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Solar Krafte Utilities Inc.

Wrentham Solar Project

Wildlife Assessment Report - Amended

REFERENCE NUMBER: B-0055-17

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EXECUTIVE SUMMARY

Basin Environmental Ltd. was retained by Solar Krafte Utilities Inc. to conduct a wildlife assessment at the proposed Wrentham Solar Project (the Project). The Project is located in the north half of 36-06-16 W4M. The Solar Photovoltaic (PV) facility will generate up to 41.4 megawatt (MW) of electric power that will be added to two Fortis Alberta distribution feeders.

The purpose of the wildlife assessment was to provide information about wildlife species and wildlife habitat found within the proposed Spring Coulee Solar Project development. Potential impacts that the Project may have on wildlife species and their habitat will be identified to assist with Project planning, and to avoid, minimize or mitigate potential impacts which the Project may cause.

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 owls, sharp-tailed grouse, raptor nests and amphibians.

Two bird species at risk, American kestrel (*Falco sparverius*) and McCown's longspur (*Rhynchophanes mccownii*) were observed during the fall and spring migratory bird surveys, respectively. Foraging habitat was available within the Project area and 1 km buffer; however, due to ongoing disturbance from crop cultivation, and the lack of mature trees and native grassland, breeding habitat for these species was unavailable within the Project area.

Thirty-three wetlands were identified within the Project area, of which, seven (Wetlands 1, 2, 3, 7, 14, 16, and 19) were classified as seasonal wetlands. Solar Krafte will avoid direct impacts to Wetlands 1, 14, 16, and 19 by establishing a small buffer, between 10 meters (m) and 50 m. Wetland 2 will be partially impacted by Project construction, and Wetland 3 and 7 will be impacted by the construction of the perimeter fence. Although Solar Krafte was unable to maintain the 100 m setback for seasonal wetlands, potential impacts to wildlife as a result of the reduced setback will be minimal. Suitable wildlife habitat within the wetlands was poor due to a lack of surface water, water depth, suitable substrate (e.g., no sand), diverse habitat structure and ongoing disturbances from agriculture. However, a 100 m setback will be maintained from the man-made waterbody, which provides breeding and foraging habitat for wildlife as evident by whitewash, ungulate tracks, a small mammal burrow and a coyote den/tracks.

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 no more than 7 days prior to clearing by an experienced 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 or minimize potential impacts. An experienced environmental professional will be on site to monitor construction of the Wrentham 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 the applicable environmental laws and regulations are being followed.

To determine the effectiveness of the mitigation measures, 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 persistence and searcher efficiency and to monitor potential impacts that the Wrentham Solar Project may have on species at risk, sensitive species and other wildlife.

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

Solar Krafte Utilities Inc. (Solar Krafte), Belectric and innogy SE propose to permit, construct and operate the Wrentham Solar Project, a 41.4 megawatt (MW) Solar Photovoltaic (PV) facility (the Project) located approximately 9 kilometers (km) east of Wrentham, Alberta. The Project is in the White Area of Alberta, in the north half of 36-06-16 W4M (Figure 1).

1.2 PROJECT DESCRIPTION

The Project will be comprised of two different PV substructures. The north half of the Project, 23.4 MW, 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 on a single axis with the sun in an east to west direction. Computer controlled electric motors will power the trackers. The south half of the project, 18.0 MW, will consist of fixed-tilt structures with solar PV modules set up in a west/ east direction, oriented to the south and angled at 25 degrees to optimize solar resource efficiency. 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 feeders located on the roadway. The Wrentham Solar Project will encompass an area of approximately 135.2 hectares (ha); however, the proposed footprint consisting of the solar arrays, inverters and access roads will only be 33.1 ha. Construction of the Project is anticipated to occur between October 2018 and September 2019 for the north half, and between January 2019 and December 2019 for the south half.

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 120,000, 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 118,164 First Solar FS-6420 modules. These modules are 2.0 meters (m) in length and 1.2 m in width, and each produces 420 watts of DC power. For the north half of the Project, the modules are mounted one wide on the tracker, for a total array width of 2.01 m. The trackers are installed 3.0 m apart. For the south half, the modules are mounted six wide on the substructure, for a total array width of 12.2 m. The structures are installed in rows 3.0 m apart.

Basin Environmental Ltd. (Basin) was retained by Solar Krafte to conduct a wildlife assessment of the proposed Wrentham 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.

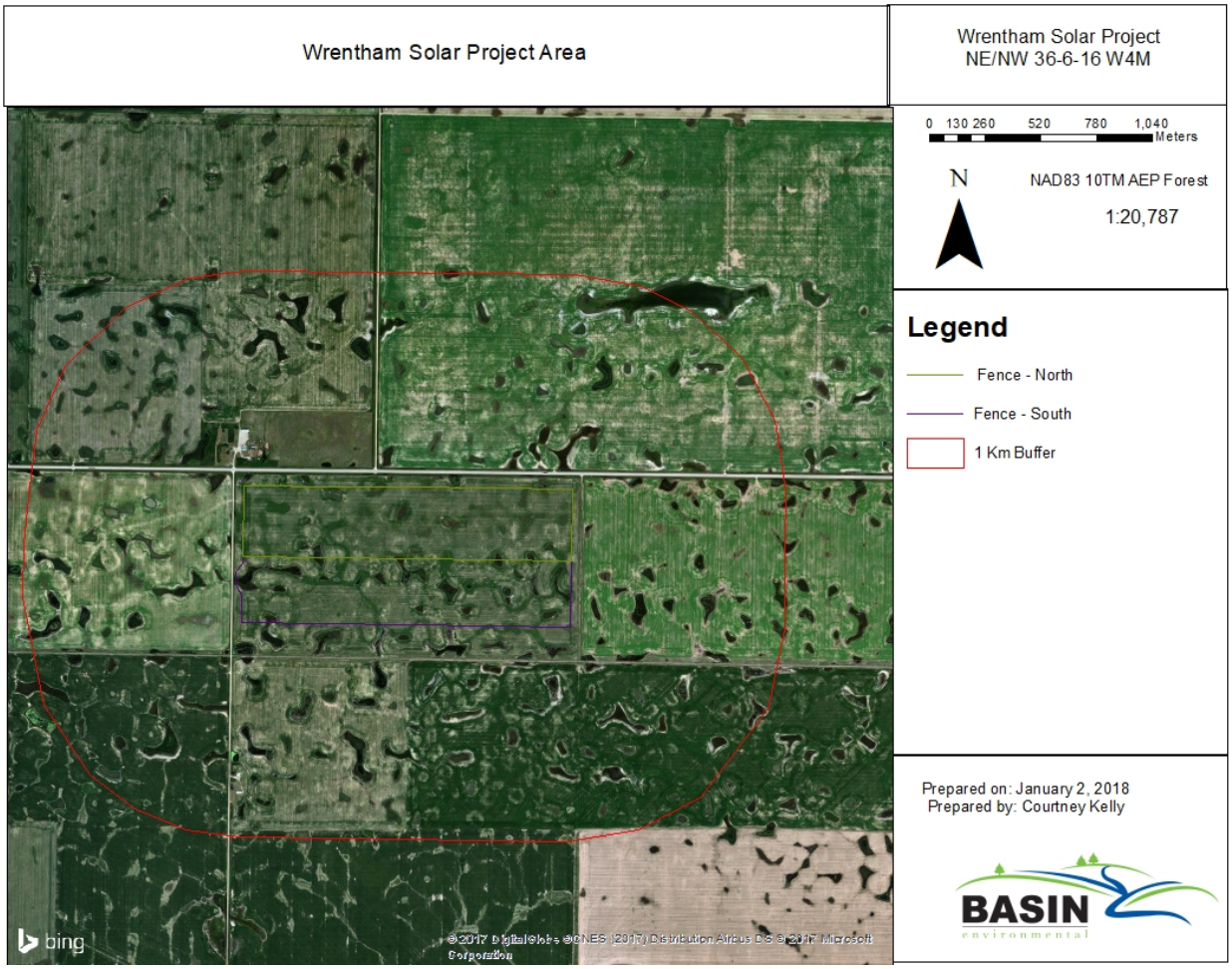

FIGURE 1. LOCATION OF THE WRENTHAM SOLAR PROJECT WITHIN ALBERTA

1.3 PURPOSE

The purpose of the wildlife assessment was to provide information about wildlife species and wildlife habitat found within the proposed Wrentham Solar Project development. Potential impacts that the Project may have on wildlife species and their habitat will be identified to assist with Project planning, and to avoid, 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 bird surveys, migratory bird surveys, burrowing owl surveys, sharp-tailed grouse surveys, raptor nest surveys, and amphibian surveys.

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

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

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.

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*.

1.4.2 SPECIES AT RISK ACT

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.

1.4.3 ALBERTA'S *WILDLIFE ACT*

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"*. Therefore, no one will hunt, disturb or harm wildlife without a permit (i.e., hunting licence or collection permit). The proponent understands that the Wildlife Renewable Energy Referral Report does not grant permission to disrupt or kill wildlife, and that all wildlife whether dead or alive, are the property of the Crown.

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.

1.4.4 GENERAL STATUS OF ALBERTA WILD SPECIES

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.

1.4.5 WILDLIFE DIRECTIVE FOR ALBERTA SOLAR ENERGY PROJECTS

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.

1.4.6 AUC RULE 007

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.

2.0 METHODS

2.1 DESKTOP REVIEW

Prior to the field assessments, background information and environmental data was reviewed to identify wildlife species and wildlife habitat 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

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), unless otherwise discussed with the AEP Wildlife Biologist. 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.. 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, both of whom are experienced wildlife biologists. All wildlife observed were identified to species, where visually possible, and the location of sensitive wildlife habitat was recorded using a handheld Garmin GPS map 64s. Where necessary, and to minimize disturbance, binoculars and a spotting scope were used to identify wildlife species observed outside of the biologist's visual range, as well as in areas where Basin did not have landowner permission.

2.2.1 BREEDING BIRD SURVEYS

Breeding bird surveys were conducted following the point-count survey method outlined in the Sensitive Species Inventory Guidelines (Alberta Government 2013). Six survey stations, S-1 to S-6 were established throughout the Project area, were established throughout the Project area, approximately 800 m 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).

When conducting the breeding bird surveys, the timing windows outlined in the Wildlife Guidelines for Alberta Solar Energy Projects: early species: May 1 to June 15, late species: June 16 to July 15 were utilized (AEP 2016a). To capture grassland bird species throughout the spring breeding season, the early spring breeding bird survey was conducted on May 1 and 2, 2017 from 0600 to 0700, and the late spring survey was conducted on June 28, 2017 from 0725 to 0800. At each survey station, a 3 to 5 minute passive survey was conducted and all bird species heard or seen were recorded within a 100 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 100 m radius were also noted.

2.2.2 MIGRATORY BIRD SURVEYS

Migratory bird surveys were conducted using a modification of the point-count survey method outlined in the Sensitive Species Inventory Guidelines (Alberta Government 2013). Five survey stations, S-1 to-S-5, were established throughout the Project area, approximately 800 m 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).

The migratory bird surveys were conducted in the morning hours to target songbirds, and in the late afternoon to target raptors and migrating waterfowl. Surveys were conducted for a total of 20 minutes at each survey station, as per standard protocols, and all bird species detected visually and/or by call/song within a 500 m radius were identified to species and recorded. The experienced wildlife biologists used spotting scopes and binoculars to increase the likelihood of observing birds within the 500 m. Given the featureless, flat terrain it was possible for observers to identify birds within this search radius. Other data recorded included the number of species observed, the direction and estimated distance to the bird, and observed wildlife habitat (e.g., nests). Species observed outside of the 500 m radius were noted as incidental species.

Spring migratory bird surveys were conducted on April 5 (early), 18 (mid), and May 1 and 2, 2017 (late). Fall migratory bird surveys were conducted on August 31 (early), September 27 (mid) and October 23, 2017 (late). All of the migratory bird surveys were conducted in the morning hours from 0545 to 1000 to target songbirds and in the afternoon/early evening from 1400 to 1900 to target raptors and migrating waterfowl.

2.2.3 SHARP-TAILED GROUSE SURVEY

A visual ground survey was conducted on April 5 and May 2, 2017 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 during this period of low light, observers listened for sharp-tailed grouse vocalizations. At sunrise, observers scanned the Project area and 1 km buffer for sharp-tailed grouse activity as light conditions improved. At each survey location the following data was recorded: date, start and end time, weather (cloud cover, temperature, wind speed, precipitation), and survey locations were recorded using a handheld GPS. Sharp-tailed grouse surveys were completed within the appropriate time period and weather conditions recommended in the Sensitive Species Inventory Guidelines. Sharp-tailed grouse surveys were completed for 15 minutes, and ended no later than 3 hours after sunrise.

2.2.4 BURROWING OWL SURVEY

Burrowing owl surveys were conducted within the Project area and within the recommended 500 m setback, where Basin had landowner permission or could access public roads. 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. Six survey stations were established throughout the Project area, 600 to 800 m apart. Each station was geo-referenced and the weather conditions, time of survey and location were recorded. The surveys were completed

on May 16, 2017 between 0730 and 0830. Binoculars and a spotting scope were utilized to further identify an individual species and to determine activity if a nest was observed.

A call-playback survey was conducted on May 16, 2017 between 0600 and 0815. 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, continuing for an additional 1 minute following the callback period. Location, abundance and age were recorded for any observed owls.

Following the callback survey on May 18, 2017, a ground search was conducted to identify potential nests/burrows. The field crew began the search from the centre of the survey area and walked in concentric circles until they reached a distance of 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.

2.2.5 RAPTOR NEST SURVEY

Prairie raptor nest surveys were conducted within the Project area and the 1 km buffer on April 5 and May 1 and 2, 2017. The Project area and the 1 km buffer were scanned with a spotting scope and binoculars, and all observed raptor species and nests were recorded. Data recorded 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).

2.2.6 AMPHIBIAN SURVEY

Auditory and visual amphibian surveys were conducted at all wetlands and areas with standing water as well as within a 100 m radius, on April 20, 2017. Northern leopard frog was the target species for these surveys; however, all amphibian species observed were recorded.

A call survey were conducted at night, after sunset, 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). At each survey site, the date, time and weather (e.g., 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. As northern leopard frogs are difficult to detect during auditory surveys, Basin consulted with AEPs wildlife biologist to determine that a visual survey for northern leopard frog should occur in August due to the increased likelihood of a successful observation.

A visual survey was conducted on April 20, 2017 during the day. 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.

Basin's experienced wildlife biologists conducted the visual survey for northern leopard frogs 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 (e.g., temperature (air and water), wind speed and precipitation), 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.

Amphibian surveys were not conducted for ephemeral breeders (e.g., plains spadefoot toad and great plains toad) due to 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). Conditions for these surveys were not appropriate in the spring of 2017.

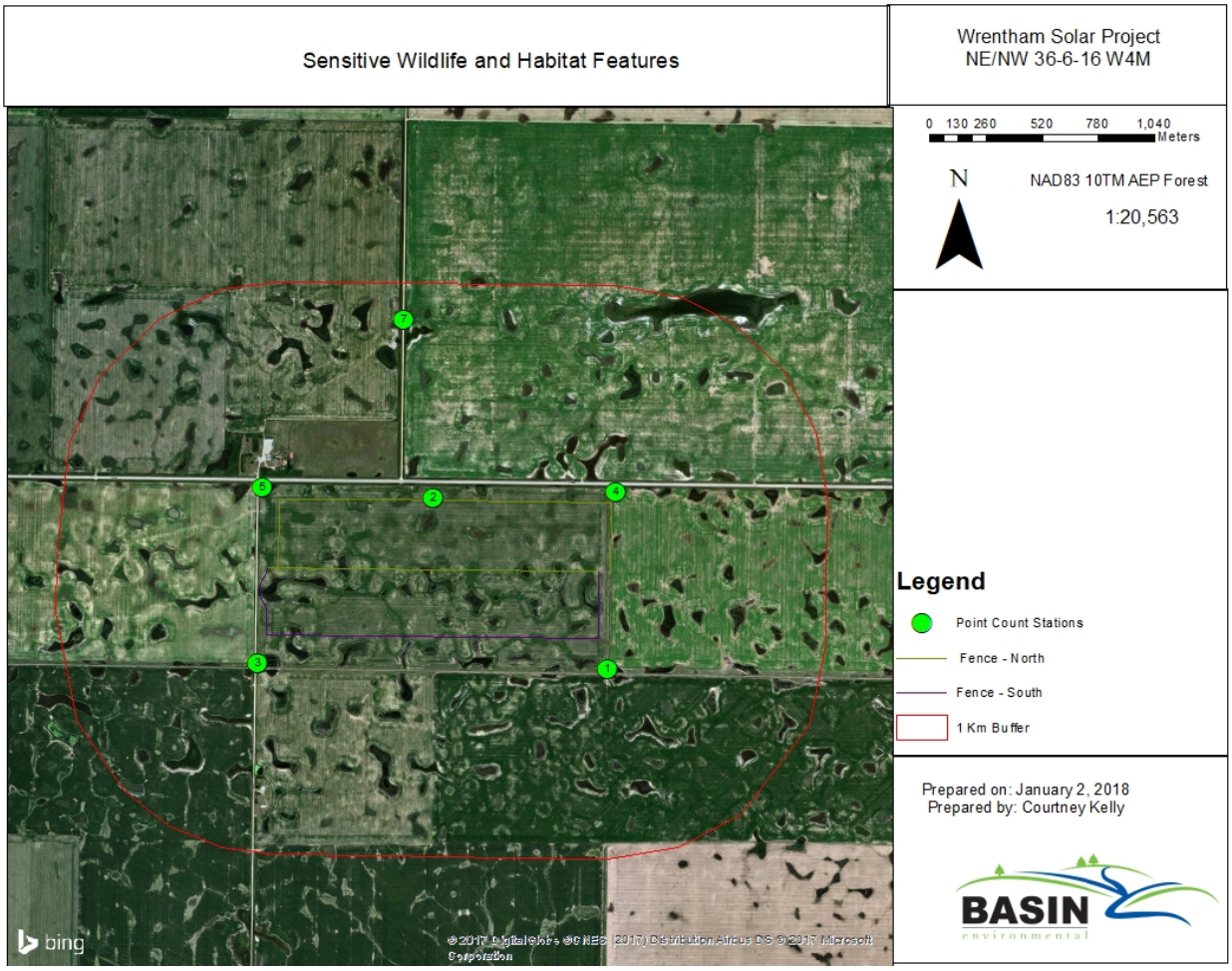

FIGURE 2. LOCATION OF WILDLIFE SURVEY STATIONS WITHIN THE PROJECT AREA AND 1 KM BUFFER

3.0 RESULTS

3.1 DESKTOP REVIEW

3.1.1 WILDLIFE HABITAT OVERVIEW

The Project is located within the Dry Mixedgrass Natural Subegion 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 Dry Mixedgrass Natural Subregion is the largest of the four Natural Subregions in the Grassland Natural Region. This Natural Subregion is characterized by gently undulating glaciated plains with inclusions of hummocky and dissected uplands. Brown Chernozems are the dominant soils with Brown Solonetzic soils developed where saline and sodic conditions prevail. Vegetation in this Subregion is characterized by low-growing, drought-tolerant mixedgrass communities. Two percent of this Subregion is occupied by open water, with three 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 two residences. The entire project area, including the 1 km buffer, was assessed for native habitat, where accessible. No native grassland habitat or rare plant species were observed. Vegetation along the field margins consisted primarily of disturbance species (i.e., non-native and weed species) and would not qualify under the definition of native grassland. Refer to Figure 3 for the habitat cover type within the 1 km buffer. It should be noted that Basin did not have permission to enter lands within the 1000 m buffer, but all attempts were made to observe habitat and species within the buffer through access on public roads.

Thirty-three wetlands were identified within the Project area and the 100 m buffer, most of which have been previously disturbed by agricultural practices which have resulted in the disturbance or removal of all wetland-dependent vegetation species, organic surface matter and soil horizons (Basin 2017). The wetlands were classified as the following:13 ephemeral, 13 temporary and 7 seasonal. Refer to the Wrentham Wetland Assessment and Impact Report

(Basin 2017) for further details.

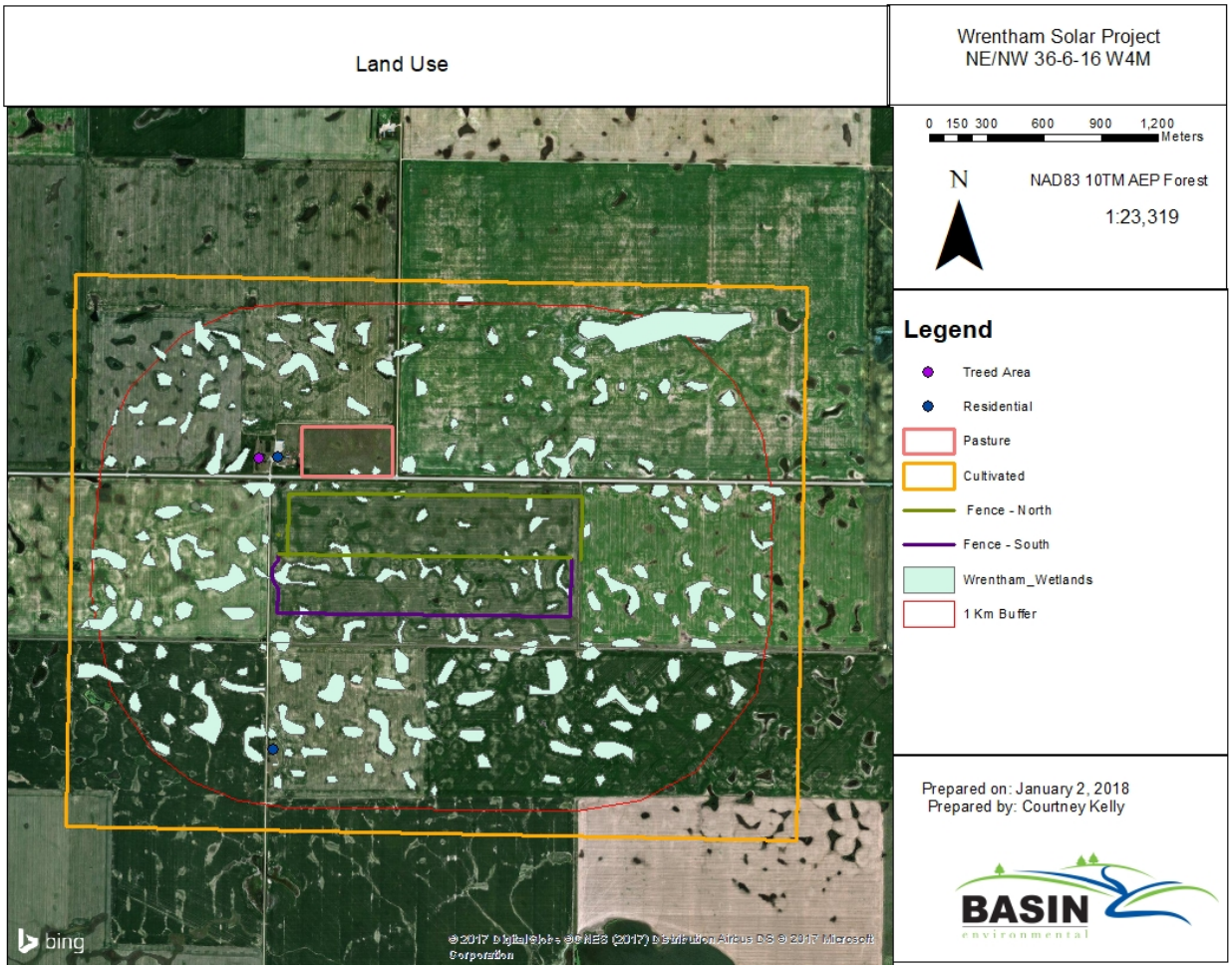

FIGURE 3. HABITAT COVER TYPE WITHIN THE PROJECT AREA AND THE 1 KM BUFFER

3.1.2 ENVIRONMENTAL SENSITIVITIES

Sensitive features that overlap the Project area include the Burrowing Owl Range; Sharp-tailed Grouse Survey Area; Sensitive Amphibian Range (i.e., northern leopard frog, great plains toad, and plains spadefoot); 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 (Government of Alberta 2017) or within or near any Important Bird Area (IBA) (Bird Studies Canada 2017). However, the Project is located in 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 were located north and south of the Project area, including Etikom Coulee approximately 7.0 km south, and Chin Coulee approximately 6.0 km north 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). Chin Coulee ESA is a new ESA, and no information was found regarding its significance; however, it may contain important riparian areas, and is used by water birds.

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 1 km buffer (Table 3, Appendix A). A search of the FWMIS database (AEP 2017c) and historical FWMIS records identified four 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[1]	Wildlife Act[2]	COSEWIC[3]	SARA[4]
Amphibians					
plains spadefoot	*Spea bombifrons*	May Be at Risk	Not Listed	Not at Risk	No Status
Birds					
chestnut-collared longspur	*Calcarius ornatus*	At Risk	Not Listed	Threatened	Threatened
sora	*Porzana carolina*	Sensitive	Not Listed	Not Listed	No Status
Mammals					
American badger	*Taxidea taxus*	Sensitive	Data Deficient	Special Concern	No Status

Common Name	Scientific Name	Provincial Designation		Federal Designation	
		Wild Species[1]	Wildlife Act[2]	COSEWIC[3]	SARA[4]

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)

3.2 FIELD SURVEY RESULTS

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

3.2.1 BREEDING BIRD SURVEYS

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 1 and 2, 44 birds from 12 different species were recorded. During the late spring survey on June 20, 35 birds from ten different species were recorded. Results of the breeding bird surveys are in Appendix C, Tables 4 and 5.

3.2.2 MIGRATORY BIRD SURVEYS

Spring migratory bird surveys were conducted on April 5, 18, and May 1and 2, 2017 and birds were recorded within a 500 m radius of the survey stations. During the spring migration surveys, 140 birds from 18 different species were recorded; and, the most abundant species observed was the horned lark (*Eremophila alpestris*). The McCown's longspur (*Rhynchophanes mccownii*) was the only species at risk observed.

Fall migratory bird surveys were conducted on August 31, September 1, 27 and October 23, 2017 and birds were recorded within a 500 m radius of the survey stations. During the fall migration surveys, 233 birds from 15 different species were recorded. The brown-headed cowbird (*Molothrus ater*) was the most abundant species observed. The American kestrel (*Falco sparverius*) was the only species at risk observed.

Results of the spring and fall migratory bird surveys are in Appendix D, Table 6 and Table 7.

3.2.3 SHARP-TAILED GROUSE SURVEY

Sharp-tailed grouse surveys were completed on April 5 and May 2, 2017. No sharp-tailed grouse, signs of grouse or leks were observed.

3.2.4 BURROWING OWL SURVEY

No burrowing owls were heard or seen, and no burrows were observed at any of the six survey stations during the May 16 and 18, 2017 callback and ground surveys.

3.2.5 RAPTOR NEST SURVEY

No raptor nests were observed within the Project area and the 1 km buffer. Nesting habitat within the Project area and the buffer was minimal, with a few sparse trees on residential properties northwest and southwest of the Project area. An American kestrel, Swainson's hawk (*Buteo swainsoni*) and northern harrier (*Circus cyaneus*) were observed during the bird surveys.

3.2.6 AMPHIBIAN SURVEY

Auditory and visual surveys were conducted at all waterbodies that contained standing water on April 20, 2017. No amphibian species at risk, tadpoles or egg masses were observed. Visual surveys were conducted on August 22, 2017 for northern leopard frogs at the man-made waterbody; the wetlands within the Project area were dry at the time of assessment.

Amphibian surveys were not conducted for ephemeral breeders (e.g., plains spadefoot toad and great plains toad) due to 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).

3.2.7 INCIDENTAL WILDLIFE SPECIES

Ungulate tracks were observed in the substrate around the man-made waterbody. A mallard was the only species observed beyond the 500 m survey radius during the spring migratory bird surveys. Species observed during the wetland assessment included: horned lark, killdeer (*Charadrius vociferus*), mallard, northern pintail (*Anas acuta*), red-winged blackbird, savannah sparrow (*Passerculus sandwichensis*) and western meadowlark (*Sturnella neglecta*).

3.2.8 SPECIES AT RISK

Two species of risk were observed during the wildlife surveys, American kestrel and McCowan's longspur. The American kestrel is listed provincially as 'Sensitive'. McCowan's longspur are listed provincially as 'May be at Risk' (AEP 2017a), and as 'Threatened' by COSEWIC and 'Special Concern' under *SARA* (Government of Canada 2017).

American kestrels prefer open areas, road sides, and pastures with short grassland vegetation and few trees, and nest in tree cavities along hedgerows and watercourses in the Grasslands NR (Federation of Alberta Naturalists 2007). McCown's longspur are ground nesters and prefer open, sparsely vegetated areas and/or crop fields where the soil remains bare after tillage (Federation of Alberta Naturalists 2007).

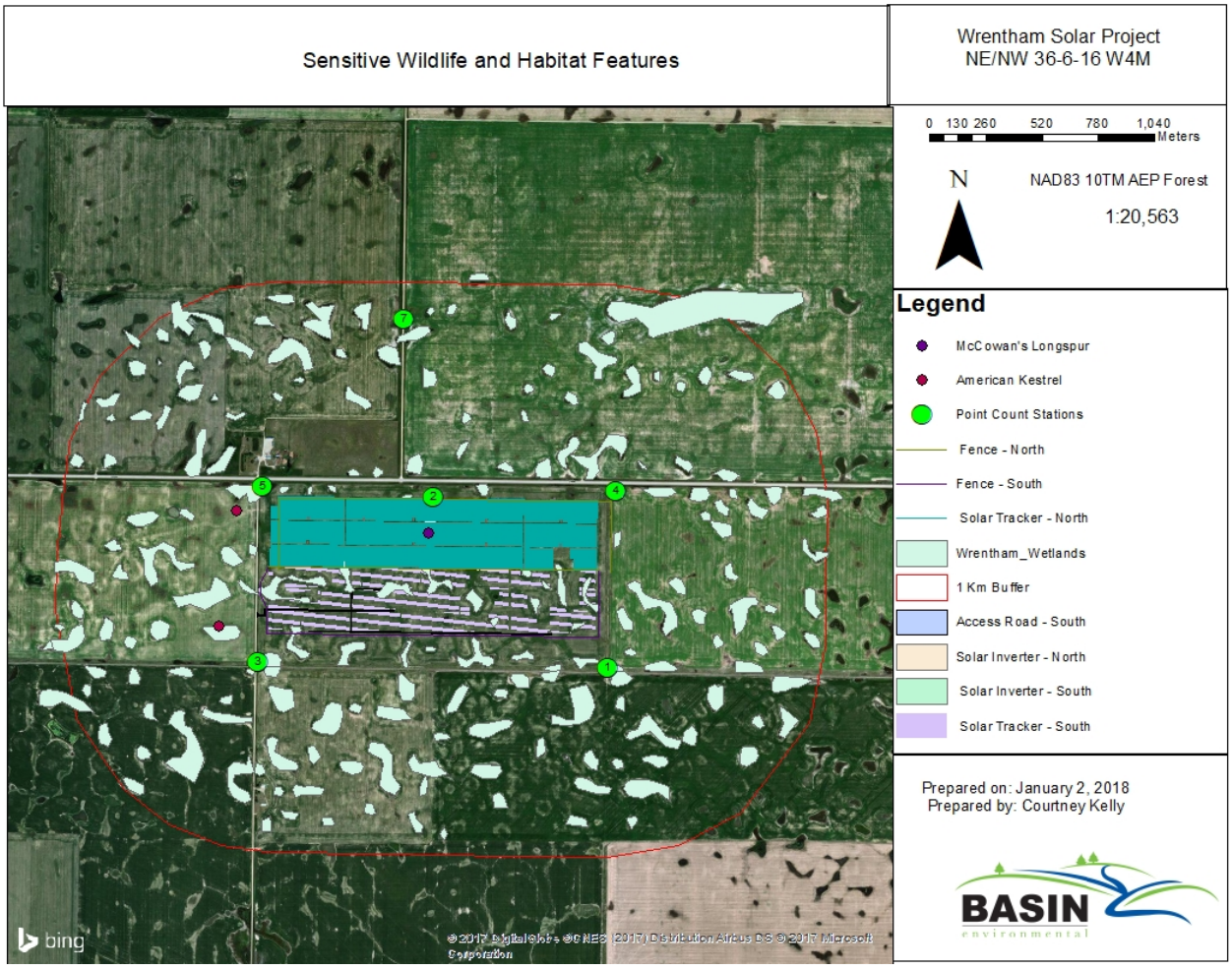

FIGURE 4. OVERVIEW MAP OF PROJECT INFRASTRUCTURE AND SENSITIVE WILDLIFE HABITAT

4.0 DISCUSSION

4.1 WILDLIFE RESULTS

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 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 Wrentham Solar Project on previously disturbed land minimizes potential impacts to wildlife.

Thirty-three wetlands were identified within the Project area, most of which had been previously disturbed by crop cultivation. Seven wetlands (Wetlands 1, 2, 3, 7, 14, 16, and 19) were classified as seasonal wetlands, and the remaining wetlands were classified as ephemeral or temporary. Detailed information regarding the wetlands can be found in the Wrentham Solar Project Wetland Assessment and Impact Report (Basin 2017) in Appendix F. Solar Krafte worked diligently with their engineers to avoid direct impacts to Wetlands 1, 14, 16, and 19. Wetland 1 will be avoided by a 10 m buffer; Wetland 3 by a 50 m buffer, although a fence will be constructed through it; and, Wetlands 14, 16 and 19 will be avoided by a 30 m buffer. Wetland 2 will be partially infilled to construct the solar arrays, and the southern boundary perimeter fence will be constructed through Wetlands 3 and 7. Wetlands 2, 6, 8, and 10 will also avoid direct impacts by the Project(Figure 5).

Although Solar Krafte was unable to achieve the 100 m setback required for seasonal wetlands; the reduced setback and partial impacts are not expected to increase the risk to wildlife. The risk will remain low as wildlife use within the area is primarily foraging rather than nesting habitat due to a lack of water depth, suitable substrate, diverse habitat structure, and vegetation composition, as well as the existence of suitable wetland habitat in surrounding land. The wetlands are subject to ongoing disturbances from tracking irrigation sprinklers and crop seeding/cultivation. These disturbances impact nesting habitat suitability and disturb breeding and foraging water birds and songbirds. Solar Krafte is committed to implementing all the

mitigation measures outlined in Section 5.0, including, but not limited to: prior to construction, silt fencing will be installed around the wetland at the setbacks, respectively, as a preventative measure; pre-construction amphibian surveys will continue to identify any amphibians on site that need to be mitigated for; an experienced wildlife biologist will also be present on-site during construction; and, as a last resort, amphibians found on the construction site will be relocated. Relocation will require a permit, and methodologies will be approved by AEP in advance.

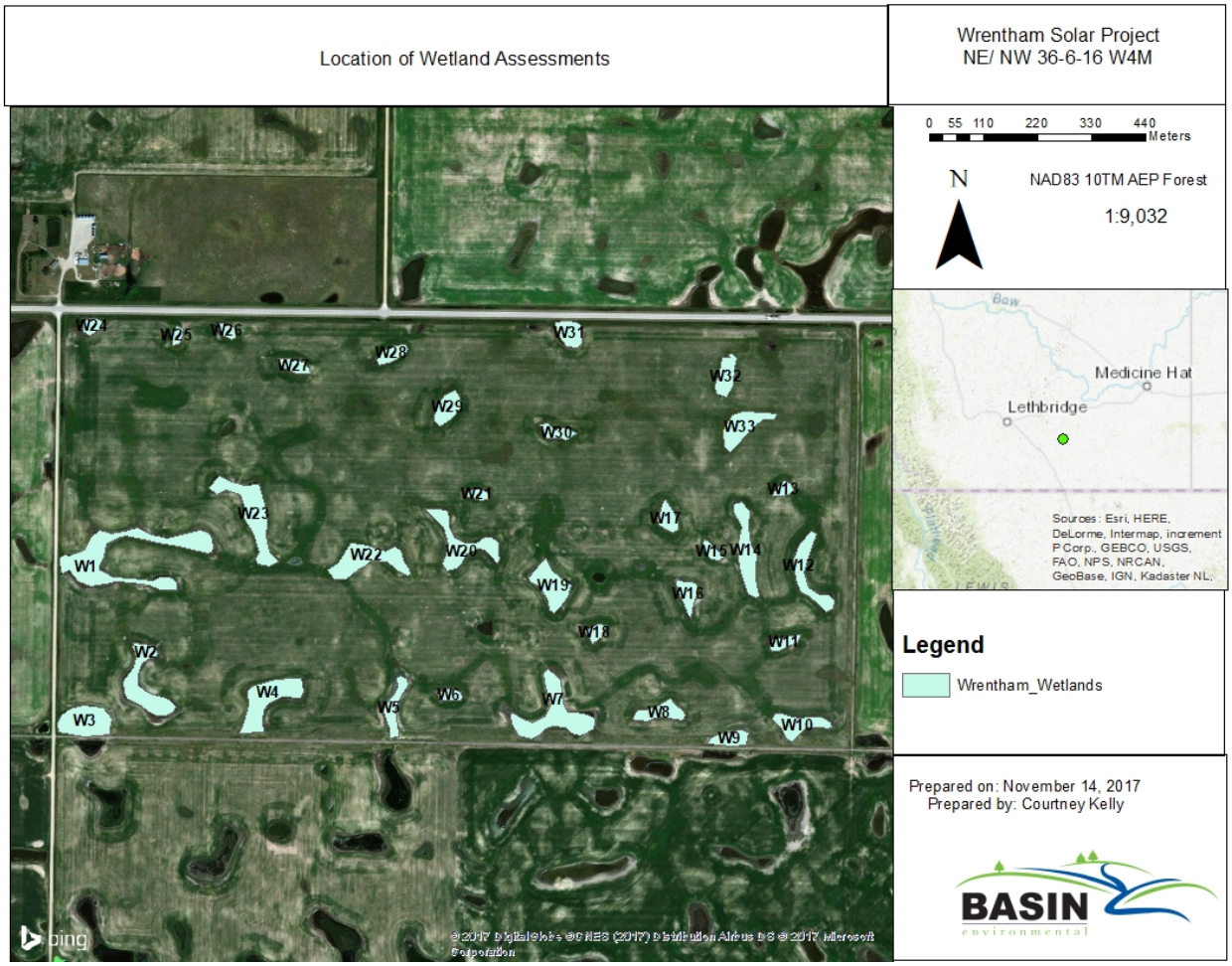

FIGURE 5. CLASSIFIED WETLANDS WITHIN THE PROJECT AREA

Also, the wetlands lacked suitable habitat for northern leopard frogs and plains spadefoot toads due to ongoing disturbances, unavailability of suitable soils and surface water depth. Northern leopard frogs require shallow, warm standing water for breeding (Stevens et al. 2010) and deep, aerated wetlands for overwintering; although, they may breed in the same waterbodies as they overwinter (Kristin Cline, pers. comm. [Aug. 9, 2017]). There was little to no water at all the

wetlands, therefore minimizing foraging opportunities for amphibians. Most of the soils were disturbed, but those with remaining soil profiles consisted of organics and clay, not sandy soils which plains spadefoot toads require (Lauzon 1999); therefore, the potential presence of these irruptive breeders is low. The wetlands also lacked suitable water depths for amphibian breeding and overwintering habitat.

A man-made waterbody, which was identified as part of Wetland 7, a seasonal wetland, was identified along the southern boundary of the Project area and is used by various wildlife species, as evident by numerous ungulate tracks, coyote tracks and whitewash near the water's edge. A coyote den and a small mammal burrow were also observed along the south berm of the man-made waterbody. To minimize potential impacts to wildlife, Solar Krafte will maintain a 100 m setback from this wetland.

Two species at risk were observed during the wildlife surveys, American kestrel and McCown's longspur. As the Project area is currently use for crop cultivation, nesting habitat for McCown's longspur was minimal due to a lack of short grass prairie and patches of bare ground. However, they will use stubble fields as a secondary habitat and were observed foraging during the late spring migratory/early breeding bird survey, shortly after crop seeding. The American kestrel was observed perched on the fence along Range Road 161. Although there were no mature trees within the Project area to provide nesting habitat for raptors, there were small clumps of deciduous trees to the northwest, within the 1 km buffer. Foraging habitat was present throughout the Project area and 1 km buffer, as evident by raptors such as Swainson's hawk and northern harrier, which were observed circling above the fields during the bird surveys.

Habitat loss due to Project activities for these species at risk, as well as for those that have previously been documented within the Project area, will be low due to a lack of native grassland habitat and wetlands with suitable foraging and hibernating habitat, as well as the presence of similar and more suitable habitat in surrounding lands. 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 an experienced environmental professional onsite during construction to ensure compliance with the appropriate environmental laws and regulations. Other potential impacts will be prevented where possible, and minimized through the implementation of the mitigation measures outlined in Section 5.0.

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. 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. To ensure the integrity of the wetlands, the future cover crop will not be planted within 50 m of any of the wetlands.

4.2 POTENTIAL IMPACTS DURING CONSTRUCTION AND OPERATION

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.

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

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 previously been permanently converted to agricultural use, therefore minimizing the impact of habitat loss resulting from the placement of the solar facility.

Cattle fencing will be erected around the perimeter of the proposed Project footprint. All of the fencing will be squared off and constructed straight to ensure there are no wildlife entrapment issues. There will be a 50 m buffer between the perimeter fence and the facility fence. For public safety and to discourage unauthorized entry to the site, the fence that surrounds the facility will

be a 6 foot chain-link fence with a single strand of barbed wire on the top. The single barbwire strand will be flagged with hi-visibility tape to increase visibility for wildlife. The bottom of the chain-link fence around the entire facility will be raised by 6 inches to allow for ease of wildlife passage into and out of the facility. The facility fence will cross Wetland 2, 3 and 12, however, raising the fence by 6 inches will minimize the likelihood of wildlife strandings on either side of the fence.

4.2.2 HABITAT DEGRADATION

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 are likely to 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 there is no significant noise attributed to the tracker movement, and PV solar systems are known to generate electricity without generating noise (Tsoutsos et. al. 2005). The manufacturer, SunGrow reported the inverters have a sound level of <70 dBA following the ISO 3746 standard.

4.2.3 MORTALITY RISK

Although there is a risk of wildlife mortality associated with the operation of the solar PV facility; there is no risk of electrocution of birds as all lines and cables will be buried underground during construction of the Wrentham Solar Project. 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. The risk of collision along the access roads may be lower than the risk to wildlife along Highway 61 and Range Road 161, which borders the Project area to the north and west, respectively.

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", which is hypothesized to occur 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, mergansers 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 Wrentham 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 proven or disproven to date due to the limited number of solar projects reviewed and due to inconsistencies in 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 these species at risk.

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).

5.0 CONSTRUCTION AND OPERATION MITIGATION PLAN

Solar Krafte is committed to implementation of the mitigation measures, standards and best management practices outlined in Table 2, which 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, 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

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, Solar Krafte will make every attempt to schedule construction outside of the grassland breeding bird season (April 1 to July 15). However, if construction does occur within the breeding bird season, pre-construction nest surveys will be conducted by an experienced 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 wildlife feature 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 and agreed to by an AEP Wildlife Biologist.

During operation, maintenance of ground cover will not occur during the breeding bird season due to the presence of ground nesting bird species. PV panels will 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. Mitigation measures will be implemented to prevent future mortalities.

TABLE 2. RECOMMENDED MITIGATION MEASURES FOR THE CONSTUCTION AND OPERATION PHASES OF THE WRENTHAM SOLAR PROJECT

Concern	Construction Mitigation	Operation Mitigation
General	• Project personnel will be provided with an environmental orientation, including site-specific environmental sensitivities and mitigation measures (e.g., spill response plan). • Project personnel will be provided environmental training as part of the site orientation. • Project personnel will report wildlife injuries/mortalities to the experienced wildlife biologist. Responses will be case-specific, in consultation with the local Fish and Wildlife office. • If handling or transportation to a wildlife rehabilitation center is required, all handling of wildlife will be conducted by an experienced wildlife biologist, in consultation with AEP. • Snake awareness and safety training will be provided to all on-site workers. If snakes are regularly found on-site (regardless of species), Solar Krafte will contact AEP to determine if a snake mitigation plan is needed for the protection of the snakes as well as the safety of their workers.	• Project personnel will be provided with an environmental orientation, including site-specific environmental sensitivities and mitigation measures (e.g., wildlife mortality reporting). • Project personnel will be provided environmental training as part of the site orientation. • Project personnel will report wildlife injuries/mortalities to the experienced wildlife biologist. Responses will be case-specific, in consultation with the local Fish and Wildlife office. • If handling or transportation to a wildlife rehabilitation center is required, all handling of wildlife will be conducted by an experienced wildlife biologist, in consultation with AEP. • Snake awareness and safety training will be provided to all on-site workers. If snakes are regularly found on-site (regardless of species), Solar Krafte will contact AEP to determine if a snake mitigation plan is needed for the protection

Concern	Construction Mitigation	Operation Mitigation
		of the snakes as well as the safety of their workers.
Timing Restrictions	• In compliance with the federal *Migratory Birds Convention Act* and the Alberta *Wildlife Act*, construction will be minimized during and the breeding bird season from April 1 to July 15 (AEP 2017b). • Amphibian surveys will be required within 100 m of wetlands during the breeding season to determine the presence of breeding habitat for amphibians. If breeding amphibians are found, silt fencing to a minimum height of 30 cm will be placed around the wetlands at the setback distance prior to construction to minimize potential impacts to amphibians.	• In compliance with the federal *Migratory Birds Convention Act* and the Alberta *Wildlife Act*, vegetation maintenance will be avoided during the breeding bird season,o April 1 to July 15 (AEP 2017b).
Nest Protection	• If work must be conducted during the breeding bird season, a nest sweep will be required no more than 7 days prior to work commencement, and is valid for 7 days. Additional sweeps will be required after 7 days to prevent contravention of the *Migratory Birds Convention Act*. • Should an active nest be found, a species appropriate setback buffer and timing restriction will be established by an experienced wildlife biologist, and the Contractor will be notified.	• If work must be conducted during the breeding bird season, a nest sweep will be required no more than 7 days prior to work commencement, and valid for 7 days. Additional sweeps will be required after 7 days to prevent contravention of the *Migratory Birds Convention Act*. • Should an active nest be found, a species appropriate setback buffer and timing restriction will be established by an experienced wildlife biologist, and the Contractor will be notified.

Concern	Construction Mitigation	Operation Mitigation
	• Active nests, dens or burrows of prescribed species will not be disturbed.	• Active nests, dens or burrows of prescribed species will not be disturbed.
Noise Abatement (management)	• 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). • All equipment will be equipped with functioning mufflers or other appropriate sound dampening devices. • Construction activities will be restricted to daytime hours if possible, to avoid noise disruption at night.	• All equipment will be equipped with functioning mufflers or other appropriate sound dampening devices.
Vehicle collisions	• 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. • Vehicle activity in sensitive areas will be minimized.	• 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. • Vehicle activity in sensitive areas will be minimized.
Wetland protection	• An experienced wildlife biologist will be on-site during construction activities to provide instruction to the contracting crew to ensure regulatory compliance for working in/around waterbodies, including wetlands. • Clearing or disturbance to vegetation near wetlands will be avoided. • Silt fence will be properly installed around all retained	• 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. • Non-biodegradable erosion and sediment control materials will be removed once the site is stabilized.

Concern	Construction Mitigation	Operation Mitigation
	wetlands at the setback distance, within and immediately adjacent to the Project footprint. • If weather and ground conditions deteriorate while working within 100 m of the wetlands/ waterbodies (outside of the established setbacks), access matting or low ground pressure (LGP) equipment will be used to avoid heavy rutting or ground compaction. • Construction will be stopped if amphibians emerge to breed during construction; and will resume at the discretion of the onsite experienced wildlife biologist in conjunction with approval from AEP. • 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. • Erosion and sediment control measures and structures will be regularly inspected and maintained during the construction activities. • Construction activities will be halted during adverse construction conditions caused by heavy rains or other weather events. • Non-biodegradable erosion and sediment control materials will	• Fuel and oil products will not be stored within 100 m of any wetland or waterbody. • 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. • Emergency spill kits will be maintained on site and readily accessible.

Concern	Construction Mitigation	Operation Mitigation
	be removed once the site is stabilized. • Fuel and oil products will not be stored within 100 m of any wetland or waterbody. • 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. • Emergency spill kits will be maintained on site and readily accessible.	
Wildlife movement	• Amphibian surveys will be conducted prior to any ground disturbance to mitigate potential wildlife disturbances. • If ephemeral breeding amphibians emerge to breed during construction, work within the area should be shut down. As a last resort, single toads (or small numbers) could be relocated out of the construction area (assuming we have a permit). • An experienced wildlife biologist will be on site to monitor the construction area and relocate any amphibians (upon AEP approval) that are found within the construction area, to reduce injury or mortality risk. • Fences will be squared off and constructed straight to avoid entrapment and restrict wildlife movement.	• Fences will be squared off and constructed straight to avoid entrapping and restricting wildlife movement.

Concern	Construction Mitigation	Operation Mitigation
Stranded and injured wildlife	• Appropriate Provincial and Federal wildlife permits/authorizations will be obtained before handling dead or injured wildlife, or conducting wildlife surveys. • Construction personnel will be prohibited from feeding, harassing and hunting wildlife. • Trenches that must be left overnight will be covered or sloped so that wildlife does not become trapped within the excavation. • Electrical collection/transmission lines will be buried.	• Appropriate Provincial and Federal wildlife permits/authorizations will be obtained before handling dead or injured wildlife, or conducting wildlife surveys. • Electrical collection/transmission lines will be buried.
Light pollution	• Construction activities will occur during daylight hours, starting half an hour after sunrise and ending half an hour before sunset. • Required lighting will be selected and positioned to minimize spill light, upward light and glare. • When possible, lights equipped with motion sensors will be used to minimize the time they are on.	• Required lighting will be selected and positioned to minimize spill light, upward light and glare. • When possible, lights equipped with motion sensors will be used to minimize the time they are on.
Vegetation Maintenance	• 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. • The use of fertilizers, herbicides and pesticides will be avoided.	• 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. • The use of fertilizers, herbicides and pesticides will be avoided. • Alternative vegetation maintenance methods, such as

Concern	Construction Mitigation	Operation Mitigation
	• Native grassland seed mixtures will be used to revegetate any disturbed natural areas. • Vegetation disturbance will be minimized using methods such as access matting, reduced stripping and winter construction.	grazing by sheep or goats, will be considered.
Invasive, Noxious and Prohibited Weeds	• All vehicles and equipment will be cleaned prior to accessing Project work sites to minimize the introduction of invasive species. • Noxious and prohibited noxious weeds will be controlled in accordance with the Alberta *Weed Control Act* (Government of Alberta 2011). • Certified weed-free seed mixes will be used during reclamation. • When possible, interim reclamation will be completed to prevent weed species from establishing.	• All vehicles and equipment will be cleaned prior to accessing Project work sites to minimize the introduction of invasive species. • Noxious and prohibited noxious weeds will be controlled in accordance with the Alberta *Weed Control Act* (Government of Alberta 2011).

6.0 POST-CONSTRUCTION MONITORING AND MITIGATION PLAN

6.1 PURPOSE AND TIMING

The purpose of post-construction monitoring is to determine the effectiveness of the protection and mitigation measures outlined in the Construction and 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 Wrentham 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.

In addition to post-construction monitoring surveys, breeding bird surveys will also be conducted to compare pre- and post-construction results.

6.2 METHODS

Post-construction monitoring will be conducted annually by two experienced wildlife biologists or experienced 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. Searcher efficiency and carcass persistence estimates will account for changes between seasons and will be done in the analysis of the post-construction monitoring results. 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.

6.2.1 MORTALITY SEARCHES

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 (45.07 ha) which equates to approximately 0.45 square kilometers (km^2). A stratified random sampling method will be used to ensure that the Project area is accurately represented within the sample. The sampling area will be selected to be representative of that of the Project area (e.g., landscape, vegetation, project infrastructure). If the Project area is homogeneous, no stratification will be required. 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_{e0} is the weighted proportion of carcasses expected to be found by searchers (searcher efficiency)
S_c is the proportion of carcasses not removed by scavengers over the search period (persistence rate)
P_s is the proportion of the area searched

6.2.2 CARCASS REMOVAL TRIALS

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 fresh carcasses are unavailable, Solar Krafte will use mortalities from window collisions as surrogate carcasses and/or inquire with Fish and Wildlife to see if they could donate any large bird carcasses, as this size class is unlikely to strike windows. If available, carcasses found during mortality searches will be also be used. Carcasses of varying size categories, small (i.e., chickadees, warblers, sparrows, finches), medium (i.e., woodpeckers, grosbeaks, thrush) and large (i.e., waterfowl, raptor, pigeon) 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 (e.g., number of carcasses from each size class, not the availability of carcasses). 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.

6.2.3 WILDLIFE CARCASS DETECTION

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, as well as ground cover height; 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.

6.2.4 WILDLIFE IMPACT MONITORING

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. High mortality rate will be determined by AEP.

6.3 POST-CONSTRUCTION MITIGATION PLAN

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 the 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.

Solar Krafte has committed to keeping the wildlife surveys (i.e., raptor nest searches, burrowing owl, and sharp-tailed grouse surveys) current, as outlined in Standard 100.2.4 of the Directive, until the commissioning of the Project. If the Project has not started construction by 2022 (i.e., 5 years), all of the wildlife surveys will be repeated, and a new referral report may be required. Mitigation measures will be implemented for all new wildlife features, in agreement with the AEP Wildlife Biologist.

6.4 REPORTING REQUIREMENTS

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.

7.0 CONCLUSIONS

The Wrentham 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 was cultivated and is bordered by Highway 61 and Range Road 161.

Thirty-three wetlands were identified within the Project area, seven of them (Wetlands 1, 2, 3, 7, 14, 16, and 19) were classified as seasonal wetlands. Solar Krafte will avoid direct impacts to Wetlands 1, 14, 16, and 19 by establishing a small buffer. Wetlands 2, 3, and 7 will be partially impacted by construction. Although Solar Krafte was unable to maintain the standard 100 m setback from seasonal wetlands as well as minimize disturbance, the potential impacts to wildlife will be minimal due to a lack of suitable nesting, foraging and overwintering habitat. The seasonal wetlands lack suitable water depth, substrate, diverse habitat structure, and vegetation composition; as well as the existence of suitable wetland habitat in surrounding land. The man-made waterbody, which has been classified as a part of Wetland 7 and will be buffered by a 100 m setback, provides breeding, foraging and potentially overwintering habitat for wildlife as evident by ungulate tracks, whitewash, a small mammal burrow, and a coyote den/tracks.

Birds utilize the Project area primarily for foraging rather than breeding habitat due to ongoing disturbances from crop cultivation. Large and small mammals utilize the habitat around the man-made waterbody, outside of the cultivated area for breeding, foraging and possibly overwintering. Once the Project is constructed, wildlife may continue to use the man-made waterbody and remaining wetlands if there is sufficient surface water.

As breeding and migratory birds utilize the Project area for foraging, there is the potential for noise disturbance and human presence during clearing, construction and site maintenance. This may cause some temporary wildlife displacement; 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 conducted 7 days prior to clearing, construction and maintenance by an experienced 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. An experienced wildlife biologist will be on site to monitor construction of the Wrentham 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 the applicable environmental laws and regulations are being followed.

To determine the effectiveness of the mitigation measures, 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 Wrentham Solar Project may have on species at risk, sensitive species and other wildlife.

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9.0 APPENDICES

APPENDIX A

SPECIES AT RISK WITH POTENTIAL TO OCCUR WITHIN PROJECT AREA

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

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

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
barn swallow	*Hirundo rustica*	Sensitive[1], Threatened[2]	Open, semi-open areas, farms, fields, marshes, lakes; buildings, bridges, cliffs near farms and cities
black-necked stilt	*Himantopus mexicanus*	Sensitive[1]	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	*Nycticorax nycticorax*	Sensitive[1]	shallow cattail and bulrush marshes, small lakes, slow rivers
black tern	*Chlidonias niger*	Sensitive[1], Not at Risk[2]	Marshes, sloughs, rivers, lakeshores, wet meadows, typically in sites with mixture of emergent vegetation and open water
bobolink	*Dolichonyx oryzivorus*	Sensitive[1], Threatened[2]	hayfields, meadows, marshes, natural prairies with dense grass, weeds and low bushes
buff-breasted sandpiper	*Calidris subruficollis*	Secure[1], Special Concern[2,3]	shortgrass prairie, stubble fields, pastures, airports, plowed fields, shores of lakes or ponds
burrowing owl	*Athene cunicularia*	At Risk[1], Threatened[2,3], Endangered[4]	open grasslands, prairie, farm fields, airstrips; flat, open ground with very short grass and bare soil
Caspian tern	*Hydroprogne caspia*	Sensitive[1]	shorelines of wetlands, lakes and river; islands in lakes and rivers
chestnut-collared longspur	*Calcarius ornatus*	At Risk[1], Threatened[2,3]	short grass prairies with longer grass and taller weeds, fields, plains
common nighthawk	*Chordeiles minor*	Sensitive[1], Threatened[2,3]	Dry coniferous forests, open cottonwood forests, meadows, larger lakes and grasslands.
common yellowthroat	*Geothlypis trichas*	Sensitive[1]	Marshes (especially cattail), thickets near water, bogs and brushy pasture.

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
eastern kingbird	*Tyrannus tyrannus*	Sensitive[1]	open areas with willow and birch shrubs, agricultural areas, riparian areas
eastern phoebe	Sayornis phoebe	Sensitive[1]	wooded areas near water, human-built structures, bare rock outcrops
ferrugious hawk	*Buteo regalis*	At Risk[1], Threatened[2,3], Endangered[4]	prairies, dry grassland, sagebrush plains, rangeland, desert, plowed fields
forster's tern	*Sterna forsteri*	Sensitive[1]	Cattail marshes, backwaters, large marshy lakes
golden eagle	*Aquila chrysaetos*	Sensitive[1], Not at Risk[2]	open mountains, foothills, prairie, open habitats
grasshopper sparrow	*Ammodramus savannarum*	Sensitive[1]	grasslands, hayfields, prairie; tall grass, weeds, scattered shrubs; sometimes cropfields
great blue heron	*Ardea herodias*	Sensitive[1]	Freshwater and brackish marshes, along lakes, rivers, bays; nests colonially in large deciduous trees.
horned grebe	*Podiceps auritus*	Sensitive[1], Special Concern[2,3]	lakes with open water and marsh vegetation surrounded by prairie
lark bunting	*Calamospiza melanocorys*	Sensitive[1], Threatened[2]	shortgrass prairie, sagebrush plains with understory of grass and weeds; prairie, agricultural fields, desert grassland, weedy vacant lots
least flycatcher	*Empidonax minimus*	Sensitive[1]	Aspen forests, alder and willow thickets, open woods, orchards; edge habitat
loggerhead shrike	*Lanius ludovicianus excubitorides*	Sensitive[1], Threatened[2,3], Special Concern[4]	Semi-open country with lookout posts, wires, trees, shrubs; open grasslands with few scattered trees, forest clearings
long-billed curlew	*Numenius americanus*	Sensitive[1], Special Concern[2,3,4]	Native dry grassland, sagebrush prairie, farm fields, marshes

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
McCown's longspur	*Rhynchophanes mccownii*	May be at Risk[1], Threatened[2], Special Concern[3]	dry open prairie with short grass, patches of open ground; shortgrass plains, bare soil such as dry lake beds, plowed fields
northern harrier	*Circus cyaneus*	Sensitive[1], Not at Risk[2]	Marshes, fields, prairies, wet meadows; open terrain, wet and dry habitats with good ground cover
olive-sided flycatcher	*Contopus cooperi*	May be at Risk[1], Threatened[2,3]	meadows, ponds, riparian forests, forest edges, open woodlands, mature spruce-fir forests
osprey	*Pandion haliaetus*	Sensitive[1]	large lakes, reservoirs, rivers; near water where large numbers of fish are present
peregrine falcon *anatum*	*Falco peregrinus anatum*	At Risk[1], Special Concern[2,3], Threatened[4]	Open country, cliffs, sometimes cities; variety of open habitats, near water, building ledges
pied-billed grebe	*Podilymbus podiceps*	Sensitive[1]	Ponds, marshes and backwaters with thick emergent vegetation.
piping plover	*Charadrius melodus circumcinctus*	At Risk[2], Endangered[2,3,4]	Sandy beaches and open lakeshores; nests on open shoreline.
prairie falcon	*Falco mexicanus*	Sensitive[1], Not at Risk[2], Special Conern[4]	Open hills, plains, prairies, deserts, grassland; open country above treeline in high mountains; farmland, lakes, reservoirs
rusty blackbird	*Euphagus carolinus*	Sensitive[1]	wet forests, areas with fens, bogs, muskeg, beaver ponds; overwinters in swamps, wet woodlands, and pond edges
sage thrasher	*Oreoscoptes montanus*	Undetermined[1], Endangered[2,3]	Sagebrush, shruby slopes, deserts, wide-open flats, grassland with scattered shrubs
sharp-tailed grouse	*Tympanuchus phasianellus*	Sensitive[1]	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,

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
			willow; open grasslands in summer; groves of trees and shrubs in winter
short-eared owl	*Asio flammeus*	May be at Risk[1], Special Concern[2,3]	Grassland, marshes, farmland, prairies, open country with high numbers of small rodents, stubble fields, small meadows, shrubby areas
sora	*Porzana carolina*	Sensitive[1]	Shallow freshwater emergent wetlands, bogs, fens, wet meadows and flooded fields
Sprague's pipit	*Anthus spragueii*	Sensitive[1], Threatened[2,3], Special Concern[4]	Native shortgrass prairie, plains, dry grassland, avoids brushy areas and cultivated fields. Winters in pastures, prairies, and grassy patches within fields of crops such as alfalfa
Swainson's hawk	*Buteo swainsoni*	Sensitive[1]	Open fields, dry grasslands, farmland, open areas with groves of trees, agricultural areas
upland sandpiper	*Bartramia longicauda*	Sensitive[1]	Hayfields, ungrazed pastures, grasslands, fields, open meadows; grasslands with tall grasses and broad-leafed weeds
western grebe	*Aechmophorus occidentalis*	At Risk[1], Special Concern[2], Threatened[4]	Marshes, sloughs, rushy lakes; fresh water lakes with large areas of both open water and marsh vegetation
western wood-pewee	*Contopus sordidulus*	May be at Risk[1]	open woodlands, riparian forests, aspen groves, pine-oak woods, cottonwood-willow groves along streams
white-winged scoter	*Melanitta deglandi*	Sensitive[1], Special Concern[4]	lakes, ponds, and slow-moving rivers, generally in open country
yellow rail	*Coturnicops noveboracensis*	Undetermined[1], Special Concern[2,3]	shallow sedge and grassy marshes, wet meadows; drier areas with dense stands of cordgrass

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
Mammals			
little brown bat	*Myotis lucifugus*	May be at Risk[1], Endangered[2,3]	large hollow trees, buildings near bodies of water, caves
red bat	*Lasiurus borealis*	Sensitive[1]	thick forest cover, open grassy areas; forages near farmlands
silver-haired bat	*Lasionycteris noctivagens*	Sensitive[1]	forests, parks, cities, farmland; hollow trees,
Western small-footed bat	*Myotis ciliolabrum*	Sensitive[1], Special Concern[4]	arid prairie regions, riverbanks, ridges, outcroppings with lots of rocks; trees, buildings, rock crevices, under bridges and shingles of old buildings
American badger	*Taxidea taxus taxus*	Sensitive[1], Special Concern[2]	grasslands, agricultural areas, open area, areas fragmented by roads, bush habitats with little groundcover
bobcat	*Lynx rufus*	Sensitive[1]	coniferous forests, deciduous forests, brushy areas, coulees
long-tailed weasel	*Mustela frenata longicauda*	May be at Risk[1], Not at Risk[2]	open grasslands, tree groves, prairie, forests
olive-backed pocket mouse	*Perognathus fasciatus*	Sensitive[1]	short grass prairie, sandy soil
pronghorn	*Antilocapra americana*	Sensitive[1]	arid grasslands, grassy brushlands, semi-desert regions
Reptiles			
bull snake	*Pituophis catenifer sayi*	Sensitive[1], Special Concern[2]	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	*Thamnophis radix*	Sensitive[1]	margins of wetlands; wet meadows; open grasslands; hibernacula found along river valleys, coulees, riparian/upland habitat transition zones

Common Name	*Scientific Name*	Conservation Status	Habitat Requirements
prairie rattlesnake	*Crotalus viridis*	Sensitive[1], Special Concern[2]	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, riparian/upland habitat transition zones
wandering garter snake	*Thamnophis elegans*	Sensitive[1]	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	*Chrysemys picta*	Sensitive[1], Not at Risk[2]	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

APPENDIX B

SITE PHOTOS

PHOTO 1; MAN-MADE	
Date: May 29, 2017	
Direction: East	
Description: View of the man-made waterbody	

PHOTO 2; MAN-MADE	
Date: May 29, 2017	
Direction: Southeast	
Description: View of the southwest side of man-made waterbody and large berm.	

PHOTO 3; UNGULATE TRACKS	
Date: August 22, 2017	
Direction:	
Description: View of ungulate tracks around the man-made waterbody.	

PHOTO 4; CANID TRACKS	
Date: August 22, 2017	
Direction:	
Description: View of coyote tracks around man-made waterbody	

PHOTO 5;
COYOTE DEN

Date:
August 22, 2017

Direction:
south

Description:
View of coyote den along south berm of man-made waterbody

APPENDIX C

BREEDING BIRD RESULTS

TABLE 4. EARLY SPRING 2017 BREEDING BIRD SURVEY RESULTS

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-1	49.515764	112.0233	savannah sparrow	1	x		N	100
S-1	49.515764	112.0233	western meadowlark	1		x	W	300
S-1	49.515764	112.0233	western meadowlark	1	x	x	S	80
S-1	49.515764	112.0233	red-winged blackbird	1	x		N	220
S-1	49.515764	112.0233	red-winged blackbird	1	x	x	E	200
S-1	49.515764	112.0233	savannah sparrow	1	x	x	N	80
S-1	49.515764	112.0233	savannah sparrow	1	x		SE	280
S-1	49.515764	112.0233	vesper sparrow	2	x	x	W	180
S-1	49.515764	112.0233	western meadowlark	1	x		S	100
S-2	49.52338	112.0366	red-winged blackbird	1	x	x	N	50
S-2	49.52338	112.0366	western meadowlark	1	x	x	N	200
S-2	49.52338	112.0366	horned lark	1	x	x	W	80
S-2	49.52338	112.0366	McCowan's longspur	2	x	x	S	180
S-2	49.52338	112.0366	Swainson’s hawk	2	x		E	300
S-2	49.52338	112.0366	vesper sparrow	1		x	E	150
S-2	49.52338	112.0366	western meadowlark	1	x	x	N	230
S-3	49.51605	112.04572	Canada goose	1	x		SW	150
S-3	49.51605	112.04572	killdeer	1		x	SE	250
S-3	49.51605	112.04572	northern harrier	1	x		SE	150
S-3	49.51605	112.04572	red-winged blackbird	2	x	x	NE	300
S-3	49.51605	112.04572	red-winged blackbird	1	x	x	N	50
S-3	49.51605	112.04572	European starling	5	x		N	120
S-3	49.51605	112.04572	Canada goose	2	x		NE	250

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance (m)
	Latitude	Longitude						
S-3	49.51605	112.04572	Canada goose	3	x		NW	180
S-3	49.51605	112.04572	killdeer	1		x	NE	220
S-3	49.51605	112.04572	mallard	2	x		NW	150
S-3	49.51605	112.04572	red-winged blackbird	6	x	x	N	80
S-3	49.51605	112.04572	Savannah sparrow	1		x	E	200
S-3	49.51605	112.04572	European starling	flock	x	x	S	80

TABLE 5. LATE SPRING 2017 BREEDING BIRD RESULTS

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance
	Latitude	Longitude						
S-1	49.515764	112.0233	brown headed cowbird	1	x		n/a	≤100
S-1	49.515764	112.0233	horned lark	4	x		n/a	≤100
S-1	49.515764	112.0233	vesper sparrow	1		x	n/a	>100
S-2	49.52338	112.0366	clay colored sparrow	1		x	n/a	≤100
S-2	49.52338	112.0366	Franklins gull	4	x		n/a	>100
S-2	49.52338	112.0366	horned Lark	2	x		n/a	≤100
S-2	49.52338	112.0366	savannah sparrow	1		x	n/a	≤100
S-2	49.52338	112.0366	savannah sparrow	1		x	n/a	>100
S-2	49.52338	112.0366	vesper sparrow	1		x	n/a	>100
S-2	49.52338	112.0366	western meadowlark	1		x	n/a	>100
S-3	49.51605	112.04572	clay colored sparrow	1		x	n/a	≤100
S-3	49.51605	112.04572	horned Lark	1		x	n/a	≤100
S-3	49.51605	112.04572	western meadowlark	1		x	n/a	≤100
S-4	49.523329	112.022628	brown headed cowbird	1	x			≤100

Survey Station	Station Location		Species	Count	Seen	Heard	Direction	Distance
	Latitude	Longitude						
S-4	49.523329	112.022628	red winged blackbird	1	x			>100
S-4	49.523329	112.022628	vesper sparrow	1		x		>100
S-5	49.523200	112.045638	eastern kingbird	1	x			≤100
S-5	49.523200	112.045638	horned lark	1		x		≤100
S-5	49.523200	112.045638	red winged blackbird	1	x			>100
S-5	49.523200	112.045638	vesper sparrow	1		x		>100
S-6	49.530230	112.036772	clay colored sparrow	1		x		≤100
S-6	49.530230	112.036772	horned lark	2		x		≤100
S-6	49.530230	112.036772	Hungarian partridge	2	x			≤100
S-6	49.530230	112.036772	red winged blackbird	2		x		≤100
S-6	49.530230	112.036772	vesper sparrow	1		x		>100

APPENDIX D

MIGRATORY BIRD RESULTS

TABLE 6. SPRING 2017 MIGRATORY BIRD SURVEY RESULTS

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Early	S-1	49.51576	112.0233	American pipit	4		x		n/a	n/a
Early	S-1	49.51576	112.0233	Canada goose	2	x		x	n/a	n/a
Early	S-1	49.51576	112.0233	horned lark	1	x	x		SW	20
Early	S-1	49.51576	112.0233	killdeer	1		x		NW	200
Early	S-1	49.51576	112.0233	black-billed magpie	2	x			n/a	n/a
Early	S-1	49.51576	112.0233	mallard	1	x			E	600
Early	S-1	49.51576	112.0233	mallard	2	x			E	300
Early	S-1	49.51576	112.0233	western meadowlark	1		x		n/a	n/a
Early	S-1	49.51576	112.0233	western meadowlark	1		x		n/a	n/a
Early	S-1	49.51576	112.0233	ring-billed gulls	2	x		x	n/a	n/a
Early	S-2	49.52338	112.0366	American pipit	1		x		S	100
Early	S-2	49.52338	112.0366	Canada goose	8	x			SE	500
Early	S-2	49.52338	112.0366	horned lark	1		x		NE	40
Early	S-2	49.52338	112.0366	horned lark	1	x	x		n/a	n/a
Early	S-2	49.52338	112.0366	mallard	2	x			NE	400
Early	S-2	49.52338	112.0366	western meadowlark	1	x	x		NE	30
Early	S-3	49.51605	112.0457	American pipit	3	x			E	10
Early	S-3	49.51605	112.0457	Canada goose	2	x			SE	300
Early	S-3	49.51605	112.0457	Canada goose	2	x		x	n/a	n/a
Early	S-3	49.51605	112.0457	European starling	1	x			NE	100
Early	S-3	49.51605	112.0457	horned lark	1	x			n/a	n/a
Early	S-3	49.51605	112.0457	killdeer	1		x		SE	130
Early	S-3	49.51605	112.0457	mallard	9	x			n/a	n/a

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Early	S-3	49.51605	112.0457	mallard	2	x			NE	175
Early	S-3	49.51605	112.0457	western meadowlark	1	x			n/a	n/a
Early	S-3	49.51605	112.0457	western meadowlark	1	x			NE	175
Early	S-3	49.51605	112.0457	northern pintail	2	x			NE	175
Early	S-3	49.51605	112.0457	American robin	1		x		SW	200
Early	S-3	49.51605	112.0457	Swainson's hawk	1	x			W	350
Mid	S-1	49.51576	112.0233	Canada goose	2	x			S	400
Mid	S-1	49.51576	112.0233	European starling	1	x		x	n/a	n/a
Mid	S-1	49.51576	112.0233	horned lark	2		x		S	100
Mid	S-1	49.51576	112.0233	horned lark	1	x			SE	250
Mid	S-1	49.51576	112.0233	red-winged blackbird	1	x	x		W	20
Mid	S-1	49.51576	112.0233	ring-billed gulls	1	x		x	n/a	n/a
Mid	S-1	49.51576	112.0233	Swainson's hawk	1	x			NW	400
Mid	S-1	49.51576	112.0233	western meadowlark	1		x		SW	300
Mid	S-1	49.51576	112.0233	western meadowlark	1		x		S	110
Mid	S-2	49.52338	112.0366	American pipit	2	x	x		SE	80
Mid	S-2	49.52338	112.0366	American pipit	1	x			N	80
Mid	S-2	49.52338	112.0366	horned lark	1		x		N	200
Mid	S-2	49.52338	112.0366	horned lark	1		x		NW	30
Mid	S-2	49.52338	112.0366	horned lark	1		x		N	130
Mid	S-2	49.52338	112.0366	horned lark	1		x		S	100
Mid	S-2	49.52338	112.0366	western meadowlark	1	x			SE	20
Mid	S-2	49.52338	112.0366	western meadowlark	1	x	x		W	10
Mid	S-3	49.51605	112.0457	horned lark	1	x			SE	160
Mid	S-3	49.51605	112.0457	killdeer	2		x		NE	120

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Mid	S-3	49.51605	112.0457	Lapland's longspur	1		x		NE	180
Mid	S-3	49.51605	112.0457	red-winged blackbird	1	x			N	200
Mid	S-3	49.51605	112.0457	red-winged blackbird	2	x	x		NE	20
Late	S-1	49.51576	112.0233	savannah sparrow	1	x			N	100
Late	S-1	49.51576	112.0233	western meadowlark	1		x		W	300
Late	S-1	49.51576	112.0233	western meadowlark	1	x	x		S	80
Late	S-1	49.51576	112.0233	red-winged blackbird	1	x			N	220
Late	S-1	49.51576	112.0233	red-winged blackbird	1	x	x		E	200
Late	S-1	49.51576	112.0233	savannah sparrow	1	x	x		N	80
Late	S-1	49.51576	112.0233	savannah sparrow	1	x			SE	280
Late	S-1	49.51576	112.0233	vesper sparrow	2	x	x		W	180
Late	S-1	49.51576	112.0233	western meadowlark	1	x			S	100
Late	S-2	49.52338	112.0366	red-winged blackbird	1	x	x		N	50
Late	S-2	49.52338	112.0366	western meadowlark	1	x	x		N	200
Late	S-2	49.52338	112.0366	horned lark	1	x	x		W	80
Late	S-2	49.52338	112.0366	McCown's longspur	2	x	x		S	180
Late	S-2	49.52338	112.0366	Swainson's hawk	2	x			E	300
Late	S-2	49.52338	112.0366	vesper sparrow	1		x		E	150
Late	S-2	49.52338	112.0366	western meadowlark	1	x	x		N	230
Late	S-3	49.51605	112.0457	Canada goose	1	x			SW	150
Late	S-3	49.51605	112.0457	killdeer	1		x		SE	250
Late	S-3	49.51605	112.0457	northern harrier	1	x			SE	150
Late	S-3	49.51605	112.0457	red-winged blackbird	2	x	x		NE	300
Late	S-3	49.51605	112.0457	red-winged blackbird	1	x	x		N	50
Late	S-3	49.51605	112.0457	European starling	5	x			N	120

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Late	S-3	49.51605	112.0457	Canada goose	2	x			NE	250
Late	S-3	49.51605	112.0457	Canada goose	3	x			NW	180
Late	S-3	49.51605	112.0457	killdeer	1		x		NE	220
Late	S-3	49.51605	112.0457	mallard	2	x			NW	150
Late	S-3	49.51605	112.0457	red-winged blackbird	6	x	x		N	80
Late	S-3	49.51605	112.0457	savannah sparrow	1		x		E	200
Late	S-3	49.51605	112.0457	European starling	Flock*	x	x		S	80

Note: [1] Early: April 5, Mid: April 18, Late: May 1 and 2
* Flock – 1 to 20 individuals; averaged to 10 individuals

TABLE 7. FALL 2017 MIGRATORY BIRD SURVEY RESULTS

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Early	S-1	49.51576	112.0233	no birds						
Early	S-2	49.52338	112.0366	northern harrier	1	x			E	200
Early	S-3	49.51605	112.0457	no birds						
Early	S-1	49.51576	112.0233	Canada goose	3	x		x	S	0
Early	S-1	49.51576	112.0233	horned lark	2	x			S	20
Early	S-1	49.51576	112.0233	savannah sparrow	3	x			W	60
Early	S-1	49.51576	112.0233	vesper sparrow	1	x	x		W	30
Early	S-2	49.52338	112.0366	Canada goose	2	x			E	300
Early	S-3	49.51605	112.0457	horned lark	1	x			S	20
Early	S-3	49.51605	112.0457	American kestrel	1	x			NE	262
Mid	S-1	49.51576	112.0233	American pipit	5	x	x	x	W	0

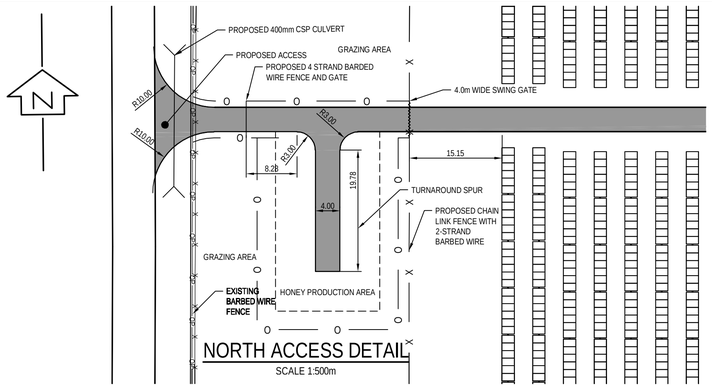
Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Mid	S-1	49.51576	112.0233	American pipit	2	x			E	40
Mid	S-1	49.51576	112.0233	black-billed magpie	1	x			SW	150
Mid	S-1	49.51576	112.0233	horned lark	3	x			N	30
Mid	S-2	49.52338	112.0366	horned lark	2		x		S	120
Mid	S-2	49.52338	112.0366	Lapland longspur	3	x	x		SE	30
Mid	S-3	49.51605	112.0457	Hungarian partridge	7	x			W	110
Mid	S-3	49.51605	112.0457	Lapland longspur	12	x	x		E	80
Late	S-1	49.51576	112.0233	Canada goose	32	x			E	250
Late	S-1	49.51576	112.0233	common redpoll	40	x	x		N	60
Late	S-2	49.52338	112.0366	brown headed cowbird	60	x	x		S	80
Late	S-2	49.52338	112.0366	gull ssp.	1	x			S	280
Late	S-2	49.52338	112.0366	horned lark	1	x			E	80
Late	S-2	49.52338	112.0366	northern harrier	1	x			SW	180
Late	S-2	49.52338	112.0366	tundra swan	15	x			E	350
Late	S-3	49.51605	112.0457	American pipit	3	x	x		E	80
Late	S-3	49.51605	112.0457	horned lark	1	x	x		W	60
Late	S-4	49.523329	112.02262	brown headed cowbird	1	x			n/a	≤100
Late	S-4	49.523329	112.02262	red winged blackbird	1	x			n/a	>100
Late	S-4	49.523329	112.02262	vesper sparrow	1		x		n/a	>100
Late	S-5	49.523200	112.04563	eastern kingbird	1	x			n/a	≤100
Late	S-5	49.523200	112.04563	horned lark	1		x		n/a	≤100
Late	S-5	49.523200	112.04563	red winged blackbird	1	x			n/a	>100
Late	S-5	49.530230	112.036772	vesper sparrow	1		x		n/a	>100
Late	S-6	49.530230	112.036772	clay colored sparrow	1		x		n/a	≤100
Late	S-6	49.530230	112.036772	horned lark	2		x		n/a	≤100

Migration Timing[1]	Survey Station	Station Location		Species	Count	Seen	Heard	Fly By	Direction	Distance (m)
		Latitude	Longitude							
Late	S-6	49.530230	112.036772	Hungarian partridge	2	x			n/a	≤100
Late	S-6	49.530230	112.036772	red winged blackbird	2		x		n/a	≤100
Late	S-6	49.530230	112.036772	vesper sparrow	1		x		n/a	>100
Late	S-4	49.523329	112.02262	brown headed cowbird	1	x			n/a	≤100
Late	S-4	49.523329	112.02262	red winged blackbird	1	x			n/a	>100
Late	S-4	49.523329	112.02262	vesper sparrow	1		x		n/a	>100

Note: [1] Early: August 31 and September 1, Mid: September 27, Late: October 23

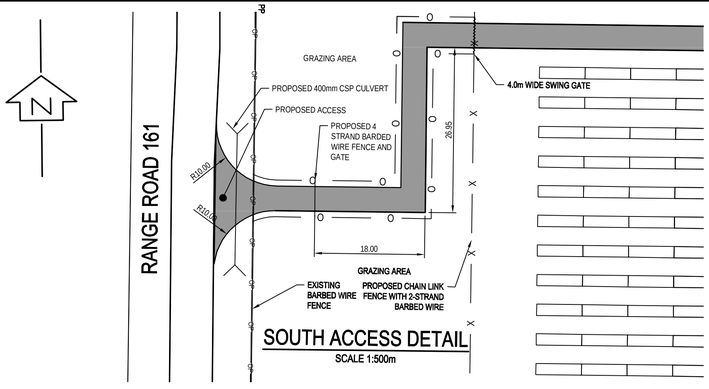
APPENDIX E

WRENTHAM SOLAR PROJECT SITE PLAN



NORTH ACCESS DETAIL

SCALE 1:500m



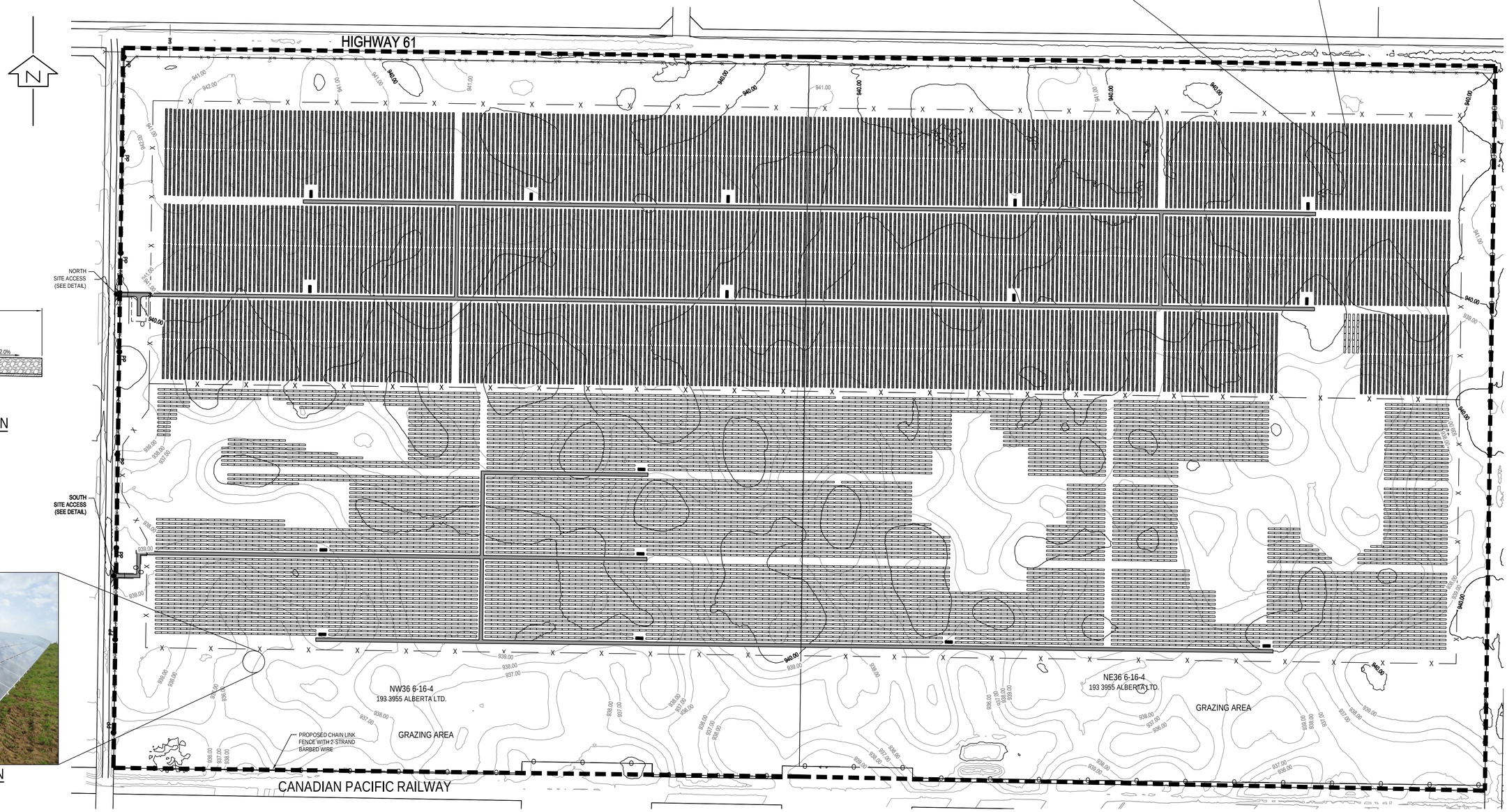
SOUTH ACCESS DETAIL

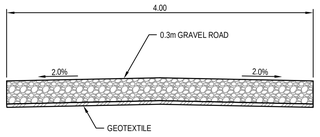
SCALE 1:500m

TYPICAL INSTALLATION

LEGEND

- SITE BOUNDARY
- POWER POLE
- CHAIN LINK FENCE
- BARBED WIRE FENCE
- SITE ACCESS ROAD
- SOLAR TRACKER
- INVERTER





GRAVEL ROAD SECTION

SCALE 1:40

TYPICAL INSTALLATION

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THIS DRAWING IS NOT TO BE SCALED.

ISS/REV	DATE	DESCRIPTION	DES	CHK	PM
2	2017-11-16	RE-ISSUED FOR RINAL	MA	--	--
1	2017-11-15	ISSUED FOR FINAL	MA	--	--
0	2017-10-18	ISSUED FOR APPROVAL	MA	GW	TP

SEAL:

CLIENT: solarkrafte

CLIENT REF. NO:

3509 6th AVENUE NORTH
LETHBRIDGE, ALBERTA T1J 5C1
TEL: 403-327-7746 | FAX: 403-380-2825 | WWW.WSPGROUP.COM

PROJECT: WRENTHAM SOLAR PROJECT

PROJECT NO: 171-01873-00
ORIGINAL SCALE: 1:2500
DATE: 2017-11-16
DESIGNED BY: MA
DRAWN BY: MA
DISCIPLINE:

TITLE: CONRAD SITE PLAN

DRAWING NO: C-002
SHEET NO: OF

ISSUE: RE-ISSUED FOR FINAL 2017-11-16
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APPENDIX F

WETLAND ASSESSMENT AND IMPACT REPORT

PROVIDING ENVIRONMENTAL SERVICES THROUGHOUT WESTERN CANADA
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Solar Krafte Utilities Inc.

Wrentham Solar Project

Wetland Assessment and Impact Report

REFERENCE NUMBER: B-0055-17

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1.0 INTRODUCTION

1.1 BACKGROUND

Solar Krafte Utilities Inc. (Solar Krafte), Belectric, and innogy SE propose to permit, construct, and operate a 41.4 megawatt (MW) Solar Photovoltaic (PV) facility (the Project) located approximately 9 kilometers (km) west of the Hamlet of Wrentham, Alberta (AB). The Project, called Wrentham Solar Project, will be located in the White Area in the northern portion of 36-6-16 west of the 4th meridian (Figure 1).

The Project will be comprised of two different PV substructures. The north half of the Project, 23.4 MW, 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 south half of the project, 18.0 MW, will consist of fixed-tilt structures with solar PV modules set up in a west/east direction, oriented to the south and angled at 25 degrees to optimize solar resource efficiency. The Project will transfer electric power generated by the solar PV system through an underground cable and directly into two 25 kilovolt (kV) Fortis Alberta distribution feeders located on the roadway. Construction of the Project is anticipated to occur between October 2018 and September 2019 for the north half, and between January 2019 and December 2019 for the south half of the Project.

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 120,000, and, given advancement in solar PV technology, it is expected that the impacted area may be reduced before commercial operation. For the design reference case, the Project is using 118,164 First Solar FS-6420 modules. These modules are 2.0 meters (m) in length and 1.2 m in width, and each produces 420 Watts of DC power. For the north half of the Project, the modules will be mounted one wide on the tracker, for a total array width of 2.01 m. The trackers are installed 3.0 m apart. For the south half of the Project, the modules will be mounted six wide on the substructure, for a total array width of 12.2 m. The structures will be installed in rows 3.0 m apart.

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

2.0 STUDY AREA

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. In total, 33 wetlands were identified within the Project area. The Project area is situated in the White Area of Alberta where the land use is primarily agriculture, specifically crop cultivation. One dugout is located on the southern boundary of the Project area and was assessed as being part of a wetland (Wetland 7).

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 some 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 receives little precipitation, with hot summers, dry winds, high evaporation rates, and long, cold winters with little snow cover (Alberta Parks 2014).

The total Project area is **135.2 hectares** (**ha**). Of this total area, the proposed Project footprint will be **33.1 ha**. This represents a 24% coverage, consisting predominantly of the solar arrays as well as the lands directly affected by construction of the Project (Figure 2 and 3).

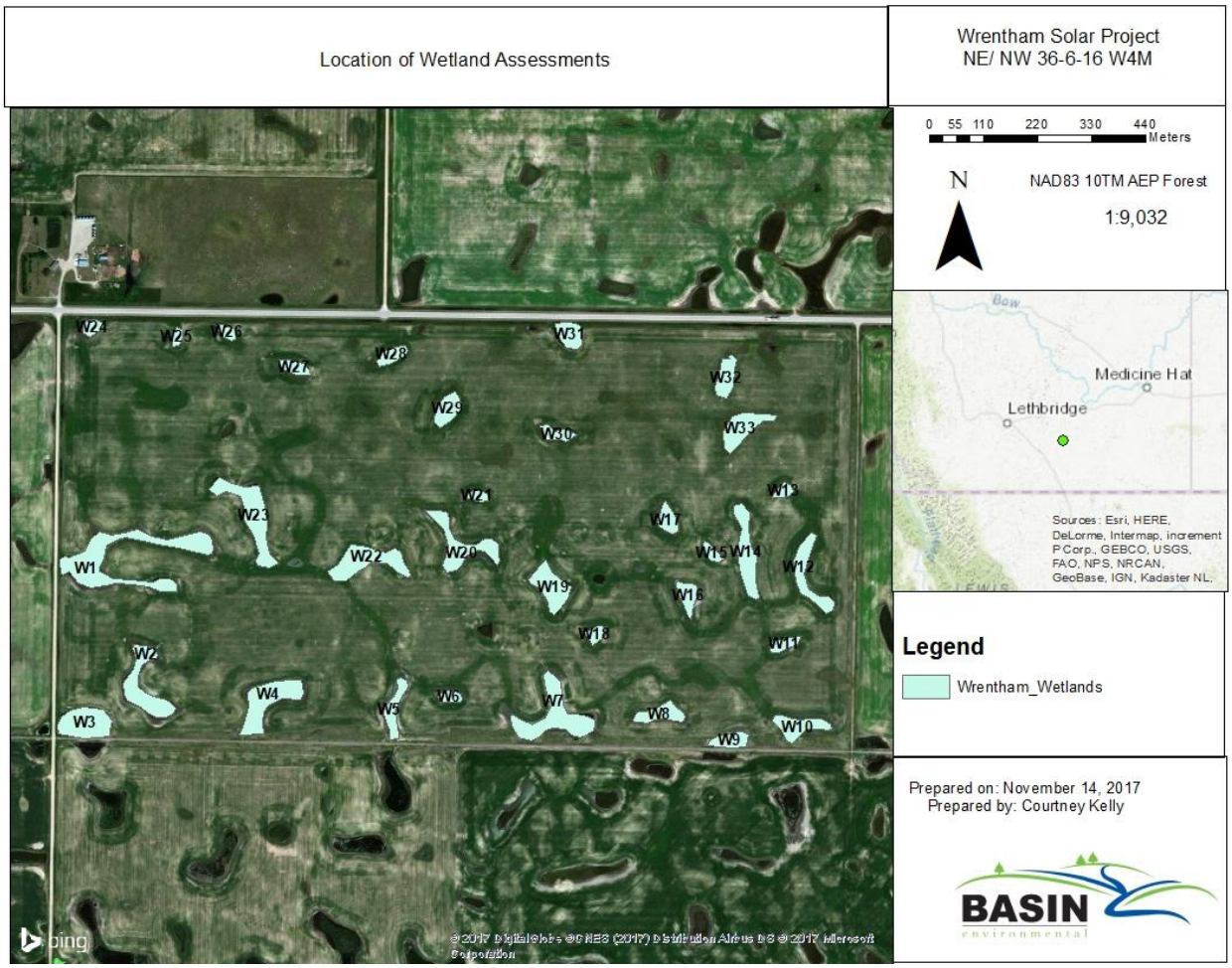


FIGURE 1 OVERVIEW MAP OF THE STUDY AREA. WETLAND ARE DELINEATED IN TEAL (WET AREAS IN THIS IMAGERY THAT ARE NOT DELINEATED ARE NOT CONSISTENT THROUGHOUT THE HISTORICAL RECORD AND WERE NOT EVIDENT DURING THE FIELD ASSESSMENT).

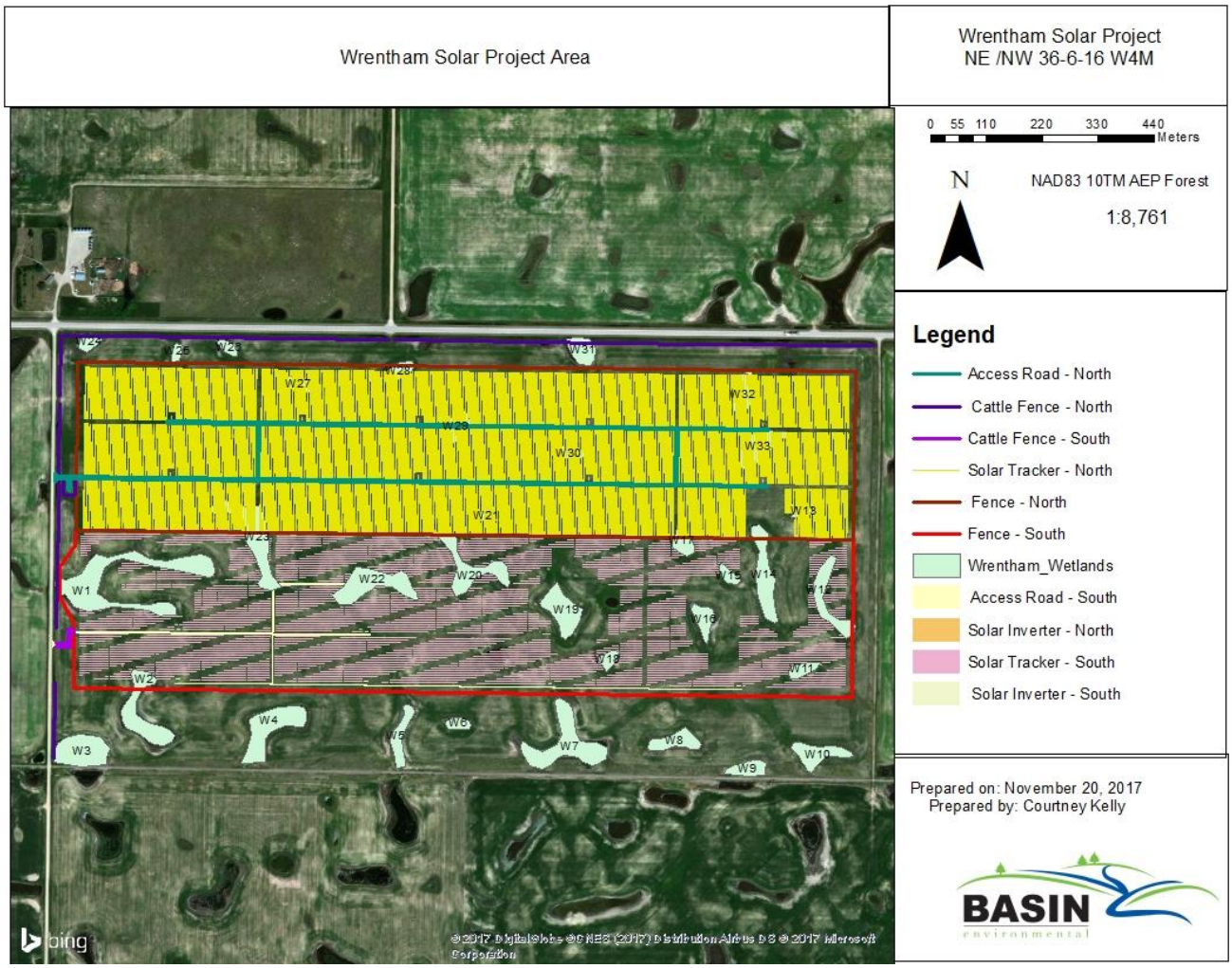


FIGURE 2 PROJECT SITE PLAN LOCATION IN RELATION TO WETLANDS

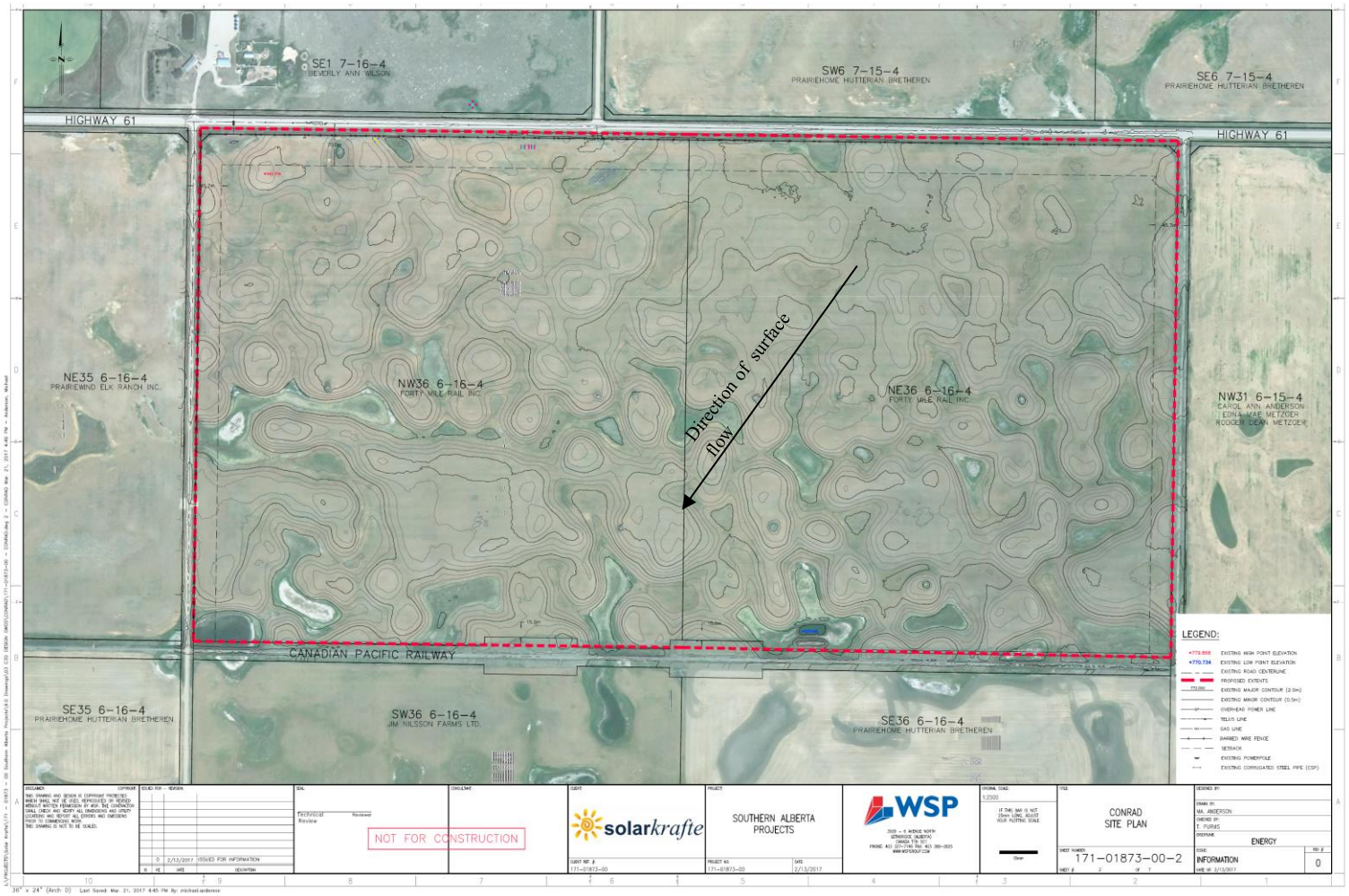


FIGURE 3 TOPOGRAPHY OF THE PROJECT AREA

2.1 STUDY OBJECTIVES

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 as per 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 29, 2017, within the Project area.

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

3.0 METHODS

3.1 WETLAND DELINEATION AND CLASSIFICATION

A wetland is an ecosite dominated by hydrophytic vegetation where soils are water-saturated for a sufficient length of time such. 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]	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

Historical aerial photography taken between 1950 and 2012 (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 extent of wetland boundaries.

Photographs 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 (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

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 Sensitive Areas (ESA)
- Historic Resource Values (Historic Resources Management Branch 2015)
- Landscape Analysis Tool (LAT)

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 polygon identified as No. 1286. The landscape is described as undulating or high relief hummocky, low relief with a limiting slope of 6 %. Soils for this polygon are described as Orthic 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 Raptor Range (i.e., bald eagle, ferruginous hawk, golden eagle, peregrine falcon, and prairie falcon); and, the Sensitive Amphibian Range and Other Sensitive and Endangered Species (Government of Alberta 2017b). The Project is not located within, or near, a Key Wildlife or Biodiversity Zone (Government of Alberta 2017b).

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 the one of the most important breeding areas for waterfowl within North America, in particular 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 at risk primarily use habitats associated with wetlands, cultivated areas, and waterbodies (Environment Canada 2013).

A search of the FWMIS database (AEP 2017), FWMIS records, and the LAT revealed five wildlife species of concern (Table 2).

TABLE 2 WILDLIFE SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE PROJECT AREA

Common Name	Scientific Name	Provincial Designation		Federal Designation	
		Wild Species[1]	Wildlife Act[2]	COSEWIC[3]	SARA[3]
Amphibians					
Northern leopard frog	*Lithobates pipiens*	At Risk	Threatened	Special Concern	Special Concern
Plains spadefoot	*Spea bombifrons*	May Be at Risk	Not Listed	Not at Risk	No Status

Great plains toad	*Anaxyrus cognatus*	Sensitive	Not Listed	Special Concern	Special Concern
Birds					
Burrowing owl	*Athene cunicularia*	At Risk	Endangered	Endangered	Endangered
Sharp-tailed grouse	*Tympanuchus phasianellus*	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 2017b)

4.1.3 ALBERTA CONSERVATION INFORMATION MANAGEMENT SYSTEM (ACIMS)

A search of ACIMS revealed no sensitive plant species within the Project area (AEP 2011).

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: Etikom Coulee approximately 7.0 km south; and Chin Coulee approximately 6.0 km north 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 songbirds, burrowing owls (*Athene cunicularia*), and ferruginous hawks (*Buteo regalis*). It is an important area for waterfowl staging and production, as well as a moulting and staging area for ducks and geese (Sweetgrass Consultants 1997). No information was found regarding Chin Coulee significance.

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 wetlands potentially affected by the Project do not meet the criteria for Crown ownership. Seasonal wetlands impacted by the Project are considered highly disturbed and do not have characteristics that support water depth and aquatic vegetation.

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

4.2 AERIAL IMAGERY INTERPRETATION

Seven historical aerial photos spanning a period from 1950 to 2012 were used in the analysis and were obtained from the Edmonton Airphoto Library and Bing Imagery. Land use showed that agricultural practices dominate current and past land use within the Project area. It is unknown when the area was originally cleared for agricultural use. A total of 33 wetlands were identified within the Project area. All 33 wetlands have been historically impacted by agricultural practices (Appendix B).

Using the historical aerial photographs, a permanence assessment identified 33 wetlands on the Project area: 13 ephemeral; 13 temporary and 7 seasonal. Ephemeral wetlands are characterized by low depressions affected by the water table for a short period of days, but not long enough to promote the formation of water-altered soils within 30 cm of the ground surface or a dominance of water-tolerant vegetation (Government of Alberta, 2015b). Temporary wetlands are characterized as mineral wetlands that are typically flooded every year for a short period of time, but otherwise lack surface water; temporary wetlands are affected by the water table for long enough to promote the formation of water-altered soils within 30 cm of ground surface and a dominance of water-tolerant vegetation during parts of the growing season (Government of Alberta, 2015b). Finally, seasonal wetlands are characterized as mineral wetlands that are typically flooded for most 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 a dominance of water-tolerant vegetation (Government of Alberta, 2015 b).

4.3 FIELD SURVEY

A field survey was conducted by Courtney Kelly, B.Sc., P.Biol., of Basin on May 29, 2017. Soils, vegetation, hydrology, and water chemistry were examined to document, classify, and delineate wetlands. Delineation of wetlands was done using a handheld GPS and verifying a number of representative points along the perimeter of the wetlands.

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 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.

4.4 WILDLIFE

During the May 29, 2017, field assessment, incidental wildlife occurrences were noted (Table 3).

Wetlands were not considered ideal for supporting waterfowl due to lack of surface water. Point count surveys and targeted wildlife surveys (e.g., for burrowing owl, sharp-tail-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 Wrentham Solar (Basin 2017).

TABLE 3 INCIDENTAL WILDLIFE SPECIES OBSERVED

Common Name	Latin Species Name
Horned lark	*Eremohila alpestris*
Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Northern pintail	*Anas acuta*
Red-winged blackbird	*Agelaius phoeniceus*
Savannah sparrow	*Passerculus sandwichensis*
Western Meadowlark	*Sturnella magna*

4.5 RARE PLANTS

No rare plants were identified during the field surveys. Rare plants and rare ecological community presence is considered unlikely due to long-term crop cultivation.

One noxious weed was found throughout the Project area. Creeping thistle (*Cirsium arvense*) is listed as a noxious weed under the Alberta *Weed Control Act* (Government of Alberta 2011).

4.6 WETLAND CLASSIFICATION RESULTS

Thirty-three wetlands were identified in the Project area prior to the field assessments. All identified wetlands were assessed and biophysical features were recorded. Most of the wetlands displayed signs of disturbance from ongoing agricultural practices. Thus, organic surface matter and soil horizons were not evident in most of the wetlands. Additionally, agricultural practices removed most facultative and obligate wetland vegetation; however, some evidence of common cattail (*Typha latifolia*) was found within a few of these disturbed wetlands. Four wetlands (Wetlands 3, 7, 9, and 10) along the southern boundary of the Project area were considered the most intact and had some wetland characteristics, such as graminoid emergent taxa and evidence of clay-based soils altered by water (i.e. gleying). Only one wetland (Wetland 7) had enough standing water to record water chemistry. Tables 4 and 5 detail the field indicators observed for all wetlands present within the Project area.

TABLE 4 FIELD INDICATORS USED TO IDENTIFY AND DELINEATE WETLANDS

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
Wetland 1	M-G-III	1.3	1x1	12U 424378 5485676	Common Cattail	*Typha latifolia*	Y	2
					Reed canary grass	*Phalaris arundinacea*	Y	5
					Creeping thistle	*Cirsium arevense*	N	2
Wetland 2	M-G-III	0.5	1 x1	12U 424469 5485423	Curly-leaved dock	*Rumex crispus*	Y	2
					Dandelion	*Taraxacum officinale*	N	1
					Rough hair grass	*Agrostis scabra*	Y	5
Wetland 3	M-G-III	0.58	1x1	12U 424381 5485367	Reed canary grass	*Phalaris arundinacea*	Y	40
					Common cattail	*Typha latifolia*	Y	10
					Dandelion	*Taraxacum officinale*	N	5
					Small-fruited rush	*Scirpus microcarpus*	Y	10
					Curly-leaved dock	*Rumex crispus*	Y	10
					Gmelin's crowfoot	*Ranunculus gmelinii*	Y	Trace

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
Wetland 4	M-G-II	0.66	1x1	12U 424757 5485409	Common cattail	*Typha latifolia*	Y	2
					Curly-leaved dock	*Rumex crispus*	Y	2
Wetland 5	M-G-II	0.25	1x1	12U 424990 5485359	Common Cattail	*Typha latifolia*	Y	40
					Dandelion	*Taraxacum officinale*	N	2
					Reed canary grass	*Phalaris arundinacea*	Y	5
					Curly leaved dock	*Rumex crispus*	Y	2
Wetland 6	M-G-I	0.09	1x1	12U 425105 5485403	Cultivated	N/A	N/A	N/A
Wetland 7	M-G-f-III	0.83	1x1	12U 425327 5485348	Curly leaved dock	*Rumex crispus*	Y	5
					Dandelion	*Taraxacum officinale*	N	5
					Common Cattail	*Typha latifolia*	Y	10
					Creeping thistle	*Cirsium arvense*	Y	5
					Mudwort	*Limosella aquatica*	Y	Trace

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
					Reed canary grass	*Phalaris arundinacea*	Y	50
Wetland 8	M-G-II	0.27	1x1	12U 425567 5485378	Creeping thistle	*Cirsium arvense*	N	2
					Common Cattail	*Typha latifolia*	Y	2
					Curley leaved dock	*Rumex crispus*	Y	1
Wetland 9	M-G-II	0.19	1x1	12U 425698 5485320	Common Cattail	*Typha latifolia*	Y	30
					Curly-leaved dock	*Rumex crispus*	Y	5
					Reed canary grass	*Phalaris arundinacea*	Y	50
					Dandelion	*Taraxacum officinale*	N	5
Wetland 10	M-G-II	0.33	1x1	12U 425797 5485313	Mudwort	*Limosella aquatica*	Y	2
					Curly-leaved dock	*Rumex crispus*	Y	5
					Dandelion	*Taraxacum officinale*	N	Trace
					Crested wheat grass	*Agropyron cristatum*	N	5
					Reed canary grass	*Phalaris arundinacea*	Y	90

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
Wetland 11	M-G-I	0.13	1x1	12U 425782 5485508	Cultivated	N/A	N/A	N/A
Wetland 12	M-G-II	0.42	1x1	12U 425817 5485638	Common cattail	*Typha latifolia*	Y	1
Wetlands 13	M-G-I	0.08	1x1	12U 425794 5485814	Cultivated	N/A	N/A	N/A
Wetland 14	M-G-III	0.51	1x1	12U 425713 5485670	Cultivated	N/A	N/A	N/A
Wetland 15	M-G-II	0.09	1x1	12U 425637 5485695	Cultivated	N/A	N/A	N/A
Wetland 16	M-G-III	0.19	1x1	12U 425594 5485611	Cultivated	N/A	N/A	N/A
Wetland 17	M-G-II	0.18	1x1	12U 425570 5485754	Common Cattail	*Typha latifolia*	Y	2
Wetland 18	M-G-I	0.10	1x1	12U 425413 5485525	Cultivated	N/A	N/A	N/A

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
Wetland 19	M-G-III	0.44	1x1	12U 399314 5572300	Cultivated	N/A	N/A	N/A
Wetland 20	M-G-II	0.54	1x1	12U 425127 5485696	Cultivated	N/A	N/A	N/A
Wetland 21	M-G-I	0.08	1x1	12U 425173 5485810	Cultivated	N/A	N/A	N/A
Wetland 22	M-G-II	0.62	1x1	12U 424963 5485676	Cultivated	N/A	N/A	N/A
Wetland 23	M-G-II	0.75	1x1	12U 424735 5485750	Cultivated	N/A	N/A	N/A
Wetland 24	M-G-I	0.11	1x1	12U 424384 5486149	Cultivated	N/A	N/A	N/A
Wetland 25	M-G-I	0.06	1x1	12U 424550 5486132	Cultivated	N/A	N/A	N/A
Wetland 26	M-G-I	0.09	1x1	12U 424662 5486134	Cultivated	N/A	N/A	N/A

Wetland ID	Wetland Class	Size (ha)	Strata	Location (UTM)	Common Name	Scientific Name	Facultative or Obligate Species (Y/N)	Percent Cover
Wetland 27	M-G-I	0.14	1x1	12U 424791 5486062	Cultivated	N/A	N/A	N/A
Wetland 28	M-G-I	0.16	1x1	12U 424995 5486089	Cultivated	N/A	N/A	N/A
Wetland 29	M-G-II	0.26	1x1	12U 425106 5485974	Cultivated	N/A	N/A	N/A
Wetland 30	M-G-I	0.13	1x1	12U 425348 5485936	Cultivated	N/A	N/A	N/A
Wetland 31	M-G-II	0.23	1x1	12U 425356 5486121	Cultivated	N/A	N/A	N/A
Wetland 32	M-G-I	0.25	1x1	12U 425667 5486034	Cultivated	N/A	N/A	N/A
Wetland 33	M-G-I	0.41	1x1	12U 425700 5485944	Cultivated	N/A	N/A	N/A

TABLE 5 INFORMATION AND EVIDENCE TO CLASSIFY WETLANDS

Wetland ID	Location (UTM)	Classification	Soil Characteristics (cm)	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 1	12U 424378 5485676	M-G-III	Soil disturbed	No standing water	Vegetation characteristics consistent with seasonal graminoid marsh	1. Common cattail 2. Reed canary grass
Wetland 2	12U 424469 5485423	M-G-III	Soil disturbed	No standing water	Majority cultivated through	1. Curly-leaved dock
Wetland 3	12U 424381 5485367	M-G-III	0-1 organic 1-30 CL Gleying evident	No standing water	Vegetation characteristics consistent with temporary graminoid marsh	1. Reed canary grass 2. Common cattail 3. Small-fruited rush
Wetland 4	12U 424757 5485409	M-G-II	Soil disturbed	No standing water	Majority cultivated through; mostly bare ground	1. Common Cattail 2. Curly-leaved dock
Wetland 5	12U 424990 5485359	M-G-II	Soil disturbed	No standing water	Vegetation characteristics consistent with temporary graminoid marsh	1. Reed canary grass

Wetland ID	Location (UTM)	Classification	Soil Characteristics (cm)	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 6	12U 425105 5485403	M-G-I	Soil disturbed	No standing water	Cultivated	N/A
Wetland 7	12U 425327 5485348	M-G-f-III	0-1organic 1-30 CL Gleying evident	pH -7.5 Conductivity - 428 Temperature - 22.1 Depth: 20 cm	Vegetation characteristics consistent with seasonal graminoid marsh	1. Common cattail 2. Reed canary grass
Wetland 8	12U 425567 5485378	M-G-II	Soil disturbed	No standing water	Vegetation characteristics consistent with temporary graminoid marsh	1. Common cattail 2. Curly-leaved dock
Wetland 9	12U 425698 5485320	M-G-II	0-1organic 1-30 CL Gleying evident	No standing water	Vegetation characteristics consistent with temporary graminoid marsh	1. Curly-leaved dock 2. Reed canary grass
Wetland 10	12U 425797 5485313	M-G-II	0-2- Organic 2-30 CL Mottling present	No standing water	Vegetation characteristics consistent with seasonal graminoid marsh	1. Curly-leaved dock 2. Reed canary grass
Wetland 11	12U 425782 5485508	M-G-I	Soil disturbed	No standing water	Cultivated	N/A

Wetland ID	Location (UTM)	Classification	Soil Characteristics (cm)	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 12	12U 425817 5485638	M-G-II	Soil disturbed	No standing water	Cultivated, few common cattail	1. Common cattail
Wetland 13	12U 425794 5485814	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 14	12U 425713 5485670	M-G-III	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 15	12U 425637 5485695	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 16	12U 425594 5485611	M-G-III	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 17	12U 425570 5485754	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 18	12U 425413 5485525	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 19	12U 399314 5572300	M-G-III	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 20	12U 425127 5485696	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 21	12U 425173 5485810	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 22	12U 424963 5485676	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 23	12U 424735 5485750	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A

Wetland ID	Location (UTM)	Classification	Soil Characteristics (cm)	Hydrologic Characteristics	Vegetation Characteristics	Indicator Species
Wetland 24	12U 424384 5486149	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 25	12U 424550 5486132	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 26	12U 424662 5486134	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 27	12U 424791 5486062	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 28	12U 424995 5486089	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 29	12U 425106 5485974	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 30	12U 425348 5485936	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 31	12U 425356 5486121	M-G-II	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 32	12U 425667 5486034	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A
Wetland 33	12U 425700 5485944	M-G-I	Soils disturbed; no horizons	No standing water	Cultivated	N/A

5.0 WETLAND AVOIDANCE AND MINIMIZATION

5.1 AVOIDANCE

Thirty-three wetlands were identified within the Project area. Given the size of the facility and land constraints, impacts to all the wetlands will not be avoidable; however, Solar Krafte diligently tried to avoid as many wetlands as possible. Upon the recommendation of wetland professionals, Solar Krafte worked with their engineers to develop a site plan that avoids direct impacts to eight wetlands (1, 4, 6, 8, 10, 14, 16, and 19). Specifically, Wetland 1, a seasonal wetland will be avoided with a buffer of 10 m. Wetlands 14, 16, and 19 seasonal wetlands will be avoided by a buffer of 30 m. Finally, Wetland 3 a seasonal wetland ranked highest for intactness, permanence, and overall functionality by wetland professionals will be given a 50 m buffer from solar panels; however, given its location, a fence must still be installed through this wetland therefore it will have direct impacts. Finally, Wetlands 14, 16, and 19 seasonal wetlands will be avoided by a buffer of 30 m. Inverter pads will not be located in any of the 33 wetlands (Figure 44.

5.2 IMPACTS TO WETLANDS

Module array supports, underground conductor runs, and access roads will impact some of the wetlands in the Project area (Table 6). The module array racking is supported by 15 cm diameter square or round steel piles, which are hydraulically driven into the soil to a depth of 130-180 cm. Underground conductor runs will require trenching during initial lay down. Access roads to the invertors consist of 30 cm of compacted three quarter (¾) inch crush road base, which will be laid on top of geotextile fabric. Figure 4 shows the Project area site plan and includes an access road cross-section.

The total Project area is **135.2 ha**. Of this total area, the proposed Project footprint will be **33.1 ha** This represents a 24 % coverage of the Project area, which consist primarily of solar modules. In total, 33 wetlands with a combined area of **10.97 ha** were assessed. The total area of impact for all of the wetlands within the Project area will be **0.14 ha**.

Due to the tilt of the PV arrays, some wetland areas will be shaded more frequently during parts of the day, which may result in a change of vegetation composition; however, this is not considered a permanent impact and does not require compensation (Matthew Wilson, Wetland Restoration and Compensation Specialist, AEP [pers. comm., July 10, 2017]).

TABLE 6 IMPACTS TO WETLANDS

Wetland Identifier	Impacting Activities	Area of Impact (ha)
Wetland 1	Avoided	0
Wetland 2	1. Module array supports 2. Underground conductor runs 3. Fence posts	0.0012
Wetland 3	4. Fence posts	0.00011
Wetland 4	Avoided	0
Wetland 5	5. Fence posts	0.0003
Wetland 6	Avoided	0
Wetland 7	6. Fence posts	0.0003
Wetland 8	Avoided	0
Wetland 9	Fence posts	0.0014
Wetland 10	Avoided	0
Wetland 11	7. Module array supports 8. Underground conductor runs	0.0012
Wetland 12	9. Module array supports 10. Underground conductor runs 11. Fence posts	0.0027
Wetland 13	12. Module array supports 13. Underground conductor runs	0.00075
Wetland 14	Avoided	0
Wetland 15	14. Module array supports 15. Underground conductor runs	0.00045
Wetland 16	Avoided	0
Wetland 17	16. Module array supports 17. Underground conductor runs 18. Fence posts	0.0015
Wetland 18	19. Module array supports 20. Underground conductor runs	0.0009
Wetland 19	Avoided	0
Wetland 20	21. Module array supports 22. Underground conductor runs 23. Fence posts	0.0033
Wetland 21	24. Module array supports 25. Underground conductor runs	0.0006
Wetland 22	26. Module array supports 27. Underground conductor runs 28. Access road	0.048

Wetland Identifier	Impacting Activities	Area of Impact (ha)
Wetland 23	29. Module array supports 30. Underground conductor runs 31. Access road 32. Fence posts	0.027
Wetland 24	33. Fence posts	0.00008
Wetland 25	34. Fence posts	0.00003
Wetland 26	35. Fence posts	0.00006
Wetland 27	36. Module array supports 37. Underground conductor runs	0.00012
Wetland 28	38. Module array supports 39. Underground conductor runs 40. Fence posts	0.00003
Wetland 29	41. Module array supports 42. Underground conductor runs 43. Access road	0.033
Wetland 30	44. Module array supports 45. Underground conductor runs	0.0012
Wetland 31	46. Fence posts	0.00008
Wetland 32	47. Module array supports 48. Underground conductor runs 49. Fence posts	0.0015
Wetland 33	50. Module array supports 51. Underground conductor runs 52. Access road	0.0165
Total		0.14

5.2.1 HYDROLOGY

Water quantity within the wetlands is not anticipated to increase as a result of runoff from solar arrays and access roads. Water from precipitation falling onto the solar panels will infiltrate the ground at the base of each solar panel. The nearly flat topography of the Project area (National Topographic System Maps, 2016) ensures that runoff from precipitation will infiltrate the ground where it falls, and that soil erosion will not be a concern. Access roads will use 30 cm of road base crush on geotextile to allow for some water attenuation on internal roadways within the Project area. Access roads will not have ditches, and runoff will be directed off the roads and allowed to infiltrate the soil adjacent to the access roads. The hydroperiod for each wetland will not be altered as a result of surface water runoff either from the roads or arrays.

Outsourced municipal water will be used to clean the solar arrays. The amount of water required for cleaning will be minimal and will be brought to the site by the cleaning crews on an as-needed basis. The method used for cleaning the panels involves the use of a wet sponge/squeegee tool; spraying the panels with water will not be required. Due to the small amount of water required, runoff from the cleaning process will be negligible and infiltrate the soil below the solar panels. Additionally, Solar Krafte will ensure that excess water from cleaning will not enter any of the wetlands. This will be made explicit to individuals cleaning the panels during the operation phase of the Project.

Quantitatively, a maximum of 3.4 cubic meters (m^3) of water per hectare per year may be used. Using industry standard practices, without the additional, minimal-use wetland water intrusion avoidance measures that will be employed above wetland areas, 50% of all used water is expected to evaporate on the modules without ever reaching the ground. This equates to an impact of 0.17 millimeters (mm) of additional precipitation per year reaching the ground, in the area covered by arrays. Based on the total annual precipitation of 380 mm in Wrentham, this represents a 0.053% increase in average annual precipitation.

Sedimentation can alter the aquatic environment, including basic wetland functions related to water quality and nutrient cycling. Additionally, sedimentation within wetlands is significantly exacerbated in agricultural fields. Cultivated wetlands receive more sediment from upland areas through land use practices (Gleason and Euliss 1998). As these wetlands have been cultivated for over 50 years, the rates of sediment accumulation in the wetlands are expected to decrease from current conditions. The elimination of crop cultivation is anticipated to improve hydrology and nutrient distribution within the Project area.

5.2.2 VEGETATION

The cessation of crop cultivation should re-establish native wetland vegetation along with a corresponding decrease in bare ground. Therefore, Project impacts may alter the vegetation community in uplands and also inadvertently wetlands in a positive manner, with a potential increase in biodiversity and species richness.

Vegetation composition may change due to increased shading from solar arrays; however, this is considered an indirect impact (Northrup and Wittemyer 2011).

One noxious weed, creeping thistle, was identified within the Project area. Guidelines outlined in the Alberta *Weed Control Act* (2011) will be followed during clearing and construction to prevent further spread of weed species.

5.2.3 SOIL

Soils within the Project area lacked the characteristics of water-altered soils (i.e. gleying and mottling). Evidence of soil compaction from farm machinery was evident at some of the wetlands during the time of assessment. The Project area will not be graded, and a cover crop will be seeded before construction and maintained during the operation of the Project. This will reduce sedimentation and erosion of soils around wetlands and throughout the Project area.

5.2.4 WILDLIFE

Potential impacts to wildlife from solar energy development include habitat loss and fragmentation, loss of connectivity, alteration and degradation of wildlife habitat, and water use (RSPB 2014; Bird Life International 2017). Other reports have identified wildlife displacement and mortality as additional impacts from solar PV facility developments (RSPB 2014; Bird Life International 2017).

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 solar developments. The loss and fragmentation of habitat can result in the displacement of wildlife from areas around the facility, which could lead to altered species composition and changes in behavior (Northrup and Wittemyer 2013). Specific to the proposed Project, this impact has been minimized through the placement of the facility on previously disturbed lands.

5.3 MINIMIZATION

Disruption to the natural flow of water into a wetland can result in changes to wetland vegetation, as well as 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 the 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 the existing surface drainage into the wetlands will allow for re-establishment of native wetland vegetation and promote biodiversity via an increase in species richness. The construction of the Project and ongoing maintenance activities, such as the cleaning of solar panels, will not alter the natural hydrologic regimes of the wetlands. There are no plans to actively restore the exiting wetlands within the Project area and anticipated increases in species richness and diversity will be an inadvertent and positive side effect from the cessation of agricultural practices within the wetlands.

A cover crop, such as barley, will be used for dust control and maintained via mechanical mowing. Mowing will be done during late summer and fall when surface water is not present in

the wetlands and when impacts to wildlife, such as breeding birds, will be 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 and/or wildlife will be minimized by construction timing and by following the standards and best management practices outlined in the Wrentham Wildlife Assessment Report (Basin 2017).

The following standard mitigation measures should be implemented during Project construction:

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

Table 7 details the mitigation measures that will be used to minimize the indirect impacts to the wetland, where possible.

TABLE 7 MITIGATION MEASURES

Resource Feature	Mitigation Measures
Vegetation and Hydrology	• Construction will be performed during dry ground conditions, specifically when ephemeral and temporary wetlands are dry (e.g., during late summer and fall months). • Establishment of weed species will be minimized by ensuring all equipment is cleaned prior to arriving on site. • Weeds will be controlled according to the *Alberta Weed Control Act* (Government of Alberta 2011). • Native seed mixes will be used, including wetland-dependent species, to revegetate any disturbed areas. • Clearing or damage to vegetation within riparian areas of wetland, if present, will be avoided where possible. Equipment operators will not disturb or destroy vegetation outside of the Project area.
Soil and Hydrology	• Construction will be performed 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. • Installation of effective erosion and sediment control measures before starting work to prevent sediments from entering waterbodies or wetlands. • Regularly inspect and maintain erosion and sediment control measures and structures during the construction activities. • Repair erosion and sediment control measures and structures if damage occurs. • Remove non-biodegradable erosion and sediment control materials once the site is stabilized. • 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. • Activities will be halted during adverse construction conditions caused by heavy rains or other weather events.

Resource Feature	Mitigation Measures
Wildlife	• Impacts to migratory birds and their nests will be avoided in accordance with the federal *Migratory Birds Convention Act* by avoiding wetland impacts during the restricted activity period of April 15 to August 21 (Environment and Climate Change Canada 2016). 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 *Wildlife Act* (Government of Alberta 2012), *Migratory Bird Convention Act* (Government of Canada 1994), and the *Species at Risk Act* (Government of Canada 2014) will be conserved. • 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 *Migratory Birds Convention Act*.

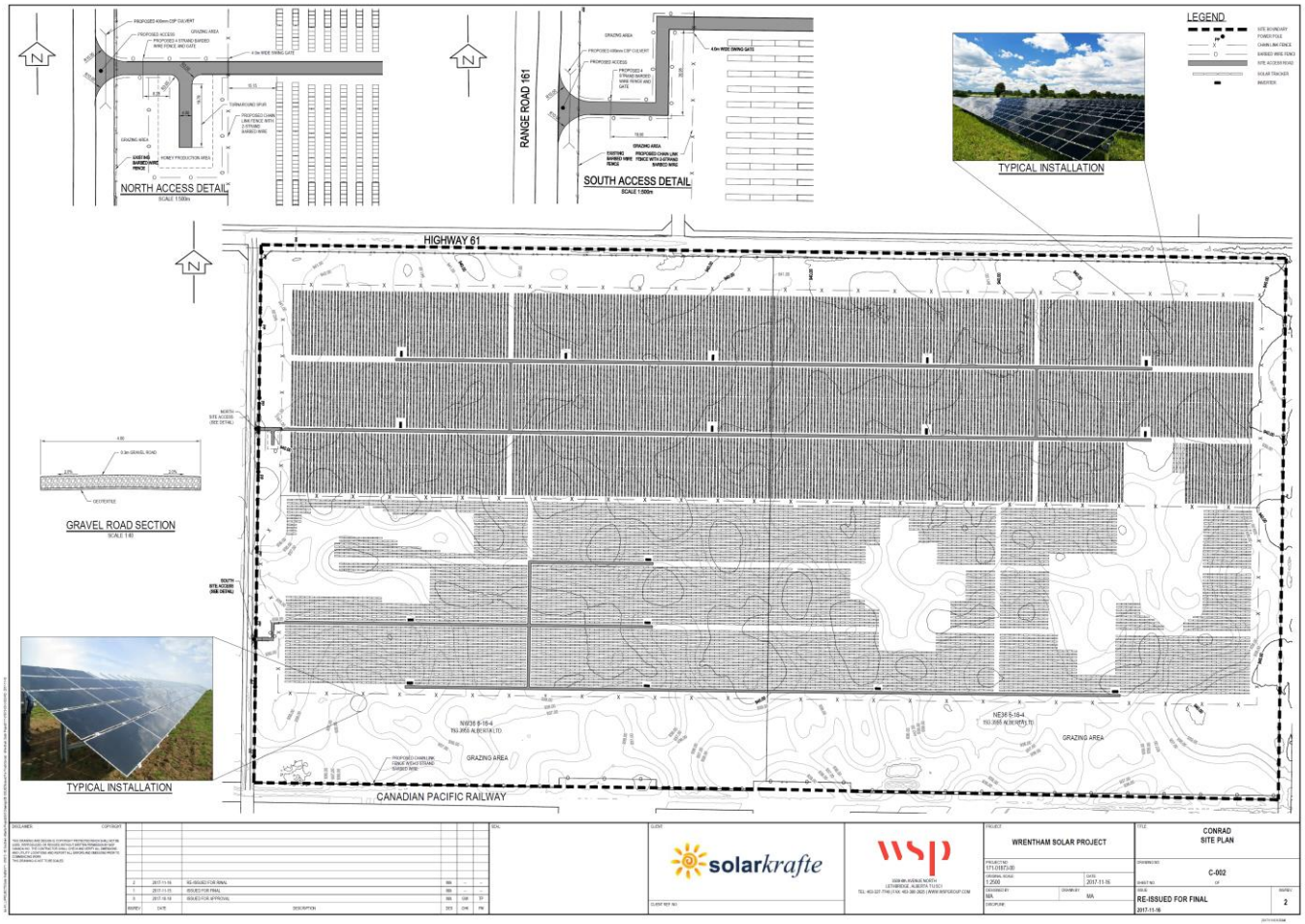


FIGURE 4 WRENTHAM SOLAR PROJECT SITE PLAN

6.0 WETLAND REPLACEMENT PROPOSAL

The Alberta Wetland Mitigation Directive (Government of Alberta 2017e) states that wetlands must be replaced when impacts cannot be avoided; however, replacing wetlands with same functionality as those lost is difficult. Thus, the area replaced must be greater than that lost to sufficiently compensate for loss in complexity and function. Replacement ratios have been put in place to address the disparity between the restored wetland and the lost wetland area. Impacted wetlands are assessed using the Alberta Wetland Rapid Assessment Tool-Actual (ABWRET-A). Using this tool, wetlands are assigned a relative wetland value, which determines the appropriate ratio required to cover its loss.

To fulfill the replacement obligation, Solar Krafte proposes to make a payment to a Wetland Replacement Agent via the in-lieu fee program. Table 8 summarizes the anticipated fee required for replacement of direct impacts to some of the 33 wetlands.

TABLE 8 SUMMARY OF REPLACEMENT PROPOSAL

Wetland ID	ABWRET A Final Score	Anticipated Area of Wetland Permanently Lost due to Activity (ha)	Replacement Ratio[1]	Relative Value Assessment Unit	In-lieu Rate ($/ha)	Amount Owed
Wetland 1	D	0	Avoided	Avoided	Avoided	Avoided
Wetland 2	B	0.0012	4:1	15	17,300	$ 83.04
Wetland 3	C	0.00011	2:1	15	17,300	$ 3.81
Wetland 4	B	0	Avoided	Avoided	Avoided	Avoided
Wetland 5	C	0.00003	2:1	15	17,300	$ 1.04
Wetland 6	Ephemeral	0	N/A	N/A	N/A	N/A
Wetland 7	B	0.00003	2:1	15	17,300	$ 2.08
Wetland 8	C	0	Avoided	Avoided	Avoided	Avoided
Wetland 9	C	0.00014	2:1	15	17,300	$ 4.48
Wetland 10	C	0	Avoided	Avoided	Avoided	Avoided
Wetland 11	Ephemeral	0.0012	N/A	N/A	N/A	N/A
Wetland 12	C	0.0027	2:1	15	17,300	$934.20
Wetland 13	Ephemeral	0.00075	N/A	N/A	N/A	N/A
Wetland 14	C	0	Avoided	Avoided	Avoided	Avoided
Wetland 15	C	0.00045	2:1	15	17,300	$ 15.57
Wetland 16	C	0	Avoided	Avoided	Avoided	Avoided
Wetland 17	C	0.0015	2:1	15	17,300	$ 51.90
Wetland 18	Ephemeral	0.0009	N/A	N/A	N/A	N/A
Wetland 19	C	0	Avoided	Avoided	Avoided	Avoided
Wetland 20	B	0.0033	4:1	15	17,300	$228.36

Wetland ID	ABWRET A Final Score	Anticipated Area of Wetland Permanently Lost due to Activity (ha)	Replacement Ratio[1]	Relative Value Assessment Unit	In-lieu Rate ($/ha)	Amount Owed
Wetland 21	Ephemeral	0.0009	N/A	N/A	N/A	N/A
Wetland 22	B	0.048	4:1	15	17,300	$ 3,321.60
Wetland 23	B	0.027	4:1	15	17,300	$ 1, 868.40
Wetland 24	Ephemeral	0.00008	N/A	N/A	N/A	N/A
Wetland 25	Ephemeral	0.00003	N/A	N/A	N/A	N/A
Wetland 26	Ephemeral	0.00006	N/A	N/A	N/A	N/A
Wetland 27	Ephemeral	0.0012	N/A	N/A	N/A	N/A
Wetland 28	Ephemeral	0.0003	N/A	N/A	N/A	N/A
Wetland 29	C	0.033	2:1	15	17,300	$ 1,141.80
Wetland 30	Ephemeral	0.0012	N/A	N/A	N/A	N/A
Wetland 31	B	0.00008	2:1	15	17,300	$ 5.54
Wetland 32	Ephemeral	0.0015	N/A	N/A	N/A	N/A
Wetland 33	Ephemeral	0.0165	N/A	N/A	N/A	N/A
Total		**0.14**				**$ 5,793.42**

Notes: Ratios: 1:1 required to replace D wetland; 2:1 to replace a C wetland; 4:1 to replace a B wetland.

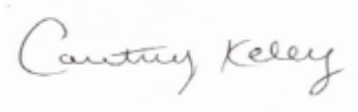
7.0 CLOSURE

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

Sincerely,

Basin Environmental Ltd.

Report Prepared by:



Courtney Kelly, B.Sc., P.Biol.
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Reviewed by:

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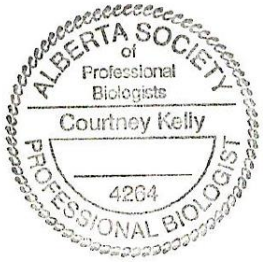
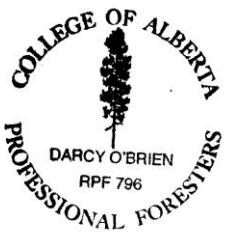
Principal, Senior Project Manager





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APPENDIX A

RESULTS OF HISTORICAL AERIAL PHOTOGRAPH ASSESSMENT

TABLE 1 HISTORICAL AERIAL PHOTO ASSESSMENT FOR WETLAND 1

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 1	May 10, 1950	AS182	209	1: 31,680	Spring	M-G-III	Not available	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 1	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 1	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 1	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 1	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	DVI	Dry; Wetland margins are not evident	N
Wetland 1	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 1	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 1	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wetland margins evident; small pockets of water in wetland area	Y

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[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 2	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	DV	Dry; Wetland margins still evident	N
Wetland 2	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 2	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 2	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 2	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	DVI	Dry; Wetland margins are not evident	N
Wetland 2	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wetland margins evident; water throughout area	Y
Wetland 2	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 2	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wetland margins evident; water in wetland area	Y

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 3 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 3

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 3	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 3	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 3	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 3	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 3	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	DV	Dry; Wetland margins are evident	N
Wetland 3	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wetland margins evident; water throughout area	Y
Wetland 3	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 3	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wetland margins evident; water in wetland area	Y

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 4 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 4

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 4	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 4	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 4	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 4	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	DV	Dry; Wetland margins still evident	N
Wetland 4	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins are evident	N
Wetland 4	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins evident; water throughout area	Y
Wetland 4	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 4	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wetland margins evident; water in wetland area	Y

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 5 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 5

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 5	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 5	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 5	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 5	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	DV	Dry; Wetland margins still evident	N
Wetland 5	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DVI	Dry; Wetland margins are evident	N
Wetland 5	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins evident; water throughout area	Y
Wetland 5	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins are evident	N
Wetland 5	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wetland margins evident; water in wetland area	Y

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 6 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 6

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 6	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 6	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 6	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 6	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DV	Dry; Wetland margins still evident	N
Wetland 6	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are evident	N
Wetland 6	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 6	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are evident	N
Wetland 6	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins are evident	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 7 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 7

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 7	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	W	Partially wet; wetland margins are evident	Y
Wetland 7	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 7	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins are evident	N
Wetland 7	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	DV	Dry; Dugout in wetland area	N
Wetland 7	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	W	Partially wet; wetland margins are evident; dugout in wetland area	Y
Wetland 7	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wetland margins still evident	Y
Wetland 7	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	DV	Dry; Wetland margins are evident	N
Wetland 7	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wet; Wetland margins are evident	Y

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 8 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 8

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 8	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DV	Dry; Wetland margins still evident	N
Wetland 8	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 8	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 8	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wet; Wetland margins are evident	Y
Wetland 8	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins are not evident	N
Wetland 8	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins are evident	Y
Wetland 8	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins are evident	N
Wetland 8	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wet; Wetland margins are evident	Y

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 9 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 9

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 9	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DV	Dry; Wetland margins still evident	N
Wetland 9	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 9	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 9	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wet; Wetland margins are evident	Y
Wetland 9	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins are not evident	N
Wetland 9	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins are evident	Y
Wetland 9	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins are evident	N
Wetland 9	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wet; Wetland margins are evident	Y

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 10 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 10

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 10	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DV	Dry; Wetland margins still evident	N
Wetland 10	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 10	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 10	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wet; Wetland margins are evident	Y
Wetland 10	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DVI	Dry; Wetland margins are not evident	N
Wetland 10	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	DV	Wetland margins are evident	N
Wetland 10	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins are evident	N
Wetland 10	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wet; Wetland margins are evident	Y

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 11 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 11

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 11	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DV	Dry; Wetland margins still evident	N
Wetland 11	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 11	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 11	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wet; Wetland margins are evident	Y
Wetland 11	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 11	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Wetland margins are evident	N
Wetland 11	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 11	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Wetland margins are evident	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 12 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 12

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 12	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 12	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 12	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 12	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wet; Wetland margins are evident	Y
Wetland 12	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 12	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins are evident	Y
Wetland 12	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	W	Wetland margins are evident	Y
Wetland 12	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wetland margins are evident	Y

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 13 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 13

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 13	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 13	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 13	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DV	Dry; Wetland margins still evident	N
Wetland 13	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wet; Wetland margins are evident	Y
Wetland 13	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 13	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 13	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 13	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	W	Wetland margins are evident	Y

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 14 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 14

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 14	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 14	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 14	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 14	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wet; Wetland margins are evident	Y
Wetland 14	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 14	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wet; Wetland margins are evident	Y
Wetland 14	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	DVI	Dry; Wetland margins are not evident	N
Wetland 14	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wetland margins are evident	Y

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 15 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 15

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 15	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; water throughout area	Y
Wetland 15	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 15	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins still evident	N
Wetland 15	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wet; Wetland margins are evident	Y
Wetland 15	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 15	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wet; Wetland margins are evident	Y
Wetland 15	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 15	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 16 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 16

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 16	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	W	Wetland margins evident; water throughout area	Y
Wetland 16	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 16	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 16	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wet; Wetland margins are evident	Y
Wetland 16	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 16	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wet; Wetland margins are evident	Y
Wetland 16	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	DVI	Dry; Wetland margins are not evident	N
Wetland 16	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wet; Wetland margins are evident	Y

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 17 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 17

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 17	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; partially wet	Y
Wetland 17	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 17	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 17	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	DV	Dry; Wetland margins still evident	N
Wetland 17	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	W	Wetland margins evident; pockets of water throughout area	Y
Wetland 17	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wet; Wetland margins are evident	Y
Wetland 17	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 17	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 18 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 18

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 18	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DV	Dry; Wetland margins still evident	N
Wetland 18	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DV	Dry; Wetland margins still evident	N
Wetland 18	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 18	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DVI	Dry; Wetland margins are not evident	N
Wetland 18	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 18	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 18	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 18	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 19 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 19

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 19	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- III	Not available	W	Wetland margins evident; partially wet	Y
Wetland 19	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 19	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- III	D	DV	Dry; Wetland margins still evident	N
Wetland 19	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- III	W	W	Wetland margins evident; wet throughout	Y
Wetland 19	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- III	N	DV	Dry; Wetland margins still evident	N
Wetland 19	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- III	N	W	Wetland margins evident; wet throughout	Y
Wetland 19	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- III	D	W	Wetland margins evident; wet throughout	Y
Wetland 19	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- III	N	W	Wetland margins evident; partially wet	Y

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 20 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 20

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 20	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; partially wet	Y
Wetland 20	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 20	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 20	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wetland margins evident; wet throughout	Y
Wetland 20	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 20	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins evident; wet throughout	Y
Wetland 20	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 20	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	W	Wetland margins evident; partially wet	Y

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 21 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 21

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 21	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 21	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DV	Dry; Wetland margins still evident	N
Wetland 21	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 21	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wetland margins evident; wet throughout	Y
Wetland 21	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 21	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 21	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DV	Dry; Wetland margins still evident	N
Wetland 21	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 22 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 22

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 22	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; partially wet	Y
Wetland 22	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 22	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 22	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wetland margins evident; wet throughout	Y
Wetland 22	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 22	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 22	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 22	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 23 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 23

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 23	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	W	Wetland margins evident; partially wet	Y
Wetland 23	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 23	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 23	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	W	Wetland margins evident; wet throughout	Y
Wetland 23	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 23	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	W	Wetland margins evident; partially wet	Y
Wetland 23	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DV	Dry; Wetland margins still evident	N
Wetland 23	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 24 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 24

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 24	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 24	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 24	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 24	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wetland margins evident; wet throughout	Y
Wetland 24	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 24	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 24	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 24	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 25 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 25

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 25	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 25	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 25	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 25	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wetland margins evident; wet throughout	Y
Wetland 25	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 25	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	W	Wetland margins evident; wet throughout	Y
Wetland 25	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 25	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 26 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 26

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 26	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 26	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 26	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 26	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wetland margins evident; wet throughout	Y
Wetland 26	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 26	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 26	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 26	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 27 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 27

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 27	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 27	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 27	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 27	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	W	Wetland margins evident; wet throughout	Y
Wetland 27	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 27	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 27	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 27	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 28 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 28

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 28	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 28	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 28	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 28	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DV	Dry; Wetland margins still evident	N
Wetland 28	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DVI	Dry; Wetland margins are not evident	N
Wetland 28	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 28	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 28	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 29 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 29

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 29	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 29	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 29	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 29	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	DV	Dry; Wetland margins still evident	N
Wetland 29	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 29	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 29	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 29	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 30 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 30

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 30	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 30	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 30	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 30	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DV	Dry; Wetland margins still evident	N
Wetland 30	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 30	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 30	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 30	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 31 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 31

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 31	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- II	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 31	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 31	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 31	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- II	W	DV	Dry; Wetland margins still evident	N
Wetland 31	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 31	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- II	N	DV	Dry; Wetland margins still evident	N
Wetland 31	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- II	D	DVI	Dry; Wetland margins are not evident	N
Wetland 31	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- II	N	DV	Dry; Wetland margins still evident	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 32 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 32

Wetland No.	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 32	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 32	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 32	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 32	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DV	Dry; Wetland margins still evident	N
Wetland 32	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 32	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 32	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 32	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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 33 HISTORICAL AERIAL PHOTOS ASSESSMENT FOR WETLAND 33

	Photo Date	Photo ID (roll)	Photo Number	Resolution	Season[1]	AWCS Class	Precipitation Year [2]	Open Water Visible [3]	Photo Notes	Permanent
Wetland 33	May 10, 1950	AS182	209	1: 31,680	Spring	M-G- I	Not available	DVI	Dry; Wetland margins are not evident	N
Wetland 33	August 8, 1961	AS813	176	1: 31,680	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 33	September 21, 1976	AS2998	156	1: 25,000	Fall	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 33	September 21, 1979	AS3032	142	1: 20,000	Fall	M-G- I	W	DV	Dry; Wetland margins still evident	N
Wetland 33	August 6, 1984	AS3080	82	1:30,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 33	July 25, 1997	AS4800	256	1:20,000	Summer	M-G- I	N	DV	Dry; Wetland margins still evident	N
Wetland 33	July 24, 2004	AS5295 B	136	1:20,000	Summer	M-G- I	D	DVI	Dry; Wetland margins are not evident	N
Wetland 33	September 22, 2012	AS5483	22	1:30,000	Fall	M-G- I	N	DV	Dry; Wetland margins still evident	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

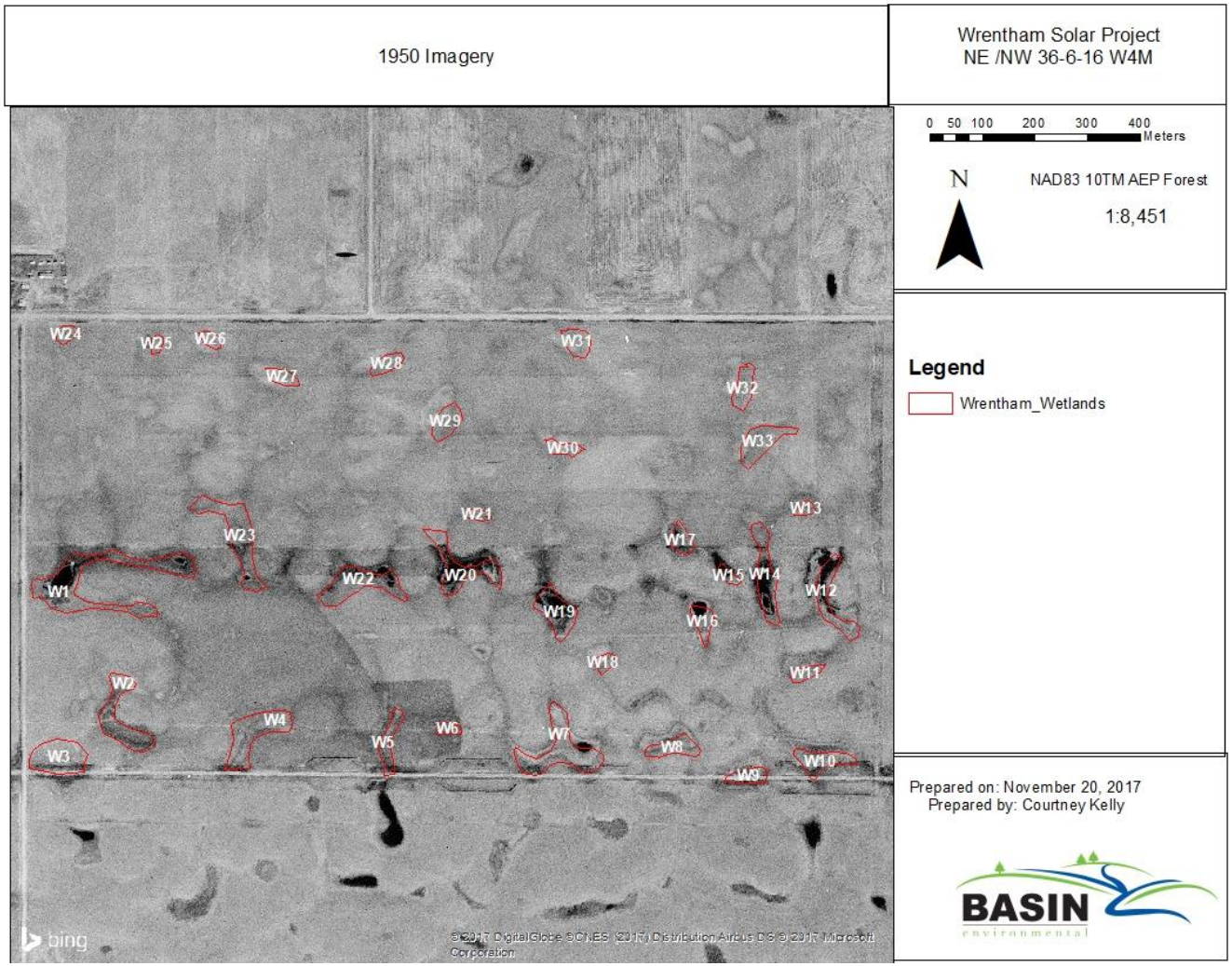

FIGURE 1 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1950

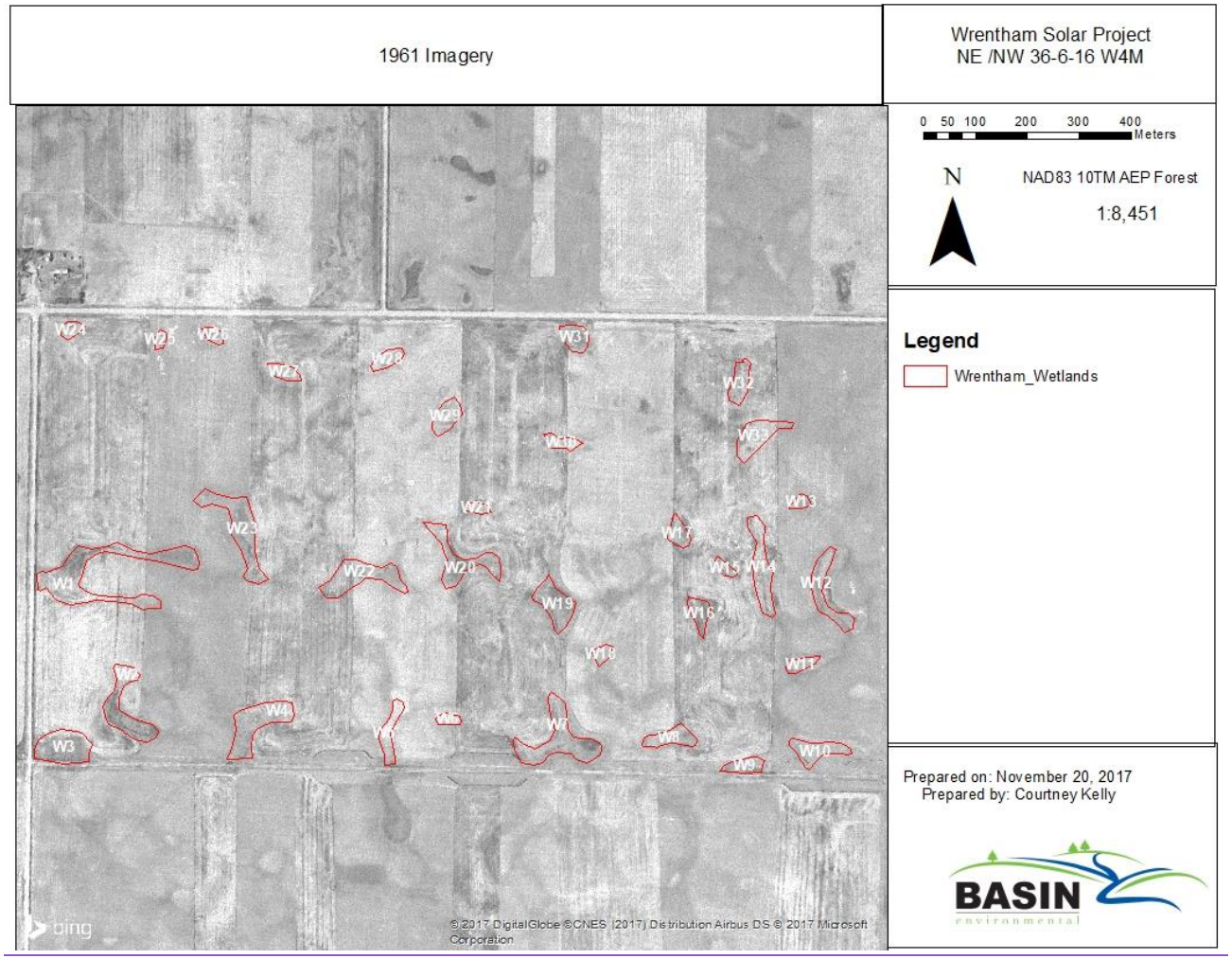

FIGURE 2 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1961

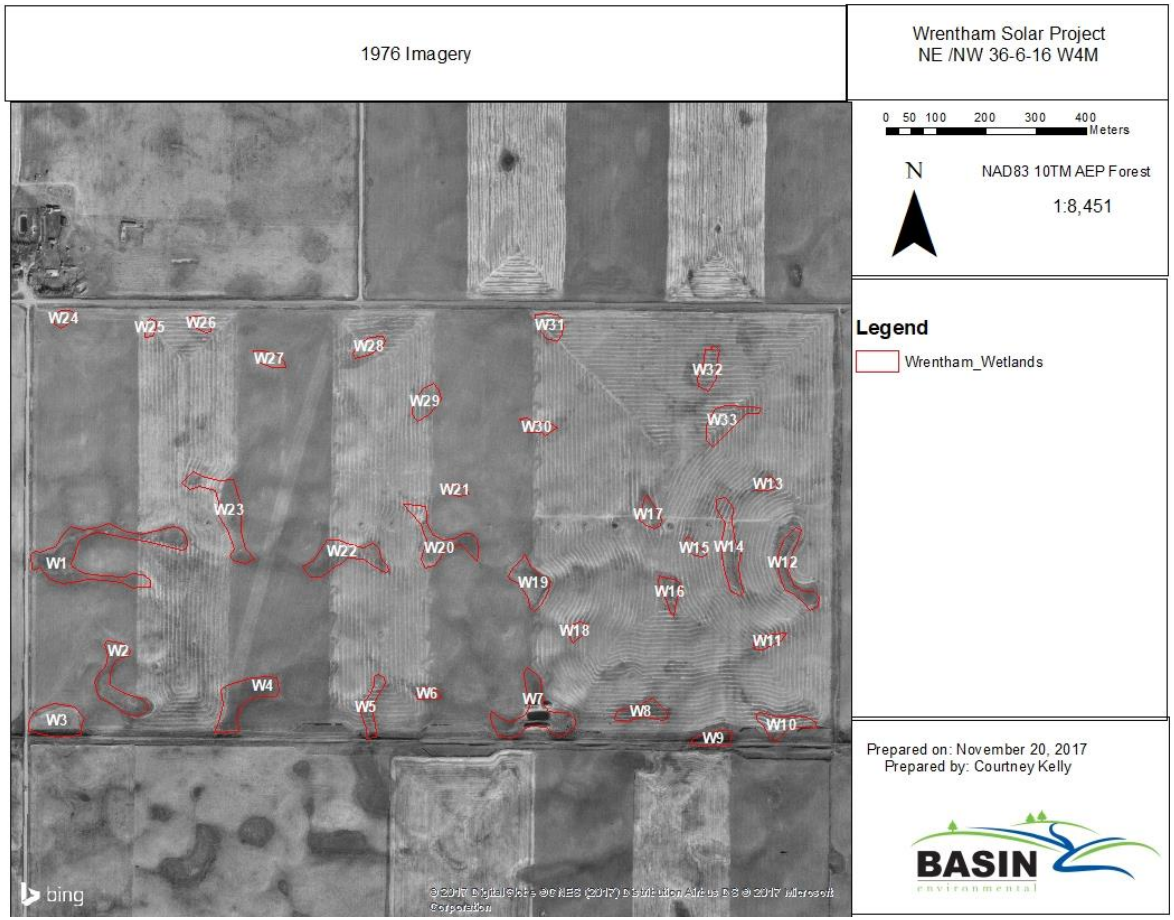

FIGURE 3 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1976

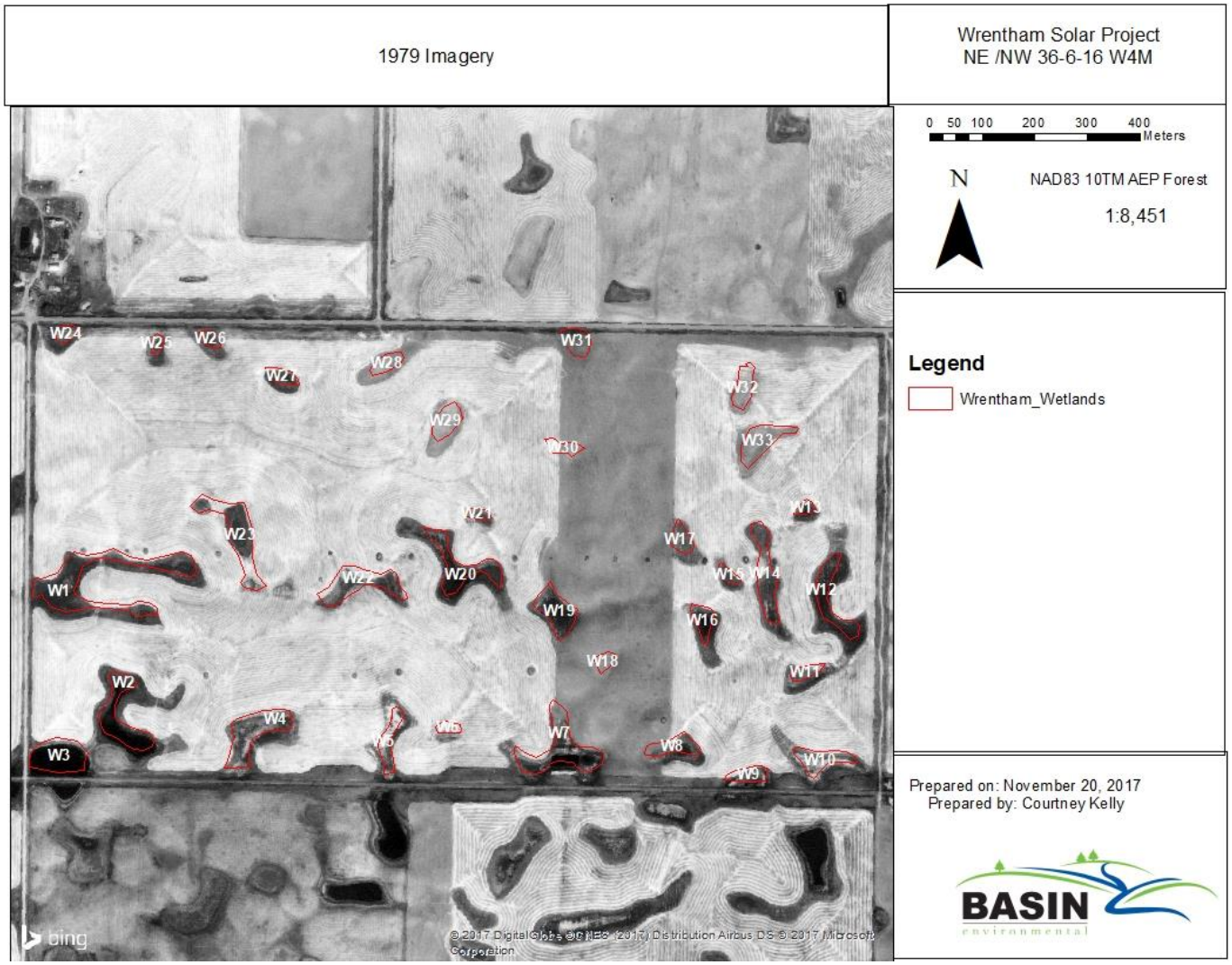

FIGURE 4 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1979

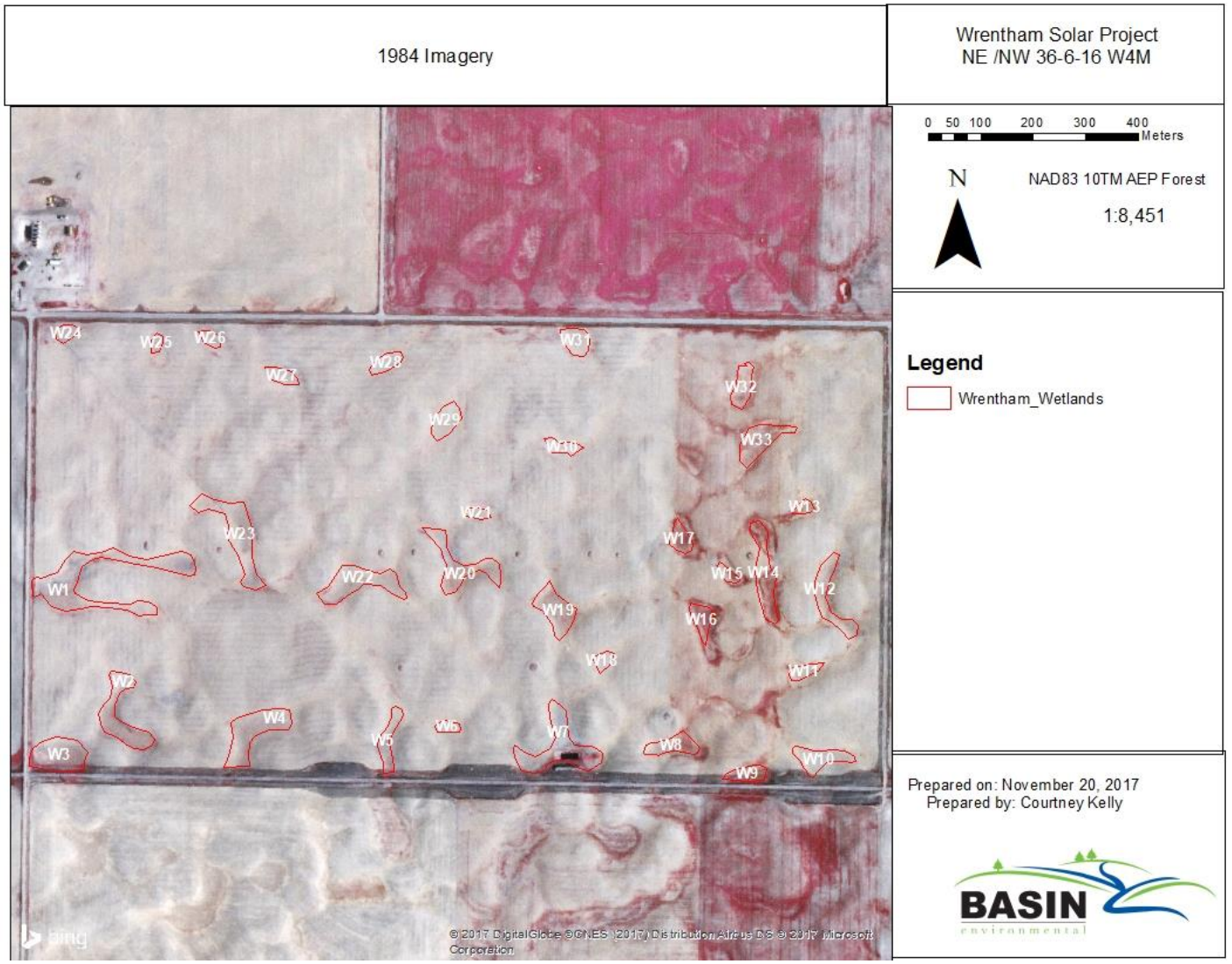

FIGURE 5 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1984

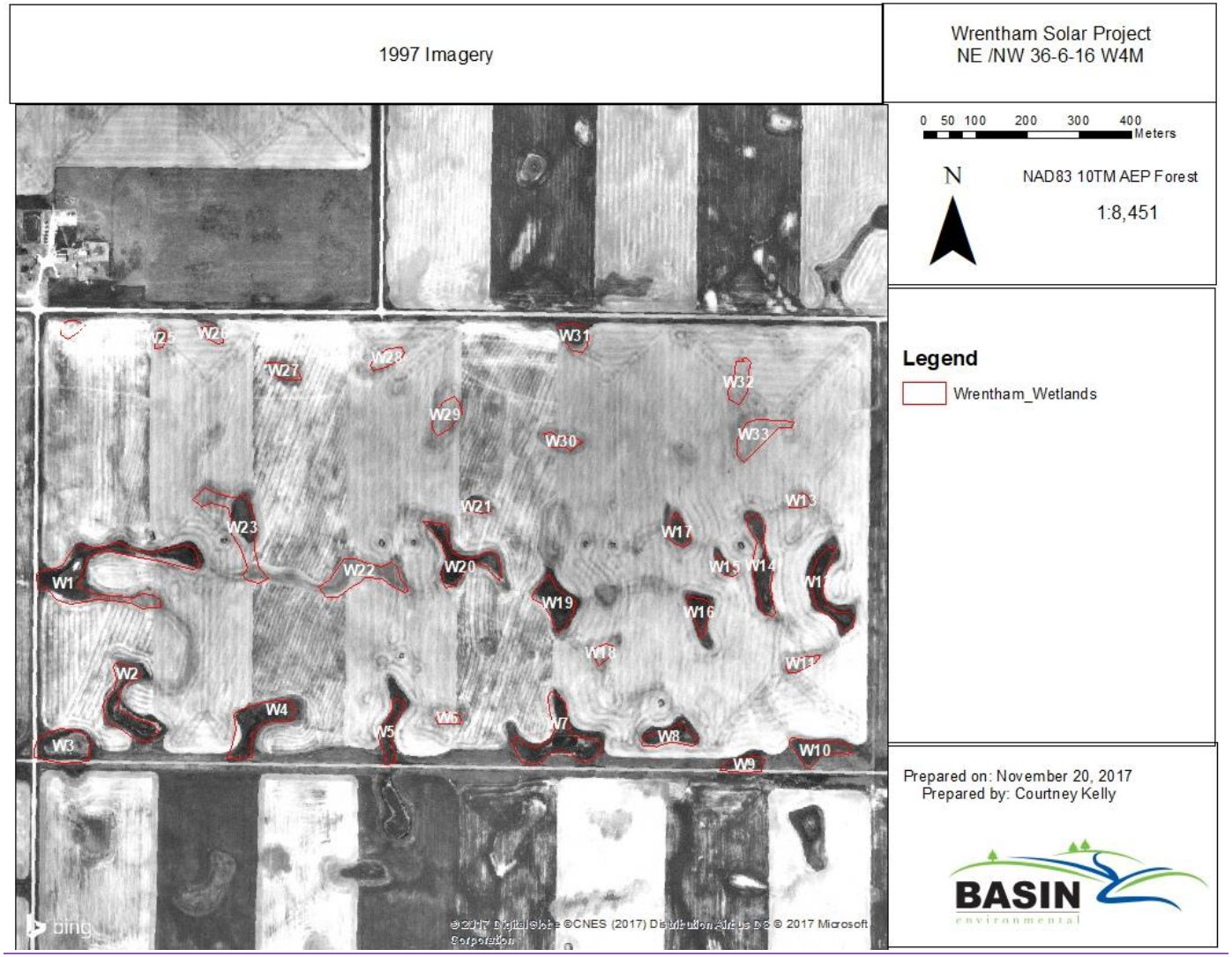

FIGURE 6 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 1997

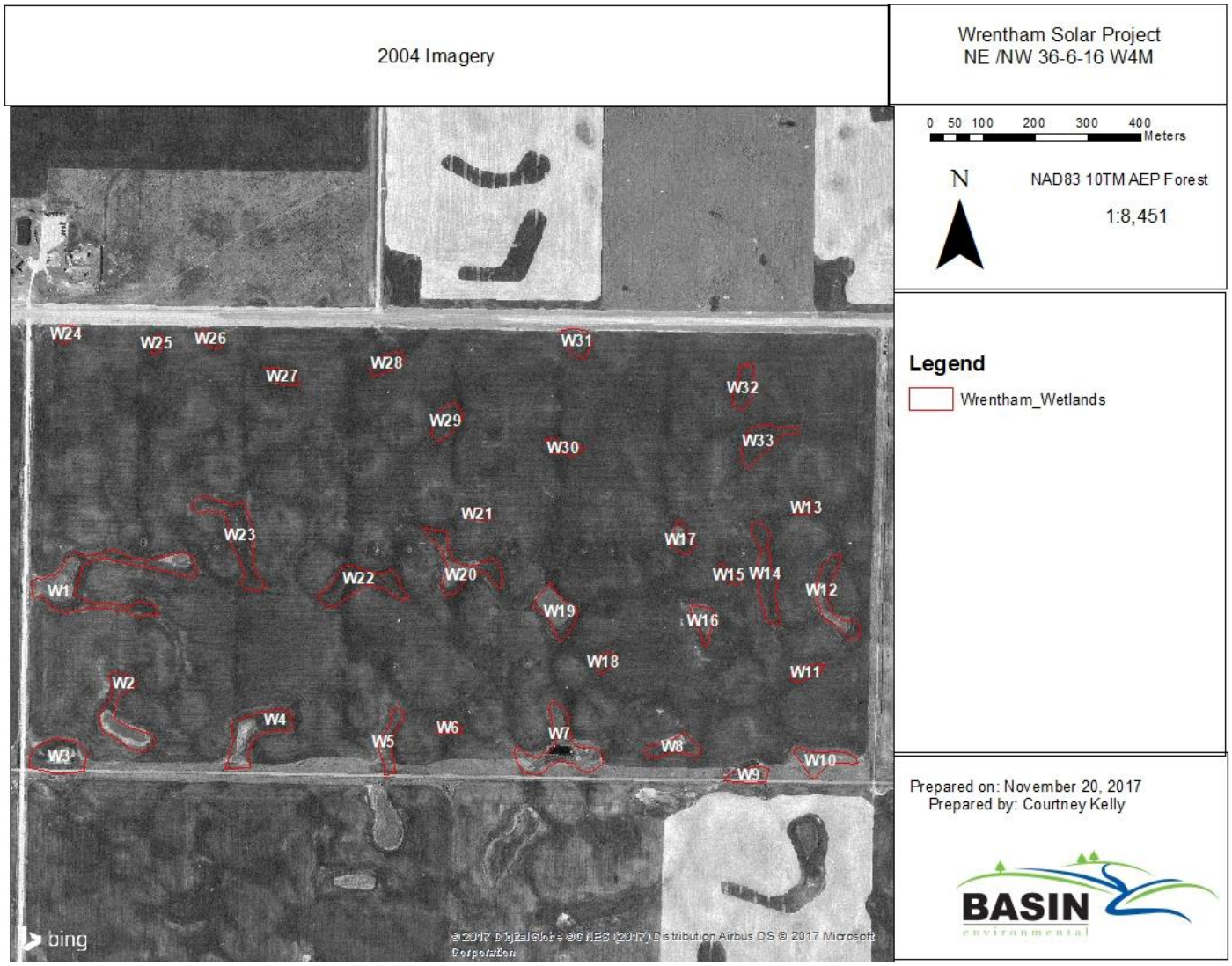

FIGURE 7 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 2004

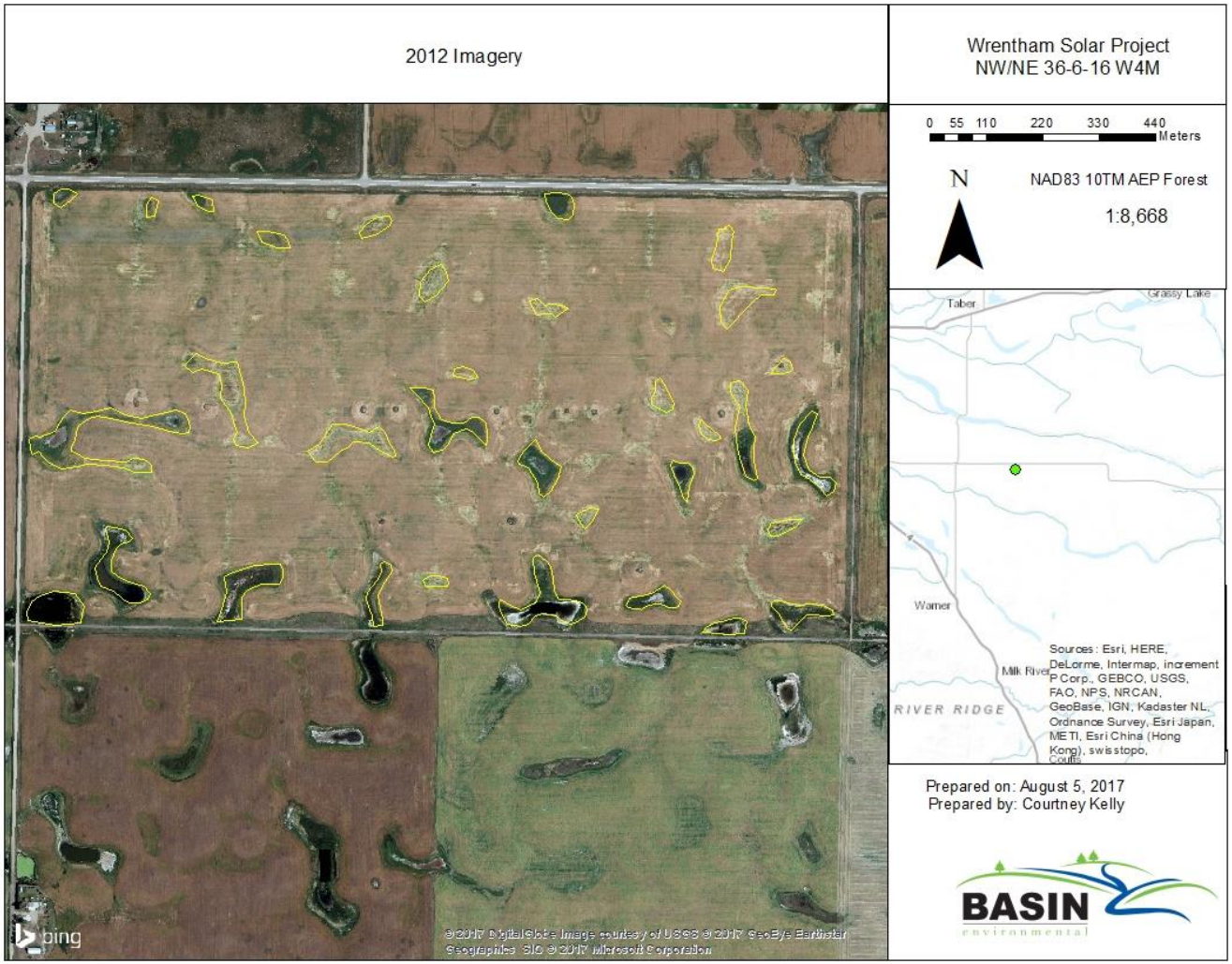

FIGURE 8 AERIAL PHOTO OF PROPOSED PROJECT AREA IN 2012

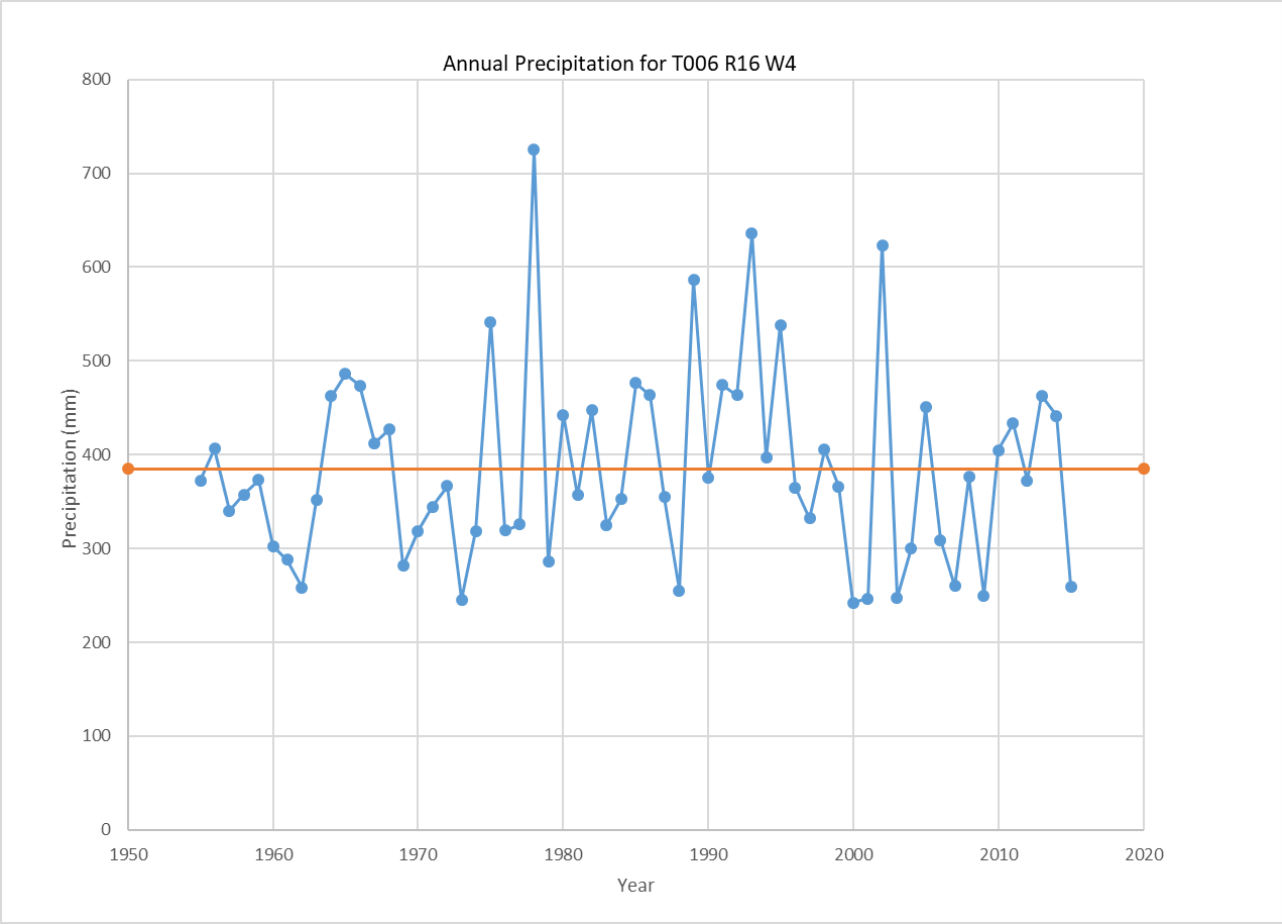

FIGURE 9 PRECIPITATION DATA FROM 1955 TO 2015 (ALBERTA AGRICULTURE 2017)

APPENDIX B

SITE PHOTOGRAPHS

WETLAND 1	
Date: May 29, 2017	
Direction: North from ditch along eastern property line	
Description: Some wetland vegetation evident along edge	
Wetland Classification: M-G-III	

WETLAND 2	
Date: May 29, 2017	
Direction: West	
Description: Wetland margins difficult to distinguish in field	
Wetland Classification: M-G-III	

WETLAND 3

Date: May 29, 2017	
Direction: Southeast	
Description: Some wetland vegetation evident.	
Wetland Classification: M-G-III	

WETLAND 4

Date: May 29, 2017	
Direction: East	
Description: Low depression. Wetland margins not evident	
Wetland Classification: M-G-II	

WETLAND 5	
Date: May 29, 2017	
Direction: Northeast	
Description: Wetland margins difficult to distinguish	
Wetland Classification: M-G-II	

WETLAND 6	
Date: May 29, 2017	
Direction: North	
Description: Wetland margins difficult to distinguish	
Wetland Classification: M-G-I	

WETLAND 7	
Date: May 29, 2017	
Direction: Southeast	
Description: Dugout apart of the wetland complex. Wetland vegetation and margins evident	
Wetland Classification: M-G-III	

WETLAND 8	
Date: May 29, 2017	
Direction: South	
Description: Wetland margins difficult to distinguish	
Wetland Classification: M-G-II	

WETLAND 9	
Date: May 29, 2017	
Direction: North	
Description: Wetland vegetation evident along fence line.	
Wetland Classification: M-G-II	

WETLAND 10	
Date: May 29, 2017	
Direction: Ground	
Description: Low area. Some wetland vegetation evident along fence line	
Wetland Classification: M-G-II	

WETLAND 11 AND 12	
Date: May 29, 2017	
Direction: Northwest	
Description: Hard to distinguish. Hydrologically connected to wetland 12	
Wetland Classifications: M-G-I and M-G-II, respectively	

WETLAND 13	
Date: May 29, 2017	
Direction: Southwest	
Description: Wetland margins hard to distinguish	
Wetland Classification: M-G-I	

WETLAND 14	
Date: May 29, 2017	
Direction: South	
Description: Wetland margins hard to distinguish	
Wetland Classification: M-G-III	

WETLAND 15	
Date: May 29, 2017	
Direction: ground	
Description: Trace amount of horsetail evident	
Wetland Classification: M-G-II	

WETLAND 16 AND 17	
Date: May 29, 2017	
Direction: North	
Description: Margins hard to distinguish	
Wetland Classifications: M-G-III and M-G-II, respectively	

WETLAND 18	
Date: May 29, 2017	
Direction: East	
Description: Margins hard to distinguish	
Wetland Classification: M-G-I	

WETLAND 19	
Date: May 29, 2017	
Direction: Southeast	
Description: *Typha latifolia* evident.	
Wetland Classification: M-G-III	

WETLAND 20 AND 21	
Date: May 29, 2017	
Direction: Northwest	
Description: Margins hard to distinguish	
Wetland Classification: M-G-II and M-G-I, respectively	

WETLAND 22

Date: May 29, 2017
Direction: Northwest
Description: Margins hard to distinguish
Wetland Classification: M-G-II

WETLAND 23

Date: May 29, 2017
Direction: Southeast
Description: Margins hard to distinguish
Wetland Classification: M-G-II

WETLAND 24	
Date: May 29, 2017	
Direction: Southeast	
Description: Some wetland vegetation evident	
Wetland Classification: M-G-I	

WETLAND 25 AND 26	
Date: May 29, 2017	
Direction: Southeast	
Description: Margins hard to distinguish	
Wetland Classification: M-G-I	

WETLAND 28 AND 29	
Date: May 29, 2017	
Direction: Southeast	
Description: Margins hard to distinguish	
Wetland Classification: M-G-I and M-G-II, respectively	

WETLAND 32	
Date: May 29, 2017	
Direction: Southeast	
Description: Margins hard to distinguish	
Wetland Classification: M-G-I	

SOIL PROFILE	
Date: May 29, 2017	
Direction: Ground	
Description: No soil horizons	

APPENDIX C

DATABASE SEARCH RESULT

Alberta Environment and Parks

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 29-Aug-2017 16:00

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
No Species Found in Search Extent	BADGER	No Species Found in Search Extent
	CHESTNUT-COLLARED LONGSPUR	
	PLAINS SPADEFOOT	
	SORA	

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Buffer Radius:
715315, 5487722	10-TM AEP Forest	SE 6 7 15 4	1 kilometers

Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

Please not that actual locations of FWMIS records were requested from AEP and these observations were also included in Table 2 of the report.

Additional Application Requirements

Wildlife Survey	Yes	DND Area	

Sensitive Features

Wildlife and Other Sensitive Species

	Intersected		Intersected
Burrowing Owl Range	Yes	Piping Plover Waterbodies	
Caribou Range		Sensitive Amphibians Ranges	Yes
Colonial Nesting Birds		Sensitive Raptor Range	Yes
Eastern Short-horned Lizard Range		Sensitive Snake Species Range	
Endangered and Threatened Plants Ranges		Sharp-tailed Grouse Leks and Buffer	
Greater Sage Grouse Range		Sharp-tailed Grouse Survey	Yes
Greater Sage Grouse Leks and Buffer		Special Access Zone	
Grizzly Bear Zone		Swift Fox Range	
Key Wildlife and Biodiversity Areas		Trumpeter Swan Buffer	
Mountain Goat and Sheep Areas		Trumpeter Swan Waterbodies/Watercourse	
Ord's Kangaroo Rat Range			
Other Sensitive and Endangered Species	Yes		

Federal Orders:

	Intersected
Greater Sage Grouse	

Grassland and Parkland Natural Region:

	Intersected
Grassland and Parkland Natural Region	Yes

Function (ABWRET-A Normalized Score)	W1	W2	W3	W4	W5	W7	W8	W9	W10	W12	W14	W15	W16	W17	W19	W20	W22	W23	W29	W31
Surface Water Storage (WS)	0.27	0.72	0.72	0.72	0.72	0.77	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.81
Stream Flow Support (SFS)	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Streamwater Cooling (WC)	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sediment & Toxicant Retention & Stabilization (SR)	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus Retention (PR)	0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Nitrate Removal & Retention (NR)	0.07	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Organic Nutrient Export (OE)	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fish Habitat (FH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aquatic Invertebrate Habitat (INV)	0.67	0.60	0.57	0.73	0.52	0.53	0.45	0.44	0.45	0.46	0.46	0.45	0.45	0.45	0.48	0.55	0.57	0.62	0.49	0.49
Amphibian Habitat (AM)	0.69	0.64	0.62	0.73	0.61	0.60	0.57	0.57	0.57	0.57	0.57	0.56	0.56	0.57	0.58	0.62	0.63	0.66	0.57	0.57
Waterbird Habitat (WB)	0.24	0.25	0.24	0.30	0.22	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.17	0.18	0.21	0.22	0.24	0.19	0.19
Songbird, Raptor, & Mammal Habitat (SBM)	0.29	0.23	0.20	0.37	0.27	0.24	0.22	0.22	0.22	0.20	0.21	0.19	0.19	0.20	0.21	0.27	0.22	0.26	0.14	0.13
Pollinator & Native Plant Habitat (PH)	0.28	0.24	0.22	0.32	0.24	0.34	0.20	0.20	0.20	0.24	0.24	0.23	0.23	0.23	0.25	0.29	0.26	0.28	0.21	0.21
Human Use & Recognition (HU)	0.10	0.05	0.07	0.04	0.03	0.07	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.10
Normalized Score (ABWRET_A) Based on Wetlands in RWVAU	W1	W2	W3	W4	W5	W7	W8	W9	W10	W12	W14	W15	W16	W17	W19	W20	W22	W23	W29	W31
Normalized Hydrological Health (HH)	0.49	0.72	0.72	0.72	0.72	0.77	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.81
Normalized Water Quality (WQ)	0.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Normalized Ecological Health (EH)	0.69	0.64	0.62	0.73	0.61	0.60	0.57	0.57	0.57	0.57	0.57	0.56	0.56	0.57	0.58	0.62	0.63	0.66	0.57	0.57
Normalized Human Use (HU)	0.10	0.05	0.07	0.04	0.03	0.07	0.01	0.01	0.01	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.10
RWVAU #	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Normalized Value Score (ABWRET_a)	0.48	0.71	0.71	0.74	0.70	0.72	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.72	0.72	0.73	0.70	0.72
Value Category (a, b, c, d)	d	c	d	c	d	c	d	d	d	d	d	d	d	d	d	c	c	c	d	c
Abundance Factor	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Final Score(A, B, C, D)	D	B	C	B	C	B	C	C	C	C	C	C	C	C	C	B	B	B	C	B