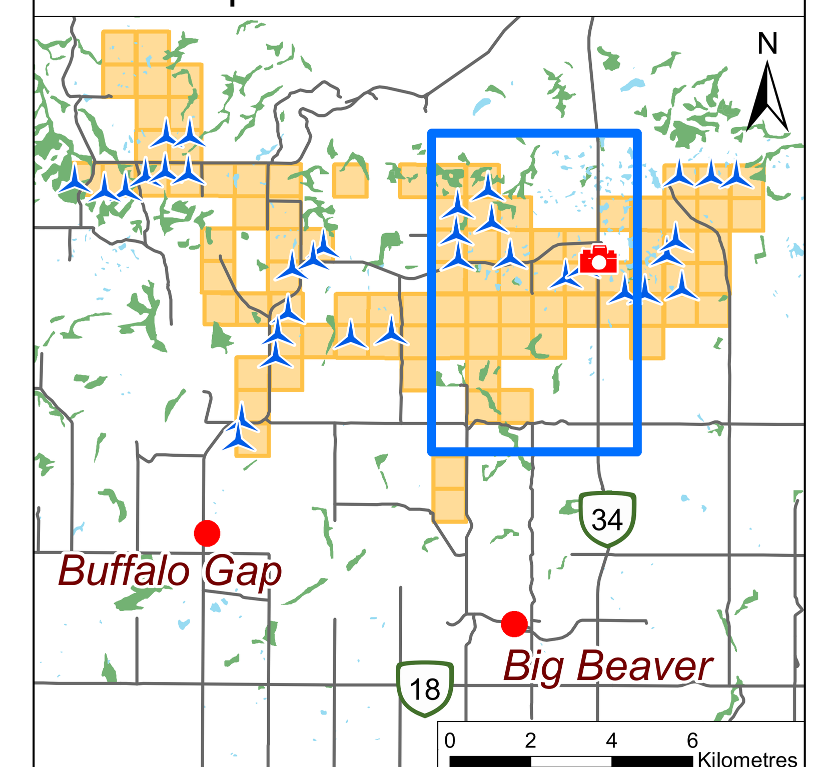
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 3 EAST OF SITE

Index Map



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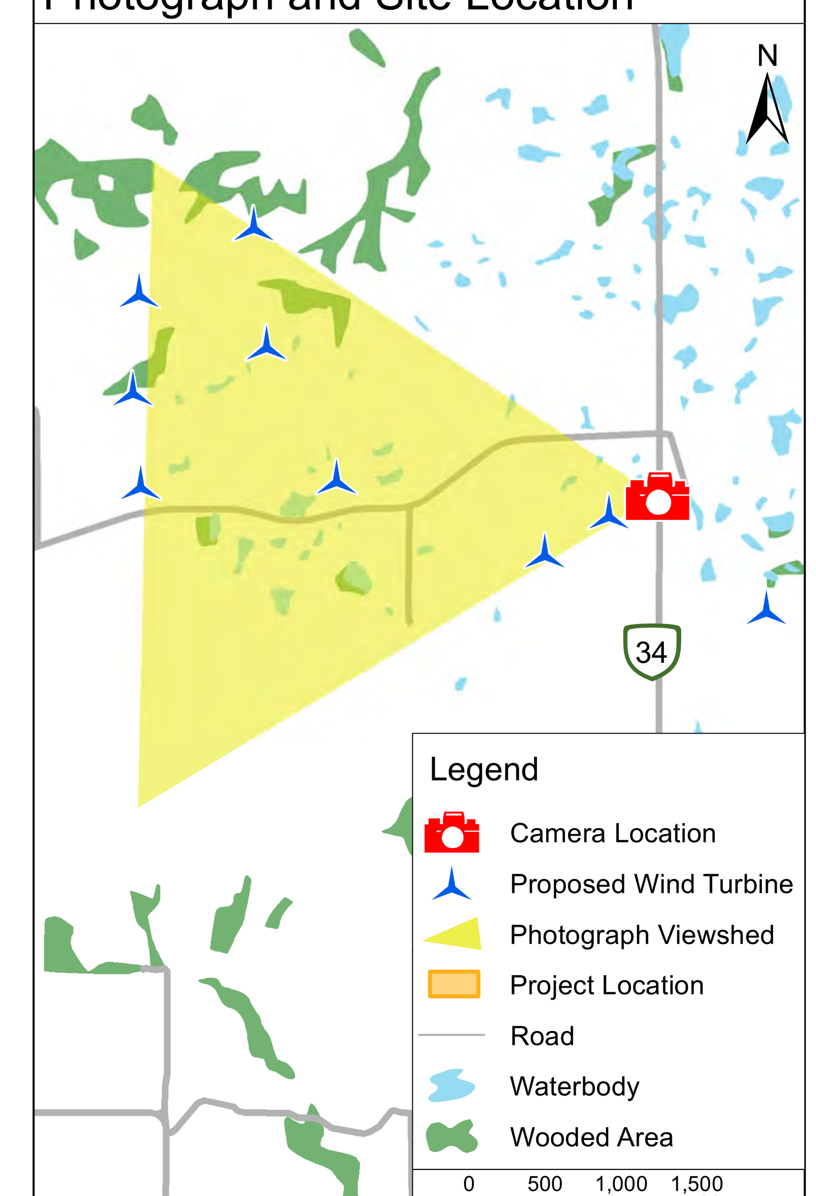

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Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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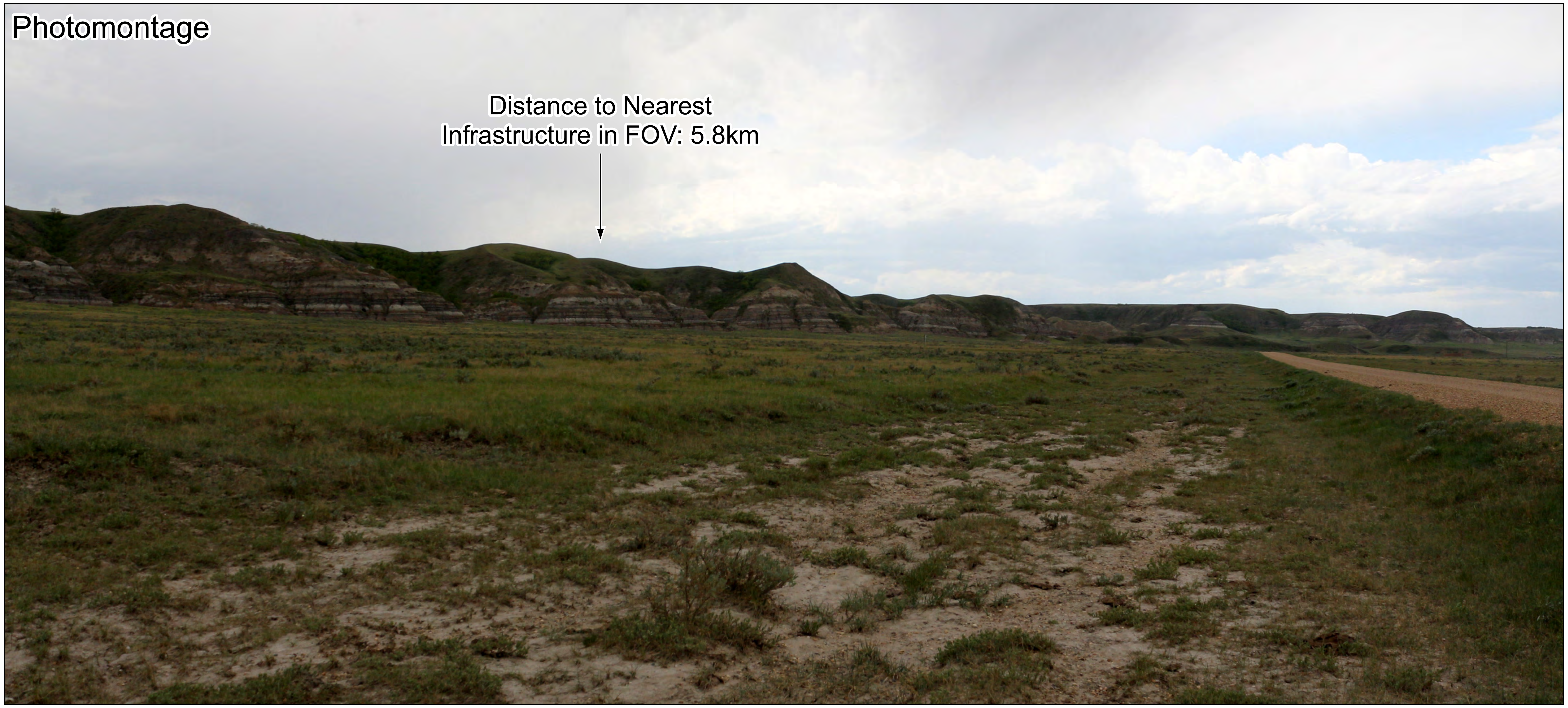
Map17-0242 - Outlaw Trails 100mw - Vantage Point 3

Photomontage



Original Photograph

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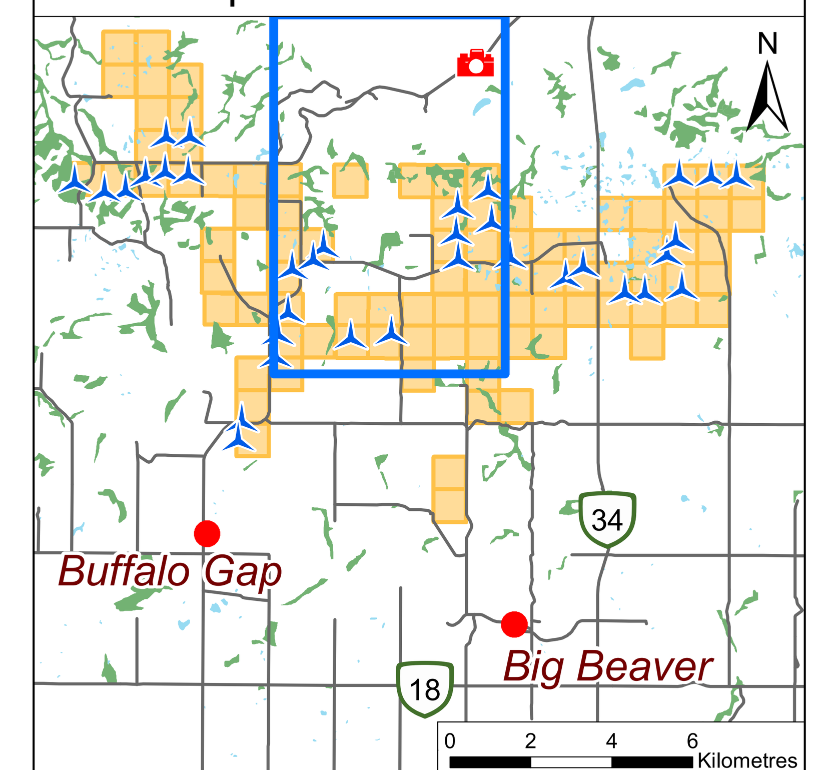
Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 4 NORTH OF SITE

Index Map



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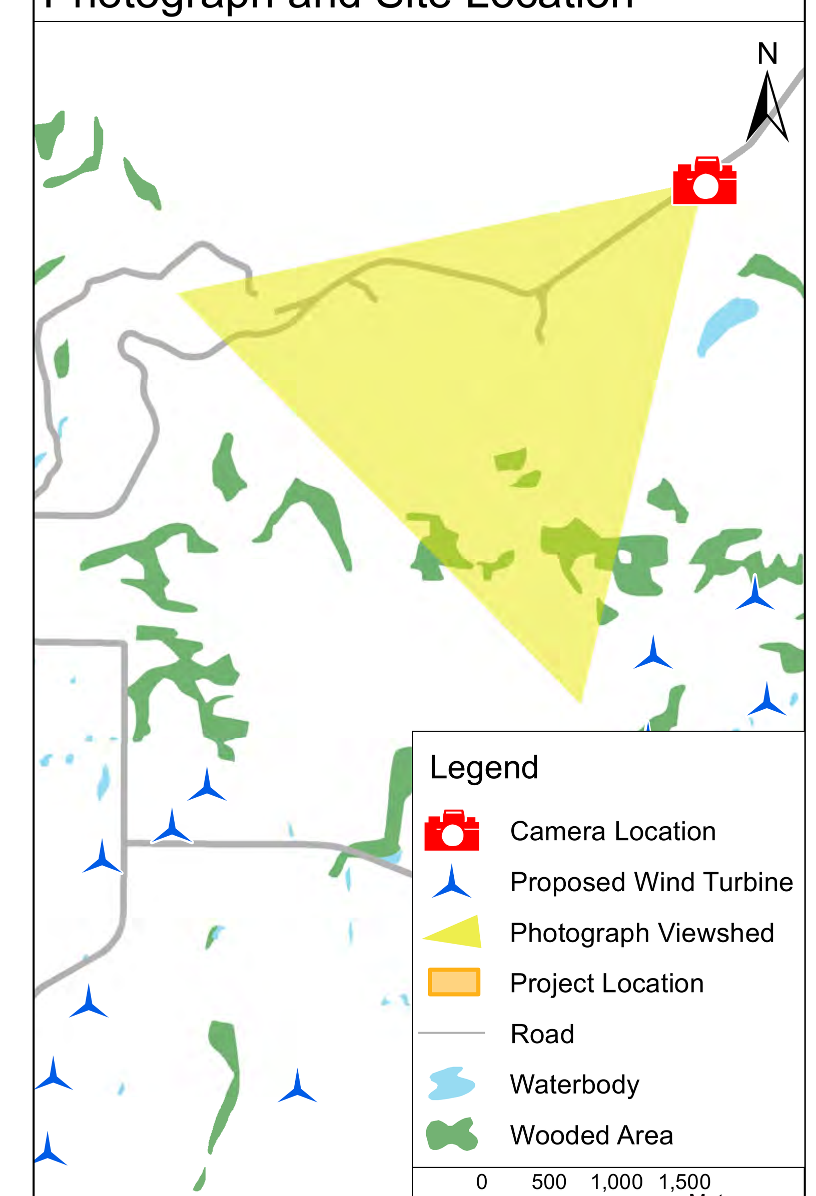

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Photomontage

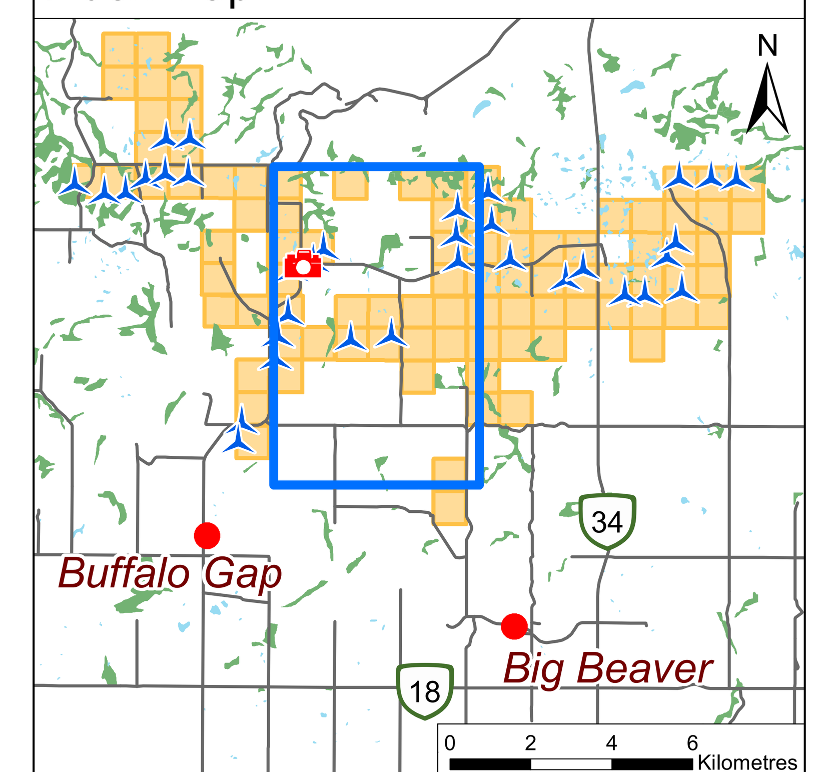
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 5 WEST OF SITE

Index Map



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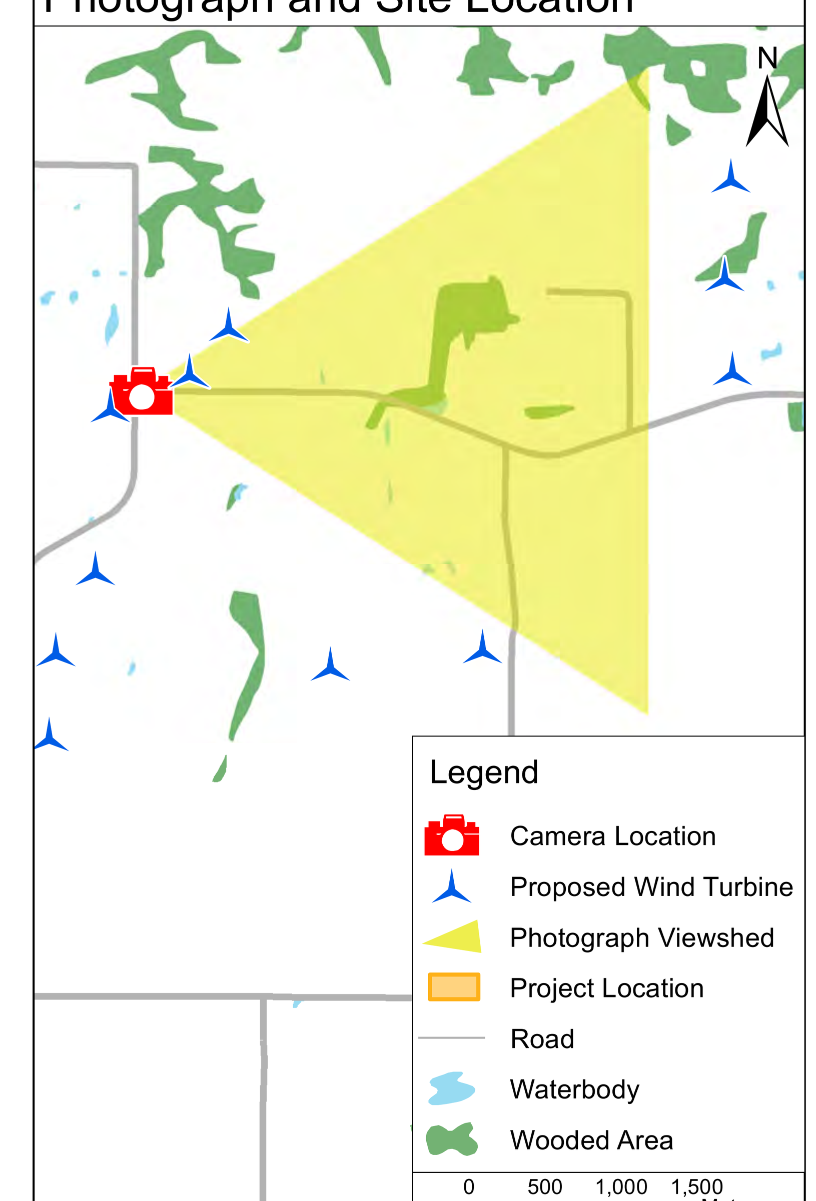

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
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Sources: Natural Resources Canada.

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Map17-0242 - Outlaw Trails 100mw - Vantage Point 5

Photomontage

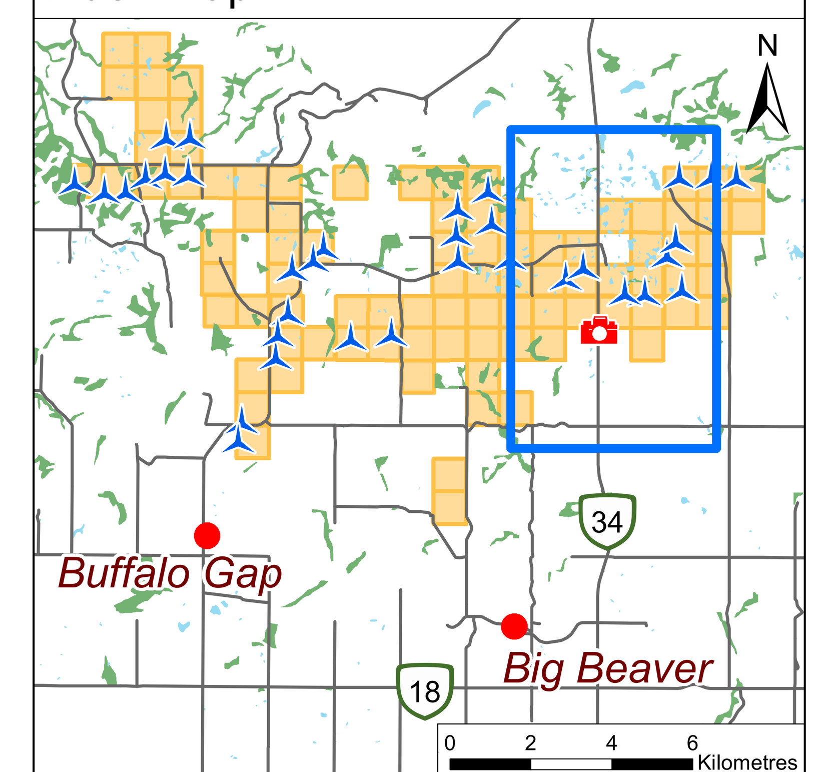
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 100MW WIND TURBINES FROM VANTAGE POINT 6 EAST OF SITE

Index Map



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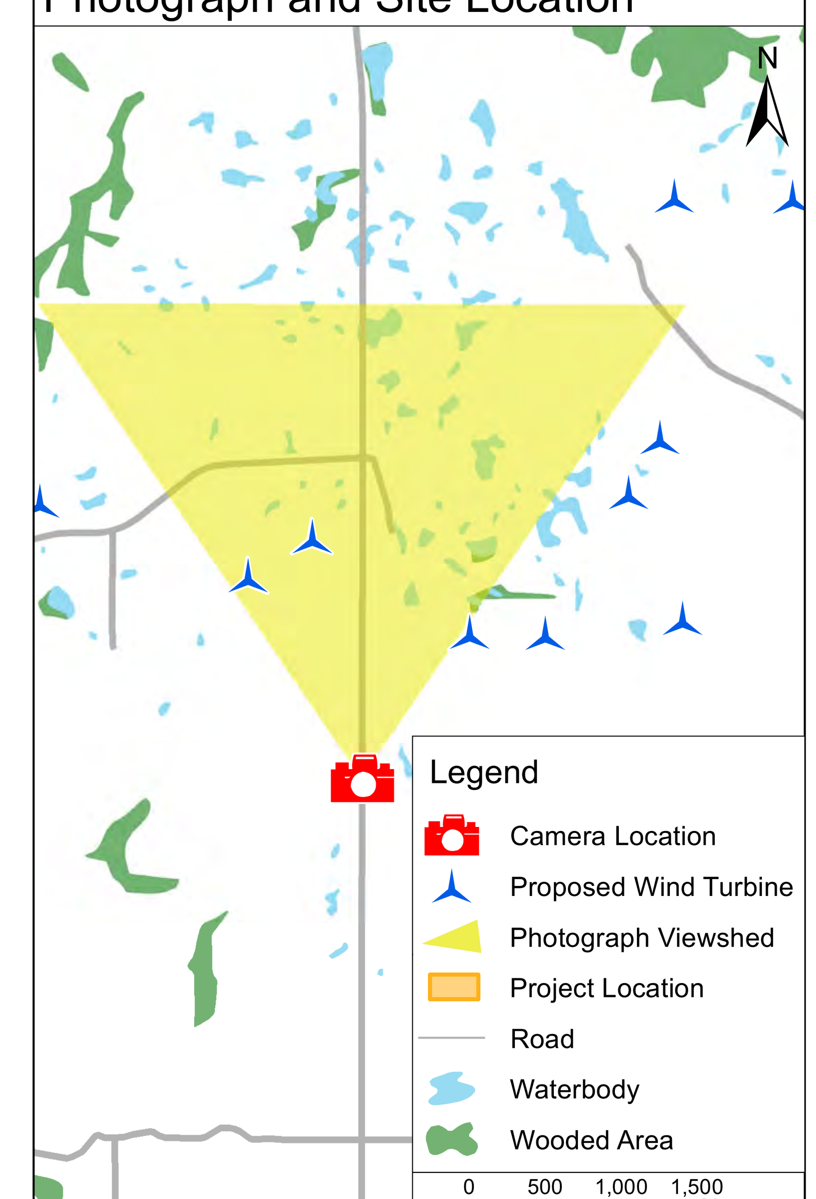

Note: This photomontage is a general visual simulation of the proposed wind turbines. The final layout and design is subject to change.
Date: June 6, 2017
Photo Taken: May 24, 2017
Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Map17-0242 - Outlaw Trails 100mw - Vantage Point 6

Photomontage

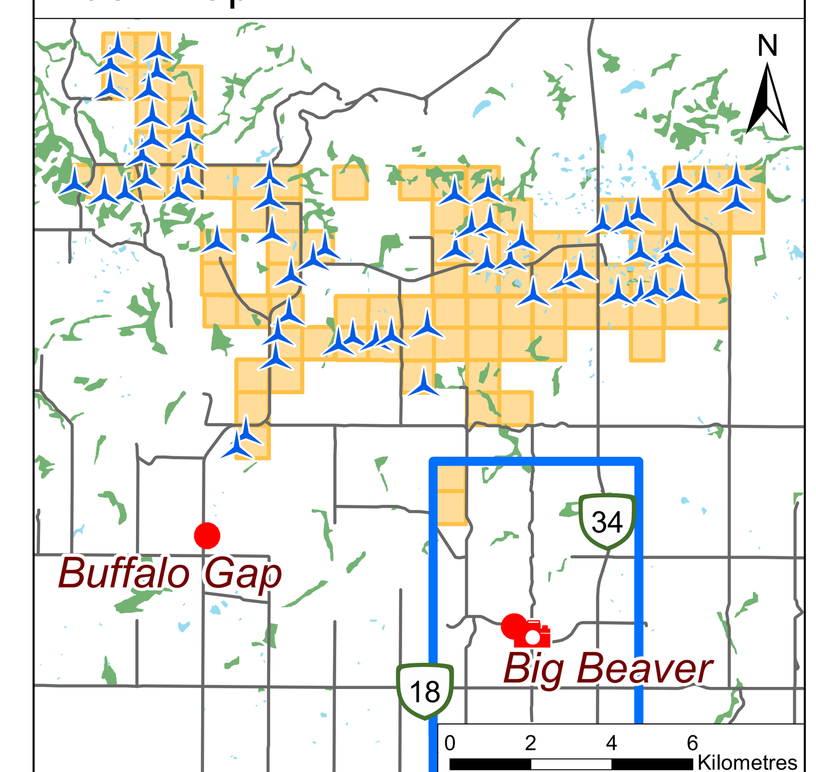
Original Photograph

BluEarth RENEWABLES INC.

Outlaw Trail Wind Project

PHOTOMONTAGE OF PROPOSED 200MW WIND TURBINES FROM VANTAGE POINT 2 SOUTH OF SITE

Index Map



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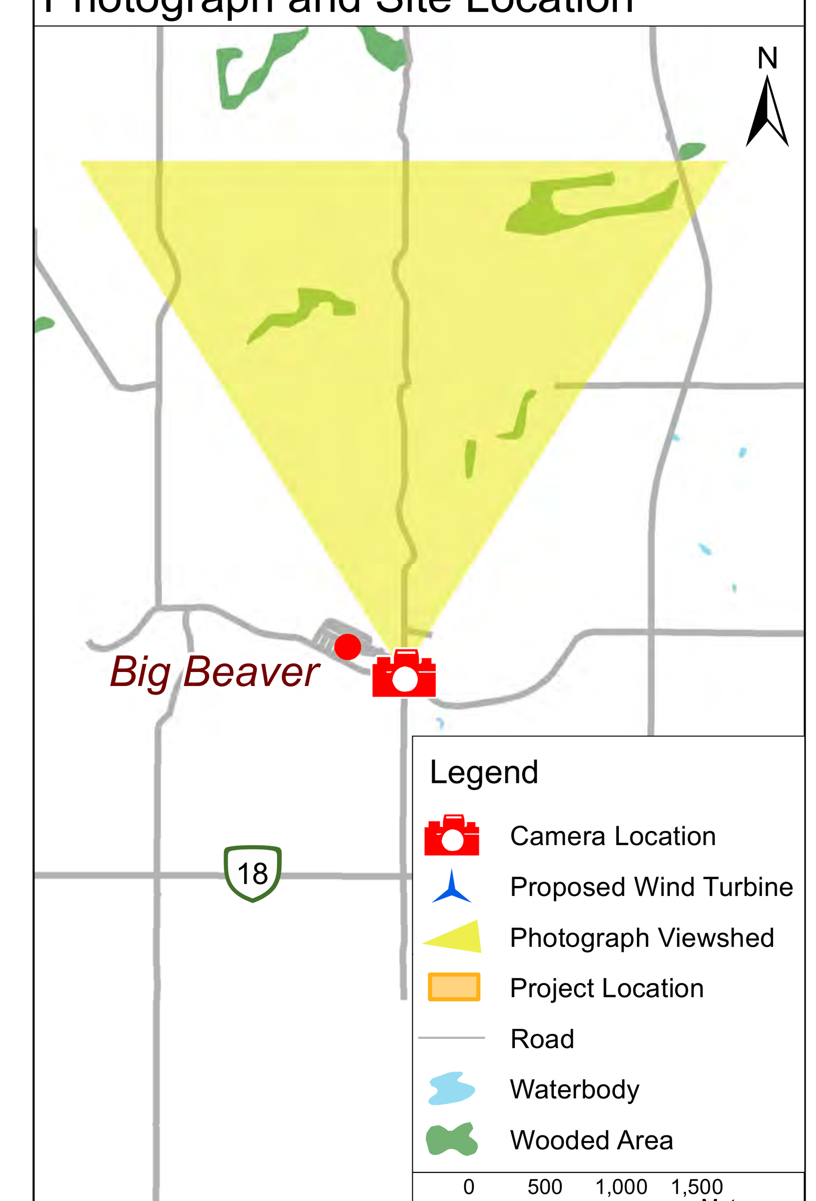

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Projection: NAD 1983 UTM Zone 13N
Sources: Natural Resources Canada.

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Appendix I NOISE TECHNICAL DATA REPORT

FINAL REPORT

OUTLAW TRAIL 210MW WIND POWER PROJECT

BLUEARTH RENEWABLES INC.

NOISE IMPACT ASSESSMENT

RWDI #1700812

April 17, 2018

SUBMITTED TO

Adam Nerland
BluEarth Renewables Inc.
200, 4723 1 Street SW
Calgary, Alberta
T2G 4Y8

SUBMITTED BY

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

VERSION HISTORY

Index	Date	Pages	Author
			[Name of Sender]

REPORT SIGNATURES

EXECUTIVE SUMMARY

BluEarth Renewables Inc. (BER) is proposing to develop the Outlaw Trail Wind Power Project (OTWPP, or "the Project") approximately 5 km north of Big Beaver, SK. This study assesses the noise impacts from the proposed project on nearby homes. As Saskatchewan does not currently have any noise regulations, the study follows specific guidance outlined for wind power projects by the Alberta Utilities Commission (AUC) under Rule 012: Noise Control (AUC 2017).

The OTWPP will see the development of 60 Vestas 4.2 MW wind turbines totaling approximately 210 MW. The OTWPP is applying for 60 permitted wind turbines locations, including 10 alternate wind turbine locations. This assessment considers noise from all 60 proposed OTWPP wind turbine locations. The OTWPP will also include a substation with two 150 MVA transformers. The location of the substation has not been finalized; however, 4 potential locations have been identified. This assessment considers noise from all 4 potential substation locations. No other significant noise emitters were noted in the OTWPP area.

The results of the predictive modelling indicate the sound levels from the OTWPP are expected to comply with the AUC Permissible Sound Level limits at residences. The potential for low frequency sound created by the OTWPP is considered to be low.

1 INTRODUCTION

BluEarth Renewables Inc. (BER) is proposing to develop the Outlaw Trail Wind Power Project (OTWPP, or "the Project") approximately 5 km north of Big Beaver, SK. This study assesses the noise impacts from the proposed project on nearby homes. As Saskatchewan does not currently have any noise regulations, the study follows specific guidance outlined for wind power projects by the Alberta Utilities Commission (AUC) under Rule 012: Noise Control (AUC 2017).

The OTWPP will see the development of 50 Vestas 4.2 MW wind turbines totaling approximately 210 MW. The OTWPP is applying for 60 permitted wind turbine locations, including 10 alternative wind turbine locations. This assessment considers project will also develop a substation with two 150 MVA transformers. The location of the substation has not been finalized; however, 4 potential locations have been identified. This assessment considers noise from all 4 potential substation locations. The AUC Rule 012 approach to noise assessment also requires the inclusion of other significant noise emitters in a cumulative assessment which have been included where identified.

A noise model was generated and compliance determined according to the cumulative noise level approach specific for wind power projects as outlined in AUC Rule 012. All work was completed by technical staff experienced in acoustic assessment, as detailed in Appendix A.

2 ASSESSMENT APPROACH

Noise from the OTWPP has been estimated using predictive modelling to determine the impact at the nearest receptors. The assessment was completed by:

- Identifying receptors per Rule 012;
- Determining the applicable sound level limit (PSL – permissible sound level) for receptors per Rule 012;
- Estimating any third-party noise levels affecting receptors;
- Estimating sound emissions from the OTWPP;
- Modelling sound emissions to predict noise levels at receptors; and,
- Comparing results to the Rule 012 PSLs.

This report details the methods and model used in the noise assessment.

2.1 Environmental Noise Descriptors

As environmental noise varies over time, a single number descriptor known as the Energy Equivalent Sound Level or L_{EQ} is used to quantify noise. The L_{EQ} value, expressed in dBA, is the energy-averaged A-weighted sound level for a specified time period. It is defined as the steady continuous sound level, over a specified time period, that has the same acoustic energy as the actual varying sound levels occurring over the same time period. The L_{EQ} values are reported as A-weighted sound levels expressed in units of dBA (A-weighted decibels). The A-weightings are assigned to account for the frequency response of the human ear, which is most sensitive to mid-frequency sounds. The L_{EQ} in dBA is the primary sound level criteria addressed by AUC criteria. An additional measure used by the AUC is the L_{90}. The L_{90} is a statistical measurement for a sound level that is exceeded 90 per cent of the time.

Rule 012 has different allowable sound levels for daytime, which it defines as 07:00 to 22:00 hours, and nighttime, which it defines as 22:00 to 07:00 hours. The L_{EQ} during daytime periods is the 15-hour A-weighted energy equivalent sound level and is denoted as the $L_{EQ\ Day}$. Similarly, the L_{EQ} during nighttime periods is a 9-hour A-weighted energy equivalent sound level and is denoted as the $L_{EQ\ Night}$.

In addition to assessing A-weighted L_{EQ} sound levels, Rule 012 recommends that low frequency noise (LFN) be assessed at the NIA stage where data is available. LFN is measured using C-weighted L_{EQ} sound levels, expressed in dBC, which represent a nearly flat frequency response. The C-weighted levels are a better indicator than A-weighted levels for potential disturbance caused by high levels of LFN. Rule 012 assesses the potential for LFN complaints based on the difference between the dBC and dBA levels, and whether there is tonality of the sound within the LFN frequencies.

A detailed glossary of terms is provided in Appendix B to aid the non-technical reader.

2.2 Computer Modelling

Modelling for this assessment was conducted using CadnaA (Version 2017) sound level prediction software set to use the environmental sound propagation calculation methods prescribed by the ISO Standard 9613 (ISO 1993, 1996). The ISO 9613 sound propagation method predicts sound levels under moderately developed temperature inversion and downwind conditions, which enhance sound propagation to the receptor. The evaluation was based on typical summertime weather conditions, as outlined in Rule 012. Table 1 describes the configuration of the calculation parameters used to complete the noise modelling.

Table 1: Model Configuration Parameters

Parameter	Model Settings	Description/Notes
Calculation Standard	ISO 9613 only	All sources and attenuators treated as required by the cited standard.
Source Directivity	Vertical sources applied to larger structures	Directivity of the source emission and the barrier effect of buildings, if present.
Ground Absorption	0.7 (index value 0 to 1)	Values used for mixed, but soft ground. Applied to the entire modelling domain.
Temperature and Humidity	10°C/70% Relative Humidity	Average summer conditions for area.
Wind Conditions	Default ISO 9613	The propagation conditions in the ISO 9613 (1996) standard are valid for wind speeds between 4 and 18 km/h; all points are considered downwind.
Terrain	Terrain applied	Terrain in the area is modelled at 2 m vertical resolution to account for any natural barriers within the study area (CDED 2009).
Reflections	1	One reflection is taken into account for reflections from on-site structures, if present
Search Radius	5000 m	All sources within this radius of a receptor or grid point are calculated.

2.1 Summary of OTWPP Sources

The OTWPP will see the development of 50 Vestas 4.2 MW wind turbines totaling approximately 210 MW. As wind resourcing and other technical studies continue during the permitting process, 10 alternate turbine locations are being requested in the event some of the primary turbine locations become non-viable during the remainder of project development. For example, geotechnical investigation may indicate a location is not suitable for development. As a conservative measure, the 10 alternate wind turbine locations were included as operating at full capacity along with all 50 other turbines.

The Project will also include a single location for a substation. The substation will consist of two 150 MVA ONAF transformers, that were considered as running continuously. At the time of this assessment, the final location had not yet been determined, so four potential locations that have been identified are included in this assessment. The modelling conservatively examined all four locations operating simultaneously along with normal turbine operations. This allows for any one of the four locations to be selected at a later date.

3 STUDY AREA AND RECEPTORS

Rule 012 defines a noise-sensitive receptor as any permanent or seasonally occupied dwelling within 1.5 km of a facility, or with wind farms, 1.5 km of the turbine base. Therefore, a 1.5 km boundary from each turbine has been created, with overlapping boundaries merged to create a continuous 1.5 km boundary for the OTWPP. This study area defines the receptors that are considered in the noise impact assessment; specifically, any receptors that lie within this boundary are evaluated.

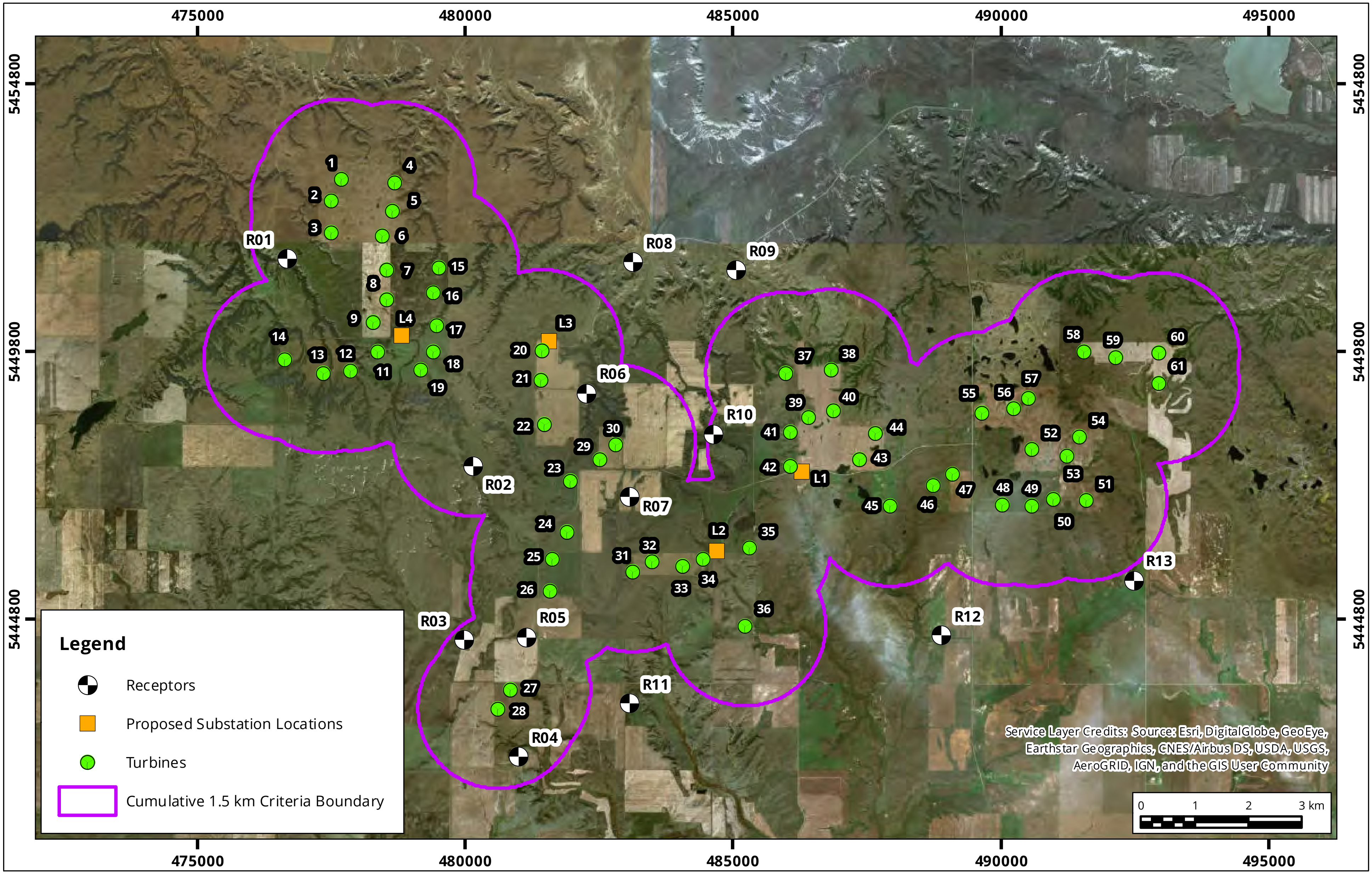
A combined approach was used to verify dwelling receptors, which included a desktop search of mapping for presence of structures, then onsite field observations to verify locations with homes. Table 2 indicates the receptors that are within the 1.5 km boundary from the turbines, and which will be evaluated. Table 2 also indicates the distance and direction to the nearest OTWPP turbine.

Other third party facilities that may contribute to noise at receptors must be evaluated along with the Project sound sources, and depending on the cumulative potential, may require the inclusion of receptors farther than 1.5 km from the turbines. No active third party oil and gas facilities were located within the Project area so no additional receptors required inclusion. Details regarding the desktop and field survey for other energy related facilities are further discussed in Section 5.2.

Figure 1 shows the 1.5 km Criteria Boundary, as well as the locations of the receptors.

Table 2: Location of Receptors and Spatial Locations from Nearest Turbine

Receptor ID	UTM Coordinates (NAD 83, Zone 13)		Distance to Nearest Turbine (m)	Nearest Turbine ID	Angle to Nearest Turbine (0º as North)
	Easting (m)	Northing (m)			
R01	476654	5451529	955	3	60
R02	480142	5447656	1546	22	60
R03	479955	5444403	1274	27	137
R04	480980	5442232	972	28	337
R05	481131	5444462	976	26	27
R06	482252	5449017	874	21	286
R07	483055	5447078	886	30	322
R08	483129	5451471	2373	20	226
R09	485056	5451315	2129	37	154
R10	484632	5448256	1437	41	89
R11	483055	5443226	2237	27	276
R12	488893	5444500	2594	45	338
R13	492477	5445520	1730	51	330



Outlaw Trail Wind Power Project

Detailed Project Location, Receptors, and Cumulative 1.5 km Criteria Boundary

Map Projection: NAD 1983 UTM Zone 13N

BluEarth Renewables Inc. - Saskatchewan

True North

Project #: 1700812

Drawn by: ABU	Figure: 1
Approx. Scale:	1:100,000
Date Revised:	Mar 15, 2018

4 PERMISSIBLE SOUND LEVEL

4.1 Permissible Sound Level Determination

The requirements of Rule 012 limit the amount of sound contribution at a receptor location that may be generated by facilities. The sound level limits for a receptor are set by calculating permissible sound levels (PSLs) according to the procedures in Rule 012. Where dwellings or receptors are present, the PSL is determined using a Basic Sound Level (BSL) plus any allowed adjustments. Where no special conditions exist, the PSL is determined as follows:

Permissible Sound Level	=	Basic Sound Level (Table 1 in Rule 012)	+	Daytime Adjustment (If applicable)

The BSL is determined based on dwelling density and proximity to heavily travelled roadways. All receptors are rural residences with a dwelling density of less than 8 dwellings per quarter section, and the resulting PSL is 40 dBA for nighttime and 50 dBA for daytime. A summary of the PSLs is provided in Table 3.

Where no permanent or seasonally-occupied human dwelling exists within a distance of 1.5 km from the OTWPP, Rule 012 requires that the cumulative sound level at 1.5 km from the OTWPP "fenceline" not exceed 40 dBA L_{EQ} during nighttime hours. Thirteen receptors have been identified, so no Criteria Boundary receptors are identified.

Regarding LFN, Rule 012 states that a complaint condition may exist where the difference between the OTWPP's time weighted average dBA and dBC levels is equal to or greater than 20 dB, and where a clear tonal component exists at a frequency below 250 Hz.

Table 3: PSL Determination (Rule 012 – Table 1)

Receptor ID	Proximity to Transportation Category[1]	Dwelling Density per Quarter Section of Land [2]	Dwelling Category [3]	Nighttime BSL[4]	Permissible Sound Level	
					Night[5] (dBA)	Day [6] (dBA)
R01	1	1 to 8 dwelling	1	40	40	50
R02	1	1 to 8 dwelling	1	40	40	50
R03	1	1 to 8 dwelling	1	40	40	50
R04	1	1 to 8 dwelling	1	40	40	50
R05	1	1 to 8 dwelling	1	40	40	50
R06	1	1 to 8 dwelling	1	40	40	50
R07	1	1 to 8 dwelling	1	40	40	50
R08	1	1 to 8 dwelling	1	40	40	50
R09	1	1 to 8 dwelling	1	40	40	50
R10	1	1 to 8 dwelling	1	40	40	50
R11	1	1 to 8 dwelling	1	40	40	50
R12	1	1 to 8 dwelling	1	40	40	50
R13	1	1 to 8 dwelling	1	40	40	50

Notes:
1 - Category 1 dwelling units are more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers (AUC, 2013).
2 - Density per quarter section refers to a quarter section with affected dwellings at the center (a 451m radius). For quarter sections with various land uses or with mixed densities, the density chosen is averaged for the area under consideration (AUC, 2017).
3 – As identified per Table 1 of AUC Rule 012.
4 - Basic sound level as identified per Table 1 of AUC Rule 012.
5 - Nighttime PSL is equal to the BSL as there are no A, B, or C adjustments.
6 - Daytime PSL is equal to the BSL plus the 10 dBA daytime adjustment, as there are no A, B, or C adjustments.

5 EXISTING CONDITIONS

5.1 Ambient Conditions

According to AUC Rule 012, the Ambient Sound Level (ASL) is assumed to be five dBA less than the BSL for night, while the daytime ASL is the nighttime ASL plus daytime correction (10 dB). For all receptors, the ASL is 35 dBA during the night and 45 dBA during the day.

5.2 Third Party Facilities

AUC Rule 012 requires that a cumulative assessment be considered for the development of any energy related facilities. The cumulative assessment must include the contributions from other third party existing and approved facilities. While the province of Saskatchewan does not have noise regulations directly applicable to other industry, noise is a factor considered in the environmental evaluation of projects, where warranted. Therefore, this assessment considered other energy or industrial noise sources in the cumulative assessment, consistent with the intent of AUC Rule 012.

Third party facilities within the project boundaries are expected to be sources that may affect sound levels at receptors. These sound sources need to be considered in the turbine layout design, and subsequently would be used to establish cumulative noise effects as required for Noise Impact Assessments under Rule 012.

Third party facilities were identified using publicly available data sources for Saskatchewan and through field observation. The data sources come from the listings provided by the National Pollutant Release Inventory (NPRI 2016), and the government of Saskatchewan mining and petroleum GeoAtlas database (SMOE 2017). The data sources are used to identify typical facilities that may contribute sound to the wind projects and must be considered in future noise impact assessments per Rule 012.

The desktop survey resulted in the identification of sixteen potential third party facilities within the project area; however, all facilities were noted in the database as abandoned wells. The field survey confirmed that no noise sources were present on these sites. No third party facilities required inclusion in this assessment.

6 PREDICTION RESULTS

6.1 Noise Sources

The OTWPP will consist of 60 Vestas 4.2 MW wind turbines at a hub height of 82 m. The sound power level for the wind turbines is taken from the Vestas supplied acoustic specifications. Predictions use the vendor supplied sound power for the turbine.

The turbine reaches a maximum sound output of 103.9 dBA at 12 m/s hub height wind speed. The equivalent standardized wind speed (speed at a height of 10 m) is 8.5 m/s for the Vestas 4.2 MW at 82 m hub height. Calculated wind speed at a standardized height of 10 m are determined in accordance with IEC 61400-11 (IEC 2012).

The turbines were modelled at the proposed hub height of 82 m elevation above grade and assumed continuous operation over the day and night periods.

The Project will also include a substation, consisting of two 150 MVA ONAF transformers. As the locations for the substation has yet to be finalized, four potential sites have been considered in the modelling to demonstrate compliance with Rule 012 regardless of final location.

Table 4 shows the sound power level for each substation, and for the wind turbines used in the noise model.

Table 4: Project Sound Power Levels

Item	UTM Coordinates (NAD 83, Zone 12)		Levels at Octave Band Center Frequencies (dB)									Overall Sound Power	
	Easting (m)	Northing (m)	31.5	63	125	250	500	1,000	2,000	4,000	8,000	(dBA)	(dB)
Outlaw Trail Substation - 150 MVA Transformers[1]	(3)	(3)	100.6	106.6	108.6	103.6	103.6	97.6	92.6	87.6	80.6	104.0	112.6
Vestas 4.2 MW Turbines[2] (wind speed 12.0 m/s)	(3)	(3)	113.9	111.2	108.7	105.8	102.2	97.9	92.7	86	78.4	103.9	117.1

Notes: 1 - Derived using theoretical calculations based on power ratings, dimensions, and capacities provided by the client (Crocker 2009).
2 - Turbine spectrum listed here does not include an additional 1 dB increase to account for variability. This was included in the modelling.
3 – Substation and turbine locations provided in Appendix C.

6.2 Operation Results

6.2.1 Assessment of Compliance with Standard AUC Rule 012 PSL

Table 5 and Table 6 show the compliance determination with the daytime and nighttime PSLs, respectively, according to the standard AUC Rule 012 outline. The results indicate that the OTWPP will comply with the PSLs.

Figure 2 shows the predicted noise contours due to the OTWPP. As there is no operational difference between daytime and nighttime operation, the figure shows the overall predicted sound contours independent of time.

Table 5: Assessment of Compliance with Daytime PSLs

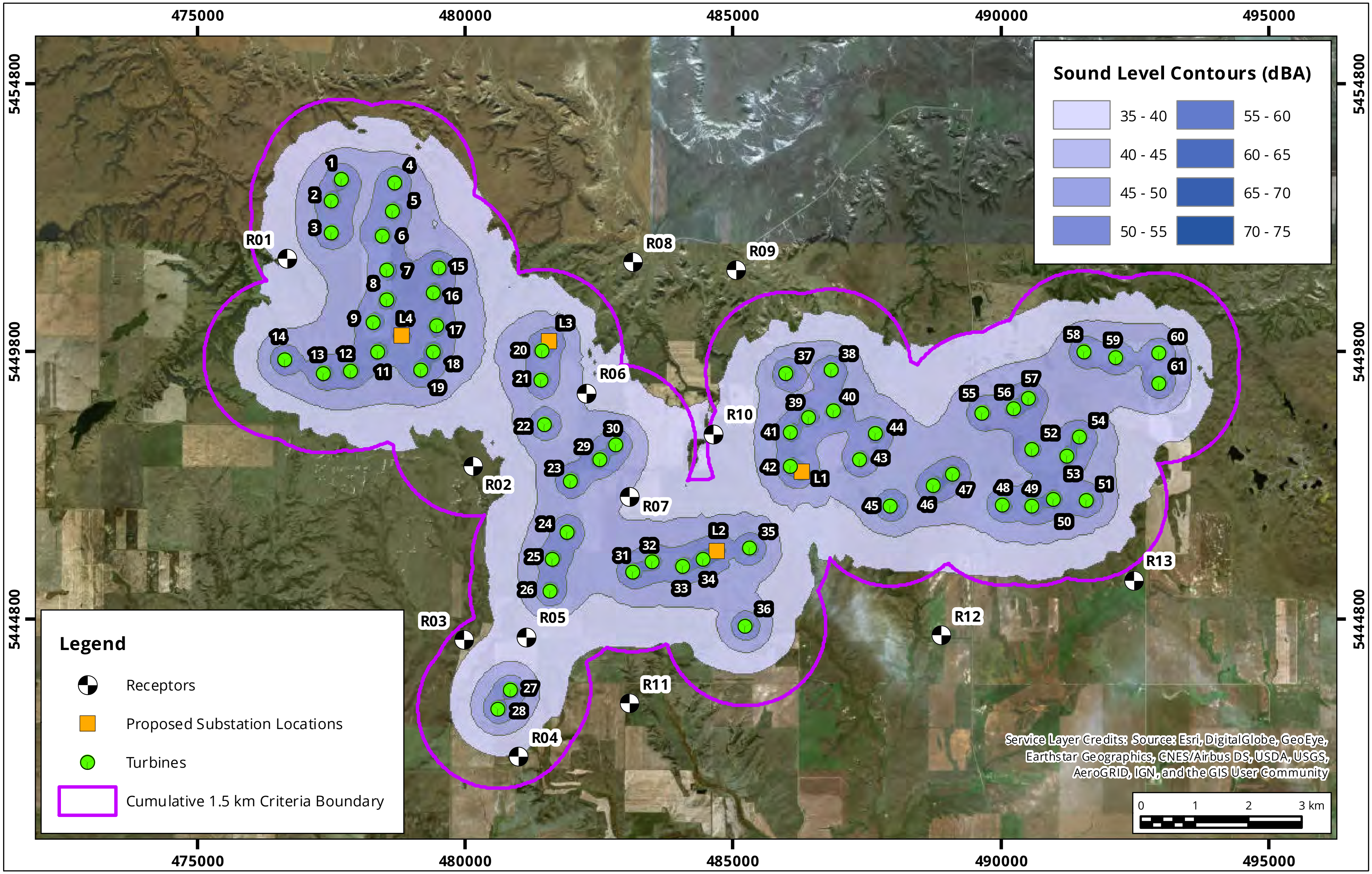
Receptor ID	Mandated Ambient Sound Level[1] (dBA)	Proposed Project Contribution (dBA)	Cumulative Sound Level[2] (dBA)	PSL[3] (dBA)	Complies with AUC Rule 012? (Y/N)
R01	45	35.0	45	50	Y
R02	45	32.0	45	50	Y
R03	45	30.6	45	50	Y
R04	45	32.2	45	50	Y
R05	45	34.8	45	50	Y
R06	45	37.3	46	50	Y
R07	45	37.4	46	50	Y
R08	45	25.4	45	50	Y
R09	45	25.8	45	50	Y
R10	45	33.4	45	50	Y
R11	45	28.7	45	50	Y
R12	45	28.1	45	50	Y
R13	45	26.8	45	50	Y

Notes: 1 - Ambient sound level as outlined by AUC Rule 012, Table 1.
2 - The cumulative sound level is the logarithmic sum of mandated ambient and the project contribution.
3 - Permissible sound level as outlined by AUC Rule 012.

Table 6: Assessment of Compliance with Nighttime PSLs

Receptor ID	Mandated Ambient Sound Level[1] (dBA)	Proposed Project Contribution (dBA)	Cumulative Sound Level[2] (dBA)	PSL[3] (dBA)	Complies with AUC Rule 012? (Y/N)
R01	35	35.0	38	40	Y
R02	35	32.0	37	40	Y
R03	35	30.6	36	40	Y
R04	35	32.2	37	40	Y
R05	35	34.8	38	40	Y
R06	35	37.3	39	40	Y
R07	35	37.4	39	40	Y
R08	35	25.4	35	40	Y
R09	35	25.8	35	40	Y
R10	35	33.4	37	40	Y
R11	35	28.7	36	40	Y
R12	35	28.1	36	40	Y
R13	35	26.8	36	40	Y

Notes: 1 - Ambient sound level as outlined by AUC Rule 012, Table 1.
2 - The cumulative sound level is the logarithmic sum of mandated ambient and the project contribution.
3 - Permissible sound level as outlined by AUC Rule 012.



Outlaw Trail Wind Power Project

Predicted Noise Contours - Project Only

Map Projection: NAD 1983 UTM Zone 13N

BluEarth Renewables Inc. - Saskatchewan

True North

Project #: 1700812

Drawn by: ABU	Figure: 2
Approx. Scale:	1:100,000
Date Revised:	Mar 15, 2018

6.3 Low Frequency Noise

The C-Weighted sound level (dBC) results generated by the OTWPP have been reviewed for the receptors to determine if there is potential for LFN due to the Project. The first part of the definition of LFN reviews the difference between C-weighted and A-weighted sound levels from the Project. The analysis shows three receptors where the C-weighted-Aweighted values exceed 20 dB with the greatest difference being 21.6 dB at receptor R12, as shown in Table 7.

Table 7: Low Frequency Noise Potential

Receptor ID	C-Weighted Sound Level	A-Weighted Sound Level	dBC-dBA
R01	53.8	35	18.8
R02	51.3	32	19.3
R03	49	30.6	18.4
R04	50.4	32.2	18.2
R05	53.2	34.8	18.4
R06	55.4	37.3	18.1
R07	55.8	37.4	18.4
R08	45.1	25.4	19.7
R09	45.8	25.8	20.0
R10	52.4	33.4	19.0
R11	49.3	28.7	20.6
R12	49.7	28.1	21.6
R13	45.4	26.8	18.6

The second condition that defines LFN in Rule 012 is the presence of tonal sound at frequencies lower than 250 Hz. The Vestas 1/3 octave bands provided in Appendix C were analyzed using the tonal analysis provided by the AUC in Appendix E of AUC Rule 012. The tonal analysis comprises of two parts, a calculation of the low frequency 1/3 octave band data and a comparison of the individual octave band data. The Vestas 1/3 octave bands for all modelled turbines were found to have no octave band that was ≥10 dB within two octave bands less than 250 Hz. The comparison of 1/3 octave data bands also indicated no tonal component.

The Vestas 1/3 octave band data has no tonality present according to American National Standards Institute (ANSI) and the Acoustical Society of America (ASA) standard practice for determining tones (ANSI 2005).

Given the second condition defining LFN is not met, the potential for and LFN issue or complaint is considered to be low.

7 CONSTRUCTION NOISE

AUC Rule 012 requires Licensees to manage the impact of construction noise. Construction plans are not available at this stage of Project design; so quantitative effects are not known. BER will consider construction-generated noise in its execution plans and through the consultation program, including the following measures identified in Rule 012:

a) Conduct construction activity between the hours of 7 a.m. and 10 p.m., where practical
b) Advise nearby residents of significant noise-causing activities and schedule these events to reduce disruption to them
c) Ensure that all internal combustion engines are well maintained with muffler systems

8 CONCLUSIONS

This assessment was completed using the methods and criteria as set out in AUC Rule 012: Noise Control. The results show that cumulative noise levels including the OTWPP will comply with PSL limits at residences as calculated using AUC Rule 012 guidelines.

Although the low frequency analysis showed some dBC-dBA values were greater than 20 dB, the tonal sound from the turbines was not present. Therefore, the potential for a low frequency noise issue or complaint is low.

9 REFERENCES

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APPENDIX A

APPENDIX A: PRACTITIONER BIOGRAPHIES

Teresa Drew, B.Sc., INCE. Technical Director

Teresa joined RWDI in 2011 as a Senior Consultant/Technical Director for the Noise group in the Calgary office. Teresa is an accomplished professional with over 25 years of consulting experience, focused on the acoustic environment. She has extensive experience in project management, acoustic & environmental consulting, environmental impact assessments and industrial permit applications. The skills Teresa has acquired in the acoustics field have allowed her to play a prominent role in both domestic and international projects for multiple industries.

Her experience in the wind power industry includes applications, noise predictions, and compliance monitoring and policy development. She has lead the technical studies for provincial (Alberta and British Columbia) power project approvals as well as provided expert testimony at federal, provincial and municipal level hearings.

Daniel Kremer, M.Sc., E.I.T. Intermediate Scientist/Engineer.

Daniel joined RWDI in 2013 as a Noise & Vibration Scientist specializing in environmental noise. He has completed many environmental noise studies for regulatory compliance in Alberta and British Colombia. His work has focused on long-term monitoring programs, sound source measurements and predictive modelling for noise and acoustics to support regulatory requirements (AUC Rule 012, AER Directive 038).

His experience is focused on environmental noise related to energy, oil & gas, and mining applications in Western Canada and includes oil sands mining, in-situ oil sands projects, conventional oil and gas extraction, and wind turbine projects. His expertise has been to model and develop noise strategies for large scale projects for future developments at the provincial and federal levels.

Daniel has experience in the planning and post construction stages of wind power development, and in providing analysis and reporting to meet regulatory requirements (AUC Rule 012). He has provided detailed analysis on the relationships between meteorological conditions and turbine operating parameters, and the effects at receptors, including conducting comprehensive post-construction sound level surveys for wind turbines.

APPENDIX B

APPENDIX B: ENVIRONMENTAL NOISE DESCRIPTORS AND TERMINOLOGY

Abnormal noise events

Noises that are sufficiently infrequent as to be uncharacteristic of an area or that occur so close to the microphone as to dominate the measurements in an unrealistic manner. Consideration must be given to deleting occurrences of abnormal noise from the measurements to obtain a reasonably accurate representation of the sound environment. Examples of abnormal noises include a dog barking close to the microphone, a vehicle passing nearby, people talking in the vicinity of the microphone in a quiet environment, or a passing road grader.

Airborne Sound

Sound that reaches the point of interest by propagation through air.

Ambient noise or sound

All noises that exist in an area and are not related to a facility under study. Ambient noise may include sound from other existing industrial facilities, transportation sources, animals, and nature. Context for ambient noise should be defined for each project.

Attenuation

The reduction of sound intensity by various means (e.g., air, humidity, porous materials, etc.)

A-weighted sound level

The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear.

A-weighting shows that the measured sound pressure levels have been filtered using a frequency weighting network that mimics the response of the human ear.

The resultant sound pressure level with the associated unit “dBA” is therefore a representative of the subjective response of the human ear. The weightings are assigned in a way to reflect the higher sensitivity of human ear to sound in the mid and high frequency band as shown in the curve labelled A-weighting in Figure B-1.

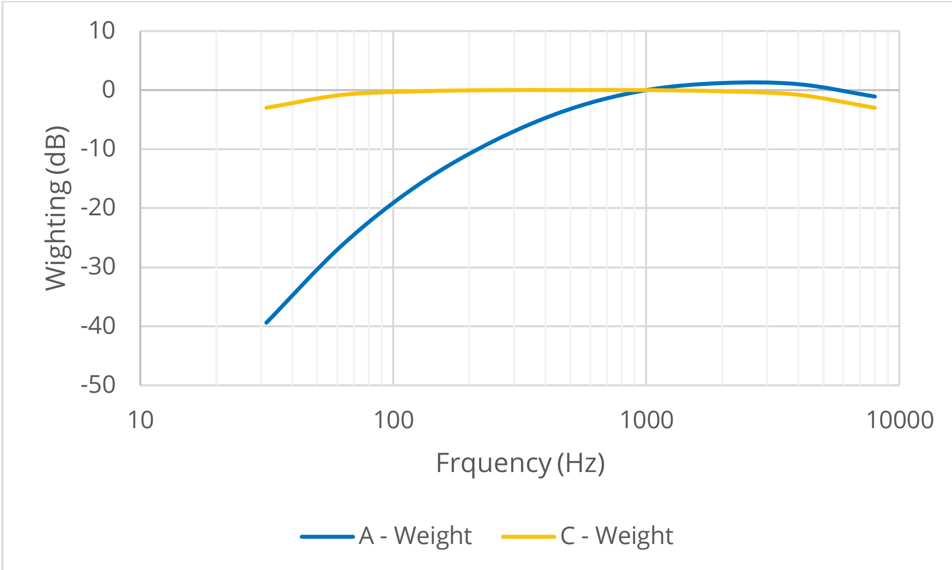


Figure B-1 Sound Weighting Network

Calibration

The procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Calibration must take place before and after the sound level measurements.

C-Weighted Sound Level

The sound level as measured on a sound level meter using a setting that emphasizes the low and middle frequency components. The weightings are assigned as shown in the curve labelled C-weighting in Figure B-1. The resultant sound pressure level is reported with the associated unit "dBC"

Daytime

Defined as the hours from 07:00 to 22:00.

dB (decibel)

A unit of measure of sound pressure that compresses a large range of numbers into a more meaningful scale. Hearing tests indicate that the lowest audible pressure is approximately 2 x 10-5 Pa (0 dB), while the sensation of pain is approximately 2 x 102 Pa (120 dB). Generally, an increase of 10 dB is perceived as twice as loud.

dBA

The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response at low frequencies.

dBC

The decibel (dB) sound pressure level filtered through the C filtering network to highlight low and middle frequencies.

Dwelling

Any permanently or seasonally occupied residence with the exception of an employee or worker residence, dormitory, or construction camp located within an industrial plant boundary. Trailer parks and campgrounds may qualify as a dwelling unit if it can be demonstrated that they are in regular and consistent use during the applicable season.

Energy equivalent sound level (Leq)

The Leq is the average A-weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. If a sound level is constant over the measurement period, the Leq will equal the constant sound level where f is the fraction of time the constant level L is present.

Standardized Wind Speed at 10 m

The standardized wind speed at a height of 10 m is calculated in accordance with IEC 614000-11 (2012) and is given below. In the case of calculating the standardized wind speed for turbines in Alberta, a roughness length of 0.05 m is used, which is representative of farmland with vegetation.

$$V_H = V_{10}\left[\frac{\ln\left(\frac{H}{z_{0ref}}\right)}{\ln\left(\frac{10}{z_{0ref}}\right)}\right]$$

Where:

V_H is the wind speed at hub height z (m), determined from the power curve;

V_{10} is the standardized wind speed at 10m;

z_{0ref} is the reference roughness length of 0.05 m; and

H is the rotor centre height (m).

Far Field

Describes a region in free space where the sound pressure level from a source obeys the inverse-square law (the sound pressure level decreases 6 dB with each doubling of distance from the source). Also, in this region the sound particle velocity is in phase with the sound pressure. Closer to the source where these two conditions do not hold constitutes the “near field” region.

Frequency

The number of times per second that the sine wave of sound or of a vibrating object repeats itself. The unit is expressed in hertz (Hz), formerly in cycles per second (cps).

Human Perception of Sound

The human perception of noise impact is an important consideration in qualifying the noise effects caused by projects. The following table presents a general guideline.

Table B-1 Human Perception of Sound

Increase in Noise Level (dBA)	Perception
1 to 3	Imperceptible to possibly perceptible
4 to 5	just-noticeable difference
6 to 9	marginally significant
10 or more	significant, perceived as a doubling of sound level

Impulsive Noise

Single or multiple sound pressure peak(s) (with either a rise time less than 200 milliseconds or total duration less than 200 milliseconds) spaced at least by 500 millisecond pauses. A sharp sound pressure peak occurring in a short interval of time.

L_{EQ}

See Energy equivalent sound level.

Nighttime

Defined as the hours from 22:00 to 07:00.

Noise

Generally defined as the unwanted portion of sound.

Noise Level

This is the same as sound level except that it is applied to unwanted sounds, general the sound level at a point of reception.

Sound

A dynamic (fluctuating) pressure.

Sound level meter (SLM)

An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure level. It normally has several features that would enable its frequency response and averaging times to be changed to make it suitable to simulate the response of the human ear.

Sound Pressure Level (SPL)

The logarithmic ratio of the RMS sound pressure to the sound pressure at the threshold of hearing. The sound pressure level is defined by equation (1) where P is the RMS pressure due to a sound and P0 is the reference pressure. P0 is usually taken as 2.0 × 10-5 Pascals.

(1) SPL (dB) = 20 log(PRMS/P0)

Sound Power Level (PWL)

The logarithmic ratio of the instantaneous sound power (energy) of a noise source to that of an international standard reference power. The sound power level is defined by equation (2) where W is the sound power of the source in watts, and W0 is the reference power of 10-12 watts.

(2) PWL (dB) = 10 log(W/W0)

Interrelationships between sound pressure level (SPL) and sound power level (PWL) depend on the location and type of source.

Spectrum

The description of a sound wave's resolution into its components of frequency and amplitude.

Speed of Sound in Air

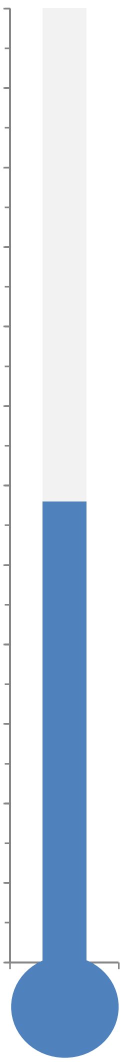
344 m/s at 70°F (21°C) in air at sea level.

Tonal Components

Some industrial facilities typically exhibit a tonal component. Examples of tonal components are transformer hum, sirens, and piping noise. The test for the presence of tonal components consists of two parts. The first part must demonstrate that the sound pressure level of any one of the slow-response, A-weighted, 1/3-octave bands between 20 and 16000Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two 1/3-octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within 2 bandwidths on the opposite side. The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

RELATIONSHIPS BETWEEN EVERYDAY SOUNDS

Deafening | Very Loud | Loud | Moderate | Faint | Very Faint



dBA	Sources of Noise
120	- threshold of feeling / pain
110	- accelerating motorcycle a few feet distance
	- loud auto horn 3 m (10 ft) away
100	- aance club / maximum human vocal output
	- jack hammer at 15 m (50 ft) distance
90	- indoors in a noisy factory
	- heavy truck pass-by at 15 m (50 ft) distance
80	- noisy bar or school cafeteria
	- near the edge of a major highway / inside an automobile travelling at 60 km/h
70	- noisy restaurant
	- normal human speech (unraised voice) at 1 m (3 ft) distance
60	- typical background noise in large department store
50	- inside average urban home/moderate rainfall/quiet street
40	- typical sound in a library
	- average background sound level in remote Alberta (Per AER/AUC)
30	- bedroom of a country Home
	- average whisper
20	- deep woods on a very calm day
10	
0	- threshold of hearing

APPENDIX C

APPENDIX C: TURBINE LOCATIONS

Table C-1: Turbine Locations

Turbine Number	UTM Coordinates (NAD 83, Zone 13)		Turbine Number	UTM Coordinates (NAD 83, Zone 13)	
	Easting (m)	Northing (m)		Easting (m)	Northing (m)
1	477668	5453007	32	483476	5445866
2	477481	5452613	33	484052	5445786
3	477478	5452010	34	484430	5445909
4	478671	5452953	35	485313	5446118
5	478635	5452425	36	485226	5444673
6	478436	5451959	37	485986	5449399
7	478529	5451311	38	486820	5449453
8	478520	5450762	39	486406	5448574
9	478267	5450351	40	486877	5448689
11	478357	5449787	41	486069	5448280
12	477848	5449438	42	486072	5447651
13	477336	5449399	43	487367	5447784
14	476608	5449654	44	487659	5448258
15	479488	5451370	45	487935	5446911
16	479401	5450892	46	488738	5447294
17	479457	5450274	47	489098	5447511
18	479395	5449793	48	490033	5446930
19	479158	5449454	49	490588	5446912
20	481423	5449821	50	490973	5447041
21	481414	5449264	51	491601	5447012
22	481478	5448436	52	490579	5447967
23	481959	5447388	53	491244	5447843
24	481896	5446426	54	491470	5448200
25	481618	5445926	55	489647	5448657
26	481575	5445331	56	490235	5448727
27	480832	5443479	57	490522	5448921
28	480604	5443128	58	491546	5449794
29	482797	5448051	59	492149	5449682
30	482504	5447771	60	492951	5449763
31	483116	5445683	61	492954	5449204

Table C-2: Substation Locations

Substation Location	UTM Coordinates (NAD 83, Zone 13)	
	Easting (m)	Northing (m)
Substation Location 1	486283	5447540
Substation Location 2	484691	5446070
Substation Location 3	481558	5449980
Substation Location 4	478801	5450100