

## Solar Krafte Utilities Inc.

### Stirling Solar Project

# Wildlife Assessment Report

REFERENCE NUMBER: B-0051-17



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## EXECUTIVE SUMMARY

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Basin Environmental Ltd. was retained by Solar Krafte Utilities Inc. to conduct a wildlife assessment at the proposed Stirling Solar Project (the Project). The Project is located in the southwest corner of Section 27, Township 06, Range Road 19, West of the 4<sup>th</sup> Meridian (SW 27-6-19-04). The Solar Photovoltaic (PV) facility will generate up to 17.4 megawatt (MW) of electric power that will be added to the Fortis Alberta distribution feeder.

The purpose of the wildlife assessment was to identify species at risk located within the Project area and the surrounding 1 kilometre (km) buffer. In addition, the wildlife assessment identified the presence of sensitive habitat, and potential impacts that the Project may have on species at risk and their habitat. The results of the wildlife assessment were used to assist with Project siting, and to address, minimize or mitigate potential impacts.

The wildlife surveys were conducted from April to October 2017 to identify the potential for species at risk to occur within the Project area. Wildlife concerns were identified, through targeted surveys selected from consultation with the AEP Regional Wildlife Biologist, and surveys outlined in the Wildlife Guidelines for Alberta Solar Energy Projects (AEP 2016a). The wildlife surveys that were recommended to target potential species at risk included breeding birds, migratory birds, burrowing owl, sharp-tailed grouse, raptor nests surveys and amphibian species at risk.

No species at risk were observed during any of the wildlife surveys, however, a black-necked stilt (*Himantopus mexicanus*) and a great blue heron (*Ardea herodias*) were previously documented approximately 600 m northwest of the Project area, within the 1 km buffer. An active Swainson's hawk (*Buteo swainsoni*) nest was observed approximately 550 m northwest of the Project area, in a clump of deciduous trees adjacent to Highway 4. There are no mature trees within the Project area for nesting raptors.

The availability of wildlife habitat within the Project area is low due to ongoing disturbance from crop cultivation, livestock grazing, and a lack of native grassland habitat. Wildlife use within the area is primarily for foraging rather than denning or nesting habitat due to a lack of diverse habitat structure and vegetation composition, as well as the existence of more suitable habitat in surrounding land. Therefore, siting the Stirling Solar facility on previously disturbed land minimizes potential impacts to wildlife.

Two wetlands were identified within the Project area, a Class I ephemeral wetland (Wetland 2) and a Class III seasonal wetland (Wetland 1). Both wetlands were dry at the time of the assessment and heavily grazed by livestock. A 10 m setback will be established around the Class

I wetland, and a 50 m setback around the Class III wetland. The reduced setback is not expected to increase the risk to wildlife due to the lack of wildlife habitat available and ongoing livestock grazing. The dugout, which is fenced in, lacks emergent vegetation therefore does not provide suitable amphibian and bird nesting habitat; however, the dugout will be avoided by the Project. The irrigation canal will be avoided by a 30 m to 35 m setback; however, impacts from Project activities will be low due to ongoing fluctuations in water levels throughout the year which does not provide suitable, stable amphibian habitat.

Pre-construction clearing and may potentially impact bird nests, burrows, dens as well as direct impact from vehicle collisions during construction. To ensure the risk to wildlife is low during construction and operation, the mitigation measures outlined in Section 5 will be in place to eliminate and/or minimize potential impacts. A qualified environmental professional will be on site to monitor construction of the Stirling Solar Project to ensure that the mitigation measures are in place and are being followed, to ensure the safe relocation of any potential wildlife (with AEP's approval) that may be encountered during construction, and to ensure that all of the applicable environmental laws and regulations are being followed.

To determine the effectiveness of the mitigation measures established during construction and operation, wildlife biologists will conduct post-construction monitoring of the facility for a minimum of 3 years once the facility is operational, to identify any ongoing impacts or risks to wildlife. Wildlife surveys will be conducted on an annual basis to document wildlife mortality, determine carcass removal and searcher efficiency and to monitor potential impacts that the Stirling Solar Project may have on species at risk, sensitive species and other wildlife.

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Appendix C	Breeding Bird Results
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Appendix E	Stirling Solar Project Site Plan
Appendix F	Wetland Assessment and Impact Report

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## 1.0 INTRODUCTION

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### 1.1 PROJECT OVERVIEW

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Solar Krafte Utilities Inc. (Solar Krafte), Belectric and innogy SE propose to permit, construct and operate the Stirling Solar Project, a 17.4 megawatt (MW) Solar Photovoltaic (PV) facility located approximately 1.6 kilometers (km) east of Stirling, Alberta (the Project). The Project is in the White Area in SW-27-6-19 W4M (Figure 1).

### 1.2 PROJECT DESCRIPTION

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The Project will consist of flat, single access trackers with solar PV modules set up in a north/south direction to allow the solar PV system to track/ tilt with the sun in an east to west direction. Computer controlled electric motors will power the trackers. The Project will transfer electric power generated by the solar PV system through an underground cable and directly into the 25 kilovolt (kV) Fortis Alberta distribution feeder located on the roadway. Two Class VI access roads will be constructed, one on the west side of the Project from Range Road 193, and one on the south side from Township Road 64 to allow access to the electrical inverters. The Stirling Solar Project will encompass an area of approximately 61.3 hectares (ha), however, the proposed footprint consisting of the solar arrays, inverters and access roads will only be 15.7 ha. Construction of the Project is anticipated to occur between April of 2018 and March 2019.

The specific make and model of the solar PV modules have not yet been identified. However, the total number of modules installed is not expected to exceed 175,000, and given advancement in solar PV technology, it is expected that the impacted area may be reduced prior to commercial operation. For the design reference case, the Project is using 174,180 First Solar FS-4120-3 modules. These modules are 1.2 meters (m) in length and 0.6 m in width, and each produces 120 watts of DC power. The modules are mounted 4 wide on the tracker, for a total array width of 2.54 m. The module racking allows for small gaps between the modules, ergo individual drip edges, thus no material impact on stormwater attenuation. The trackers are installed 3.81 m apart.

Basin Environmental Ltd. (Basin) was retained by Solar Krafte to conduct a wildlife assessment of the proposed Stirling Solar Project. In accordance with Alberta Utilities Commission (AUC) Rule 007 (AUC 2016), the Wildlife Assessment Report will be submitted to Alberta Environment and Parks (AEP) for review and sign off. AEP will issue a *Wildlife Renewal Energy Referral Report* to be submitted with the application to the AUC.

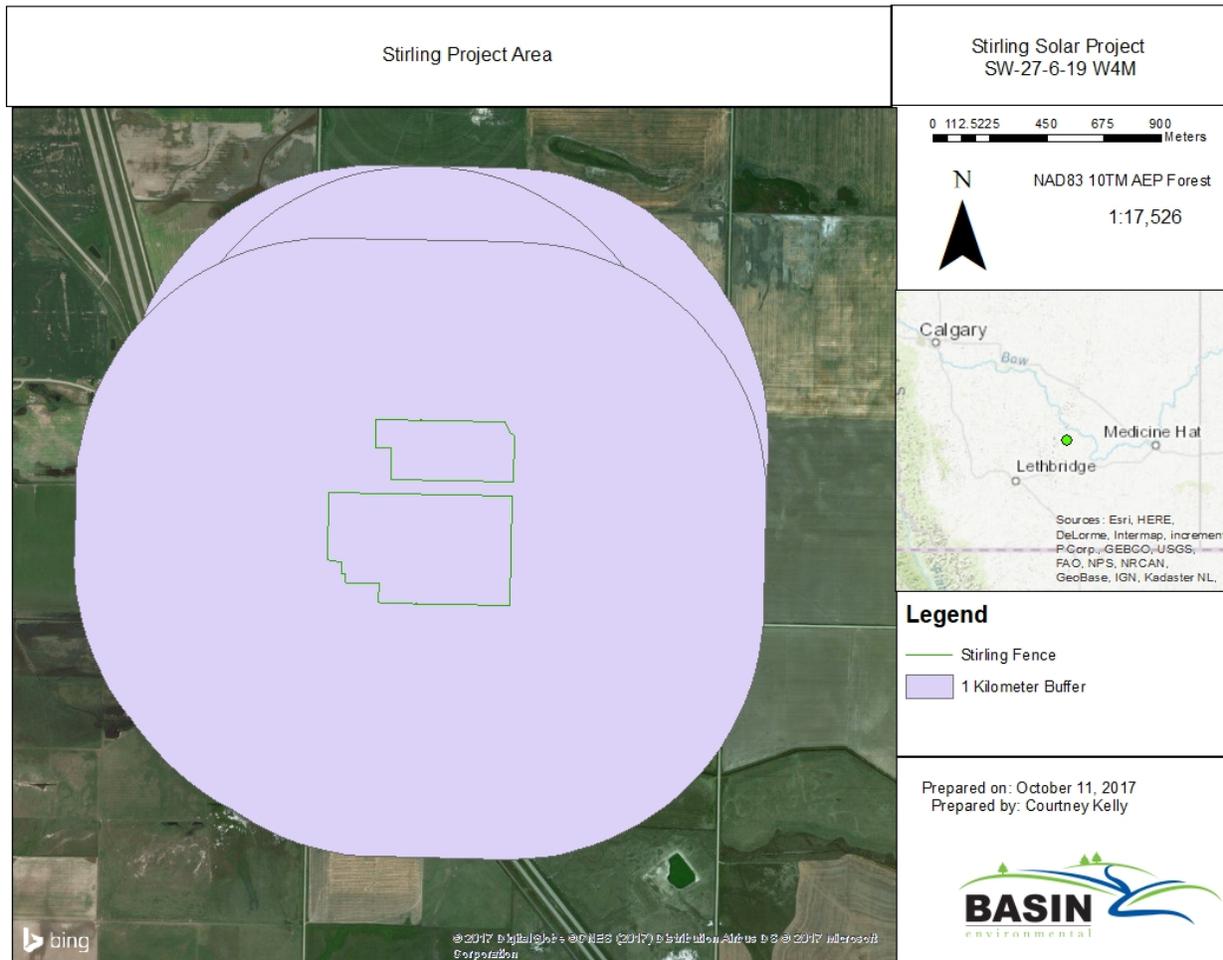


FIGURE 1. LOCATION OF THE STIRLING SOLAR PROJECT WITHIN ALBERTA

### 1.3 PURPOSE

The purpose of the wildlife assessment was to identify species at risk located within the Project area and the surrounding 1 km buffer. In addition, identify the presence of sensitive habitats used for migration, breeding, rearing, and overwintering. Potential impacts that the Project may have on species at risk and their habitat will be identified to assist with Project planning, and to address, minimize or mitigate potential impacts which the Project may cause.

Preliminary consultations with the regional biologist with Alberta Environment and Parks (AEP) outlined the potential for species at risk to occur within the Project area. To assess the potential for wildlife concerns it was determined that the following surveys would be conducted: breeding

and migratory bird, burrowing owl, sharp-tailed grouse, raptor nest, and amphibian species at risk.

For this assessment, wildlife species at risk were defined as:

- Species listed in Alberta’s general assessment as ‘At Risk’, ‘May Be at Risk’ and ‘Sensitive’ (AEP 2017a).
- Legally designated species listed under the Alberta *Wildlife Act* as ‘Endangered’, ‘Threatened’ and ‘Special Concern’ (AEP 2015).
- Species listed in Schedule 1 of the *Species at Risk Act* (Government of Canada 2017).
- Species listed as ‘Endangered’, ‘Threatened’ and ‘Special Concern’ under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Government of Canada 2017).

## 1.4 REGULATORY SETTING

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Potential impacts on wildlife and wildlife habitat are subject to provincial and federal legislation as well as approval from AEP as per Rule 007 (AUC 2016).

### 1.4.1 MIGRATORY BIRDS CONVENTION ACT

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The *Migratory Birds Convention Act (MBCA)* protects and conserves migratory bird populations, individuals, and their nests. The *MBCA* is administered by Environment and Climate Change Canada (ECCC) through the Canadian Wildlife Service (CWS) and applies to the following migratory birds (refer to Environment Canada 1991 for the full list of species protected by the *MBCA*):

- Songbirds (e.g., swallows, robins, woodpeckers)
- Waterfowl (e.g., ducks, swans, loons)
- Shorebirds (e.g., sandpipers, killdeer)
- Cranes (e.g., herons, egrets)

Section 6 of the Migratory Bird Regulations prohibits the disturbance, destruction, or removal of a nest, egg or nest shelter of a migratory bird. Section 5(1) of the *MBCA* prohibits the deposition of oil, oil wastes, or other substances harmful to migratory birds in any waters or any areas frequented by migratory birds. During the breeding season, as per CWS’ recommendations, a minimum 30 m buffer should be placed around songbird nests and a minimum 100 m buffer around raptor and waterfowl nests.

CWS does not issue permits or authorizations for the removal of migratory birds, their nests or eggs, therefore mitigation measures and best management practices identified in Section 5.0 should be followed to prevent contravention of the *MBCA*.

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#### 1.4.2 SPECIES AT RISK ACT

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The *Species at Risk Act (SARA)* is a key tool for the protection and conservation of Canada's biological diversity and native species. The goal of *SARA* is to prevent wild species from becoming extinct or extirpated; to aid in the recovery of species at risk; and, to ensure species listed as 'Special Concern' do not become endangered or threatened (Government of Canada 2017).

COSEWIC assesses, designates the status of a species and recommends the species for legal designation under *SARA*. Those species added to the List of Wildlife Species at Risk (Schedule 1) are protected from the following offenses under *SARA*:

- *“To kill, harm, harass, capture or take an individual;*
- *to possess, collect, buy, sell or trade an individual or any part of an individual; and,*
- *to damage or destroy the residence (e.g., nest or den) of one or more individuals”.*

Although species listed as 'Special Concern' are protected in part through management plans, none of the above restrictions apply to these species.

*SARA* also has a provision to protect 'critical habitat' which is necessary for the survival and/or recovery of a species at risk. If clearing and construction are expected to destroy 'critical habitat' for a species listed in Schedule 1, potential regulatory requirements may need to be met depending on jurisdiction and land ownership.

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#### 1.4.3 ALBERTA'S WILDLIFE ACT

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The *Wildlife Act* and Wildlife Regulation provide the legislation and regulatory provisions to protect and manage wildlife in Alberta. The Minister responsible for Fish and Wildlife Management has the authority under the *Wildlife Act* to influence and control human activities that may have direct adverse effects on the populations and habitat of wildlife species. The *Wildlife Act* [Sec. 103 (1) (u)] enables the Minister to establish regulations, *“...respecting the protection of wildlife habitat and restoration of habitat that has been altered, and enabling the Minister to order persons responsible for the alteration to restore the habitat and to charge them with the cost of it if they have failed to affect the restoration.”*

The Scientific Subcommittee (SSC) of the Endangered Species Conservation Committee (ESCC) reviews detailed status reports for species listed with a general status of ‘At Risk’ or ‘May Be at Risk’. The ESCC provides recommendations to the Minister of AEP who then determines if the species will be legally designated (e.g., Endangered or Threatened) under the *Wildlife Act*. Schedule 6 of the Wildlife Regulation lists the species that are legally designated.

Section 36(1) of the *Wildlife Act*, states that: “A person shall not willfully molest, disturb or destroy a house, nest or den of prescribed wildlife or a beaver dam in prescribed areas and at prescribed times”. If the proposed development is anticipated to disturb or destroy habitat of wildlife species listed under the Schedule 4 of the *Wildlife Act* Regulation, potential regulatory requirements may need to be met.

Those bird species that are not protected under federal legislation are protected by the *Wildlife Act* and include upland game birds (e.g., grouse, quail, pheasants, ptarmigan), raptors (e.g., hawks, owls, eagles, falcons), cormorants, pelicans, crows, jays, kingfishers and some blackbirds.

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#### 1.4.4 GENERAL STATUS OF ALBERTA WILDLIFE SPECIES

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The General Status of Alberta’s Wild Species is a report that is generated every five years as new knowledge and research becomes available, the last one was completed in 2015 (AEP 2017a). The report details the status listing of all of the vertebrate species in Alberta determined by evaluating population trends, abundance and distribution, and threats to a species and habitat.

The Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta (Alberta Government 2011) identifies specific restricted activity periods and disturbance setback distances for select wildlife species.

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#### 1.4.5 WILDLIFE DIRECTIVE FOR ALBERTA SOLAR ENERGY PROJECTS

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The new Wildlife Directive for Alberta Solar Energy Projects (AEP 2017b) provides standards and recommendations for solar energy projects in Alberta to avoid, minimize or mitigate risk to wildlife and wildlife habitat during the siting, construction and operational phases. The Directive is an update of the Wildlife Guidelines for Alberta Solar Energy Projects (AEP 2016a) which previously described the pre-construction survey requirements and the post-construction monitoring requirements for solar projects in Alberta.

The Directive, in conjunction with consultation with the Regional AEP Wildlife Biologist, details the required wildlife surveys necessary to provide baseline data for each solar energy

project. All wildlife surveys are required to follow the methods outlined in the Sensitive Species Inventory Guidelines (Alberta Government 2013), unless otherwise specified by Regional AEP Wildlife Biologist, and are to be conducted within the Project area, and a 1 km buffer surrounding the Project area. Results from the pre-construction wildlife surveys are valid for a period of 2 years. Should construction and operation not occur within 5 years, then new pre-construction surveys are required.

Risks that are unable to be avoided or minimized are addressed in a construction and operation mitigation plan where site- and/or species-specific mitigation and timing restrictions are outlined. To assess the effectiveness of the recommended mitigation, post-construction wildlife monitoring will be conducted to identify any ongoing wildlife risks from the operation of the solar energy project. A post-construction monitoring and mitigation plan will evaluate and identify the solar energy project's impacts on wildlife over a period of 3 years. If high levels of risk to wildlife are found during the monitoring surveys, then mitigation measures outlined in the plan will be implemented and/or acceptable alternatives developed in consultation with the Regional AEP Wildlife Biologist, and a further 2 years of monitoring will occur to ensure the measures are successful in minimizing risk to wildlife.

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#### 1.4.6 AUC RULE 007

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Approval under AUC Rule 007 - Applications for Power Plants, Substations, Transmission Lines, Industrial System, Designations and Hydro Developments (AUC 2016) is required to alter, construct, connect or operate power plants, substations and transmission lines and industrial systems designations.

The wildlife assessment has been completed following the Wildlife Directive for Alberta Solar Energy Projects and will be submitted to Kristin Cline, AEP's Renewable Energy Projects Wildlife Biologist for Approval. Once approved, AEP will issue a signed copy of the *Wildlife Renewable Energy Referral Report* to Solar Krafte for submission with their application to the AUC.

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## 2.0 METHODS

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### 2.1 DESKTOP REVIEW

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Prior to the field assessments, background information and environmental data were reviewed to identify sensitive habitats and wildlife within the Project area and within a 1 km buffer of the Project area. The following sources were used for the desktop review:

- Aerial imagery (Google Earth Pro 2017)
- Alberta Biological Monitoring Institute (2014)
- Alberta Atlas of Breeding Birds (Federation of Alberta Naturalists 2007)
- Environmentally Significant Areas (Fiera Biological Consulting Ltd. [Fiera] 2014)
- Alberta Wild Species Database (AEP 2017a)
- eBird Canada (2017)
- Environment Canada's Bird Conservation Regions (Environment Canada 2013)
- Fish and Wildlife Management Information System (FWMIS) (AEP 2017c)
- FrogWatch Alberta (NatureWatch 2017)
- Important Bird Areas (IBA) (Bird Studies Canada 2017)
- Landscape Analysis Tool (Government of Alberta 2017)
- *Species at Risk Act* Public Registry (Government of Canada 2017)

### 2.2 WILDLIFE SURVEYS

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The wildlife surveys targeting potential species at risk were determined through consultations with Brandy Downey, Senior Species at Risk Biologist at AEP, in addition to, the surveys outlined in the Wildlife Guidelines for Alberta Solar Energy Projects (AEP 2016a). At the time of scoping the field surveys, the Wildlife Directive for Alberta Solar Energy Projects (AEP 2017b) had not yet been issued.

Wildlife surveys were conducted between April and October 2017 in accordance with the methods outlined in the Sensitive Species Inventory Guidelines (Alberta Government 2013). The surveys targeted breeding birds, migratory birds, sharp-tailed grouse (*Tympanuchus phasianellus*), burrowing owls (*Athene cunicularia*), raptor nests and amphibian species at risk. Incidental wildlife species observed during the surveys were also recorded. All the surveys, except for the amphibian surveys, were conducted within the Project area and within a 1 km radius of the Project boundaries. Survey station locations are identified in Figure 2.

Wildlife surveys were conducted by Basin biologists Courtney Kelly, B.Sc., P.Biol., and Dan Cooper, B.Sc., B.I.T. All wildlife observed were identified to species, where possible, and locations of sensitive habitats recorded using a handheld Garmin GPS map 64s. Where necessary and to minimize disturbance, wildlife species observed outside of the biologist's visual range were identified using binoculars and a spotting scope.

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### 2.2.1 BREEDING AND MIGRATORY BIRD SURVEYS

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Breeding and migratory bird surveys were conducted following the point-count survey method outlined in the Sensitive Species Inventory Guidelines (Alberta Government 2013). Two survey stations were established throughout the Project area, approximately 1.1 km apart. Each station was geo-referenced and the weather conditions, time of survey and locations were recorded. Other data recorded included the number of species observed, the direction and estimated distance to the bird, and observed wildlife habitat (e.g., nests).

Two breeding bird surveys were conducted on May 2, 3 and June 28, 2017 to capture grassland bird species breeding throughout the spring season. At each survey station, a 3 to 5 minute a passive survey was conducted and all bird species heard or seen were recorded within a 500 m radius. Other data recorded included the number of species observed, and the direction and estimated distance to the bird. Species observed outside of the 500 m radius were recorded as incidentals.

Spring migratory bird surveys were conducted on April 5, 18, May 2 and 3, 2017 and in the fall on September 1, 27 and October 23, 2017. The surveys were conducted using a point-count survey method in the morning hours from 0545 to 0900 to target songbirds and in the afternoon/early evening from 1400 to 1900 to target raptors and migrating waterfowl. A 3 to 5 minute passive survey was conducted at each station and all bird species detected visually and/or by call/song were identified to species and recorded. Other data recorded included the number of species observed, the direction and estimated distance to the bird, and observed wildlife habitat (e.g., nests).

Due to the overlapping time frame of late spring migratory bird and early breeding bird periods, the migratory and breeding bird surveys were conducted jointly on May 2 and 3, 2017.

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### 2.2.2 SHARP-TAILED GROUSE SURVEY

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Two visual ground surveys were conducted in conjunction with the April 5, 18, May 2 and 3, 2017 migratory bird surveys to identify potential lek sites and the presence of individual sharp-

tailed grouse and their habitat. Observers arrived at the Project location 30 minutes prior to sunrise and the following data was recorded at each survey location: date, start and end time, weather (cloud cover, temperature, wind speed, precipitation), and survey locations were recorded using a handheld GPS.

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### 2.2.3 BURROWING OWL SURVEY

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The burrowing owl surveys consisted of two methods, the call back method and the ground search method, which were used to observe and locate burrowing owls and their nest. Two survey stations were established within the Project area. The stations were geo-referenced and the weather conditions, time of survey and location were recorded. The surveys were completed on May 18, 2017 between 0730 and 0900. Binoculars and a spotting scope were utilized to further identify an individual species and to determine activity if a nest was observed.

Each callback survey was conducted for a total of 7 minutes. At each survey station, the field crew waited for approximately 3 minutes for the owls to adjust from the noise of their arrival. Once the 3 minutes was complete, the call of the burrowing owl was played for a period of 3 minutes using a wildlife caller set to 80 dB. The caller was rotated 360° to ensure calls were broadcasted throughout the entire circumference of the survey area. The field crew watched for owls throughout the entire 3 minute period, and then passively observed for 1 minute. Location, abundance and age were recorded for any observed owls.

Following the callback survey, a ground search was conducted to search for potential nests/burrows. The field crew began the search from the centre of the survey area and walked in concentric circles until they reached 100 m. All burrows with an opening of greater than 10 centimetres (cm) were investigated for sign (*e.g.*, whitewash, feathers, pellets, prey bones or loose soil). Any observed burrows were geo-referenced using a handheld GPS and the number of adults, young of the year and nest status were recorded in the field notes. If an active burrow was located, its activity status was recorded.

Ground truthing for owl sign and burrows was conducted on May 18, 2017 during the wetland surveys.

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### 2.2.4 RAPTOR NEST SURVEY

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Prairie raptor nest surveys were conducted in conjunction with the breeding and migratory bird surveys in April, May and June 2017. The “look and see” approach was used within the Project area and the 1 km buffer, and all observed raptor species and nests were recorded. Where

possible, data collected on individual raptors observed included behaviour (e.g., perching, flying or nesting), number; life stage (e.g., fledgling, juvenile or adult) and sex (if known) was recorded.

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### 2.2.5 AMPHIBIAN SURVEY

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Auditory and visual amphibian surveys were conducted at all wetlands and areas with standing water as well as within a 100 m radius of these features, on April 28, 2017 after sunset. The target species for these surveys included the plains spadefoot toad, great plains toad, and northern leopard frog, however, all amphibian species observed were recorded.

Call surveys were conducted at night when air and water temperatures were a minimum of 10 degrees Celsius (°C), winds were below 20 km/hr and precipitation was minimal (e.g., light rain). Three call surveys were completed during the breeding season to ensure species composition and numbers were obtained. At each survey site, the date, time, weather, cloud cover, temperature and wind levels were recorded. Each survey lasted 3 minutes during which time all amphibian species and number of individuals heard and observed were recorded.

Upon completion of the call survey, a visual survey of each location was completed. The wetlands were surveyed on foot to search for egg masses, tadpoles and adult amphibians along the shallow edges, aquatic vegetation, and substrate. All observations were recorded.

A visual encounter survey for northern leopard frog was conducted on August 22, 2017 due to the increased potential for successful northern leopard frog observations as the frogs are concentrated in a more localized area while the young-of-the-year undergo metamorphosis and disperse from breeding areas (Kendall 2002). The survey was conducted for a minimum of 20 minutes at all waterbodies with standing and/or flowing water when temperatures ranged between 10°C and 25°C. The date, start and end time, weather, temperature (air and water), wind speed, water color and turbidity, substrate and vegetation were recorded. The shallow water zone and shore zone were surveyed by walking at a constant speed around the wetland, and a meter stick was used to flush frogs from potential vegetated habitats. All species observed, including incidental species, as well as their life stage were recorded.



FIGURE 2. LOCATION OF WILDLIFE SURVEY STATIONS WITHIN THE PROJECT AREA AND 1 KM BUFFER

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## 3.0 RESULTS

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### 3.1 DESKTOP REVIEW

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#### 3.1.1 WILDLIFE HABITAT OVERVIEW

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The Project is located within the Mixedgrass Natural Subregion in the Grassland Natural Region (Natural Regions Committee 2006). The Grassland NR, also known as the prairies, is the driest, warmest and most fertile region in Alberta. Distinct habitats in this region include sand plains, dune fields, rocky outcrops and the badlands which provide important breeding habitat for species at risk and local wildlife (Alberta Parks 2014). The Mixedgrass Natural Subregion curves north from the Alberta–Montana border to the Red Deer River in a 50 to 100 km wide band. Undulating and hummocky till plains, level lacustrine areas, and undulating to hummocky eolian deposits are typical landforms in this Subregion. Soils in the Mixedgrass Natural Subregion are predominantly Orthic Dark Brown Chernozems. Vegetation in this Subregion is dominated by mixedgrass communities, with the occurrence of species associated with cooler and moister conditions in comparison with the drier Dry Mixedgrass Natural Subregion. One percent of this Subregion is occupied by open water, with five percent occupied by wetlands. Agriculture forms the dominant land use in this Subregion (Natural Regions Committee 2006).

Land use within the Project area consisted of primarily agricultural crop cultivation and livestock grazing. No native grassland habitat or rare plant species were observed. Two wetlands, a dugout and an irrigation canal were identified within the Project area. The dugout was considered anthropogenic as it did not display classifying characteristics of a wetland.

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#### 3.1.2 ENVIRONMENTAL SENSITIVITIES

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Sensitive features that overlap the Project area include the Burrowing Owl Range; Sharp-tailed Grouse Survey Area; Sensitive Amphibian Range; Sensitive Raptor Range (i.e., bald eagle, ferruginous hawk, golden eagle, peregrine falcon and prairie falcon), and Other Sensitive and Endangered Species (Government of Alberta 2017). The Project is not located within or nearby any Key Wildlife or Biodiversity Zone.

The Project is not located within or nearby any Key Wildlife or Biodiversity Zone (Government of Alberta 2017) or within or near any Important Bird Area (IBA) (Bird Studies Canada 2017). However, the Project is also located within Bird Conservation Region 11 which provides critical

migratory and breeding habitat for waterfowl and over 200 bird species (Environment Canada 2013).

No Environmentally Significant Areas (ESA) are located within the Project area. However, based on the most recent ESA study (Fiera Biological Consulting Ltd. [Fiera] 2014), two ESAs are located north and south of the Project area, including Etzikom Coulee which is approximately 7.0 km northeast; and several wetlands located approximately 4.8 km northwest of the Project area.

The Etzikom Coulee is considered a provincially significant ESA as it is a major glacial spillway, and contains one of the few nesting areas for Clark’s grebes (*Aechmophorus clarkii*) and white-faced ibis (*Plegadis chihi*). In addition, it contains nesting areas for a variety of birds, including burrowing owls (*Athene cunicularia*) and ferruginous hawks (*Buteo regalis*). It is an important area for waterfowl staging and production, as well as moulting and staging area for ducks and geese (Sweetgrass Consultants 1997). The wetlands to the northwest scored high in Criterion 3 (i.e., ecological integrity) based on the new Fiera (2014) criteria for ESAs; however, no additional information was found.

### 3.1.3 SPECIES AT RISK

A desktop review identified 69 species at risk that have the potential to occur within the Project area and surrounding lands (Appendix A, Table 3). A search of the FWMIS database (AEP 2017b) and historical FWMIS records identified two wildlife species at risk documented within the Project area and 1 km buffer (Table 1).

TABLE 1. WILDLIFE SPECIES AT RISK DOCUMENTED WITHIN THE PROJECT AREA AND 1 KM BUFFER

Common Name	Scientific Name	Provincial Designation		Federal Designation	
		Wild Species <sup>1</sup>	Wildlife Act <sup>2</sup>	COSEWIC <sup>3</sup>	SARA <sup>4</sup>
<b>Birds</b>					
black-necked stilt	<i>Himantopus mexicanus</i>	Sensitive	Not Listed	Not Listed	No Status
great blue heron	<i>Ardea herodias</i>	Sensitive	Not Listed	Not Listed	No Status

- Notes:
- 1 Status assigned in the 2015 General Status of Alberta Wild Species (AEP 2017a)
  - 2 *Wildlife Act*, Alberta Queen’s Printer, May 2012.
  - 3 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Government of Canada 2017)
  - 4 Federal Species at Risk Act (SARA), Schedule 1, Public Registry (Government of Canada 2017)

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## 3.2 FIELD SURVEY RESULTS

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Photographs of the sensitive wildlife habitats and features observed within the Project area are depicted in Appendix B.

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### 3.2.1 BREEDING AND MIGRATORY BIRD SURVEYS

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Breeding bird surveys were conducted in the early and late spring to ensure all potential bird species that breed at various times throughout the season are observed. In the early spring survey on May 2 and 3, 51 birds, not including flocks from 12 different bird species were recorded within a 500 m radius of the stations. During the late spring survey on June 28, 11 birds, not including flocks, from 6 different bird species were recorded within a 500 m radius of the stations. Results of the breeding bird surveys are in Table 4 and Table 5 (Appendix C).

Migratory bird surveys were conducted in April and May to target spring migration and from September to the end of October during the fall migration and numbers were recorded within a 500 m radius of the survey stations. During the spring migration surveys, 148 birds, flocks not included, from 16 different species were recorded. During the spring breeding bird and migratory bird surveys, the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*) and red-winged blackbird (*Agelaius phoeniceus*) were the most abundant species observed. No species at risk were observed during the bird surveys.

Three migratory bird surveys were conducted in the fall on September 1, 27 and October 23, 2017. Twelve different bird species and 67 individual birds were recorded during the fall bird migration surveys. During the fall migratory bird surveys, the European starling and Brewer's blackbird (*Euphagus cyanocephalus*) were the most abundant species observed. Results of the migratory bird surveys are in Table 6 and Table 7 (Appendix D).

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### 3.2.2 SHARP-TAILED GROUSE SURVEY

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Sharp-tailed grouse surveys were completed at sunrise before the breeding and migratory bird surveys in April and May. No sharp-tailed grouse, signs of grouse or leks were observed.

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### 3.2.3 BURROWING OWL SURVEY

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No burrowing owls were heard or seen, and no burrows were observed at any of the three survey stations during the May 19, 2017 callback and ground surveys.

### 3.2.4 RAPTOR NEST SURVEY

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An active Swainson's hawk nest and a breeding pair were observed during the raptor nest survey. The nest was located approximately 350 m west of the Project boundary, within the 1 km buffer.

### 3.2.5 AMPHIBIAN SURVEY

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Auditory and visual surveys were conducted at the wetland and along the irrigation canal on April 20, 2017. No amphibian species at risk, tadpoles or egg masses were observed.

A visual survey for northern leopard frogs was conducted along the irrigation canal on August 22, 2017; the wetlands were dry at the time of survey. No frogs were observed.

Amphibian surveys were not conducted for ephemeral breeders (e.g., plains spadefoot toad and great plains toad) due the lack of wetlands within the Project area as well as low precipitation during their breeding period between May 1 and June 30, 2017. These toads are selective breeders and will only emerge from hibernation after a short rainfall event (e.g., minimum of 50 mm in 1 to 5 days) otherwise they will skip years of breeding (Alberta Government 2013).

### 3.2.6 INCIDENTAL WILDLIFE SPECIES

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Incidental wildlife species observed during the wildlife and wetland surveys included a northern harrier (*Circus cyaneus*), western meadowlark and Wilson's snipe (*Gallinago delicata*).

### 3.2.7 SPECIES AT RISK

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No species at risk were observed during the wildlife surveys.

Figure 3 shows the location of the solar facility infrastructure and its proximity to sensitive wildlife habitat.

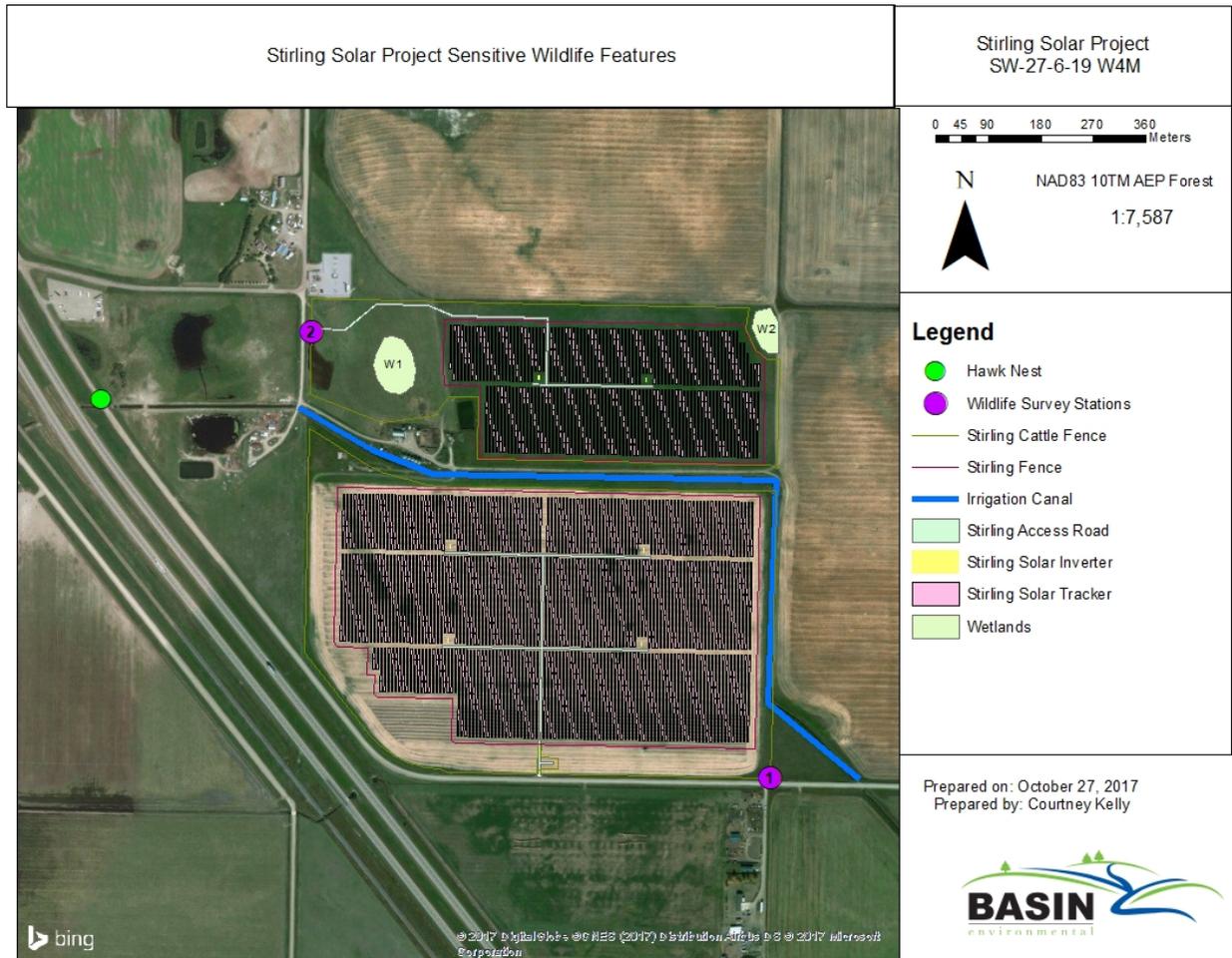


FIGURE 3. OVERVIEW MAP OF THE PROJECT INFRASTRUCTURE, SENSITIVE WILDLIFE HABITAT AND OBSERVED SPECIES AT RISK

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## 4.0 DISCUSSION

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### 4.1 WILDLIFE RESULTS

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The wildlife surveys identified the potential occurrence and presence of species at risk and sensitive wildlife habitat within the Project area as well as within the 1 km buffer. The data gathered from these surveys was used to assist with Project planning and to mitigate potential impacts through adjustments to the solar facility siting location (Figure 4, Appendix E).

The availability of wildlife habitat within the Project area is low due to ongoing disturbance from crop cultivation, livestock grazing, and a lack of native grassland habitat. Impacts to wildlife habitat will be minimal as biodiversity tends to be lower in agriculturally impacted areas (Government of Canada 2011, Turney and Fthenakis 2011) and the wildlife habitat available within the Project area is mostly temporary. Wildlife use within the area is primarily for foraging rather than denning or nesting habitat due to a lack of diverse habitat structure and vegetation composition, as well as the existence of more suitable habitat in surrounding land. Therefore, siting the Stirling Solar facility on previously disturbed land minimizes potential impacts to wildlife.

Two wetlands were identified within the Project area, a Class I ephemeral wetland (Wetland 2) and a Class III seasonal wetland (Wetland 1). Both wetlands were dry at the time of the assessment and heavily grazed by livestock which has caused the removal of all wetland-dependent vegetation and had promoted weed growth. Organic surface matter and soil horizons were not evident, due to pugging and mounding caused by livestock. Detailed information regarding the wetlands and compensation can be found in the Stirling Solar Project Wetland Assessment and Impact Report (Basin 2017) in Appendix F.

Solar Krafte will avoid the Wetland 2 by a 10 m setback and Wetland 1 by a 50 m setback. Although Solar Krafte was unable to achieve the 100 m setback required for Wetland 2 that will be avoided; the reduced setback is not expected to increase the risk to wildlife. The risk will remain low due to ongoing wetland disturbance within the Project area from livestock grazing through the wetland. This disturbance as well as the lack of emergent vegetation impacts nesting habitat. Wildlife use within the area is primarily foraging rather than denning or nesting habitat due to a lack of diverse habitat structure and vegetation composition, as well as the existence of more suitable habitat in surrounding land.

The dugout, which is fenced in, lacks emergent vegetation therefore does not provide suitable amphibian and bird nesting habitat; however, the dugout will be avoided by the Project. A

qualified wildlife biologist will be on site during Project clearing and construction to ensure any observed species are safely captured and relocated, upon approval from AEP, in order to minimize potential impacts to species that may use the wetlands and dugout but that were not observed during the wildlife surveys.

The irrigation canal system which has grassy banks was dry during the spring and fall wildlife surveys, and flowing during the August northern leopard frog survey. As a result of water level fluctuations in the canal, habitat suitability for amphibian species was low. Solar Krafte will maintain a buffer of approximately 30 m to 35 m around the irrigation canal. Potential impacts from Project construction and operation will be minimal as the canal lacks suitable amphibian habitat.

There was no raptor nesting habitat available within the Project area, however, there were small clumps of deciduous trees within the 1 km buffer. A Swainson's hawk nest and a breeding pair were observed west of the Project area. The nest was in a tree on an undeveloped parcel of land, adjacent to Highway 4. A 100 m buffer should be maintained around the nest, if active, if construction is to occur within the breeding season.

No species at risk were observed during any of the wildlife surveys, however, a black-necked stilt and a great blue heron were previously documented approximately 600 m northwest of the Project area, within the 1 km buffer. Habitat loss due to Project activities is low due to a lack of suitable nesting habitat and the availability of similar habitat for foraging outside of the Project area. There is the potential for noise disturbance and human presence during clearing and construction and site maintenance that may temporarily displace wildlife, however, these species will likely find suitable habitat elsewhere. Also, these impacts will be minimized through the implementation of mitigation measures such as nest sweeps prior to clearing and construction, and having a qualified environmental professional onsite during construction to ensure compliance with the appropriate environmental laws and regulations.

During the operation of the solar PV facility, wildlife may benefit from management of the vegetation growing beneath and around the panels if it is mowed, mulched or sprayed and maintained without chemicals, fertilizers and pesticides (RSPB 2014). A cover crop will be planted and used for dust control, and maintained through mowing. To ensure the integrity of the seasonal wetland, the cover crop will not be planted within 50 m of the wetland. Solar Krafte will also consult with local farmers to develop site appropriate noxious and prohibited noxious weed and agricultural pest control methods.

Solar Krafte is working with Alberta honey producers and a professional agrologist to evaluate plant species such as alfalfa, borage, milkvetch and sainfoin as a future cover crop under and

around the solar arrays for honey production. These species are being considered due to their stunted growth and minimal maintenance requirements, once established.

## 4.2 POTENTIAL IMPACTS DURING CONSTRUCTION AND OPERATION

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Environmental assessments of solar PV facilities in the United States, Europe and Africa have shed light on potential wildlife impacts resulting from siting, construction and operation of these facilities. Solar energy is relatively new to Alberta; therefore, the information discussed in this section has been compiled from literature reviews of solar PV facility projects.

To minimize Project impacts, artificial structures can be built to provide suitable habitat for nesting, roosting and hibernating wildlife such as hibernacula for reptiles and amphibians, log piles for invertebrates, and nesting and/or roosting boxes for birds and bats (RSPB 2014).

Potential impacts to wildlife from solar energy development include habitat loss and fragmentation, loss of connectivity, alteration and degradation, and water use (Turney and Fthenakis 2011; RSPB 2014; Bird Life International 2017). Other reports have identified wildlife displacement and mortality as additional impacts from solar PV facility developments (Turney and Fthenakis 2011; RSPB 2014; Bird Life International 2017). Proper siting of the facility may reduce wildlife impacts (Northrup and Wittemyer 2013).

### 4.2.1 HABITAT LOSS AND FRAGMENTATION

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Habitat loss and fragmentation can be the largest contributor to impacts resulting from the siting of the solar PV facility (Bird International 2017) and is an unavoidable result of project developments. Although species at risk require large amounts of connecting habitat and are more susceptible to edge effects and habitat alteration (Fahrig 2003, AEP 2016b), the native grassland habitats within the Project area have been permanently converted to agricultural use, therefore minimizing the impact of habitat loss resulting from the placement of the solar facility.

Fencing will be erected around the perimeter of the proposed Project footprint which will cause some habitat fragmentation. While the fences may exclude some large mammals such as pronghorn, they will not restrict all wildlife movements, as small mammals, birds, amphibians and reptiles should still be able to access the vegetation growing beneath and around the solar arrays by going through and over the fence. Also, to minimize any potential impacts to wildlife movement, where desirable, the bottom of the fence will be raised by six inches to allow for ease of wildlife passage into and out of the facility.

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#### 4.2.2 HABITAT DEGRADATION

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Construction and operation of the Project may result in area avoidance by wildlife due to human presence, and noise impacts during construction activities; however, wildlife species that frequent the Project area may be habitat generalists and may find more suitable habitat nearby. In addition, these wildlife species may be acclimatized to seasonal disturbances from cultivation and farming activities. Impacts to wildlife from noise during the operation of the facility may be minimal as PV solar systems are known to generate electricity without generating noise (Tsoutsos *et. al.* 2005).

The operation of the solar facility will require the use of water to clean the dust and debris off the solar arrays. This use of water may impact local and regional hydrology and associated avifauna (e.g., amphibians, water birds) depending on usage and extraction rate; however, Solar Krafte intends to truck water into the facility from an outside source, which will minimize potential hydrological impacts and subsequent habitat degradation. Also, a water management plan will be implemented prior to facility construction.

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#### 4.2.3 MORTALITY RISK

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There is a risk of wildlife mortality associated with the operation of the solar PV facility. These impacts include incidental wildlife deaths due to the risk of collision with the surface of the panels should they resemble waterbodies (Jenkins *et al.* 2015) and collisions with maintenance vehicles and equipment. Although the risk of collision along the access roads may be lower than the risk to wildlife along Highway 4, Range Road 193 and Township Road 64, which run perpendicular and parallel to the Project area.

The reflection of polarized light from the solar arrays may impact avian foraging behavior, navigation and orientation (US Fish and Wildlife Service 2015), as well as aquatic insects and insectivorous predators (e.g., bats) which may result in direct mortality from collision trauma (Horvath *et.al.* 2009, RSPB 2014, Jenkins *et al.* 2015, Harrison *et. al.* 2016). Other contributors that may influence direct mortality impacts from the solar PV facility may be the siting location and its proximity to bird habitats (e.g., wetlands, migration routes) (Northrup and Wittemyer 2013), geographic setting for bird migration patterns, seasonal differences in species abundance, weather, and daytime vs. nighttime (Walston *et.al.* 2015).

Avian wildlife are at a higher risk of mortality due to collisions and stranding as a result of the “lake effect” hypothesis, which occurs when water birds mistake the large arrays of PV panels as open bodies of water or wetlands (Horvath *et.al.* 2009, Jenkins *et al.* 2015). Diving bird species

such as grebes, coots and loons are at risk of collisions and stranding on the solar arrays as they require water to take flight (Walston *et.al.* 2015). This impact may be minimal for the Stirling Solar Project as there is no permanent wetland habitat within the Project area and other, more important breeding, nesting and migratory habitats are located nearby. It should be noted however, that the “lake effect” hypothesis has not been supported or disproven to date due to the limited number of solar projects reviewed and to inconsistencies of mortality observations by species groups (Walston *et.al.* 2015). There is also a potential risk of collisions with the panels from ground nesting bird species (Harrison *et. al.* 2016) as birds may nest underneath the panels once ground cover has been established. Maintenance of the ground cover outside of the breeding bird season will minimize impacts to ground nesting species.

Carcasses collected at solar energy sites in the United States have included a wide array of taxa including ducks, raptors, rails, shorebirds, and songbirds that have died from collisions with infrastructure and the ground (Kagan *et al.* 2016; Smith and Dyer 2016). To reduce fatalities, RSPB (2014) and Bird Life International (2017) recommends siting the solar PV facility away from water (e.g., wetlands, lakes), and placing white grid partitioning on the solar panels to help reduce or eliminate the polarized light and to deter birds and insects (Horvath *et. al.* 2010).

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## 5.0 CONSTRUCTION AND OPERATION MITIGATION PLAN

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The implementation of the mitigation measures, standards and best management practices outlined in Table 2 will help to minimize the potential impacts identified in Section 4. Regulatory requirements and mitigation measures will be reviewed during pre-job meetings to ensure that all mitigation requirements are understood and can be implemented.

Avoidance is the primary strategy for preventing negative impacts on wildlife. The Project area is currently used for agricultural crop cultivation and livestock grazing, so native grassland habitat will not be impacted by construction and operation activities. The absence of native grassland habitat within the Project area reduces the risk of conflict with nesting birds and other wildlife.

### 5.1 MITIGATION MEASURES

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Minimizing impacts during construction activities will involve good working practices, site restoration and avoidance of sensitive habitats (Tsoutsos *et. al.* 2005). The mitigation measures, outlined in Table 2 are included to minimize and/or eliminate potential impacts to wildlife, species at risk and sensitive habitats.

Sediment and erosion control, and waste water management mitigation measures will be implemented throughout construction to minimize impacts to wildlife and wildlife habitat in and around the Project area.

To further reduce the risk of adverse effects to breeding birds, where possible, construction activities will be scheduled for completion outside of the breeding bird season (April 1 to July 15). If any land clearing or construction activities must be completed within the breeding bird season, pre-construction nest surveys will be conducted by a qualified wildlife biologist. A species-specific setback buffer will be established around any active nests, burrows and dens that are identified, and no construction activity will be permitted within the setback until the nest is determined to be inactive. Species appropriate setbacks are identified in Appendix C of the Wildlife Directive for Alberta Solar Energy Projects (AEP 2017b). For all species that are not listed in the Directive, a 100 m setback will be the standard, unless otherwise discussed with the AEP Regional Wildlife Biologist.

During operation, maintenance of ground cover should not occur during the breeding bird season due to the presence of ground nesting bird species. PV panels should be installed at a sufficient height so that mowing is not needed during the breeding bird season. Any wildlife mortalities

discovered during construction will be investigated and documented. If possible, mitigation will be implemented to prevent future mortalities.

TABLE 2. RECOMMENDED MITIGATION MEASURES FOR THE CONSTRUCTION AND OPERATION PHASES OF THE STIRLING SOLAR PROJECT

Concern	Construction Mitigation	Operation Mitigation
<b>General</b>	<ul style="list-style-type: none"> <li>Project personnel will be provided with an environmental orientation, including site-specific environmental sensitivities and mitigation measures (e.g., spill response plan).</li> </ul>	<ul style="list-style-type: none"> <li>Project personnel will be provided with an environmental orientation, including site-specific environmental sensitivities and mitigation measures (e.g., wildlife mortality reporting).</li> </ul>
<b>Timing Restrictions (where possible)</b>	<ul style="list-style-type: none"> <li>In compliance with the federal <i>Migratory Birds Convention Act</i> and the Alberta <i>Wildlife Act</i>, construction will be avoided during the restricted activity period of April 13 to August 24 (ECCC 2017a) and April 1 to July 15 (AEP 2017b).</li> <li>Amphibian surveys will be required within 100 m of wetlands to determine the presence of breeding habitat for amphibian species at risk. If breeding amphibians are found, construction should occur outside of the overwintering period, and during the breeding and dispersal period (April to August) when amphibians will not be buried in sediment.</li> </ul>	<ul style="list-style-type: none"> <li>In compliance with the federal <i>Migratory Birds Convention Act</i> and the Alberta <i>Wildlife Act</i>, vegetation maintenance will be avoided during the restricted activity period of April 13 to August 24 (ECCC 2017a) and April 1 to July 15 (AEP 2017b).</li> </ul>
<b>Nest Protection</b>	<ul style="list-style-type: none"> <li>If work must be conducted during the breeding bird season, a nest sweep will be required 7 days prior to work commencement and valid for 7 days. Additional sweeps will be</li> </ul>	<ul style="list-style-type: none"> <li>If work must be conducted during the breeding bird season, a nest sweep will be required 7 days prior to work commencement and valid for 7 days. Additional sweeps will be</li> </ul>

<b>Concern</b>	<b>Construction Mitigation</b>	<b>Operation Mitigation</b>
	<p>required after 7 days to prevent contravention of the <i>Migratory Birds Convention Act</i>.</p> <ul style="list-style-type: none"> <li>• Should an active nest be found, a species appropriate setback buffer and timing restriction will be established by a qualified biologist, and the Contractor will be notified.</li> <li>• Active nests, dens or burrows of prescribed species will not be disturbed.</li> </ul>	<p>required after 7 days to prevent contravention of the <i>Migratory Birds Convention Act</i>.</p> <ul style="list-style-type: none"> <li>• Should an active nest be found, a species appropriate setback buffer and timing restriction will be established by a qualified biologist, and the Contractor will be notified.</li> <li>• Active nests, dens or burrows of prescribed species will not be disturbed.</li> </ul>
<b>Noise Abatement (management)</b>	<ul style="list-style-type: none"> <li>• If construction is required during the breeding bird season, noise levels will be monitored to ensure they do not exceed an average of 10 dB above natural ambient levels, or 50 dB (ECCC 2017b).</li> <li>• All equipment will be equipped with functioning mufflers or other appropriate sound dampening devices.</li> <li>• Construction activities will be restricted to daytime hours if possible, to avoid noise disruption at night.</li> </ul>	<ul style="list-style-type: none"> <li>• All equipment will be equipped with functioning mufflers or other appropriate sound dampening devices.</li> </ul>
<b>Vehicle collisions</b>	<ul style="list-style-type: none"> <li>• A 30 km/hour speed limit will be in effect on all access roads within the Project area. Any wildlife mortalities will be reported to AEP.</li> <li>• Vehicle activity in sensitive areas will be minimized.</li> </ul>	<ul style="list-style-type: none"> <li>• A 30 km/hour speed limit will be in effect on all access roads within the Project area. Any wildlife mortalities will be reported to AEP.</li> <li>• Vehicle activity in sensitive areas will be minimized.</li> </ul>
<b>Wetland protection</b>	<ul style="list-style-type: none"> <li>• An environmental professional should be on-site during construction activities. The professional will provide</li> </ul>	<ul style="list-style-type: none"> <li>• A site-specific Erosion and Sediment Control Plan will be developed and implemented to minimize erosion and prevent</li> </ul>

Concern	Construction Mitigation	Operation Mitigation
	<p>instruction to the contracting crew to ensure regulatory compliance for working in/around waterbodies, including wetlands.</p> <ul style="list-style-type: none"> <li>• A site-specific Erosion and Sediment Control Plan will be developed and implemented to minimize erosion and prevent sedimentation within waterbodies during all phases of the project.</li> <li>• Clearing or disturbance to vegetation near wetlands will be avoided where possible.</li> <li>• Silt fence will be properly installed around all retained wetlands within and immediately adjacent to the Project footprint.</li> <li>• Erosion and sediment control measures and structures will be regularly inspected and maintained during the construction activities.</li> <li>• Construction activities will be halted during adverse construction conditions caused by heavy rains or other weather events.</li> <li>• Non-biodegradable erosion and sediment control materials will be removed once the site is stabilized.</li> <li>• Fuel and oil products will not be stored within 100 m of any wetland or waterbody.</li> <li>• Maintenance or refueling of vehicles and equipment will be conducted a minimum of 100 m</li> </ul>	<p>sedimentation within waterbodies during all phases of the project.</p> <ul style="list-style-type: none"> <li>• Non-biodegradable erosion and sediment control materials will be removed once the site is stabilized.</li> <li>• Fuel and oil products will not be stored within 100 m of any wetland or waterbody.</li> <li>• Maintenance or refueling of vehicles and equipment will be conducted a minimum of 100 m away from the wetlands and irrigation canals, and spill trays will be used.</li> <li>• Emergency spill kits will be maintained on site and readily accessible.</li> </ul>

Concern	Construction Mitigation	Operation Mitigation
	<p>away from the wetlands and irrigation canals, and spill trays will be used.</p> <ul style="list-style-type: none"> <li>• Emergency spill kits will be maintained on site and readily accessible.</li> </ul>	
<b>Wildlife movement</b>	<ul style="list-style-type: none"> <li>• Amphibian surveys will be conducted prior to any ground disturbance to mitigate potential wildlife disturbances.</li> <li>• A qualified biologist will be on site during critical periods to monitor the construction area and relocate any amphibians (upon AEP approval) to reduce injury or mortality risk.</li> <li>• Fences will be constructed to avoid restricting wildlife movement.</li> </ul>	<ul style="list-style-type: none"> <li>• Fences will be constructed to avoid restricting wildlife movement.</li> </ul>
<b>Stranded and injured wildlife</b>	<ul style="list-style-type: none"> <li>• Appropriate Provincial and Federal wildlife permits/authorizations will be obtained before handling dead or injured wildlife, or conducting wildlife surveys.</li> <li>• Construction personnel will be prohibited from feeding or harassing wildlife.</li> <li>• Trenches that must be left overnight will be covered or sloped so that wildlife does not become trapped within the excavation.</li> <li>• Electrical collection/transmission lines will be buried.</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate Provincial and Federal wildlife permits/authorizations will be obtained before handling dead or injured wildlife, or conducting wildlife surveys.</li> <li>• Electrical collection/transmission lines will be buried.</li> </ul>
<b>Light pollution</b>	<ul style="list-style-type: none"> <li>• Construction activities will occur during daylight hours, starting half an hour after sunrise and</li> </ul>	<ul style="list-style-type: none"> <li>• Required lighting will be selected and positioned to</li> </ul>

Concern	Construction Mitigation	Operation Mitigation
	<p>ending half an hour before sunset.</p> <ul style="list-style-type: none"> <li>• Required lighting will be selected and positioned to minimize spill light, upward light and glare.</li> <li>• When possible, lights equipped with motion sensors will be used to minimize their time on.</li> </ul>	<p>minimize spill light, upward light and glare.</p> <ul style="list-style-type: none"> <li>• When possible, lights equipped with motion sensors will be used to minimize their time on.</li> </ul>
<b>Vegetation Maintenance</b>	<ul style="list-style-type: none"> <li>• Vegetation clearing will occur outside of the breeding bird window; if clearing is required within it, nest sweeps will be completed a minimum of 7 days prior to any disturbance.</li> <li>• The use of fertilizers, herbicides and pesticides will be avoided.</li> <li>• Appropriate native seed mixes will be used to revegetate any disturbed natural areas.</li> <li>• Vegetation disturbance will be minimized using methods such as access matting, reduced stripping and winter construction.</li> </ul>	<ul style="list-style-type: none"> <li>• Vegetation clearing will occur outside of the breeding bird window; if clearing is required within it, nest sweeps will be completed a minimum of 7 days prior to any disturbance.</li> <li>• The use of fertilizers, herbicides and pesticides will be avoided.</li> <li>• Alternative vegetation maintenance methods, such as grazing by sheep or goats, will be considered.</li> </ul>
<b>Invasive, Noxious and Prohibited Weeds</b>	<ul style="list-style-type: none"> <li>• All vehicles and equipment will be cleaned prior to accessing Project work sites to minimize the introduction of invasive species.</li> <li>• Noxious and prohibited noxious weeds will be controlled in accordance with the Alberta <i>Weed Control Act</i> (Government of Alberta 2011).</li> <li>• Certified weed-free seed mixes will be used during reclamation.</li> </ul>	<ul style="list-style-type: none"> <li>• All vehicles and equipment will be cleaned prior to accessing Project work sites to minimize the introduction of invasive species.</li> <li>• Noxious and prohibited noxious weeds will be controlled in accordance with the Alberta <i>Weed Control Act</i> (Government of Alberta 2011).</li> </ul>

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Concern	Construction Mitigation	Operation Mitigation
	<ul style="list-style-type: none"><li>• When possible, interim reclamation will be completed to prevent weed species from establishing.</li></ul>	

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## 6.0 POST-CONSTRUCTION MONITORING AND MITIGATION PLAN

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### 6.1 PURPOSE AND TIMING

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The purpose of post-construction monitoring is to determine the effectiveness of the protection and mitigation measures outlined in the Operations Mitigation Plan (Section 5.0) and identify any ongoing impacts or risks to wildlife. Monitoring will determine whether additional or modified mitigation measures are required.

Post-construction monitoring wildlife surveys are required annually, for a minimum of three years, after the Stirling Solar Project is operational. Post-construction monitoring surveys will consist of:

- documenting wildlife mortality within specific the solar arrays,
- determining carcass removal by scavengers or other means,
- determining searcher efficiency in detecting wildlife carcasses, and
- monitoring impacts of the solar energy project on species at risk, sensitive species or other wildlife.

### 6.2 METHODS

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Post-construction monitoring will be conducted annually by two professional wildlife biologists or qualified professionals between March 1 and November 15 during the spring and fall migration, and the summer breeding season. Weekly surveys will be conducted during the migratory periods from March 1 to May 15, and from August 15 to November 15. During the summer breeding season, surveys will be conducted bi-weekly from May 16 to August 14.

Carcasses detected during the mortality searches will be recorded, and carcass persistence rates and searcher efficiency rates (see below) will be used to produce an estimated mortality rate for the Project area. The observed and estimated mortality rates will be provided to AEP in an annual post-construction monitoring report.

A Wildlife Research Permit and Collection License will be obtained from AEP prior to conducting the post-construction monitoring surveys.

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## 6.2.1 MORTALITY SEARCHES

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Mortality searches will be conducted to determine the number of dead, injured and stranded wildlife found within the Project area. Stranded and injured wildlife will be included in the mortality count. If stranded and/or injured wildlife are found, the monitors will contact the AEP Fish and Wildlife Office in Brooks (403-362-1232) for specific advice or contact the Alberta Wildlife Rehabilitators Association (403-946-2361). All carcasses of species at risk and sensitive species will be collected, identified, labeled, frozen and submitted to AEP.

Sampling areas will be randomly distributed throughout one third of the entire footprint (20.4 ha) which equates to approximately 0.20 square kilometers (km<sup>2</sup>). A stratified random sampling method will be used to ensure that the Project area is accurately represented within the sample. To adjust for imperfect detection, carcass detection and removal trials will be conducted to help calculate the estimated mortality rate. Narrow transects (e.g., 10 m wide) will be used within the sampling areas to increase the detection rate/searcher efficiency. The transects will be walked at a slow pace, consistent with walking speeds used during the carcass detection trials. Exact speeds will be determined in the field, as they are dependent on the amount of cover within the search areas.

Mortality estimates will be corrected using the following formula (Ontario Ministry of Natural Resources [OMNR] 2011):

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

C is the corrected number of bird fatalities

c is the number of carcasses found

S<sub>e0</sub> is the weighted proportion of carcasses expected to be found by searchers (searcher efficiency)

S<sub>c</sub> is the proportion of carcasses not removed by scavengers over the search period (persistence rate)

P<sub>s</sub> is the proportion of the area searched

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## 6.2.2 CARCASS REMOVAL TRIALS

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Carcass removal trials will be conducted to determine the duration of time that a carcass is expected to persist in the Project area before decomposing or being removed by a scavenger. This persistence rate can be influenced by location, carcass size, and season.

Fresh carcasses (i.e., frozen within 24 hours of death) will be used, and will be thawed prior to placement. If available, carcasses found during mortality searches will be also be used. Carcasses of varying size categories (small, medium, large) will be placed around the Project area to mimic collision mortalities. The trial carcasses will be marked to distinguish from other mortalities, and their locations (UTM coordinates) will be recorded. A suitable method to be used for marking will be determined in consultation with AEP. A minimum of five carcasses will be used in each trial, preferably two from each size class, dependent on availability. A minimum of two carcass removal trials will be conducted each season (e.g., spring, summer, fall).

The trial carcasses will be placed on site for four weeks, or until they disappear. They will be inspected daily for the first four days, followed by increasing intervals between inspections. An example schedule would include inspection on days 1, 2, 3, 4, 7, 10, 14, 21, and 28.

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### 6.2.3 WILDLIFE CARCASS DETECTION

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Carcass detection trials will be conducted to determine searcher efficiency at locating carcasses within the Project area. Similar to persistence rates, searcher efficiency rates can be influenced by location (e.g., habitat/cover type), carcass size, season (height of vegetation), and searcher experience. A minimum of twenty carcasses of various sizes will be used in each trial, randomly placed throughout the search area. Locations (UTM coordinates) of the trial carcasses will be recorded, and the carcasses will be collected after the trial for use in the carcass removal trials. Detection trials will be conducted once per season (e.g., spring, summer, fall) for each biologist who will be assisting with the mortality searches.

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### 6.2.4 WILDLIFE IMPACT MONITORING

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All notable wildlife observations made during the mortality searches, carcass removal trials, and carcass detection trials will be recorded. For bird mortalities, the following information will be collected:

- Species (if possible);
- Age and sex (if possible);
- Condition of carcass (e.g., injuries, state of decomposition, estimated time of death);
- Location (UTM coordinates);
- Proximity to Project structures and/or habitat features;
- Date and time of discovery;
- Weather conditions; and,
- Photos of the carcass and surrounding area.

In addition to mortality data, any observed changes in wildlife behavior, changes in species composition, or potential threats to wildlife will be documented and reported.

If any sensitive species or species at risk mortalities are found, the carcasses will be labeled, frozen, and submitted to AEP. No carcasses of sensitive species or species at risk will be used for the carcass removal or detection trials. If a high rate of bird mortality is observed during monitoring, AEP will be contacted to discuss additional mitigation options. Mortality rate to be determined in consultation with AEP.

### 6.3 POST-CONSTRUCTION MITIGATION PLAN

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As part of an adaptive management approach, mitigation measures will be adjusted if an unacceptably high level of wildlife mortality is observed during the post-construction monitoring period. Ineffective mitigation measures will be redesigned and implemented, in consultation with AEP. Potential mitigation measures could include installation of bird deterrents, addition of white gridlines to the solar panels, or increased spacing between the solar arrays. If necessary, cameras can be set up to help investigate the mortalities.

If post-construction mitigation measures are required, Solar Krafte will conduct a further 2 years of post-construction monitoring to assess their success and ensure the mitigation measures used are effective. If the mitigation is unsuccessful, then further mitigation measures and post-construction monitoring will be required as prescribed by the AEP Wildlife Biologist (AEP 2017c). Solar Krafte will allow access to the Project area and ensure that private landowners are aware of and consent to visits to the site by AEP Wildlife Biologist(s) or associated researcher(s) upon receipt of a written request.

### 6.4 REPORTING REQUIREMENTS

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A post-construction monitoring report will be submitted annually to AEP, date to be determined once Project construction is complete, in consultation with the AEP Regional Wildlife Biologist. The report will include the following:

- A detailed description of the survey methods;
- the raw data, using the appropriate FWMIS datasheet for each solar collector/reflector;
- results of searcher efficiency trials and scavenger removal trials;
- the uncorrected fatality rate for birds and other wildlife expressed as the number of mortalities per megawatts per year;

- the corrected rates of mortalities/megawatts/year as per Huso (2011) or acceptable alternative;
- a summary of species killed and the condition of their carcasses;
- results of pre-construction wildlife surveys;
- a comparison of pre- and post-construction survey results if required as per Standard 100.4.3d; and,
- a statement of compliance with the Directive and the signature of the lead biologist.

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## 7.0 CONCLUSIONS

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The Stirling Solar Project was sited on previously disturbed land to avoid native grassland habitat and minimize potential impacts to species at risk. The land within the proposed Project footprint is cultivated and grazed by livestock. Two dry wetlands were present, a Class I ephemeral wetland and a Class III seasonal wetland; however, the Class III was highly disturbed from ongoing livestock grazing which had removed all the emergent vegetation and caused the soils to mound. Wildlife surveys targeting breeding birds, migratory birds, burrowing owl, sharp-tailed grouse, raptor nests and amphibian species at risk were conducted to determine the presence of species at risk within the Project area and a 1 km buffer.

No species at risk were observed, however, a black-necked stilt and great blue heron had been previously documented within the 1 km buffer. Habitat loss for these species as well as other species with the potential to occur within the Project area is low due to ongoing disturbances from crop cultivation, livestock grazing, and a lack of native grassland habitat. Although the Project area is currently used as a stop-over for migrating wildlife to forage and rest, the lack of permanent, mature trees, habitat structures, disturbances within the wetlands and ongoing agricultural practices limit the availability of nesting and breeding habitat for species at risk and other wildlife.

Pre-construction clearing has the risk to potentially impact bird nests, burrows, dens as well as direct impact from vehicle collisions during construction. Should construction occur within the breeding bird season, a wildlife sweep will be conducted a minimum of 7 days prior to clearing by a qualified wildlife biologist. To ensure the risk to wildlife is low during construction and operation, the mitigation measures outlined in Section 5 will be in place to eliminate and/or minimize potential impacts. A qualified environmental professional will be on site to monitor construction of the Stirling Solar Project to ensure that the mitigation measures are in place and are being followed, to ensure the safe relocation of any potential wildlife (with AEP's approval) that may be encountered during construction, and to ensure that all of the applicable environmental laws and regulations are being followed.

To determine the effectiveness of the mitigation measures outlined in Section 5, wildlife biologists will conduct post-construction monitoring of the facility for a minimum of 3 years once the facility is operational, to identify any ongoing impacts or risks to wildlife. Wildlife surveys will be conducted on an annual basis to document wildlife mortality, determine carcass removal and searcher efficiency and to monitor potential impacts that the Stirling Solar Project may have on species at risk, sensitive species and other wildlife.

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## 9.0 APPENDICES

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## APPENDIX A

### SPECIES AT RISK WITH POTENTIAL TO OCCUR WITHIN PROJECT AREA

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TABLE 3. SPECIES AT RISK WITH POTENTIAL TO OCCUR WITHIN THE PROJECT AREA

Common Name	Scientific Name	Conservation Status	Habitat Requirements
<b>Amphibians</b>			
northern leopard frog	<i>Lithobates pipiens</i>	At Risk <sup>1</sup> , Special Concern <sup>2,3</sup> , Threatened <sup>4</sup>	springs, moist upland meadows, riparian areas, ponds, permanent waterbodies; clear, clean water
great plains toad	<i>Anaxyrus cognatus</i>	Sensitive <sup>1</sup> , Special Concern <sup>2,3</sup>	shallow wetlands, upland grasslands, sandy soil; fresh, clear water; Class 1 to 3 wetlands
plains spadefoot	<i>Spea bombifrons</i>	May be at Risk <sup>1</sup> , Not at Risk <sup>2</sup>	short grass prairie, sandy soil
western tiger salamander	<i>Ambystoma mavortium</i>	Special Concern <sup>2</sup>	small bodies of water, lakes; logs, debris, burrows
<b>Birds</b>			
alder flycatcher	<i>Empidonax alnorum</i>	Sensitive <sup>1</sup>	willows, alders, brushy swamps, swales; thickets of deciduous trees and shrubs near ponds, streams and bogs
American bittern	<i>Botaurus lentiginosus</i>	Sensitive <sup>1</sup>	Emergent wetlands; tall, dense grasses and bulrush
American kestrel	<i>Falco sparverius</i>	Sensitive <sup>1</sup>	open to semi-open habitats; cities, forest edges, farmland, grassland; raised perches
American white pelican	<i>Pelecanus erythrorhynchos</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	large shallow lake, rivers and marshes; isolated, low-lying islands
Baird's sparrow	<i>Ammodramus bairdii</i>	Sensitive <sup>1</sup> , Special Concern <sup>2,3</sup>	Native prairie, tall grass, tall weeds, low bushes, wheat fields, lightly grazed pastures
bald eagle	<i>Haliaeetus leucocephalus</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	Near large rivers, lakes; mountains, open country, dry areas near water
Baltimore oriole	<i>Icterus galbula</i>	Sensitive <sup>1</sup>	open woodland, forest edge, orchards, riparian forests, parks, backyards

Common Name	Scientific Name	Conservation Status	Habitat Requirements
bank swallow	<i>Riparia riparia</i>	Sensitive <sup>1</sup> , Threatened <sup>2</sup>	near water, fields, marshes, streams, lakeshores, open areas; steep banks of dirt and sand
barn swallow	<i>Hirundo rustica</i>	Sensitive <sup>1</sup> , Threatened <sup>2</sup>	Open, semi-open areas, farms, fields, marshes, lakes; buildings, bridges, cliffs near farms and cities
black-necked stilt	<i>Himantopus mexicanus</i>	Sensitive <sup>1</sup>	Grassy marshes, mudflats, pools, shallow lakes (fresh and alkaline), edges of exposed mudflats; margins of shallow water in very open country, especially where there is lots of marsh growth
black-crowned night heron	<i>Nycticorax nycticorax</i>	Sensitive <sup>1</sup>	shallow cattail and bulrush marshes, small lakes, slow rivers
black tern	<i>Chlidonias niger</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	Marshes, sloughs, rivers, lakeshores, wet meadows, typically in sites with mixture of emergent vegetation and open water
bobolink	<i>Dolichonyx oryzivorus</i>	Sensitive <sup>1</sup> , Threatened <sup>2</sup>	hayfields, meadows, marshes, natural prairies with dense grass, weeds and low bushes
buff-breasted sandpiper	<i>Calidris subruficollis</i>	Secure <sup>1</sup> , Special Concern <sup>2,3</sup>	shortgrass prairie, stubble fields, pastures, airports, plowed fields, shores of lakes or ponds
burrowing owl	<i>Athene cunicularia</i>	At Risk <sup>1</sup> , Threatened <sup>2,3</sup> , Endangered <sup>4</sup>	open grasslands, prairie, farm fields, airstrips; flat, open ground with very short grass and bare soil
Caspian tern	<i>Hydroprogne caspia</i>	Sensitive <sup>1</sup>	shorelines of wetlands, lakes and river; islands in lakes and rivers

Common Name	Scientific Name	Conservation Status	Habitat Requirements
chestnut-collared longspur	<i>Calcarius ornatus</i>	At Risk <sup>1</sup> , Threatened <sup>2,3</sup>	short grass prairies with longer grass and taller weeds, fields, plains
common nighthawk	<i>Chordeiles minor</i>	Sensitive <sup>1</sup> , Threatened <sup>2,3</sup>	Dry coniferous forests, open cottonwood forests, meadows, larger lakes and grasslands.
common yellowthroat	<i>Geothlypis trichas</i>	Sensitive <sup>1</sup>	Marshes (especially cattail), thickets near water, bogs and brushy pasture.
eastern kingbird	<i>Tyrannus tyrannus</i>	Sensitive <sup>1</sup>	open areas with willow and birch shrubs, agricultural areas, riparian areas
eastern phoebe	<i>Sayornis phoebe</i>	Sensitive <sup>1</sup>	wooded areas near water, human-built structures, bare rock outcrops
ferruginous hawk	<i>Buteo regalis</i>	At Risk <sup>1</sup> , Threatened <sup>2,3</sup> , Endangered <sup>4</sup>	prairies, dry grassland, sagebrush plains, rangeland, desert, plowed fields
Forster's tern	<i>Sterna forsteri</i>	Sensitive <sup>1</sup>	Cattail marshes, backwaters, large marshy lakes
golden eagle	<i>Aquila chrysaetos</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	open mountains, foothills, prairie, open habitats
grasshopper sparrow	<i>Ammodramus savannarum</i>	Sensitive <sup>1</sup>	grasslands, hayfields, prairie; tall grass, weeds, scattered shrubs; sometimes crop fields
great blue heron	<i>Ardea herodias</i>	Sensitive <sup>1</sup>	Freshwater and brackish marshes, along lakes, rivers, bays; nests colonially in large deciduous trees.
horned grebe	<i>Podiceps auritus</i>	Sensitive <sup>1</sup> , Special Concern <sup>2,3</sup>	lakes with open water and marsh vegetation surrounded by prairie
lark bunting	<i>Calamospiza melanocorys</i>	Sensitive <sup>1</sup> , Threatened <sup>2</sup>	shortgrass prairie, sagebrush plains with understory of grass and weeds; prairie, agricultural fields, desert grassland, weedy vacant lots

Common Name	Scientific Name	Conservation Status	Habitat Requirements
least flycatcher	<i>Empidonax minimus</i>	Sensitive <sup>1</sup>	Aspen forests, alder and willow thickets, open woods, orchards; edge habitat
loggerhead shrike	<i>Lanius ludovicianus excubitorides</i>	Sensitive <sup>1</sup> , Threatened <sup>2,3</sup> , Special Concern <sup>4</sup>	Semi-open country with lookout posts, wires, trees, shrubs; open grasslands with few scattered trees, forest clearings
long-billed curlew	<i>Numenius americanus</i>	Sensitive <sup>1</sup> , Special Concern <sup>2,3,4</sup>	Native dry grassland, sagebrush prairie, farm fields, marshes
McCown's longspur	<i>Rhynchophanes mccownii</i>	May be at Risk <sup>1</sup> , Threatened <sup>2</sup> , Special Concern <sup>3</sup>	dry open prairie with short grass, patches of open ground; shortgrass plains, bare soil such as dry lake beds, plowed fields
northern harrier	<i>Circus cyaneus</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	Marshes, fields, prairies, wet meadows; open terrain, wet and dry habitats with good ground cover
olive-sided flycatcher	<i>Contopus cooperi</i>	May be at Risk <sup>1</sup> , Threatened <sup>2,3</sup>	meadows, ponds, riparian forests, forest edges, open woodlands, mature spruce-fir forests
osprey	<i>Pandion haliaetus</i>	Sensitive <sup>1</sup>	large lakes, reservoirs, rivers; near water where large numbers of fish are present
peregrine falcon <i>anatum</i>	<i>Falco peregrinus anatum</i>	At Risk <sup>1</sup> , Special Concern <sup>2,3</sup> , Threatened <sup>4</sup>	Open country, cliffs, sometimes cities; variety of open habitats, near water, building ledges
pied-billed grebe	<i>Podilymbus podiceps</i>	Sensitive <sup>1</sup>	Ponds, marshes and backwaters with thick emergent vegetation.
pileated woodpecker	<i>Picoides arcticus</i>	Sensitive <sup>1</sup>	mature deciduous and mixed deciduous forests, suburban areas with large trees, patches of forest; wildlife trees

Common Name	Scientific Name	Conservation Status	Habitat Requirements
piping plover	<i>Charadrius melodus circumcinctus</i>	At Risk <sup>2</sup> , Endangered <sup>2,3,4</sup>	Sandy beaches and open lakeshores; nests on open shoreline.
prairie falcon	<i>Falco mexicanus</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup> , Special Concern <sup>4</sup>	Open hills, plains, prairies, deserts, grassland; open country above treeline in high mountains; farmland, lakes, reservoirs
rusty blackbird	<i>Euphagus carolinus</i>	Sensitive <sup>1</sup>	wet forests, areas with fens, bogs, muskeg, beaver ponds; overwinters in swamps, wet woodlands, and pond edges
sage thrasher	<i>Oreoscoptes montanus</i>	Undetermined <sup>1</sup> , Endangered <sup>2,3</sup>	sagebrush, shrubby slopes, deserts, wide-open flats, grassland with scattered shrubs
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	Sensitive <sup>1</sup>	Prairie, shrub areas, forest edges, open burns in coniferous forest; mixture of open prairie with groves of deciduous trees or shrubs, such as aspen, birch, willow; open grasslands in summer; groves of trees and shrubs in winter
short-eared owl	<i>Asio flammeus</i>	May be at Risk <sup>1</sup> , Special Concern <sup>2,3</sup>	Grassland, marshes, farmland, prairies, open country with high numbers of small rodents, stubble fields, small meadows, shrubby areas
sora	<i>Porzana carolina</i>	Sensitive <sup>1</sup>	Shallow freshwater emergent wetlands, bogs, fens, wet meadows and flooded fields
sprague's pipit	<i>Anthus spragueii</i>	Sensitive <sup>1</sup> , Threatened <sup>2,3</sup> , Special Concern <sup>4</sup>	Native shortgrass prairie, plains, dry grassland, avoids brushy areas and cultivated fields. Winters in pastures, prairies, and grassy patches

Common Name	Scientific Name	Conservation Status	Habitat Requirements
			within fields of crops such as alfalfa
Swainson's hawk	<i>Buteo swainsoni</i>	Sensitive <sup>1</sup>	Open fields, dry grasslands, farmland, open areas with groves of trees, agricultural areas
upland sandpiper	<i>Bartramia longicauda</i>	Sensitive <sup>1</sup>	Hayfields, ungrazed pastures, grasslands, fields, open meadows; grasslands with tall grasses and broad-leaved weeds
western grebe	<i>Aechmophorus occidentalis</i>	At Risk <sup>1</sup> , Special Concern <sup>2</sup> , Threatened <sup>4</sup>	Marshes, sloughs, rush filled lakes; fresh water lakes with large areas of both open water and marsh vegetation
western wood-pewee	<i>Contopus sordidulus</i>	May be at Risk <sup>1</sup>	open woodlands, riparian forests, aspen groves, pine-oak woods, cottonwood-willow groves along streams
white-winged scoter	<i>Melanitta deglandi</i>	Sensitive <sup>1</sup> , Special Concern <sup>4</sup>	lakes, ponds, and slow-moving rivers, generally in open country
yellow rail	<i>Coturnicops noveboracensis</i>	Undetermined <sup>1</sup> , Special Concern <sup>2,3</sup>	shallow sedge and grassy marshes, wet meadows; drier areas with dense stands of cordgrass
<b>Mammals</b>			
little brown bat	<i>Myotis lucifugus</i>	May be at Risk <sup>1</sup> , Endangered <sup>2,3</sup>	large hollow trees, buildings near bodies of water, caves
red bat	<i>Lasiurus borealis</i>	Sensitive <sup>1</sup>	thick forest cover, open grassy areas; forages near farmlands
silver-haired bat	<i>Lasionycteris noctivagans</i>	Sensitive <sup>1</sup>	forests, parks, cities, farmland; hollow trees,
Western small-footed bat	<i>Myotis ciliolabrum</i>	Sensitive <sup>1</sup> , Special Concern <sup>4</sup>	arid prairie regions, riverbanks, ridges, outcroppings with lots of rocks; trees, buildings, rock

Common Name	Scientific Name	Conservation Status	Habitat Requirements
			crevices, under bridges and shingles of old buildings
American badger	<i>Taxidea taxus taxus</i>	Sensitive <sup>1</sup> , Special Concern <sup>2</sup>	grasslands, agricultural areas, open area, areas fragmented by roads, bush habitats with little groundcover
bobcat	<i>Lynx rufus</i>	Sensitive <sup>1</sup>	coniferous forests, deciduous forests, brushy areas, coulees
long-tailed weasel	<i>Mustela frenata longicauda</i>	May be at Risk <sup>1</sup> , Not at Risk <sup>2</sup>	open grasslands, tree groves, prairie, forests
olive-backed pocket mouse	<i>Perognathus fasciatus</i>	Sensitive <sup>1</sup>	short grass prairie, sandy soil
pronghorn	<i>Antilocapra americana</i>	Sensitive <sup>1</sup>	arid grasslands, grassy brushlands, semi-desert regions
<b>Reptiles</b>			
bull snake	<i>Pituophis catenifer sayi</i>	Sensitive <sup>1</sup> , Special Concern <sup>2</sup>	prairies, grasslands, open grassy meadows bordered by woodland, wheat fields; loose sandy soil, near water sources; hibernacula found along river valleys, coulees, riparian/upland habitat transition zones
plains garter snake	<i>Thamnophis radix</i>	Sensitive <sup>1</sup>	margins of wetlands; wet meadows; open grasslands; hibernacula found along river valleys, coulees, riparian/upland habitat transition zones
prairie rattlesnake	<i>Crotalus viridis</i>	Sensitive <sup>1</sup> , Special Concern <sup>2</sup>	native grassland and sagebrush near a river valley or coulee, farm fields, pastures, rocky outcrops, sandy soil near boulder or rocky areas, stony canyons; 4hibernacula found along river valleys, coulees,

Common Name	Scientific Name	Conservation Status	Habitat Requirements
			riparian/upland habitat transition zones
wandering garter snake	<i>Thamnophis elegans</i>	Sensitive <sup>1</sup>	aquatic snake, open areas like meadows and estuaries, south facing rocky outcrops; hibernacula found along river valleys, coulees, riparian/upland habitat transition zones
western painted turtle	<i>Chrysemys picta</i>	Sensitive <sup>1</sup> , Not at Risk <sup>2</sup>	shallow waters of ponds, lakes, oxbows, marshes; slow-moving stream reaches, quiet backwater sloughs of rivers; muddy substrates, emergent aquatic vegetation, exposed cattail mats, logs, and open banks

- Notes:
- 1 Status assigned in the 2015 General Status of Alberta Wild Species (AEP 2017b)
  - 2 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Government of Canada 2017)
  - 3 Federal *Species at Risk Act (SARA)*, Schedule 1, Public Registry (Government of Canada 2017)
  - 4 *Wildlife Act*, Alberta Queen's Printer, May 2012

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## APPENDIX B

### SITE PHOTOS

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**PHOTO 1; CLASS III  
WETLAND**

Direction:  
Southeast

Description:  
Wetland covered in hay by  
landowner.

Wetland Classification:  
M-G-III



**PHOTO 2; CLASS I  
WETLAND**

Direction: South

Description:  
Wetlands margins are not  
evident

Wetland Classification:  
M-G-I



**PHOTO 3; IRRIGATION CANAL**

Direction:  
North

Description:  
Irrigation canal along east boundary.

64001–64099 Range Road 193, Warner County No. 5 AB

● 12 N 391854 5484067 ±26.2ft ▲ 3144ft



Irrigation canal  
Your Watermark - See Settings  
Stirling  
02 May 2017, 18:43

**PHOTO 4; IRRIGATION CANAL**

Direction:  
East

Description:  
Irrigation canal running through middle of Project area

64000–64098 Range Road 193, Warner County No. 5 AB

● 12 N 392064 5483971 ±26.2ft ▲ 3076ft



Irrigation canal  
Your Watermark - See Settings  
Stirling  
02 May 2017, 18:19

**PHOTO 5; DUGOUT**

Direction:  
Northeast

Description:  
Dugout

**Warner County No. 5 AB, Canada**

LAT: 49.499405 LON: -112.490669 ±26.2ft ▲ 3133ft



Dugout Stirling  
Your Watermark - See Settings 03 May 2017, 08:17

**PHOTO 6; SURVEY  
STATION 1**

Direction:  
Northwest

Description:  
Looking across Project Area  
from point count 1



**PHOTO 7; SURVEY  
STATION 2**

Direction:  
East

Description:  
Looking across Project Area  
from point count 2



**PHOTO 8;  
SWAINSON'S HAWK**

Direction:  
East

Description:  
Swainson's hawk nest



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## APPENDIX C

### BREEDING BIRD RESULTS

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TABLE 4. EARLY SPRING 2017 BREEDING BIRD SURVEY RESULTS

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-1	49.49419	112.48222	European starling	2	x	x	S	180
S-1	49.49419	112.48222	European starling	1	x	x	NW	180
S-1	49.49419	112.48222	European starling	2	x	x	S	150
S-1	49.49419	112.48222	Franklin's gull	1	x			0
S-1	49.49419	112.48222	house sparrows	flock	x	x	S	150
S-1	49.49419	112.48222	mallard	2	x		N	250
S-1	49.49419	112.48222	red-winged blackbird	1	x	x	NE	270
S-1	49.49419	112.48222	red-winged blackbird	3	x	x	S	80
S-1	49.49419	112.48222	red-winged blackbird	2	x	x	NE	180
S-1	49.49419	112.48222	red-winged blackbird	1	x	x	SE	80
S-1	49.49419	112.48222	ring-billed gull	1	x	x	SW	160
S-1	49.49419	112.48222	western meadowlark	1	x	x	E	130
S-1	49.49419	112.48222	western meadowlark	1	x	x	W	280
S-1	49.49419	112.48222	western meadowlark	1	x	x	S	10
S-2	49.50121	112.49413	American robin	1	x	x	NE	170
S-2	49.50121	112.49413	European starling	4	x	x	SE	160
S-2	49.50121	112.49413	European starling	6	x		NE	20
S-2	49.50121	112.49413	Franklin's gull	1	x		W	400
S-2	49.50121	112.49413	house sparrows	8	x	x	W	160
S-2	49.50121	112.49413	house sparrows	flock	x	x	NW	280
S-2	49.50121	112.49413	house sparrows	flock	x	x	W	10
S-2	49.50121	112.49413	killdeer	1		x	SE	300
S-2	49.50121	112.49413	northern shoveler	2	x		E	300
S-2	49.50121	112.49413	red-winged blackbird	1	x		NE	300
S-2	49.50121	112.49413	red-winged blackbird	4	x	x	SE	120

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-2	49.50121	112.49413	Swainson's hawk	1	x		W	500
S-2	49.50121	112.49413	vesper sparrow	1		x	NE	400
S-2	49.50121	112.49413	western meadowlark	1		x	NW	200
S-2	49.50121	112.49413	western meadowlark	1	x	x	SE	260

TABLE 5. LATE SPRING 2017 BREEDING BIRD RESULTS

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-1	49.49419	112.48222	red-winged blackbird	1	x	x	NE	270
S-1	49.49419	112.48222	red-winged blackbird	3	x	x	S	80
S-1	49.49419	112.48222	European starling	2	x	x	S	180
S-1	49.49419	112.48222	western meadowlark	1	x	x	E	130
S-1	49.49419	112.48222	western meadowlark	1	x	x	W	280
S-2	49.50121	112.49413	American robin	1	x	x	NE	170
S-2	49.50121	112.49413	house sparrow	8	x	x	W	160
S-2	49.50121	112.49413	house sparrow	flock	x	x	NW	280
S-2	49.50121	112.49413	killdeer	1		x	SE	300
S-2	49.50121	112.49413	red-winged blackbird	1	x		NE	300
S-2	49.50121	112.49413	European starling	4	x	x	SE	160
S-2	49.50121	112.49413	western meadowlark	1		x	NW	200
S-1	49.49419	112.48222	Franklin's gull	1	x			overhead
S-1	49.49419	112.48222	house sparrow	flock	x	x	S	150
S-1	49.49419	112.48222	mallard	2	x		N	250
S-1	49.49419	112.48222	red-winged blackbird	2	x	x	NE	180
S-1	49.49419	112.48222	red-winged blackbird	1	x	x	SE	80

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-1	49.49419	112.48222	ring-billed gull	1	x	x	SW	160
S-1	49.49419	112.48222	European starling	1	x	x	NW	180
S-1	49.49419	112.48222	European starling	2	x	x	S	150
S-1	49.49419	112.48222	western meadowlark	1	x	x	S	10
S-2	49.50121	112.49413	Franklin's gull	1	x		W	400
S-2	49.50121	112.49413	house sparrow	flock	x	x	W	10
S-2	49.50121	112.49413	northern shoveler	2	x		E	300
S-2	49.50121	112.49413	red-winged blackbird	4	x	x	SE	120
S-2	49.50121	112.49413	European starling	6	x		NE	20
S-2	49.50121	112.49413	Swainson's hawk	1	x		W	500
S-2	49.50121	112.49413	vesper sparrow	1		x	NE	400
S-2	49.50121	112.49413	western meadowlark	1	x	x	SE	260

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## APPENDIX D

### MIGRATORY BIRD RESULTS

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TABLE 6. SPRING 2017 MIGRATORY BIRD SURVEY RESULTS

Migration Timing <sup>1</sup>	Survey Station	Station Location		Species	Count	Seen	Heard	FlyBy	Direction	Distance (m)
		Latitude	Longitude							
Early	S-1	49.49419	112.4822	American pipit	1		x		N	20
Early	S-1	49.49419	112.4822	European starling	2	x	x		SE	30
Early	S-1	49.49419	112.4822	European starling	4	x			SE	250
Early	S-1	49.49419	112.4822	mallard	2	x		x		
Early	S-1	49.49419	112.4822	western meadowlark	1	x	x		NW	20
Early	S-1	49.49419	112.4822	red-winged blackbird	1	x	x			
Early	S-1	49.49419	112.4822	ring-billed gull	2	x		x		
Early	S-1	49.49419	112.4822	American robin	1		x		S	50
Early	S-2	49.50121	112.4941	American crow	1	x				
Early	S-2	49.50121	112.4941	European starling	5	x	x			
Early	S-2	49.50121	112.4941	European starling	6	x			SE	50
Early	S-2	49.50121	112.4941	house sparrow	6					
Early	S-2	49.50121	112.4941	killdeer	1	A	x		SW	200
Early	S-2	49.50121	112.4941	killdeer	1		x			
Early	S-2	49.50121	112.4941	western meadowlark	1	x	x			
Early	S-2	49.50121	112.4941	American robin	1	x	x		NE	20
Early	S-2	49.50121	112.4941	American robin	1	x				
Mid	S-1	49.49419	112.4822	Canada geese	3	x			NW	300
Mid	S-1	49.49419	112.4822	house sparrow	flock	x	x		SW	120
Mid	S-1	49.49419	112.4822	mallard	2	x			S	120
Mid	S-1	49.49419	112.4822	mallard	2	x			N	300
Mid	S-1	49.49419	112.4822	mallard	2	x			SE	70
Mid	S-1	49.49419	112.4822	mallard	1	x			S	320
Mid	S-1	49.49419	112.4822	northern pintail	2	x			SE	120
Mid	S-1	49.49419	112.4822	northern pintail	2	x			S	300

Migration Timing <sup>1</sup>	Survey Station	Station Location		Species	Count	Seen	Heard	FlyBy	Direction	Distance (m)
		Latitude	Longitude							
Mid	S-1	49.49419	112.4822	red-winged blackbird	1	A	x		NW	100
Mid	S-1	49.49419	112.4822	red-winged blackbird	1	x			NW	100
Mid	S-1	49.49419	112.4822	red-winged blackbird	2	x			N	20
Mid	S-1	49.49419	112.4822	ring-billed gull	16	x			SE	300
Mid	S-1	49.49419	112.4822	ring-billed gull	1	x			NE	250
Mid	S-1	49.49419	112.4822	ring-billed gull	1	x			NE	300
Mid	S-1	49.49419	112.4822	western meadowlark	2	x			SE	20
Mid	S-1	49.49419	112.4822	western meadowlark	1		x		N	100
Mid	S-2	49.50121	112.4941	American robin	1	x			N	80
Mid	S-2	49.50121	112.4941	European starling	4	x			NE	300
Mid	S-2	49.50121	112.4941	house sparrow	4	x			N	120
Mid	S-2	49.50121	112.4941	killdeer	1	A	x		NW	100
Mid	S-2	49.50121	112.4941	red-winged blackbird	1		x		SW	30
Mid	S-2	49.50121	112.4941	red-winged blackbird	1	x			SE	100
Mid	S-2	49.50121	112.4941	Ring-billed gull	1	x			NE	220
Mid	S-2	49.50121	112.4941	European starling	3	x				0
Mid	S-2	49.50121	112.4941	Swainson's hawk	2	x			W	200
Mid	S-2	49.50121	112.4941	Swainson's hawk	2	x			NW	200
Mid	S-2	49.50121	112.4941	western meadowlark	1		x		SE	20
Late	S-1	49.49419	112.4822	red-winged blackbird	1	x	x		NE	270
Late	S-1	49.49419	112.4822	red-winged blackbird	3	x	x		S	80
Late	S-1	49.49419	112.4822	European starling	2	x	x		S	180
Late	S-1	49.49419	112.4822	western meadowlark	1	x	x		E	130
Late	S-1	49.49419	112.4822	western meadowlark	1	x	x		W	280
Late	S-2	49.50121	112.4941	American robin	1	x	x		NE	170
Late	S-2	49.50121	112.4941	house sparrow	8	x	x		W	160

Migration Timing <sup>1</sup>	Survey Station	Station Location		Species	Count	Seen	Heard	FlyBy	Direction	Distance (m)
		Latitude	Longitude							
Late	S-2	49.50121	112.4941	house sparrow	flock	x	x		NW	280
Late	S-2	49.50121	112.4941	killdeer	1		x		SE	300
Late	S-2	49.50121	112.4941	red-winged blackbird	1	x			NE	300
Late	S-2	49.50121	112.4941	European starling	4	x	x		SE	160
Late	S-2	49.50121	112.4941	western meadowlark	1		x		NW	200
Late	S-1	49.49419	112.4822	Franklin's gull	1	x		x		
Late	S-1	49.49419	112.4822	house sparrow	flock	x	x		S	150
Late	S-1	49.49419	112.4822	mallard	2	x			N	250
Late	S-1	49.49419	112.4822	red-winged blackbird	2	x	x		NE	180
Late	S-1	49.49419	112.4822	red-winged blackbird	1	x	x		SE	80
Late	S-1	49.49419	112.4822	ring-billed gull	1	x	x		SW	160
Late	S-1	49.49419	112.4822	European starling	1	x	x		NW	180
Late	S-1	49.49419	112.4822	European starling	2	x	x		S	150
Late	S-1	49.49419	112.4822	western meadowlark	1	x	x		S	10
Late	S-2	49.50121	112.4941	Franklin's gull	1	x			W	400
Late	S-2	49.50121	112.4941	house sparrow	flock	x	x		W	10
Late	S-2	49.50121	112.4941	northern shoveler	2	x			E	300
Late	S-2	49.50121	112.4941	red-winged blackbird	4	x	x		SE	120
Late	S-2	49.50121	112.4941	European starling	6	x			NE	20
Late	S-2	49.50121	112.4941	Swainson's hawk	1	x			W	500
Late	S-2	49.50121	112.4941	vesper sparrow	1		x		NE	400
Late	S-2	49.50121	112.4941	western meadowlark	1	x	x		SE	260

Note: <sup>1</sup> Early: March 15 to April 15, Mid: April 1 to April 30, Late: April 15 to May 15

TABLE 7. FALL 2017 MIGRATORY BIRD SURVEY RESULTS

Migration Timing	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Early	S-1	49.49419	112.4822	sparrow ssp.	5	x	x		N	60
Early	S-1	49.49419	112.4822	western meadowlark	1		x		S	100
Early	S-2	49.50121	112.4941	killdeer	2	x	x		E	80
Early	S-2	49.50121	112.4941	killdeer	1	x	x		N	40
Early	S-2	49.50121	112.4941	red-tailed hawk	1	x			W	350
Early	S-2	49.50121	112.4941	savannah sparrow	2	x			E	40
Early	S-2	49.50121	112.4941	Swainson's hawk	1	x			W	60
Early	S-2	49.50121	112.4941	western meadowlark	1		x		SW	200
Mid	S-1	49.49419	112.4822	American pipit	4	x	x		N	80
Mid	S-1	49.49419	112.4822	Canada goose	2	x			W	40
Mid	S-2	49.50121	112.4941	European starling	17	x			E	40
Mid	S-2	49.50121	112.4941	European starling	18	x			E	40
Mid	S-2	49.50121	112.4941	western meadowlark	2	x			W	100
Late	S-1	49.49419	112.4822	American pipit	2	x	x		NW	60
Late	S-2	49.50121	112.4941	American robin	1	x			SE	65
Late	S-2	49.50121	112.4941	black billed magpie	1	x			N	80
Late	S-2	49.50121	112.4941	Lapland longspur	4	x	x		E	70
Late	S-2	49.50121	112.4941	northern flicker	1	x	x		NW	80
Late	S-2	49.50121	112.4941	red-tailed hawk	1	x			W	400

Note: <sup>1</sup> Early: August 15 to September 30, Mid: September 15 to October 30, Late: October 15 to November 30

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APPENDIX E

STIRLING SOLAR PROJECT

SITE PLAN

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## APPENDIX F

# WETLAND ASSESSMENT AND IMPACT REPORT

---

## Solar Krafte Utilities Inc.

### Stirling Solar Project

# Wetland Assessment and Impact Report

REFERENCE NUMBER: B-0051-17



*Prepared by:*

**Basin Environmental Ltd.**

115 Nottingham Road  
Sherwood Park, Alberta T5A 5M3  
Phone: 780.910.0615

*Prepared for:*

**Solar Krafte Utilities Inc.**

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## APPENDICES

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## CONCORDANCE REQUIREMENTS OF WAIR

Requirement	Section Number Where Located
Name and professional designation of the individual(s) who conducted the Wetland Assessment and Impact Report (WAIR)	Section 7
Date of assessment	Section 2.1
Overview of the project area	Section 2; Figure 1 and 2
Documentation of procedures and evidence used to determine the wetland delineation in accordance with the Alberta Wetland Identification and Delineation Directive	Section 4.3
Documentation and evidence used to determine wetland classification, in accordance with the Alberta Wetland Classification System (AWCS)	Section 4.6
Description of pre-disturbance vegetation, soils and hydrology of each wetland	Section 4.6
Photographs of each wetland, with GPS coordinates, figure captions and descriptions that illustrate the wetland class and vegetation communities within the wetland	Appendix B
Alberta Wetland Rapid Evaluation Tool – Actual (ABWRET-A). This must include the ‘AllSitesA’ worksheet	Appendix C
A Landscape Analysis Tool (LAT) report	Section 4.1.2 Appendix C
Alberta Conservation Information Management System (ACIMS), Fisheries and Wildlife Management Information System (FWMIS) search results	Section 4.1.2 Section 4.1.3 Appendix C
A list of dominant vegetation species found within each wetland	Section 4.6; Table 4
A list of sensitive, rare or endangered plant and wildlife species incidentally observed during the wetland assessment as deemed necessary or requested by the regulatory body	Section 4.4; Table 3
Methods and results of any species surveys that were conducted	Section 4.4
Description of all anticipated impacts to wetlands	Section 5.2
Avoidance, which must be a consideration	Section 5.1

Requirement	Section Number Where Located
Minimization of impacts	Section 5.3
Replacement outlining how replacement obligations will be fulfilled where avoidance and minimization is not feasible or is considered ineffective	Section 6

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## 1.0 INTRODUCTION

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### 1.1 BACKGROUND

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Solar Krafte Utilities Inc. (Solar Krafte), Belectric and innogy SE propose to permit, construct, and operate the Stirling Solar Project, a 17.4 megawatt (MW) Solar Photovoltaic (PV) facility located approximately 2 kilometer (km) east of Stirling, Alberta (the Project). The Project is located in the White Area of Alberta, in the southwest quarter of Section 27, Township 6, Range 19, and West of the 4<sup>th</sup> Meridian (Figure 1).

The Project will consist of flat, single access trackers with solar PV modules set up in a north/south direction to allow the solar PV system to track/ tilt with the sun in an east to west direction. Computer controlled electric motors will power the trackers. The Project will transfer electric power generated by the solar PV system through an underground cable and directly into the 25 kilovolt (kV) Fortis Alberta distribution feeder located on the roadway. Two Class VI access roads will be constructed, one in the south from Range Road 64 and one from the west off of a private access road, to allow access to the electrical inverters. Construction of the Project is anticipated to occur between April of 2018 and March of 2019.

The specific make and model of the solar PV modules have not yet been identified. However, the total number of modules installed is not expected to exceed 175,000, and given advancement in solar PV technology, it is expected that the impacted area may be reduced prior to commercial operation. For the design reference case, the Project is using 174,180 First Solar FS-4120-3 modules. These modules are 1.2 meters (m) in length and 0.6 m in width, and each produces 120 watts of DC power. The modules are mounted 4 wide on the tracker, for a total array width of 2.54 m. The module racking allows for small gaps between the modules, ergo individual drip edges, thus no material impact on storm-water attenuation. The trackers are installed 3.81 m apart.

Basin Environmental Ltd. (Basin) was retained by Solar Krafte to prepare a Wetland Assessment and Impact Report (WAIR). The WAIR provides details on the proposed Project along with the methods used to classify, map, and describe the wetlands within the Project area, including an analysis of historical aerial photographs and a field survey. Impacts to wetlands within the Project area are identified along with associated compensation requirements under the Alberta Wetland Policy (2013).

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## 2.0 STUDY AREA

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The Project area includes all lands with the potential to be directly impacted by construction and operation of the proposed facility, plus an additional 100 m buffer, the buffer area recommended by AEP for permanent wetlands. In total, two wetlands were identified within the Project area (Figure 1). Wet areas were noted to the south of the irrigation canal on aerial imagery. However, these wet areas are not consistent in location throughout imagery and upon field investigation no wetlands features were noted. Land use within the Project area is primarily agricultural crop cultivation and livestock grazing. A man-made dugout is located within the Project area. The dug-out is anthropogenic and lacks wetland characteristics, such as wetland-dependent vegetation and water altered soils; therefore, the dug-out was not classified as a wetland and is not further considered in this report.

The Project is located within the Dry Mixedgrass Natural Subregion (NSR) in the Grassland Natural Region (NR) of Alberta (Natural Regions Committee 2006). The Grassland NR, also known as the Prairies, is the driest, warmest, and the most agriculturally fertile region in Alberta. Distinct habitats in this region include sand plains, dune fields, rocky outcrops, and badlands, which provide important breeding habitat for several species of concern and local wildlife (Alberta Parks 2014). The Dry Mixedgrass NSR has numerous distinct wildlife and plant species found nowhere else in Alberta that inhabit stream valleys, tall shrub, and woodland communities (Alberta Parks 2014). The landscape is characterized by gentle, undulating terrain broken up by coulees, valleys, dune fields, and badlands. This subregion gets very little precipitation and has hot summers, dry winds, high evaporation rates, and long, cold winters with little snow cover (Alberta Parks 2014).

The total Project area is **61.3 hectares (ha)**; and of this total area, the proposed Project footprint will be **15.7 ha**, which represents a 25.6% coverage, consisting predominantly of the solar arrays (Figure 2).

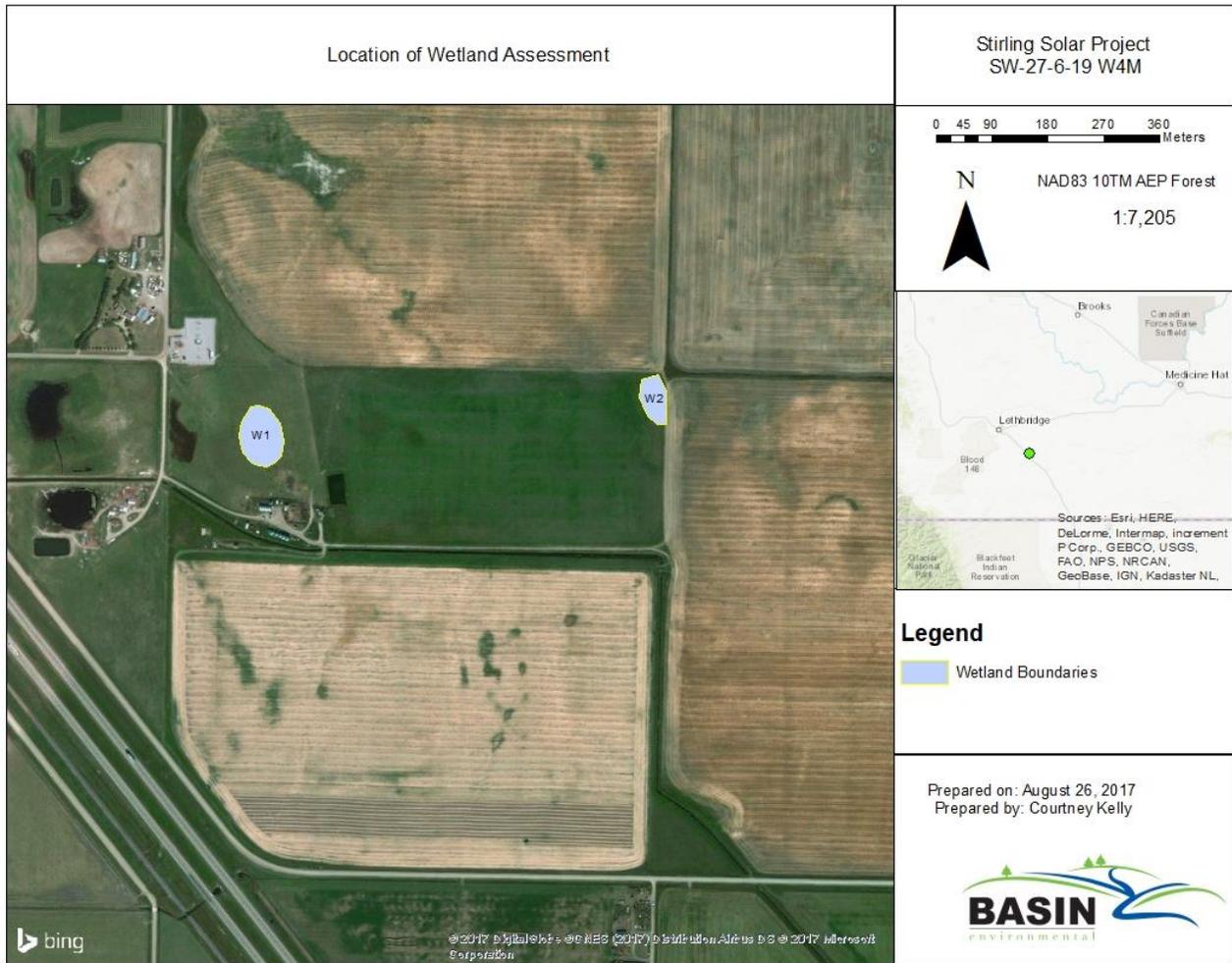


FIGURE 1 OVERVIEW MAP OF THE STUDY AREA. WETLAND DELINEATED IN PURPLE

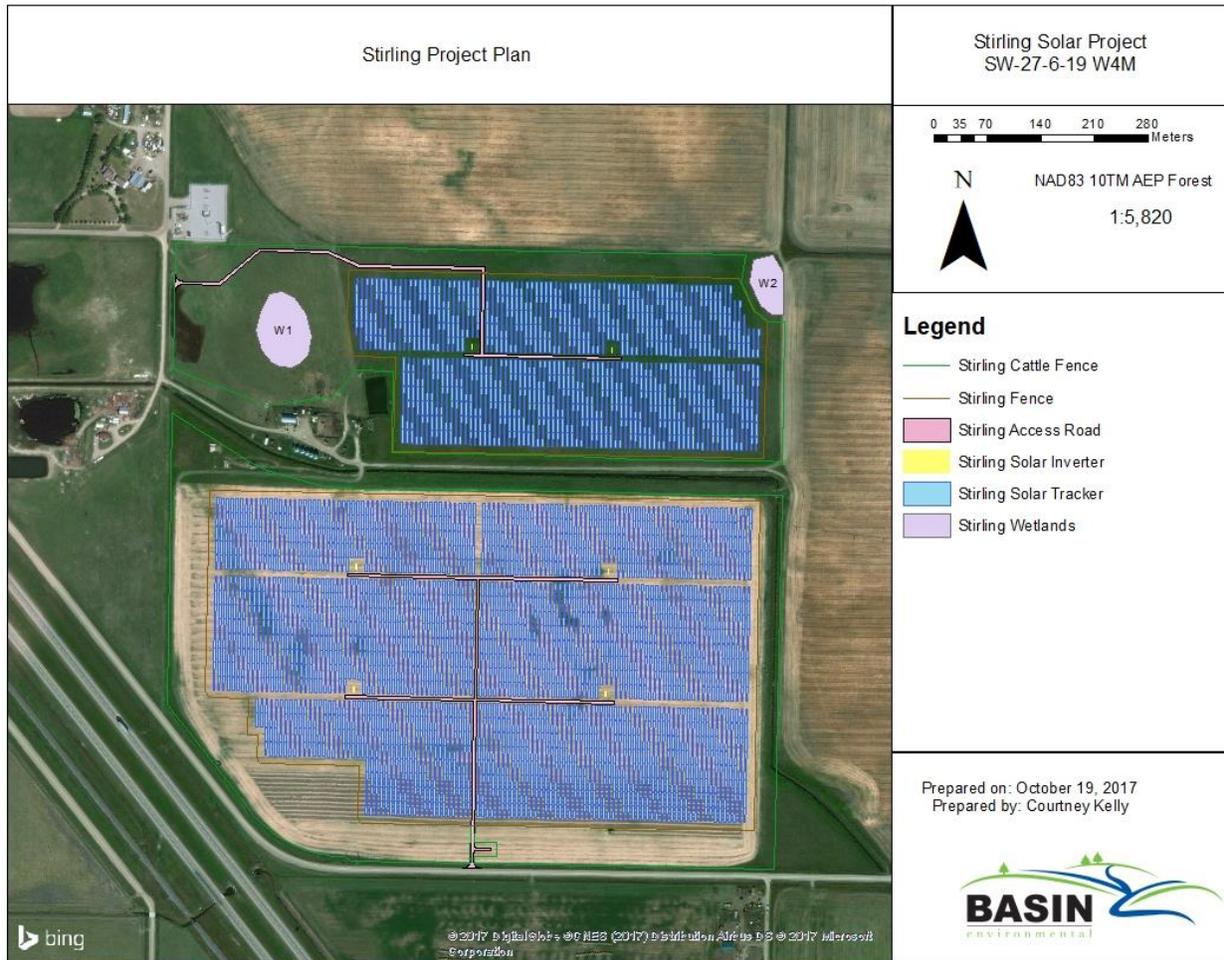


FIGURE 2 PROJECT PLAN IN RELATION TO THE WETLANDS

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## 2.1 STUDY OBJECTIVES

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In accordance with Alberta Environment and Parks (AEP) requirements, an Approval under the *Water Act* must be obtained following a consultation with a Wetland Specialist and AEP. A wetland assessment must be conducted in accordance with the Alberta Wetland Policy (Government of Alberta 2013b).

Basin was retained by Solar Krafte to prepare the WAIR report as a requirement of the *Water Act* application. This assessment consisted of a desktop review, which included an examination of historical aerial photographs, in combination with a field assessment conducted on May 19, 2017, within the Project area.

The objective of this assessment is to locate, classify, and delineate wetlands within the Project area; to identify wetlands that will be directly or indirectly impacted by the proposed Project; and, to provide recommendations for a wetland mitigation decision framework.

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## 3.0 METHODS

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### 3.1 WETLAND DELINEATION AND CLASSIFICATION

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A wetland is an ecosystem dominated by hydrophytic vegetation where soils are water-saturated for a sufficient length of time and various kinds of biological activities and processes have developed that are adapted to a wet environment. As a result, excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development (Government of Alberta 2015b). Wetlands were initially identified using available aerial photographs (Appendix A) as described in the Guide for Assessing Permanence of Wetland Basins (Government of Alberta 2016). Delineation of wetlands was done in accordance with the Alberta Wetland Identification and Delineation Directive (Government of Alberta 2015a).

Wetlands were classified in accordance with the Alberta Wetland Classification System (AWCS; Government of Alberta 2015b). The AWCS was developed and implemented by the Government of Alberta in 2015 and is specifically tailored to wetlands in Alberta. There are five classes of wetlands under the AWCS: bogs, fens, marshes, shallow open water, and swamps. These classes align with the Canadian Wetland Classification System (1997). The five wetland classes are further divided into “forms” based on vegetation structure and these forms are further subdivided into “types” based on the length of time surface water is at, or above, the soil surface level and acidity/alkalinity. Table 1 summarizes the breakdown of wetland classes, forms, and types in Alberta.

TABLE 1 ALBERTA WETLAND CLASSIFICATION SYSTEM

Class	Form	Type		
		Salinity	Water Permanence	Acidity-alkalinity
Bog [B]	Wooded, coniferous [Wc], Shrubby [S], Graminoid [G]	Freshwater [f]	-	Acidic [a]
Fen [F]	Wooded, coniferous [Wc], Shrubby [S], Graminoid [G]	Freshwater [f] to slightly brackish [sb]	-	Poor [p] Moderate-rich [mr] Extreme-rich [er]
Marsh [M]	Graminoid [G]	Freshwater [f]	Temporary [II]	-
		Freshwater [f]	Seasonal [III]	-
		Freshwater [f] to slightly brackish [sb]	Semi-permanent [IV]	-
Shallow Open Water [W]	Submersed and/or aquatic vegetation [A] or bare [B]	Freshwater [f] to moderately brackish [mb]	Seasonal [III]	-
		Freshwater [f] to sub-saline [ss]	Semi-permanent [IV]	-
		Slightly brackish [sb] to sub-saline [ss]	Permanent [V]	-
	[A]	Saline [s]	Intermittent [VI]	-
Swamp [S]	Wooded coniferous [Wc], wooded mixedwood [Wm], wooded deciduous [Wd], Shrubby [S]	Freshwater [f] to slightly brackish [sb] <sup>2</sup>	Temporary [II]	-
		Freshwater [f] to slightly brackish [sb]	Seasonal [III]	-
		Moderately brackish [mb] to sub-saline [ss]	Seasonal [III]	-

### 3.2 WETLAND BOUNDARIES MAPPING

Wetlands were delineated according to Pathway 3 of the Alberta Wetland Identification and Delineation Directive (Government of Alberta 2017a). Wetlands were identified and delineated based on the observations of the following biophysical features:

- the occurrence and visible extent of wetland vegetation, where the wetland boundary is defined by the point where the abundant plant species are made up of less than 50% of facultative or obligate wetland species;
- presence of hydric soils;

- hydrology, which includes the occurrence and visible extent of seasonal flooding; and,
- observed changes in grade from lowland to upland.

### 3.3 AERIAL IMAGERY INTERPRETATION

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Historical aerial photography taken between 1961 and 2009 (Appendix A), at various scales, was used to develop a long-term account of wetland presence and calculate wetland coverage within the Project area. Initial wetland classification was premised upon aerial imagery interpretation in accordance with the Guide for Assessing Permanence of Wetland Basins (Government of Alberta 2016). That information was later used to support field data in the delineation of the occurrence and approximate extents of wetland boundaries.

Photos were selected to provide a range of seasons in both wet and dry years to ensure a complete picture of the conditions in the Project area. A selection of wet/dry/normal years was used in conjunction with historical weather data referenced from Alberta Climate and Atlas Maps (Alberta Agriculture and Forestry [AAF] 2017). An analysis of historical aerial photographs provides a record of changing land use and conditions over time. Appendix A summarizes the historical aerial photographs obtained from the Airphoto Library in Edmonton and Bing Imagery.

### 3.4 BACKGROUND REVIEW

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A desktop review was conducted on the following databases to identify potential environmental sensitivities and/or areas of operational constraints that may apply to the Project.

- Agricultural Regions of Alberta Soil Inventory Database (AGRASID)
- Fisheries and Wildlife Management Information System (FWMIS)
- Alberta Conservation Information Management System (ACIMS)
- Environmentally Significant Areas (ESAs)
- Historic Resource Values (Historic Resources Management Branch 2015)
- Landscape Analysis Tool (LAT)

### 3.5 FIELD SURVEY

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A field survey was conducted by Courtney Kelly, B.Sc., P.Biol., of Basin on May 22, 2017. Soils, vegetation, hydrology, and water chemistry were examined to document, classify, and delineate wetlands. Wetlands were delineated using a handheld GPS, and the delineation was verified using a number of representative points.

Soils were examined to a depth of 30 cm within the unsaturated outer zone of the wetland. Depth, horizon, texture, colour (Munsell colour chart), and presence of redox features, such as gleying and mottling, were recorded. The location of all soil pits was noted, and pictures of soils were taken.

Vegetation was sampled using one randomly placed 1 m by 1 m plots. One plot at each wetland assessed percent cover for all of the species at each stratum (i.e., ground, submergent, shrub, and tree). Percent cover of dominant vascular species and percent cover of total vascular species, litter, bare ground, and open water were also recorded.

Topography of the site and evidence of ponding were used as evidence to assess hydrology. Depth of water and water chemistry was taken at all wetlands with water present using a handheld water quality meter. Water chemistry readings included pH, conductivity (adjusted for temperature), and temperature.

## 4.0 RESULTS

### 4.1 BACKGROUND REVIEW

#### 4.1.1 AGRICULTURAL REGIONS OF ALBERTA SOIL INVENTORY DATABASE (AGRASID)

The Project area is located within soil polygons identified as Nos. 5550 and 5555. The landscape is described as undulating or high relief with a limiting slope of 4%. Soils in both polygons are described as Orthic Dark Brown Chernozem on medium textured till (L, CL; AEP 2015).

#### 4.1.2 FISH AND WILDLIFE MANAGEMENT (FWMIS) AND LANDSCAPE ANALYSIS TOOL (LAT)

Sensitive features that overlap the Project area include the Burrowing Owl Range, Sharp-tailed Grouse Survey Area, Sensitive Amphibian Range, Sensitive Raptor Range (i.e., bald eagle, ferruginous hawk, golden eagle, peregrine falcon, and prairie falcon), and Other Sensitive and Endangered Species (Government of Alberta 2017). The Project is not located within or near any Key Wildlife or Biodiversity Zone. The Project is located in Bird Conservation Region 11, the Prairie Potholes Region (Environment Canada 2013). Despite the conversion of prairie and wetland habitat for agricultural use, this region is one of the most important breeding areas within North America for waterfowl, particularly dabbling and diving ducks (Environment Canada 2013). It also provides critical migratory and breeding habitat to over 200 other bird species. Within this region, bird species primarily use habitats associated with wetlands, cultivated areas, and waterbodies (Environment Canada 2013).

A search of the FWMIS database (AEP 2017) and FWMIS records revealed two wildlife species of concern in the Project area (Table 2).

TABLE 2 WILDIFE SPECIES AT RISK DOCUMENTED WITHIN THE PROJECT AREA

Common Name	Scientific Name	Provincial Designation		Federal Designation	
		Wild Species <sup>1</sup>	Wildlife Act <sup>2</sup>	COSEWIC <sup>3</sup>	SARA <sup>3</sup>
<b>Birds</b>					
Black-necked stilt	<i>Himantopus mexicanus</i>	Sensitive	Not Listed	Not Listed	No Status
Great blue heron	<i>Ardea herodias</i>	Sensitive	Not Listed	Not Listed	No Status

Notes: 1 Status assigned in the 2015 General Status of Alberta Wild Species (AEP 2017a)  
 2 *Wildlife Act*, Alberta Queen’s Printer, May 2012.

Common Name	Scientific Name	Provincial Designation		Federal Designation	
		Wild Species <sup>1</sup>	Wildlife Act <sup>2</sup>	COSEWIC <sup>3</sup>	SARA <sup>3</sup>

<sup>3</sup> Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Government of Canada 2017)

#### 4.1.3 ALBERTA CONSERVATION INFORMATION MANAGEMENT SYSTEM (ACIMS)

A search of ACIMS revealed no sensitive plant species within the Project area (AEP 2011); however, the absence of any records of rare species in the Project area does not preclude their presence in the Project area, it simply indicates that a rare species survey likely has never been conducted in the Project area.

#### 4.1.4 ENVIRONMENTALLY SIGNIFICANT AREAS

No Environmentally Significant Areas (ESA) are located within the Project area; however, based on the most recent ESA study (Fiera Biological Consulting Ltd. [Fiera] 2014), two ESAs are located north and south of the Project area, including: Etzikom Coulee, approximately 7.0 km northeast; and wetlands, approximately 4.8 km northwest of the Project area.

The Etzikom Coulee is considered a provincially significant ESA, as it is a major glacial spillway, and it contains one of the few nesting areas for Clark’s grebes (*Aechmophorus clarkii*) and white-faced ibis (*Plegadis chihi*). It also contains nesting areas for a variety of other birds, including burrowing owls (*Athene cunicularia*) and ferruginous hawks (*Buteo regalis*). It is an important area for waterfowl staging and production, as well as moulting and staging area for ducks and geese (Sweetgrass Consultants 1997). The wetlands to the northwest scored high in Criterion 3 (i.e., ecological integrity) based on the Fiera (2014) criteria for ESAs.

#### 4.1.5 CROWN OWNERSHIP AND HISTORIC RESOURCES

No Crown ownership claim or Crown surface dispositions are recorded for the Project area (AltaLIS 2013). A *Public Lands Act* water boundaries review was not completed because semi-permanent or permanent wetlands do not occur in the Project area and, as such, will not be impacted by the Project.

First Nation consultation was not completed, as the Project is not located within any identified Historic Resources Lands (Government of Alberta 2017).

### 4.2 AERIAL IMAGERY INTERPRETATION

Five historical aerial photos spanning a period from 1961 to 2009 were used in the analysis and were obtained from the Edmonton Airphoto Library and Bing Imagery. It is unknown when the

area was originally cleared for agricultural use, but land use showed that crop cultivation dominated current and past land use within the Project area. A farm equipment storage area is evident from 1961 until present. In 2009, the man-made dug-out is present and remains within the Project area currently. A total of two wetlands were identified within the Project area (Appendix B). Both wetlands have decreased in size and permanency throughout the historical record, likely a result of land use practices. Wetland 1 historically was likely semi-permanent before development around the wetland occurred (Prior to 1983). Wet areas were noted to the south of the irrigation canal on aerial imagery. However, these wet areas are not consistent in location throughout imagery and upon field investigation no wetlands features were noted.

Of the two wetlands identified within the Project area, 1 wetland was ephemeral and 1 wetland was seasonal. Ephemeral wetlands are characterized as low depressions with standing water for only short periods following heavy precipitation events or snow/ice melt in the spring. The brief periods when standing water is present in these wetlands are not long enough to promote the formation of water-altered soils within 30 centimeters (cm) of the ground surface or the establishment of water-tolerant vegetation communities (Government of Alberta, 2015b).

Seasonal wetlands are typically flooded for parts of the growing season but have little to no surface water remaining by the end of summer. Seasonal wetlands have water-altered soils within 30 cm of ground surface and are typically characterized by the presence of water-tolerant vegetation communities (Government of Alberta, 2015b).

### 4.3 WILDLIFE

The two wetlands were not considered ideal for supporting water birds due to lack of surface water. Point count surveys and targeted wildlife surveys (e.g., burrowing owl, sharp-tailed grouse, amphibians, and raptors) were conducted during the spring of 2017. Targeted surveys did not identify any sensitive species within the Project area and a 1 km buffer. Details on these surveys can be found in the Wildlife Assessment Report for the Stirling Solar Project (Basin 2017).

During the May 22, 2017, field assessment, incidental wildlife occurrences were noted within the Project area (Table 3).

TABLE 3 INCIDENTAL WILDLIFE OBSERVED

Common Name	Latin Name
Killdeer	<i>Circus cyaneus</i>
Western meadowlark	<i>Sturnella magna</i>

#### 4.4 RARE PLANTS

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No rare plants were identified during the field surveys. Rare plants and rare ecological community presence is considered unlikely due to ongoing crop cultivation and livestock grazing within the Project area.

#### 4.5 WETLAND CLASSIFICATION RESULTS

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Two wetlands were identified in the Project area before the field assessments. All wetlands were assessed, and their biophysical features were recorded. Both wetlands were dry at the time of the assessment, and they were heavily grazed. Livestock grazing within the wetlands has removed all wetland-dependent vegetation and promoted weed growth. Organic surface matter and soil horizons were not evident due to pugging and hummocking caused by livestock. Wetland 1 was also covered with hay, possibly to prevent further erosion from cattle within the wetland. None of the wetlands contained surface water at the time of the assessment. Tables 4 and 5 detail the field indicators observed for all wetlands within the Project area.

TABLE 4 FIELD INDICATORS USED TO IDENTIFY AND DELINEATE WETLANDS

Wetland ID	Wetland Class	Size (ha)	Plot Technique (m)	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover (%)
Wetland 1	M-G-III	0.54	1x1	12U 391953 5484147	Flixweed	<i>Descurainia sophia</i>	N	2
					Dandelion	<i>Taraxacum officinale</i>	N	5
					Western dock	<i>Rumex crispus</i>	Y	5
					Grasses	Too heavily grazed to determine species		85
Wetland 2	M-G-I	0.27	1x1	12U 392592 5484228	Kentucky bluegrass	<i>Poa pratensis</i>	N/A	N/A
					Dandelion	<i>Taraxacum officinale</i>		
					Lamb's quarters	<i>Chenopodium album</i>		
					Timothy	<i>Phleum pratense</i>		
					Grasses	Too heavily grazed to determine species		

TABLE 5 INFORMATION AND EVIDENCE TO CLASSIFY WETLANDS

Wetland ID	Location (UTM)	Classification	Soil Characteristics	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 1	12U 391953 5484147	M-G-III	Clay-based soils. Heavily disturbed	No standing water	Heavily grazed. No wetland-dependent vegetation evident	N/A

Wetland ID	Location (UTM)	Classification	Soil Characteristics	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 2	12U 392592 5484228	M-G-I	Clay-based soils. Heavily disturbed	No standing water	Heavily grazed. No wetland-dependent vegetation evident	N/A

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## 5.0 WETLAND AVOIDANCE AND MINIMIZATION

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### 5.1 AVOIDANCE

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Two wetlands were identified within the Project area. Wetland 1, a seasonal wetland, will be avoided and given a buffer of 50 m. Wetland 2, an ephemeral, will be avoided by a distance of 10 m.

### 5.2 IMPACTS TO WETLANDS

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Direct impacts to wetlands are not anticipated.

### 5.3 MINIMIZATION

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Disruption to the natural flow of water into a wetland can result in changes to wetland vegetation, including altered biodiversity and species richness, death of surrounding vegetation, and the establishment of weedy and undesirable plant species. To mitigate these impacts and to avoid future changes to wetland vegetation from proposed construction activities, the terrain surrounding wetlands will be left as intact as possible to ensure adequate surface water flow into the wetlands following snow/ice melt and precipitation events. This will ensure hydrologic stability of these wetlands. Maintaining surface drainage into the wetlands will allow for re-establishment of native wetland vegetation species and promote biodiversity via an increase in species richness.

A cover crop (e.g., barley) will be used for dust control and maintained via mechanical mowing. Mowing should be done during late summer and fall when surface water is not present in the wetlands and when impacts to wildlife, such as breeding or migratory birds, will be minimal or entirely avoided. Solar Krafte will also consult with local farmers to develop site-appropriate noxious and prohibited noxious weed and agricultural pest control methods.

Potential impacts to the environment or wildlife will be minimized by construction timing, and by following the standards and best management practices outlined in the Stirling Solar Project Wildlife Assessment Report (Basin 2017).

The following standard mitigation measures should be implemented at the Project area:

- A qualified environmental professional should be on-site during construction activities. The professional will provide instruction to the contracting crew to ensure regulatory compliance for working in/around waterbodies, including wetlands.

- A qualified environmental professional will recommend mitigations measures for sensitive wildlife, including, but not limited to, amphibians, if present at the time of construction. A qualified biologist should be on site to survey the construction area and relocate any amphibians to reduce the potential of injury to them during construction.
- All mitigation and regulatory requirements will be reviewed during the pre-job meeting, involving the appropriate personnel to ensure that all mitigation requirements are understood and can be implemented.

Table 6 details the measures that will be taken to minimize the indirect impacts to the wetland, where possible.

TABLE 6 MITIGATION MEASURES

Resource Feature	Mitigation Measures
Vegetation and Hydrology	<ul style="list-style-type: none"> <li>• Perform construction during dry ground conditions, specifically when ephemeral and seasonal wetlands are dry (e.g., during late summer and fall months).</li> <li>• Minimize establishment of weed species by ensuring all equipment is cleaned prior to arriving on site.</li> <li>• Weeds will be controlled according to the <i>Alberta Weed Control Act</i> (Government of Alberta 2011).</li> <li>• Use native seed mixes, including wetland-dependent species, to revegetate any disturbed areas.</li> <li>• Avoid clearing or damage to vegetation within riparian areas of wetland, where possible and present. Equipment operators should not disturb or destroy vegetation outside of the Project area.</li> </ul>
Soil and Hydrology	<ul style="list-style-type: none"> <li>• Perform construction in a manner that minimizes soil compaction, rutting and sedimentation. This will include sediment and erosion control measures, including silt fencing, geotextiles, and vegetated buffers, when and where required.</li> <li>• Install effective erosion and sediment control measures before starting work to prevent sediments from entering waterbodies or wetlands</li> <li>• Regularly inspect and maintain erosion and sediment control measures and structures during the construction activities.</li> <li>• Repair erosion and sediment control measures and structures if damage occurs.</li> <li>• Remove non-biodegradable erosion and sediment control materials once site is stabilized.</li> </ul>

Resource Feature	Mitigation Measures
	<ul style="list-style-type: none"> <li>• Fuel and oil products will not be stored within 100 m of any wetland or waterbody. Spill mitigation measures will be in place at designated refueling areas located a minimum of 100 m from all wetlands and waterbodies.</li> <li>• Activities should be halted during adverse construction conditions caused by heavy rains or other weather events.</li> </ul>
Wildlife	<ul style="list-style-type: none"> <li>• Avoid impacts to migratory birds and their nests in accordance with the federal <i>Migratory Birds Convention Act</i> by avoiding wetland impacts during the restricted activity period of April 13 to August 24 (Environment and Climate Change Canada [ECCC] 2017). Should work proceed during this time, a nest search of the area will be undertaken by a qualified Professional Biologist. All listed wildlife species identified in the Alberta <i>Wildlife Act</i> (Government of Alberta 2012), <i>Migratory Bird Convention Act</i> (Government of Canada 1994), and the <i>Species at Risk Act</i> (Government of Canada 2014) will be conserved.</li> <li>• A nest sweep is required prior to construction and is valid for 7 days. Additional sweeps will be required after 7 days to meet conditions of the <i>Migratory Birds Convention Act</i>.</li> </ul>

## 6.0 CLOSURE

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If you have any questions or require additional details, please contact the undersigned.

Sincerely,

**Basin Environmental Ltd.**

Report Prepared by:



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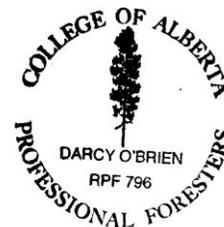
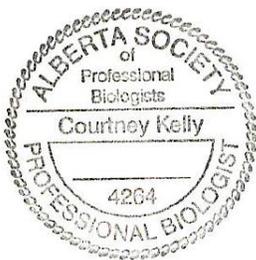
Courtney Kelly, B.Sc., P.Biol.  
Biologist

Reviewed by:



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Darcy O'Brien, B.Sc., RPF  
Principal, Senior Project Manager



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# APPENDIX A

## RESULTS OF HISTORICAL AERIAL PHOTOGRAPH ASSESSMENT

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TABLE 1 HISTORICAL AERIAL PHOTO ASSESSMENT FOR WETLAND 1

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season <sup>1</sup>	AWCS Class	Precipitation Year <sup>2</sup>	Open Water Visible <sup>3</sup>	Photo Notes	Assessment of Permanence
Wetland 1	September 13, 1961	AS813	111	1: 31,680	Fall	M-G-III	N	W	Wetland margins significantly larger than current size	Y
Wetland 1	September 29, 1979	AS2875	240	1: 20,000	Fall	M-G-III	D	W	Wetland margins significantly larger than current size	Y
Wetland 1	April 17, 1983	AS2814	220	1: 20,000	Spring	M-G-III	D	DV	Wetland margins are evident; wetland decreased in size	N
Wetland 1	April 21, 1988	AS3693	49	1: 20,000	Spring	M-G-III	D	DVI	Indistinguishable	N
Wetland 1	September 22, 2009	DS2012	011	1:30,000	Fall	M-G-III	N	DVI	Indistinguishable	N

Notes: 1 Spring = April to June; Summer = June to September; Fall = September to November  
 2 D=Drier; N=Normal; W=Wet; N/A=Not available  
 3 W=Water; D=Dry; DV= Dry vegetated; DVI= Dry, vegetated, indistinguishable

TABLE 2 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 2

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season <sup>1</sup>	AWCS Class	Precipitation Year <sup>2</sup>	Open Water Visible <sup>3</sup>	Photo Notes	Assessment of Permanence
Wetland 2	September 13, 1961	AS813	111	1: 31,680	Fall	M-G-I	N	DVI	Indistinguishable	N
Wetland 2	September 29, 1979	AS2875	240	1: 20,000	Fall	M-G-I	D	W	Very wet; margins easily defined	N
Wetland 2	April 17, 1983	AS2814	220	1: 20,000	Spring	M-G-I	D	DV	Dry; Margins evident	N
Wetland 2	April 21, 1988	AS3693	49	1: 20,000	Spring	M-G-I	D	DVI	Indistinguishable	N
Wetland 2	September 22, 2009	DS2012	011	1:30,000	Fall	M-G-I	N	DVI	Indistinguishable	N

Notes: 1 Spring = April to June; Summer = June to September; Fall = September to November  
 2 D=Drier; N=Normal; W=Wet; N/A=Not available  
 3 W=Water; D=Dry; DV= Dry vegetated; DVI= Dry, vegetated, indistinguishable



FIGURE 1 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1961



FIGURE 2 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1979



FIGURE 3 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1983



FIGURE 4 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1998



FIGURE 5 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 2009.

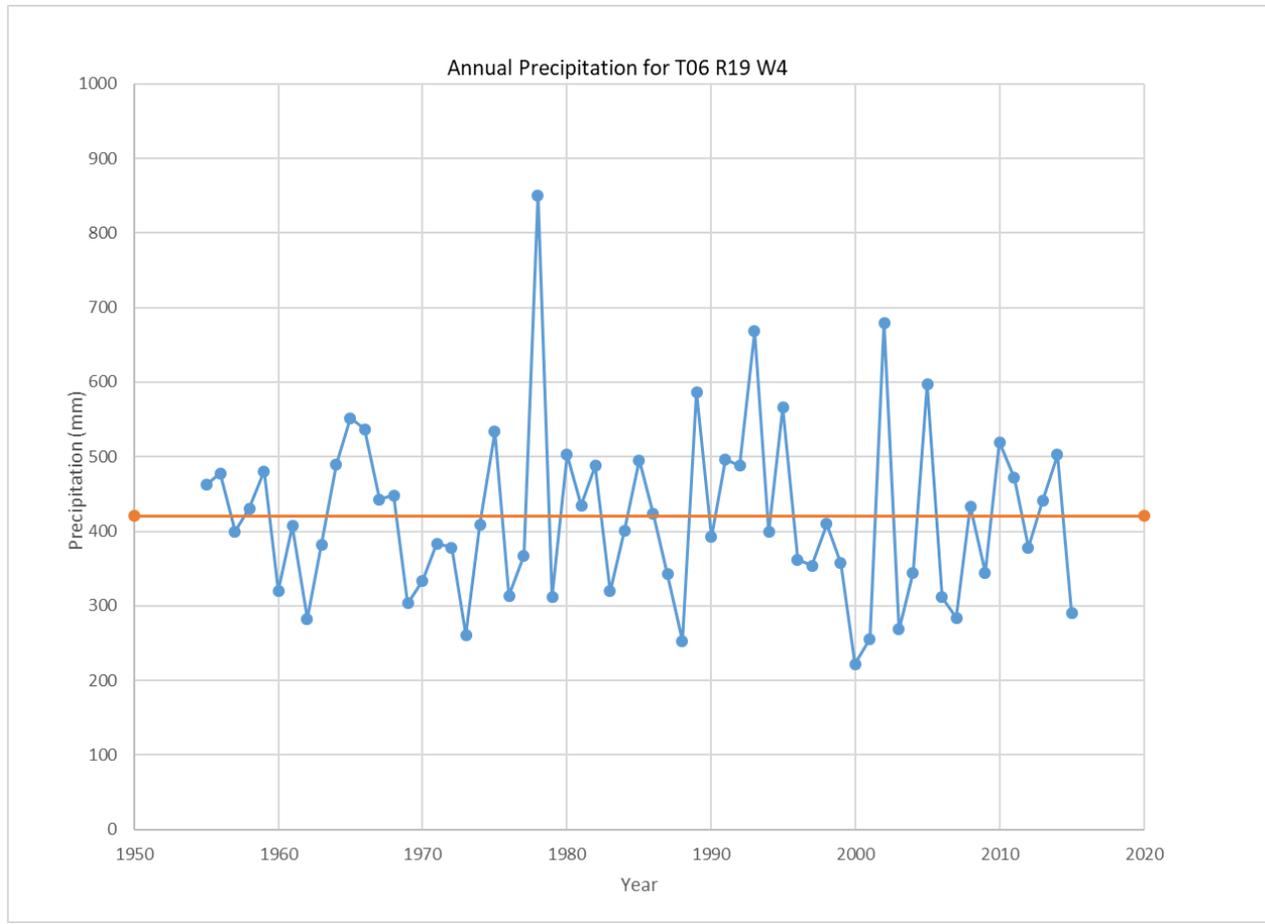


FIGURE 6 PRECIPITATION DATA FROM 1955 TO 2015 (ALBERTA AGRICULTURE 2017)

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## APPENDIX B

### SITE PHOTOGRAPHS

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**WETLAND 1**

Date:  
May 22, 2017

Direction:  
Southeast

Description:  
Wetland covered in hay by  
landowner.

Wetland Classification:  
M-G-III



**WETLAND 1**

Date:  
May 22 ,2017

Direction:  
Ground

Description:  
Weeds evident throughout  
wetland

Wetland Classification:  
M-G-III



**WETLAND 2**

Date:

May 22, 2017

Direction: South

Description:

Wetlands margins are not evident

Wetland Classification:

M-G-I

