Newell Solar Farm Development

Renewable Energy Operation Conservation and Reclamation Plan

Prepared for Irricana Power Generation

Prepared by Summit An Earth Services Company

October 26, 2020

Contents

List of Figures

List of Tables

1 Introduction

Irricana Power Generation (IPG) is applying to the Alberta Utilities Commission (AUC) for approval to construct the Newell Solar Farm Development (the Project), an 11.3 MW photovoltaic solar renewable energy operation. All Project components (Section 1.3) will be located within freehold land in NE-17-020-17 W4M.

IPG has retained Summit, an Earth Services Company (Summit) to prepare a Renewable Energy Operations Conservation and Reclamation Plan (REO C&R Plan) as a component of the Project application package to the AUC, in accordance with the Conservation and Reclamation Directive for Renewable Energy Operations (the Directive) (AEP, 2018).

The objective of the REO C&R Plan is to evaluate and document pre-disturbance conditions as a baseline for reclamation, identify potential environmental effects associated with the construction and operations, identify mitigation measures for construction, and plan for reclamation to equivalent land capability, desired end land use, and meeting reclamation criteria (ESRD, 2013).

The REO C&R Plan is divided into the 6 sections:

- Section 1: Introduction;
- Section 2: Conservation Planning;
- Section 3: Reclamation Planning;
- Section 4: Adaptive Management;
- Section 5: Potential Effects; and,
- Section 6: Mitigation Measures and Best Management Practices (BMPs).

Section 2 documents desktop assessments for the conservation and protection of current land use, soils, vegetation, and wetlands within the Project area.

Section 3 documents reclamation planning to meet equivalent land capability at the end of the Project lifecycle, as determined by reclamation criteria for the desired end land use.

Section 4 discusses how adaptive management strategies will be incorporated, following assessment programs, construction, monitoring programs, and variances between planned and as-built site conditions.

Section 5 identifies potential environmental effects associated with construction, operations, and reclamation.

Section 6 documents mitigation measures and BMPs to reduce potential environmental effects during construction, operations, and reclamation.

Construction of the proposed Project is scheduled to begin in Q3 2021, upon regulatory approvals, with a commission date of Q2 2022.

Table 1-1 specifies the location of required information within the Project REO C&R Plan in accordance with the Directive (AEP, 2018). This REO C&R Plan is considered conceptual at this time and will be updated in subsequent filings, following AUC approval.

Table 1-1 Project REO-C&R Plan Concordance Table

Information Requirements	REO C&R Plan Section
Conservation Planning	
Regulatory Alignment	2.1
Adaptive Management	4.0
Best Management Practices	6.0
Soil and Vegetation Management	2.2, 5.0
Mitigation Measures	6.0
Reclamation Planning	
Stakeholder Involvement	3.1
End Land Use	3.4
Reclamation Criteria	3.4
Reclamation Activities	3.2, 3.3, 3.4
Infrastructure	3.3
Contamination	3.3
Landscape	3.2, 3.4
Soils	3.2, 3.4
Vegetation	3.2, 3.4
Weeds	3.4.3
Wildlife	3.5

Source: Conservation and Reclamation Directive for Renewable Energy Operations (AER, 2018)

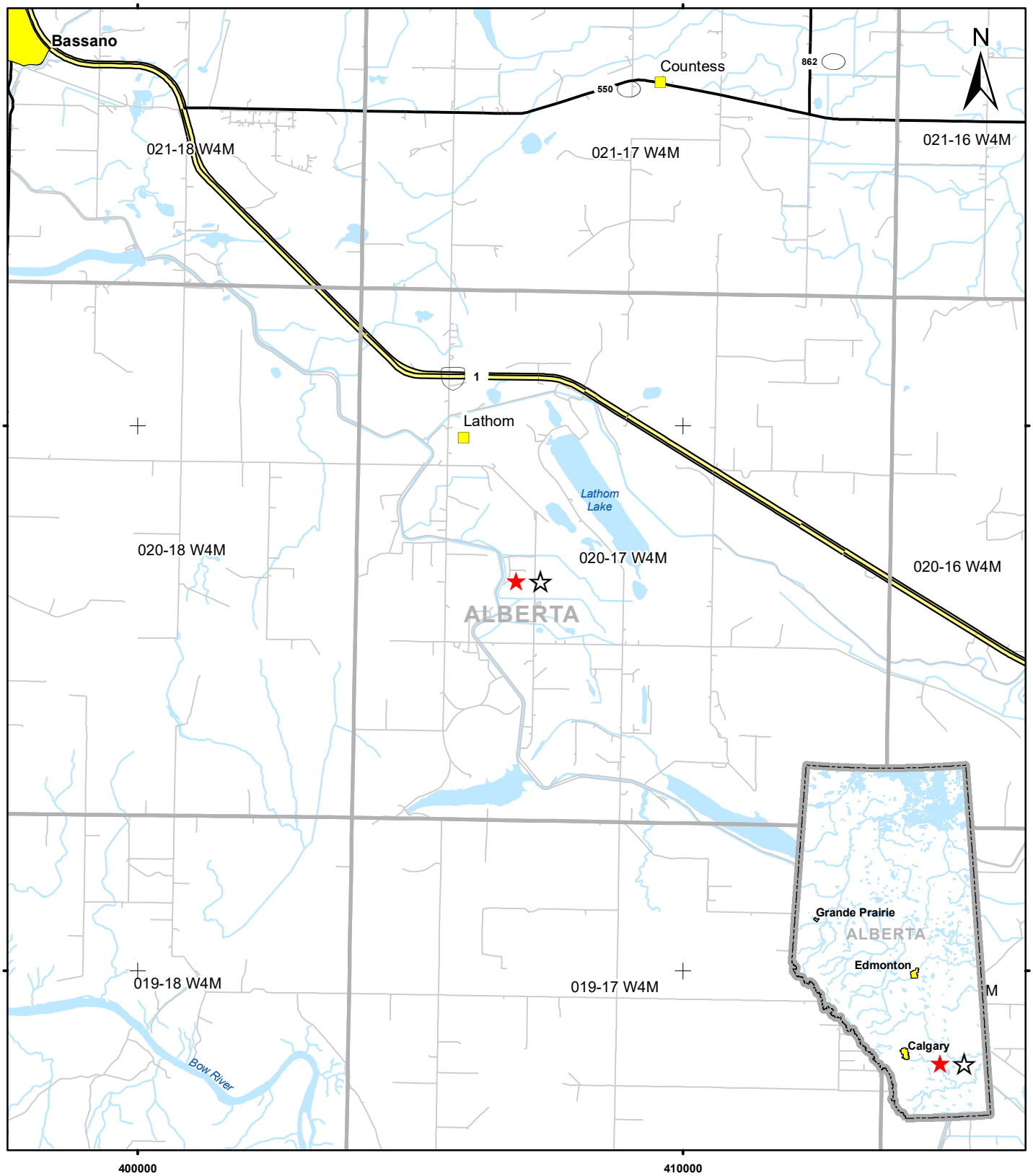
1.1 Project Overview

The Project consists of an array of 30,680 photovoltaic solar panels and associated Project components (Section 1.3).

The Project is located on freehold land owned by IPG within the South Saskatchewan Region in the County of Newell (the County), Alberta, approximately 12.5 km from the Town of Bassano.

The site will be accessed using Range Road 174, the existing residential road located on the quarter, and existing oil and gas lease access roads. All associated leaseholder permissions will be in place prior to use of private roads.

The site overview is shown in Figure 1.



LEGEND

- PROJECT LOCATION
- HAMLET
- TOWN
- WATERCOURSE
- WATERBODY

ROAD CLASS

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD

REFERENCE

Populated place, transportation, Alberta township system and hydrograpy data obtained from AltaLIS and used under the Open Government License - Alberta.

IRRICANA POWER GENERATION

PROJECT OVERVIEW MAP
NE-17-020-17 W4M

SUMMIT

PROJECT NUMBER: EPM0000110
PROJECTION: NAD 1983 UTM Zone 12N
SCALE: 1:100,000
DATE: 2/5/2020
DRAWN: CW
CHECK: NP

1 0 1
Kilometres

FIGURE 1

Document Path: T:\SUMMIT OPERATIONS\GIS\Clients\IrricanaPowerGeneration\EPM0000110\MXD\EPM0000110_SiteLocation.mxd

1.2 Siting

IPG selected the Project location to utilize previously disturbed habitat (tame pasture) with limited native vegetation communities (e.g., native prairie) and wildlife habitat. Project components are located entirely within tame pasture.

IPG considered numerous factors during location selection of Project components, including the avoidance of existing environmental features and infrastructure. The placement of Project components avoids all waterbodies and all oil and gas infrastructure rights-of-way present in NE-17-020-17 W4M, with the exception of new access road crossings of an existing pipeline right-of-way.

IPG also considered the feasibility of construction, engineering requirements, and the avoidance of sensitive wildlife features on the landscape. Siting was adjusted to proactively mitigate potential environmental issues. IPG assessed geotechnical conditions to confirm that ground stability is suitable for construction.

1.3 Project Components

Project components are shown in Figure 2.

1.3.1 Solar Panels

The Project will consist an array of 400 watt solar panels (30, 680 total) arranged in tables of 4 m by 26 m at a 30 degree tilt. Solar panels will be raised from the ground surface and supported by driven piles.

1.3.2 Inverters

Inverters will be installed at the ends of the rows of solar panels (74 total). Power generated from the solar panels will be inverted from direct current (DC) to alternating current (AC) through the inverters.

1.3.3 Transformers

Four transformers will be installed on cement pads that will extend below surface. Power collected by the collector system will be converted through transformers to a voltage suitable for transmission in the existing FortisAlberta Inc. (FortisAlberta) distribution line.

1.3.4 Collector System

The collector system will consist of an underground cable system trenched to a depth of 1 to 1.5 m conducting power between Project components.

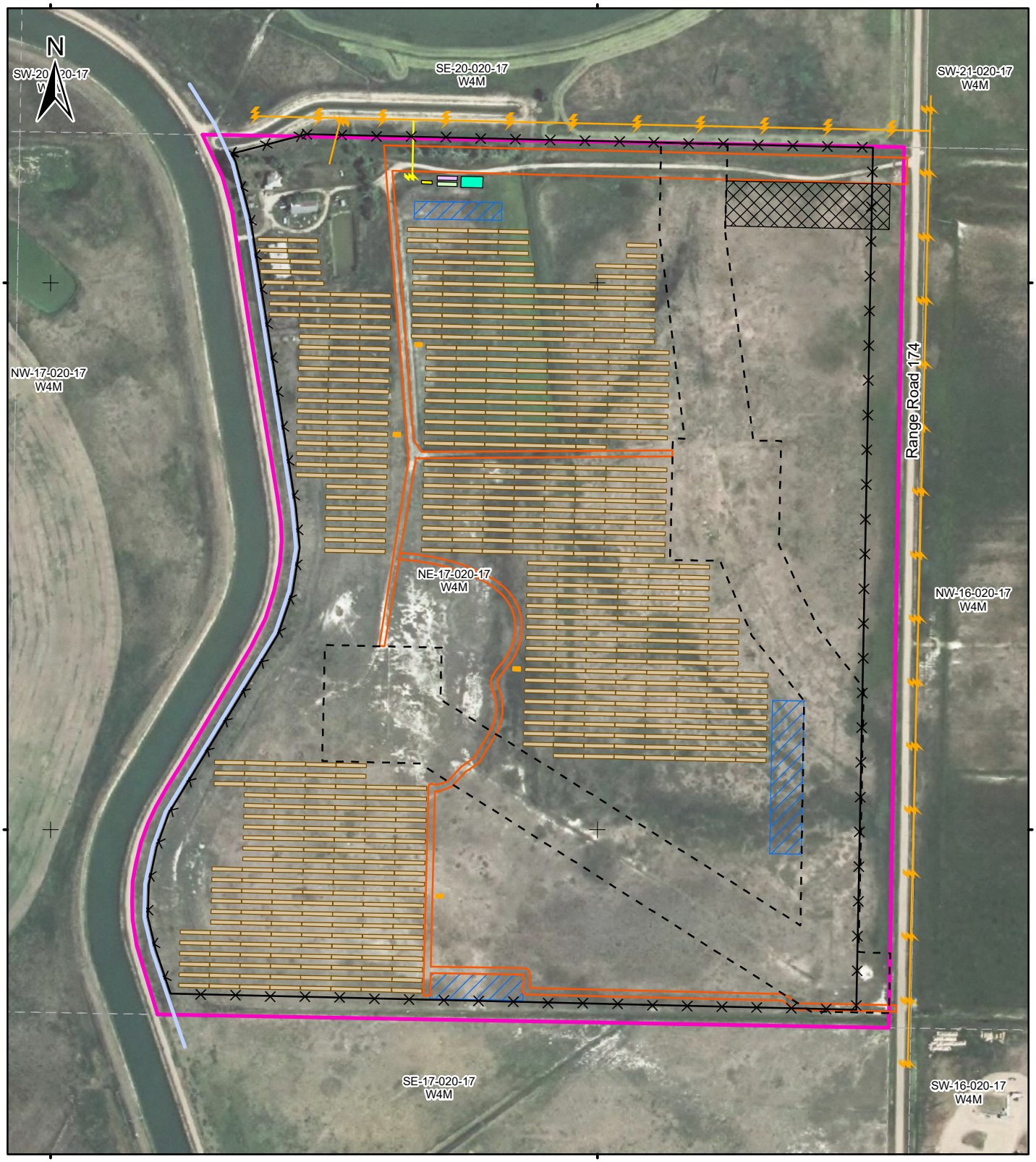
1.3.5 Perimeter Fencing

The Project will be surrounded on all sides by 8-foot chain-link fencing, topped by 3 strands of barbed wire, providing security and access control, as well as a deterrent to wildlife. Security cameras will be installed along the fencing. Access to the Project area will be restricted to gated entrances at the northeast and southeast corners of the quarter section.

1.3.6 Access Roads

Existing access roads are present within the Project area and are currently used for operation of existing wellsite infrastructure. These access roads will be used for operation of the Project, where possible.

A gravel access road will be constructed along the south boundary of the Project area connecting to the Torxen 10-17 access road to allow for operations and maintenance vehicle access to Project components. The new access road will be designed in accordance with local municipal engineering guidelines.



LEGEND

- DESKTOP REVIEW
- OIL AND GAS INFRASTRUCTURE

PROJECT COMPONENTS AND ASSOCIATED INFRASTRUCTURE

- EXISTING FORTIS LINE
- FENCE
- IRRIGATION CANAL RIGHT-OF-WAY
- NEW FORTIS LINE
- ACCESS ROAD
- CANTEEN
- DETENTION POND
- E-HOUSE
- LAYDOWN
- O & M BUILDING
- RADIO TOWER
- SOLAR PANEL
- TRANSFORMER

REFERENCE

Alberta township grid data obtained from AltaLIS and used under the Open Government License - Alberta. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

IRRICANA POWER GENERATION

PROJECT AREA
NE-17-020-17 W4M

SUMMIT

PROJECT NUMBER: EPM0000110
PROJECTION: NAD 1983 UTM Zone 12N
SCALE: 1:5,000
DATE: 2/11/2020
DRAWN: CW
CHECK: NP

50 0 50
Metres

FIGURE 2

Document Path: T:\SUMMIT OPERATIONS\GIS\Clients\IrricanaPowerGeneration\EPM0000110\MXD\EPM0000110_DRA.mxd

1.3.7 Laydown Area / Parking Lot

A designated area will be used for storage and staging of construction equipment and materials during construction. Following construction, a portion of the laydown area will be converted to a gravel parking pad.

1.3.8 Stormwater Detention Basins

Three stormwater detention basins will be constructed within the Project area for management of overland flow, erosion, and sedimentation during high precipitation events.

1.3.9 E-house Building

The E-house building, located in the northwest corner of the Project area, will house Project electrical controls and monitoring systems. The building will be powered using Project-generated power but will also contain a small uninterruptable battery supply in case of power loss. The E-house building will have the capability to communicate and be controlled remotely.

1.3.10 Operations and Maintenance (O&M) Building

The O&M building, located in the northwest corner of the Project area, will be used as storage for maintenance equipment and replaceable parts. Portions of the building may be used for office space for operations and maintenance staff.

1.3.11 Canteen

A small canteen will be constructed as a dining area for operations and maintenance staff.

1.3.12 Radio Tower

A radio tower will be constructed to facilitate secured and reliable communication channels.

1.4 Associated Infrastructure

1.4.1 Interconnector Line

Project-generated electricity will be connected to the existing FortisAlberta distribution system through a new, separately regulated, FortisAlberta interconnector line, running from the onsite Project area to an existing powerline intersecting SE-20-020-17 W4M.

1.5 Project Schedule

IPG is planning to begin construction Q3 2021 with a commission date of Q2 2022.

Table 1-2 Project Schedule

Activity	Anticipated Date
Submit Project Application Package to the AUC	Q4 2020
Receipt of all required approvals, clearances, licenses, notifications and landowner consent	Q4 2020 - Q1 2021
Pre-Disturbance Soil Assessment (PDSA)	Q2 2021
Construction	Q3 2021
Commissioning	Q2 2022
Interim Monitoring Site Assessment (IMSA)	Q2-Q3 2022, Q2-Q3 2023, Q2-Q3 2024
Submission of Updated REO C&R Plan to the AUC	2025

The expected lifespan is expected to be a minimum of 25 years with the potential for a retrofit. If the Project is retrofitted, an additional IMSA will be completed and an updated REO C&R Plan will be submitted.

When the Project is decommissioned and fully reclaimed, a reclamation certificate site assessment (RCSA) will be completed, followed by reclamation certificate application.

1.6 References

AEP (Alberta Environment and Parks). 2018. Conservation and Reclamation Directive for Renewable Energy Operations. September 14, 2018. Available at: https://open.alberta.ca/dataset/8c4e8ed9-a9bb-4a1e-8683-8136b33f8dff/resource/f1704d4c-78af-4de3-91da-d9873e9f50a4/download/direct-renewenerop-sep14-2018.pdf. Accessed January 2020.

ESRD (Environment and Sustainable Resource Development). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands. July 2013. Available at: https://open.alberta.ca/dataset/ee82f0ab-fef2-4b78-805d-8c6d341aabd2/resource/54dd817c-225a-483a-a3f1-09cab3136743/download/2013-2010-reclamation-criteria-wellsites-cultivated-lands-2013-07.pdf. Accessed February 2020.

2 Conservation Planning

Executive Summary

Conservation planning for the Project uses current knowledge and best practices to achieve successful reclamation objectives, as they pertain to the site-specific conservation of soil and vegetation in the Project area. Documenting pre-construction conditions is critical to the avoidance of sensitive environmental features, mitigation of Project effects on soil and vegetation characteristics, and establishing a baseline for returning affected landscapes to equivalent land capability following the Project lifecycle.

The Project consists of a solar renewable energy operation located on freehold land in NE-17-020-17 W4M within the Dry Mixedgrass Natural Subregion of Alberta. At the time of application, conservation planning is conceptual and has been limited to desktop assessment of the Project area and immediate surroundings (i.e., the Desktop Review Area). Conservation planning will be updated in a subsequent filing of the updated REO C&R Plan, following the PDSA and IMSA.

The current land use within the Project area comprises tame pasture and is surrounded by agricultural land uses. Existing oil and gas infrastructure (pipelines and wellsites) are present within the Project area but Project infrastructure has been sited to avoid existing infrastructure. The Project is expected to consist predominantly of minimal surface disturbance techniques (i.e., minimal vegetation removal, no stripping of topsoils); however, vegetation removal and soil stripping will be required during the construction of some Project components, and where grading is required.

Soils within the Project area are anticipated to contain a high proportion of silt and sand and will be conserved through careful soil handling and soil storage procedures. The Project area has a slope class of very gently sloping (2-5%) and is not anticipated to require extensive grading during construction of the Project. Topsoil stripping will be reduced to the extent practical.

The Project area has been previously converted to tame pasture; no known native vegetation communities exist within the Project area. The presence of rare plants and rare ecological communities is not anticipated.

Wetlands within the Project area consist of 4 temporary marshes which are highly disturbed by agricultural activities (i.e., irrigation and cattle grazing of tame pasture) and oil and gas activities, where overlapped by oil and gas infrastructure.

Site-specific mitigation measures and BMPs have been developed to reduce potential effects to current land use, soils, vegetation, and wetlands within the Project area (Section 6).

2.1 Regulatory Setting

The Project is subject to an application under AUC Rule 007 (AUC, 2019). In accordance with the *Environmental Protection and Enhancement Act* (EPEA) and the Directive (AEP, 2018), an REO C&R Plan must also be included with the Project application package submitted to the AUC.

Conservation planning is considered to be conceptual at the time of application to the AUC therefore the C&R Plan will require revision following approval, per the Directive. A subsequent update to the REO C&R Plan is required following the interim monitoring site assessment (IMSA).

The table of concordance (Table 1-1) identifies all conservation planning objectives, as required by the Directive (AEP, 2018) and the corresponding section locations within the Plan.

The Project is also under the jurisdiction of municipal, provincial, and federal regulatory frameworks outlined in this section.

2.1.1 Municipal Zoning

2.1.1.1 County of Newell Municipal Development Plan Bylaw No. 1705-10

The County Municipal Development Plan Bylaw No. 1705-10 (County of Newell, 2010) contains high-level planning goals and strategies for the County. The Project meets the County development goal of expanding and diversifying the local economy in a manner that is compatible with adjacent land uses.

2.1.1.2 County of Newell Land Use Bylaw No. 1892-17

The County Land Use Bylaw No. 1892-17 lists development requirements for commercial solar farms under the "alternative energy, industrial" land use, to be included in development permit applications. Information to be submitted includes the following:

- A site suitability analysis;
- Setbacks and proximity to property lines, structures, and on site and adjacent land uses;
- Detailed structure information;
- Energy process and output;
- Public safety and security measures;
- Preliminary grading/drainage plan;
- Impacts to public roads;
- Location of overhead utilities;
- The location of sensitive environmental or topographical features on the parcel;
- A decommissioning plan; and,
- An Environmental Assessment Review if determined to be required.

The Project is located within the Agricultural – "A" land use district, within which "alternative energy, industrial" is listed as a discretionary activity. IPG submitted a development permit application to the County in September 2019.

2.1.2 Regional and Subregional Plans

2.1.2.1 Regional Plan

The Project is located within the boundaries identified in the South Saskatchewan Regional Plan (SSRP) (GoA, 2017a). The SSRP provides long-term strategic direction and implementation of land use planning for the South Saskatchewan Region to meet economic, environmental, and social goals. The SSRP does not contain binding legal obligations; however, statements made in the SSRP are designed to inform provincial and municipal policy decisions within the South Saskatchewan Region.

The South Saskatchewan Region has natural advantages to solar development. Renewable energy sources are identified as supportive in growing the economy through diversification and transitioning to sustainable "greener energy production" (GoA, 2017a). Renewable energy potential of the region is identified in the SSRP which provides the following objectives:

> Opportunities for the responsible development of the region's renewable energy industry are maintained in support of Alberta's commitment to greener energy production and economic development.
>
> Value-added opportunities that enhance the sustainability of Alberta's industries and communities are created. (GoA, 2017a)

The SSRP provides the following strategies to meet the above objectives:

> Ensure policies are in place to promote and remove barriers to new investments in renewable energy (that is, wind, biofuels, solar, hydro) production.

Invest in the development, demonstration and deployment of renewable and alternative energy technologies targeted to improve Alberta's overall energy efficiency. This will include support for the application of new technologies and support on-going research and development in partnership with other institutions.

Ensure reinforcement of the transmission system to enable more renewable power in the region. (GoA, 2017a)

The Project is expected to meet the economic and environmental objectives and strategies of the region, as described in the SSRP.

2.1.2.2 Subregional Plan

The Project is located within the Eastern Irrigation District Integrated Resource Management Strategy (EID IRMS) (GoA, 1995). The EID IRMS provides management direction, further described as vision, goals, objectives, guidelines, and actions required for the Eastern Irrigation District (EID). The EID IRMS focuses primarily on agricultural land uses as these are the predominant land uses on the landscape. The EID IRMS does not contain binding legal obligations but instead provides allocation and management direction for natural resource development in the area.

Private lands not owned by the EID were deliberately excluded from the EID IRMS. The Project is located on private land within the EID and therefore does not fall under the management strategies of the EID IRMS.

2.1.3 Provincial Legislation

2.1.3.1 Environmental Protection and Enhancement Act

EPEA provides a framework for the development of natural resources in a manner that plans for, prevents, and mitigates potential impacts to the environment. Per the Directive, operators must plan for the conservation and reclamation of a REO and obtain a reclamation certificate following decommissioning of a project (AEP, 2018). The 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands will be used to assess the trajectory towards reclamation during the IMSA and the success of final reclamation following the RCSA (ESRD, 2013).

2.1.3.2 Water Act

Diversion, use of water, or direct impacts to the bed and banks of a waterbody require authorization under the *Water Act*, regardless of land ownership. The Alberta Wetland Policy (GoA, 2013) provides regulatory guidance under the *Water Act* for affected or potentially affected waterbodies that are defined as wetlands. The Project is not anticipated to require *Water Act* approval as it does not directly impact waterbodies.

2.1.3.3 Wildlife Act

The Alberta *Wildlife Act* provides protection to wildlife and endangered plants. A Wildlife Research Permit and Collection License is required to perform wildlife surveys that may have the potential to disturb wildlife or to collect dead wildlife. A Wildlife Research Permit and Collection License is required while conducting post-construction wildlife monitoring.

2.1.3.4 Historical Resources Act

A historic resource comprises any natural or anthropogenic work that contains palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic value. Historical resources are protected under the *Historical Resources Act* (HRA) of Alberta, regulated by the Ministry of Culture, Multiculturalism, and the Status of Women. The HRA provides protection to archaeological, palaeontological, historic, cultural, and natural resources. Construction and operation of the Project requires clearance under the HRA.

An application for clearance under the HRA has been applied for (application no: 015481763; approval no: 4941-19-0009-001).

2.1.3.5 Weed Control Act

The Alberta *Weed Control Act* provides requirements to control the spread of weeds. Per the Act and regulations, noxious weeds and prohibited noxious weeds are required to be controlled and destroyed, respectively. Weed species will be identified and monitored during the PDSA and IMSA and, if required, a Weed Management Plan will be developed and incorporated into subsequent filings of the updated REO C&R, as directed by the Directive (AEP, 2018).

2.1.4 Federal Legislation

2.1.4.1 Migratory Birds Convention Act

The purpose of the *Migratory Birds Convention Act* is to protect individual migratory birds, populations of migratory birds, and their nests. General nesting periods, as determined by Environment and Climate Change Canada (EEEC), identify time periods where nesting birds are likely to be present in an area. The general migratory bird nesting period in the Project area has been identified as mid-April to late August (ECCC, 2018). Migratory bird nests, eggs, and young may be present outside of the nesting period, however, these periods are identified such that proponents can plan activities to reduce the risk to migratory birds.

2.1.4.2 Species at Risk Act

The purpose of the *Species at Risk Act* (SARA) is to protect wildlife from becoming extirpated or extinct, and to provide recovery strategies for extirpated, endangered, or threatened wildlife. Species listed under Schedule 1 of SARA are afforded legal protections under the Act. If SARA listed species are identified within the Project area, avoidance and mitigation measures will be developed in consultation with the appropriate regulatory agencies.

2.1.4.3 Fisheries Act

The *Fisheries Act* provides a framework for the management, conservation, and protection of fish and fish habitat. Authorization under the *Fisheries Act* is required if it is determined that a project will cause the death of fish or damage to fish habitat.

The Project is located near a irrigation canal which has the potential to provide fish habitat. With the implementation of mitigation measures and setbacks, the Project is not anticipated to have any interactions with fish or fish habitat.

2.1.5 Constraints

The Project has been strategically sited to align with all applicable municipal, provincial, and federal regulations. No regulatory constraints are anticipated.

2.2 Environmental Setting

2.2.1 Land use

The Project is located entirely within the White Area of Alberta. The White Area consists predominantly of settled areas and lands designated for agriculture. The Project area is located within agricultural land overlapping several wetlands.

The Project will impact existing agricultural land uses (i.e., tame pasture) within the Project area. Adjacent and overlapping land uses as well as regional and subregional plans have been assessed to determine what effects the Project may have on the landscape. Where potential effects have been determined (Section 5), mitigation measures have been proposed (Section 6).

2.2.1.1 Desktop Review Assessment

The desktop review area (DRA) area was chosen to encompass all areas that may be potentially affected by the Project. The Project is not anticipated to affect land use, soil, vegetation, or wetlands outside of the DRA.

Desktop review was conducted within NE-17-020-17 W4M (Figure 2). The Project is bounded by an irrigation canal to the west and Range Road 174 to the east. Following AUC approval, the Project area will be field assessed during the PDSA.

Existing and Planned Land Use

The Project location overlaps agricultural lands currently used for tame pasture. Wetlands are present within the Project area but are avoided by Project components with a defined setback of 15 m (Section 1.3).

Two active gas wellsites, owned by Torxen Energy Ltd. (Torxen), and one abandoned wellhead are present within the Project boundaries. Two existing natural gas pipelines, also owned by Torxen, are present within the Project area. Project components have been sited to avoid the wellsites and pipeline RoWs, with the exception of an access road crossing of a single pipeline RoW. Existing access roads will be used for Project activities, where possible. Oil and gas infrastructure within the Project area is not anticipated to be affected by the Project.

Following decommissioning, areas disturbed by the Project are planned to be returned to tame pasture.

Environmentally Significant Areas

Environmentally Significant Areas (ESAs) are rated as being internationally, nationally, or provincially significant (Fiera, 2014). In 2014, quarter sections were given values where a criteria sum cut-off value of >0.189 to designate a quarter section as an ESA. The quarter section overlapped by the Project has an ESA criteria sum of 0.051 and is not designated as an ESA.

2.2.2 Soils

Per EPEA and the Directive, soils must be assessed for conservation and reclamation planning of the Project area to meet desired end land use, equivalent land capability, and reclamation criteria (AEP, 2018).

Potential effects to soils have been identified through a preliminary desktop assessment. Where potential effects have been determined (Section 5), mitigation measures have been proposed (Section 6).

2.2.2.1 Assessment Methodology

Soil characteristics were assessed within the boundaries defined as the DRA to identify site suitability for soil conservation and reclamation.

Desktop

A desktop review of publicly available information was completed, including the following sources:

- Aerial and satellite imagery;
- The Agricultural Regions of Alberta Soil Inventory Database (AGRASID) (Brierley et al., 2001);
- Agriculture Canada – Soil survey of the County of Newell, Alberta – Alberta Soil Survey Report No. 41. (Kjearsgaard et al., 1983);
- Salinity mapping for Resource Management within the County of Newell, Alberta (Kwiatkowski and King, 1998); and,
- Agricultural Land Resource Atlas of Alberta (AF, 2003).

Agricultural land suitability for the Project area was determined using the Land Suitability Rating System for Agricultural Crops (AIWG, 1995).

Field Verification

A soils field survey will be conducted during the PDSA. Soil sampling is anticipated to be limited to shallow depth assessments.

2.2.2.2 Results

Desktop

The Project area is very gently sloping (2-5%) from west to east and north to south, with a maximum cross-site elevation change of 7 m (Figure 3).

The Project area comprises three dominant soil series: GEM (40%), Wardlow (30%), and Tilley (30%) (Brierley et al., 2001). The characteristics of each soil series are described in Tables 2-1, 2-2, and 2-3 (Brierley et al., 2001).

Table 2-1 Characteristics of GEM (Ge) Soil Series

Characteristic		**Value**
Approximate percentage of soil polygon 2140 (%)		40
Soil Classification		Brown Solod (B.SO)
Parent material and textural group		Silt loam
Slope range (%)		2-9
Drainage Class		Moderately well drained
Soil Horizons		
Horizon	**Depth (cm)**	**Texture**
Ap	0-12	SIL
Bnt	12-35	CL
BC	35-40	SICL
Ccas	40-60	SIL
Csk	60-100	CL

Notes: CL = Clay Loam, SIL = Silt Loam, SICL = Silty Clay Loam
Source: AGRASID (Brierley et al., 2001)

Table 2-2 Characteristics of Wardlow (Wd) Soil Series

Characteristic		**Value**
Approximate percentage of soil polygon 2140 (%)		30
Soil Classification		Brown Solodized Solonetz (B.SS)
Parent material and textural group		Silt loam
Slope range (%)		2-9
Drainage Class		Moderately well drained
Soil Horizons		
Horizon	**Depth (cm)**	**Texture**
Ap	0-12	L
Bnt	12-20	L
BC	21-29	C
Ccas	29-44	L
Csk	44-58	CL
Csk	28-100	L

Notes: C = Clay, CL = Clay Loam, L = Loam
Source: AGRASID (Brierley et al., 2001)

Table 2-3 Characteristics of Tilley (Ty) Soil Series

Characteristic		Value	
Approximate percentage of soil polygon 2140 (%)		30	
Soil Classification		Solonetzic Brown Chernozem	
Parent material and textural group		Silt loam	
Slope range (%)		0.5-9	
Drainage Class		Well drained	
	Soil Horizons		
Horizon		**Depth (cm)**	**Texture**
Ap		0-12	L
Btnj		12-21	CL
Btnj		21-41	SCL
Cca		41-65	SICL
Cca		65-95	SICL
Csk		95-110	CL

Notes: CL = Clay Loam, L = Loam, SCL = Sandy Clay Loam, SICL = Silty clay Loam
Source: AGRASID (Brierley et al., 2001)

Suitability for Reclamation

AGRASID rates the polygon as 6M, indicating an “extremely severe” suitability limitation due to the water holding capacity of the soil; “crops are adversely affected by lack of water due to inherent soil characteristics” (AIWG, 1995; Brierley et al., 2001). Alberta Soil Survey rated the polygon as 4D, indicating a severe suitability limitation due to soil structure; “crops are adversely affected either by soil structure that limits the depth of rooting or by surface crusting that limits emergence of shoots” (Kjearsgaard et al., 1983; AIWG, 1995). Solonetzic soils, characteristic of Tilley and Wardlow soil series, occur on geologic parent materials that are marine in origin and contain sodium salts, or in lowland areas influenced by groundwater discharge (Anderson, 2010). These soils are constraints to the suitability for reclamation, including potential for restricted root penetration, water infiltration, and productivity.

The dominant soil series in the Project area is Brown Solod. The subsoil structure of Brown Solod creates a barrier to water adsorption, which limits the water available to growing plants. Additionally, Solods have subsoil horizons (Bnt) with strong peds and hard consistence which can create a barrier for root penetration in the subsoil. These properties are reflected by the 6M and 4D ratings given by AGRASID and the Alberta Soil Survey, respectively.

Erosion Risk

Erosion risk of soils within the Project area was determined using AGRASID and Agricultural Land Resource Atlas of Alberta (Brierley et al., 2001; AF, 2003). AGRASID identified a risk for potential erosion within the Project area due to a high proportion of sand and silt. The Agricultural Land Resource Atlas of Alberta indicates the Project area has a mild erosion risk, with an overall erosion risk of 0.28-0.35 out of a possible score of 1.00, via the Soil Erosion Risk for the Agricultural Area of Alberta map.

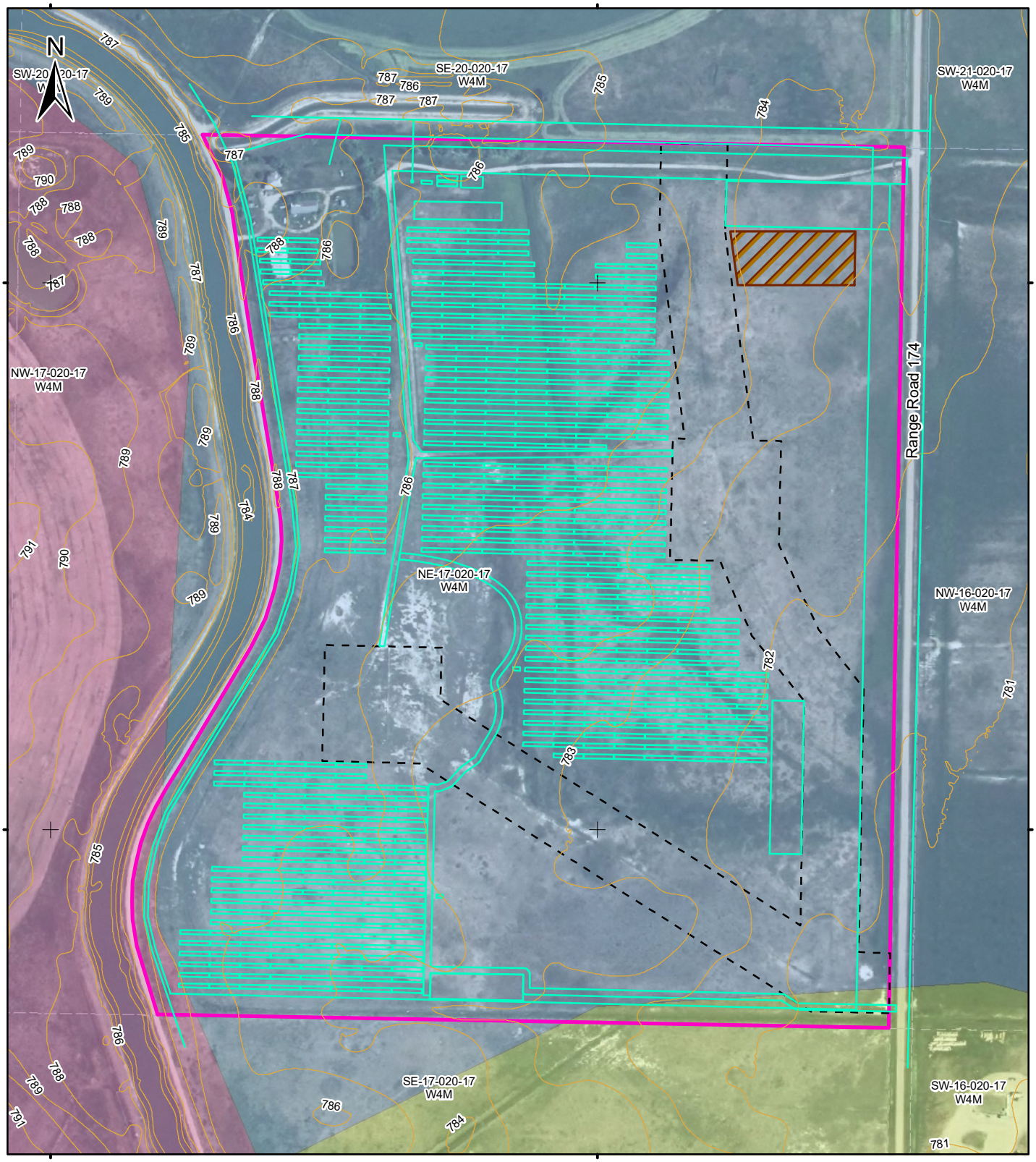
The Agricultural Land Resource Atlas of Alberta also provides a summary of risk specific to water and wind erosion. The Project area is classified as having a moderate risk for both water and wind erosion via the Risk of Water Erosion on Bare, Unprotected Mineral Soil map and the Wind Erosion Risk of the Agricultural Area of Alberta, respectively (Coote and Pettapiece, 1989; Tajek and Coote, 1993).

2.2.2.3 Soil Salvage and Storage

Soil handling will be limited to the base of the new Fortis line, the laydown area/parking lot, transformer pads, the new access road, stormwater detention basins, and in areas requiring grading and leveling. Topsoil will be stripped from these areas and stored in the soil storage area (Figure 3). Excavated subsoil will be stored directly on subsoil or on a fabric (e.g., geotextile) within the soil storage area. During installation of the collector system, topsoil and subsoil will be temporarily stripped and stored separately near the installation; soils will be immediately returned to the trench following construction. A geotextile barrier may be used under the subsoil, if required. Topsoil and subsoil piles will be stored at a distance that will avoid admixing.

Admixing of subsoil material with the topsoil may severely degrade the quality of existing topsoil. Soil handling of problem soils (e.g., Solonetzic soils), potentially present onsite, requires additional care during stripping and storage. Proper signage identifying topsoil and subsoil piles will be installed and maintained for the life of the Project.

Due to the high proportion of sand and silt within the soils present, materials may not be suitable for the construction of roads or pads required for regular access. Locally sourced suitable borrow material may be used for the construction of the laydown area/parking lot and access roads. Existing access roads will be assessed during the PDSA (along with the confirmation of soils within the Project area) to inform the selection of effective borrow materials, if required, and construction techniques. Soil depth will be assessed during the PDSA and provided in subsequent filings of the updated REO C&R Plan. Any special soil handling procedures (e.g., due to the presence of Solonetzic soils) will be identified at that time.



LEGEND

- CONTOUR (1 M INTERVAL)
- PROJECT COMPONENTS AND ASSOCIATED INFRASTRUCTURE
- DESKTOP REVIEW
- OIL AND GAS
- SOIL STOCKPILE

MAP UNIT NAME (AGRASID)

- BVL18/U1L
- GEWD16/U1L
- ROL7/U1H

IRRICANA POWER GENERATION

SOILS AND TERRAIN
NE-17-020-17 W4M

SUMMIT

PROJECT NUMBER: EPM0000110
PROJECTION: NAD 1983 UTM Zone 12N
SCALE: 1:1,000,000
DATE: 2/11/2020
DRAWN: CW
CHECK: NP

50 0 50
Metres

FIGURE 3

REFERENCE

Alberta township grid data obtained from AltaLIS and AGRASID data obtained from Alberta Agriculture and used under the Open Government License - Alberta. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: T:\SUMMIT OPERATIONS\GIS\Clients\IrricanaPowerGeneration\EPM0000110\MXD\EPM0000110_Soil.mxd

2.2.3 Vegetation

In Alberta, eight plant species are protected under the Alberta *Wildlife Act*. Provincially rare species and ecological communities are identified by the Alberta Conservation and Information Management System (ACIMS); no legal status or protections are afforded provincially designated rare plant species or rare ecological communities (AEP, 2017). Federally designated species at risk are designated and regulated under SARA. Prohibited noxious and noxious weed species are designated and regulated under the Alberta *Weed Control Act*.

The Project area has been assessed to determine potential effects the Project may have on vegetation. Where potential effects have been determined (Section 5), mitigation measures have been proposed (Section 6).

2.2.3.1 Assessment methodology

Vegetation characteristics were assessed within the boundaries defined by the DRA to identify environmental sensitivities within or adjacent to the Project area.

Desktop

A desktop review of publicly available information, including government databases and imagery, was completed.

Characteristics of rare vascular plant species and rare ecological communities with the potential to occur in the Dry Mixedgrass Natural Subregion as well as their preferred habitat(s), were reviewed (AEP, 2017; Allen, 2014; Kershaw et al., 2001; and Moss, 1983). The ACIMS database (AEP, 2017) was reviewed for historic occurrences of rare plants and rare ecological communities within township 020 range 17, W4M. Satellite imagery and the Grassland Vegetation Inventory (GVI) were reviewed to identify areas of native vegetation within the Project area with potential to support rare vegetation elements (e.g., wetlands, riparian areas) (GoA, 2019).

Clubroot prevalence in the County was reviewed using publicly available Government of Alberta mapping (AAF, 2018).

Field Verification

A vegetation field survey will be conducted during the PDSA.

Rare plant species and rare ecological communities are not anticipated in the Project area as there is limited potential for native vegetation communities to be present. Should rare plants or rare ecological communities be observed during the PDSA, thorough searches will be conducted to determine the extent of the occurrence and record its characteristics for avoidance and mitigation. Although rare plant surveys can confirm the presence of rare plants, they cannot definitively determine that rare plants are not present at a site.

The location and distribution of weeds and invasive species will also be recorded during the PDSA. Plant identification will be based on the Alberta Invasive Plant Identification Guide: Prohibited Noxious and Noxious (GoA, 2013a).

2.2.3.2 Results

Desktop

The Project is located within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region (NRC, 2006). The Dry Mixedgrass Natural Subregion is the largest natural subregion of the Grassland Natural Region and is defined by its semi-arid climate and level to gently undulating plains (AEP, 2014). Grasslands are composed of drought-tolerant species of grasses and herbs. The majority of land within the subregion is allocated to grazing. Other major land uses within the subregion include dryland farming, farming under irrigation, and oil and gas development.

While native prairie landscapes are present within the Dry Mixedgrass Natural Subregion, there is no native prairie habitat within the Project area (AEP, 2019).

Dominant grasses within the subregion include blue grama (*Bouteloua gracilis*), needle-and-thread grass (*Hesperostipa comata/curtiseta*), June grass (*Koeleria macrantha*), and western wheatgrass (*Pascopyrum smithii*). Additional ecological communities present within the subregion include:

- Sand plains, dominated by sand grass (*Calamovilfa longifolia*) and low shrubs;
- Sagebrush (*Artemisia cana*) communities, commonly located on uplands and river flats; and,
- Plains cottonwood forests (*Populus deltoides*), typically restricted to the banks for watercourses and coulees (AEP, 2014).

Rare plants and Ecological Communities

A search of the ACIMS database (AEP, 2017) returned no rare plant or rare ecological community occurrences within township 020, range 17, W4M.

Seven rare plant species known to occur within the Dry Mixedgrass Natural Subregion are listed by SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (GoC, 2018), or the Alberta *Wildlife Act* (Table 2-4).

Table 2-4 Rare plant species and rare ecological communities within the Dry Mixedgrass Natural Subregion.

Common Name	Scientific Name	SARA[1]	COSEWIC[2]	AWA[3]
Dwarf woolly-heads	*Psilocarphus brevissimus*	Special Concern	Special Concern	-
Slender mouse-ear-cress	*Halimolobos virgata*	Threatened	Threatened	Endangered
Small flowered sand verbena	*Tripterocalyx micranthus*	Endangered	Endangered	Threatened
Smooth goosefoot	*Chenopodium subglabrum*	Threatened	Threatened	-
Tiny cryptanthe	*Cryptantha minima*	Threatened	Threatened	Endangered
Western spiderwort	*Tradescantia occidentalis*	Threatened	Threatened	Endangered
Yucca/soapweed	*Yucca glauca*	Threatened	Threatened	Endangered

Notes:
[1]Status under the *Species at Risk Act*
[2]Status under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (GoC, 2018)
[3]Status under the *Alberta Wildlife Act*

A complete list of rare plant species and rare ecological communities known to occur within the Dry Mixedgrass Natural Subregions are listed in Appendix A.

The Project area has been previously disturbed and converted to tame pasture. Wetlands present within the Project area are also disturbed and composed primarily of non-native vegetation communities. Due to the lack of native vegetation expected within the Project area, the presence of rare plants and rare ecological communities is not anticipated.

In the unlikely event that rare plants or rare ecological communities are identified within the Project area during the PDSA, avoidance and mitigation measures will be implemented in consultation with the appropriate regulatory agency and provided in subsequent filings of the updated REO C&R Plan.

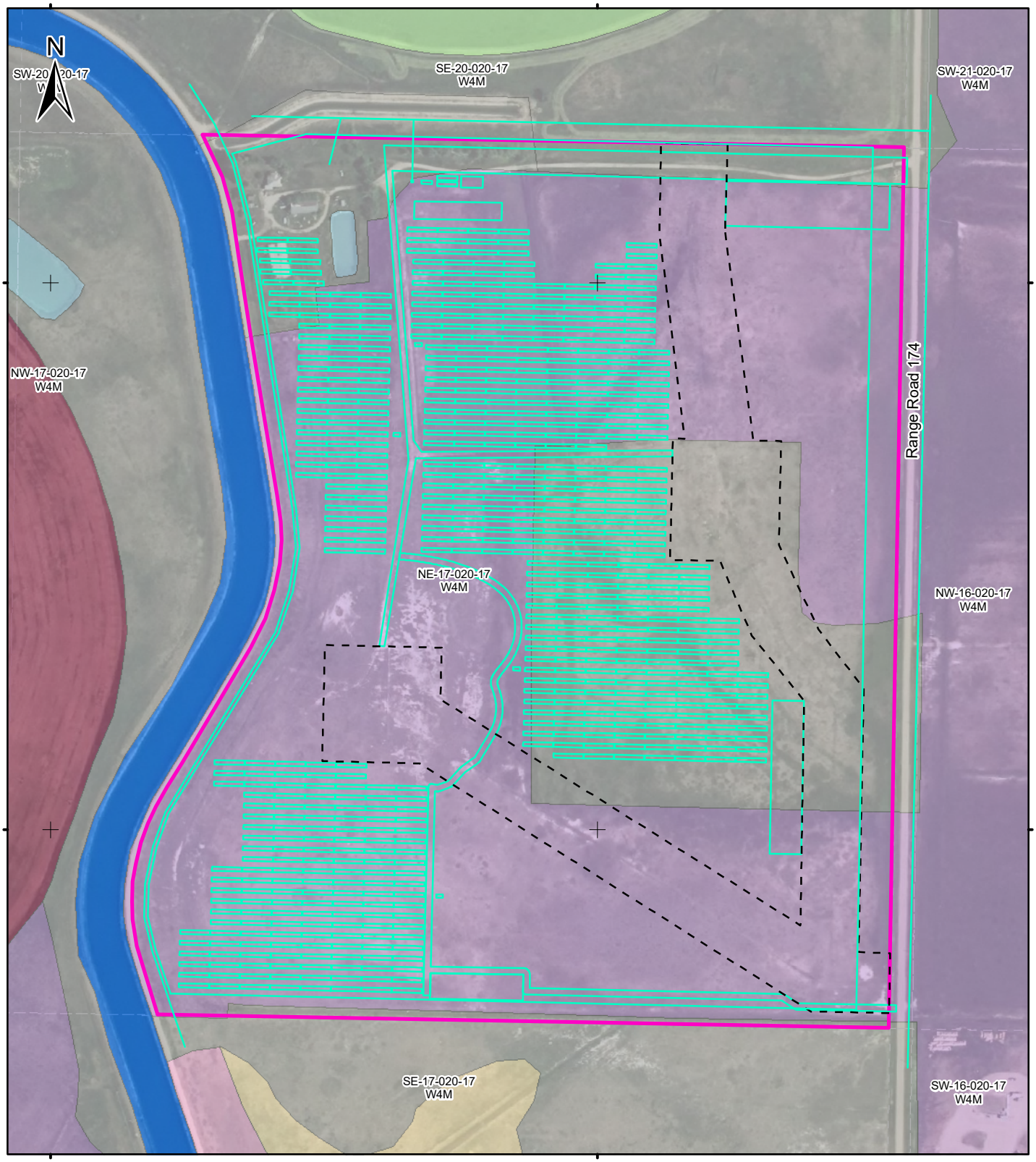
Plant communities, vegetation inventory

Vegetation within the Project area includes tame pasture species (Figure 4) and consist of a variety of tame wheatgrasses and ryegrasses. Wetland communities (Figure 5) are dominated by hydrophytic vegetation species. Vegetation mapping is shown in Figure 4.

Clubroot

Clubroot is a soil-borne disease affecting vegetation such as canola, cabbage, broccoli, cauliflower, and other vegetables of the family Brassicaceae within agricultural areas. Clubroot is considered a pest under the *Agricultural Pests Act* as the disease can significantly decrease or eliminate the yield of agricultural croplands.

Provincial information from surveys completed from 2003-2018, 1-9 fields within the County were confirmed to be infested with clubroot (AAF, 2018). Exact locations within the County could not be determined. Clubroot is a disease that affects cultivated fields and, due to the current land use of the quarter (tame pasture), the presence of clubroot is not anticipated within the Project area.



LEGEND

- PROJECT COMPONENTS AND ASSOCIATED INFRASTRUCTURE
- DESKTOP REVIEW
- OIL AND GAS

VEGETATIVE LAND COVER (GVI)

- CROP (IRRIGATED)
- LENTIC (OPEN WATER)
- LOAMY
- LOTIC (RIVER)
- SANDY
- SUBIRRIGATED
- TAME PASTURE OR HAY (IRRIGATED)
- TAME PASTURE OR HAY (NON-IRRIGATED)

REFERENCE

Alberta township grid data obtained from AltaLIS and the Grassland Vegetation Inventory data obtained from Alberta Environment and Parks and used under the Open Government License - Alberta. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

IRRICANA POWER GENERATION

VEGETATIVE LAND COVER (GVI)
NE-17-020-17 W4M

SUMMIT

PROJECT NUMBER: EPM0000110
PROJECTION: NAD 1983 UTM Zone 12N
SCALE: 1:5,000
DATE: 2/13/2020
DRAWN: CW
CHECK: NP

50 0 50
Metres

FIGURE 4

Document Path: T:\SUMMIT OPERATIONS\GIS\Clients\IrricanaPowerGeneration\EPM0000110\MXD\EPM0000110_Vegetation.mxd

2.2.4 Wetlands

Wetlands are diverse and productive ecosystems saturated with water long enough for the formation of water altered soils and aquatic vegetation (GoA, 2013b). Wetlands are governed under the Alberta Wetland Policy and are subject to the *Water Act* as regulated by the AEP.

The Project area has been assessed to determine effects the Project may have on wetlands. Where potential effects have been determined (Section 5), mitigation measures have been proposed (Section 6).

2.2.4.1 Assessment Methodology

Wetlands were assessed, delineated, and classified within the boundaries defined by the DRA to identify potential affects to hydrology within the Project area.

Desktop

In accordance with the requirements of the Alberta Wetland Identification and Delineation Directive, wetlands within the DRA were assessed by Stantec Consulting Ltd. (Stantec) in 2019 (Figure 5). Wetlands identified within DRA were classified using the Alberta Wetland Classification System (AEP, 2015; ESRD, 2015).

Field Verification

Wetlands within the Project area were field verified by Stantec between April and October 2019 (Stantec 2020).

2.2.4.2 Results

Desktop

The Project is located within the Grassland Continental Prairie Wetlands region (GoC, 1986). The Grassland Continental Prairie Wetlands is a component of the Prairie Wetland Region of Canada. Wetlands commonly found within this area include shallow basin freshwater and saline marshes. Highly saline seasonal and semi-permanent open water ponds are common with the region. Additionally, wetlands in this region do not develop peat (GoC, 1986).

Due to the current land use in the Project area (i.e., tame pasture), it is likely that the wetlands have been highly disturbed by seeding and grazing activities and may be invaded by agronomic species. Wetland W2 is partially overlapped by an existing Torxen wellsite and disturbed by wellsite activities (Figure 5).

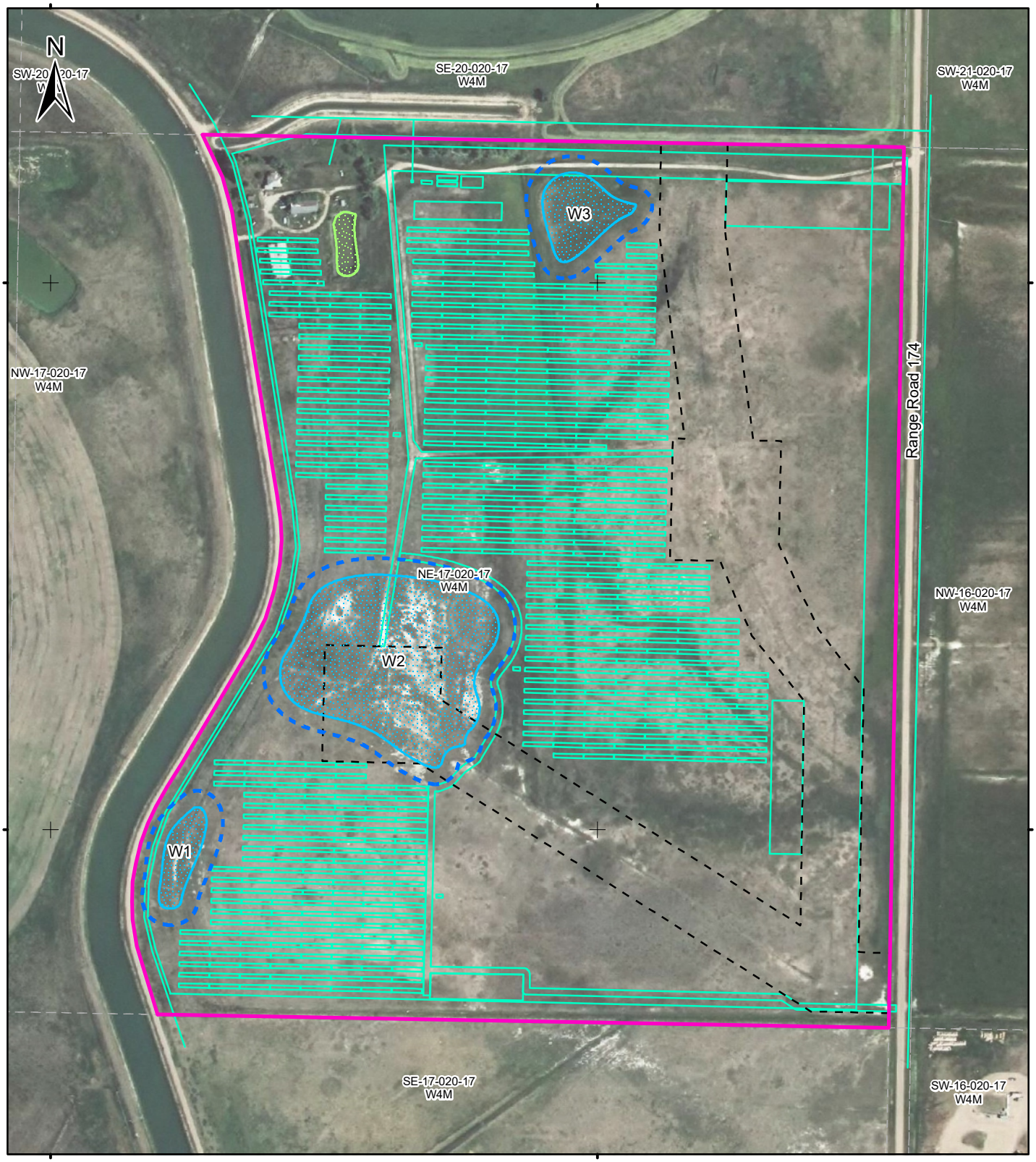
Wetland Delineation

Three wetlands are located within the DRA.

Table 2-5 Wetlands Within the DRA

Wetland #	Wetland Class Code*	Wetland Classification*
W1	M-G-II	Graminoid marsh, temporary
W2	M-G-VI	Graminoid marsh, alkaline
W3	M-G-VI	Graminoid marsh, alkaline
W4	M-G-II	Graminoid marsh, temporary

*Note: Wetland classification provided by Stantec (2020).



LEGEND

- PROJECT COMPONENTS AND ASSOCIATED INFRASTRUCTURE
- DESKTOP REVIEW
- DUGOUT
- OIL AND GAS
- TEMPORARY MARSH
- WETLAND SETBACK (15 M)

REFERENCE

Alberta township grid data obtained from AltaLIS and used under the Open Government License - Alberta. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

IRRICANA POWER GENERATION

WETLANDS
NE-17-020-17 W4M

SUMMIT

PROJECT NUMBER: EPM0000110
PROJECTION: NAD 1983 UTM Zone 12N
SCALE: 1:5,000
DATE: 2/11/2020
DRAWN: CW
CHECK: NP

50 0 50
Metres

FIGURE 5

Document Path: T:\SUMMIT OPERATIONS\GIS\Clients\IrricanaPowerGeneration\EPM0000110\MXD\EPM0000110_Wetland.mxd

2.3 References

AAF (Alberta Agriculture and Forestry). 2018. Cumulative Clubroot Infestations (2003 to 2018) in Alberta. Available at: https://www.alberta.ca/cumulative-clubroot-infestations-in-alberta.aspx. Accessed January 2020.

AENV (Alberta Environment). 2010. Environmental Code of Practice for Pesticides. Made under the Environmental Protection and Enhancement Act, RSA 2000, cE-12. Available at: www.qp.alberta.ca/documents/codes/PESTICIDE.PDF. Accessed January 2020.

AEP (Alberta Environment and Parks). 2014. Natural regions & subregions of Alberta : a framework for Alberta's parks. December 1, 2014. Available at: https://www.albertaparks.ca/media/6256258/natural-regions-subregions-of-alberta-a-framework-for-albertas-parks-booklet.pdf. Accessed January 2020.

AEP. 2015. Alberta Wetland Identification and Delineation Directive. June 5, 2015. Water Policy Branch. Edmonton, Alberta. Available at: https://open.alberta.ca/dataset/b2a69660-7f44-4c8c-9499-0da23946dafa/resource/3917b05d-7cf8-4d08-b3ae-74a15af625ce/download/2015-alberta-wetland-identification-delineation-directive-june-2015.pdf. Accessed January 2020.

AEP. 2017. ACIMS (Alberta Conservation Information Management System). October 2017. Available at: https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/. Accessed January 2020.

AEP. 2018a. Alberta Merged Wetland Inventory. October 22, 2018. Available at: https://geodiscover.alberta.ca/geoportal/rest/metadata/item/bfa8b3fdf0df4ec19f7f648689237969/html. Accessed January 2020.

AEP. 2018. Conservation and Reclamation Directive for Renewable Energy Operations. September 14, 2018. Available at: https://open.alberta.ca/dataset/8c4e8ed9-a9bb-4a1e-8683-8136b33f8dff/resource/f1704d4c-78af-4de3-91da-d9873e9f50a4/download/direct-renewenerop-sep14-2018.pdf. Accessed January 2020.

AEP. 2019. Grassland Vegetation Inventory (GVI). September 30, 2019. Available at: https://geodiscover.alberta.ca/geoportal/rest/metadata/item/9dea946a24314ca399b89723fcd857fc/html. Accessed February 2020.

AF (Alberta Agriculture and Food). 2003. Agricultural Land Resource Atlas of Alberta. 2003. Available at: https://www.alberta.ca/agricultural-land-resource-atlas-of-alberta.aspx. Accessed February 2020.

AIWG (Agronomic Interpretations Working Group). 1995. Land Suitability Rating System for Agricultural Crops. Edited by W.W. Pettapiece. Tech. Bull. 1995-6E. Centre for Land and Biological Resources Research, Agriculture and Agri-Food Canada, Ottawa. 90 pages, 2 maps.

Allen, L. 2014. Alberta Conservation Information Management System Ecological Community Tracking List. 2014. Available at: https://albertaparks.ca/media/3259838/tracked_watched_list_ecological_communities_full_report.pdf. Accessed January 2020.

Anderson, Darwin. 2010. Solonetzic Soils of the Prairie Region. Available at: http://www.prairiesoilsandcrops.ca . Accessed October 2018. pp. 65-73.

ANPC (Alberta Native Plant Council). 2012. Alberta Native Plant Council (ANPC) Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. April 2012. Alberta Native Plant Council. Available at: http://anpc.ab.ca/wp-content/uploads/2015/01/Guidelines-For-Rare-Plant-Surveys-in-AB-2012-Update.pdf. Accessed January 2020.

AUC (Alberta Utilities Commission). 2019. Rule 007 Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments. April 16, 2019. Available at: http://www.auc.ab.ca/Shared%20Documents/rules/Rule007.pdf. Accessed January 2020.

Brierley, J.A., T.C. Martin, D.J. Spiess. 2001. Agricultural Region of Alberta Soil Inventory Database (AGRASID) Soil Information Viewer. Canada – Alberta Environmentally Sustainable Agriculture (CAESA) Soil Inventory Project (SIP).

Coote, D.R. and Pettapiece, W.W. 1989. Wind Erosion Risk, Alberta. Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5255/B. Contribution Number 87-08.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002a. COSEWIC assessment and update status report on the small flowered sand verbena *Tripterocalyx micranthus* in Canada. 2002. Available at https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_smallflowered_sandverbena_e.pdf. Accessed January 2020.

COSEWIC. 2002b. COSEWIC assessment and update status report on the Western spiderwort *Tradescantia occidentalis* in Canada. 2002. Available at https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_western_spiderwort_e.pdf. Accessed January 2020.

COSEWIC. 2006. COSEWIC assessment and update status report on the dwarf woolly heads *Psilocarphus brevissimus* Southern Mountain population and Prairie population in Canada. 2006. Available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_dwarf_woolly_heads_e.pdf. Accessed January 2020.

COSEWIC. 2013. COSEWIC assessment and status report on the Soapweed *Yucca glauca* in Canada. 2013. Available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_yucca_glauque_soapweed_1213_e.pdf. Accessed January 2020.

County of Newell. 2010. Municipal Development Plan Bylaw No. 1705-10. September 2010. Available at: https://lfpublic.countyofnewell.ab.ca/WebLink/DocView.aspx?id=525929&dbid=0&repo=Newell8&cr=1. Accessed January 2020.

County of Newell. 2017. Land Use Bylaw No. 1892-17. September 2017. Available at: https://lfpublic.countyofnewell.ab.ca/WebLink/DocView.aspx?id=640527&dbid=0&repo=Newell8. Accessed January 2020.

ECCC (Environment and Climate Change Canada). 2018. General nesting periods of migratory birds. October 30, 2018. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html. Accessed January 2020.

Environment Canada. 2012. Recovery Strategy for the Slender Mouse-ear-cress (*Halimolobos virgate*) in Canada. 2012. Available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/plans/rs_slender_mouse_ear_cress_e.pdf. Accessed January 2020.

Environment Canada. 2015. Recovery Strategy for the Smooth Goosefoot (Chenopodium subglabrum) in Canada. 2015. Available at: https://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_smooth_goosefoot_e_final.pdf. Accessed January 2020.

ESRD (Environment and Sustainable Resource Development). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands. July 2013. Available at: https://open.alberta.ca/dataset/ee82f0ab-fef2-4b78-805d-8c6d341aabd2/resource/54dd817c-225a-483a-a3f1-09cab3136743/download/2013-2010-reclamation-criteria-wellsites-cultivated-lands-2013-07.pdf. Accessed February 2020.

ESRD. 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division. June 1, 2015. Edmonton, Alberta. Available at: https://open.alberta.ca/dataset/92fbfbf5-62e1-49c7-aa13-

8970a099f97d/resource/1e4372ca-b99c-4990-b4f5-dbac23424e3a/download/2015-Alberta-Wetland-Classification-System-June-01-2015.pdf. Accessed January 2020.

Fiera (Fiera Biological Consulting Ltd.). Environmentally Significant Areas of Alberta 2014 - ESA Scores. Prepared for the Government of Alberta, Edmonton. Available at: https://www.albertaparks.ca/albertaparksca/library/environmentally-significant-areas-report/. Accessed January 2020.

GoA (Government of Alberta). 1995. Eastern Irrigation District integrated resource management strategy. November 1, 1995. Available at: https://open.alberta.ca/dataset/cb6c357d-ff72-4f45-b02e-691cd8d6d1c4/resource/fd511c2a-bdab-437a-bec9-7e657dc81cdb/download/1995-easternirrigationdistrictplan-1995.pdf. Accessed January 2020.

GoA. 2013a. Alberta Invasive Plant Identification Guide: Prohibited Noxious and Noxious. Produced by Wheatland County. January 13, 2014. Available at: https://open.alberta.ca/dataset/8bb61884-bbfb-4640-bd5d-96f6e633d4ee/resource/275f7dbe-8116-4d81-ba95-329df950be7e/download/6740590-2013-alberta-invasive-plant-identification-guide-2013-06-13.pdf. Accessed January 2020.

GoA (Government of Alberta). 2013b. Alberta Wetland Policy. Edmonton, Alberta. Available at: https://open.alberta.ca/dataset/5250f98b-2e1e-43e7-947f-62c14747e3b3/resource/43677a60-3503-4509-acfd-6918e8b8ec0a/download/6249018-2013-alberta-wetland-policy-2013-09.pdf. Accessed January 2020.

GoA. 2017a. South Saskatchewan Regional Plan 2014 – 2024. February 2017. Available at: https://open.alberta.ca/dataset/460ac866-4416-4d77-a25a-a02fab85a6ec/resource/8261ce03-aa0f-4621-8e2d-c610a72ac37c/download/south-saskatchewan-regional-plan-2014-2024-february-2017.pdf. Accessed January 2020.

GoA. 2017b. Wildlife Research Permit and Collection Licence Process. June 26, 2017. Available at: https://open.alberta.ca/dataset/9c91bb96-1466-4b57-8c5d-46337d56fc15/resource/8166b3e3-0ccb-46b2-80c2-a76ca3bca574/download/wildliferesearchpermitlicenceprocess-jun2017.pdf/. Accessed January 2020.

GoC (Government of Canada). 1986. The National Atlas of Canada 5th Edition: Canada Wetland Regions Map. Geographical Services Division, Surveys and Mapping Branch, Energy, Mines and Resources Canada. Ottawa, Ontario.

Hurlburt, D. 2001. Status of Soapweed (*Yucca glauca*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 35. Available at: https://www.ab-conservation.com/downloads/AWSR/Plant%20and%20Invertebrate%20Reports/Status%20of%20Soapweed%20(Yucca)%20in%20Alberta_2001.pdf. Accessed January 2020.

Kershaw, L.J, J. Gould, J.D. Johnson, J. Lancaster. 2001. Rare Vascular Plants of Alberta. October 2001. The University of Alberta Press, Natural Resources Canada, and the Canadian Forest Service, Alberta.

Kjearsgaard, A.A., T.W. Peters, W.W. Pettapiece. 1983. Soil survey of the County of Newell, Alberta. Alberta Soil Survey Report No. 41. Alberta Institute of Pedology Report No. S-82-41. Land Resource Research Institute Contribution No. LRRI 83-48. Research Branch, Agriculture Canada.

Kwiatkowski, J., C.R. King. 1998. Salinity Mapping for Resource Management within the County of Newell, Alberta. Conservation and Development Branch. Alberta Agriculture, Food and Rural Development.

Moss, E.H. 1983. Flora of Alberta (Second edition revised by J.G. Packer). University of Toronto Press. Toronto, Ontario.

NRC (Natural Regions Committee). 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Remarchuk, K.J. 2005. Western Spiderwort (*Tradescantia occidentalis*) Inventory in Alberta, 2005. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 102. Available at: https://open.alberta.ca/dataset/ee3923ae-aa73-4930-b269-b6969674bbfa/resource/9c11721d-210f-4ac7-85da-d54ac2e81576/download/2005-sar102-westernspiderwortinventory2005.pdf. Accessed January 2020.

SRD (Alberta Sustainable Resource Development). 2003. Status of the Small-flowered Sand Verbena (*Tripterocalyx micranthus*) in Alberta. May 2003. Available at: https://open.alberta.ca/dataset/7af17018-ca5c-4fda-958e-0729178469e9/resource/74dbae4f-a896-4b68-8312-44cf66915a25/download/2003-sar-statussmallfloweredsandverbena-may2003.pdf. Accessed January 2020.

SRD and ACA (Alberta Sustainable Resource Development and Alberta Conservation Association). 2009. Status of the Slender Mouse-ear-cress (*Halimolobos virgate* or *Transberingia bursifolia* subsp. *virgata*) in Alberta: Update 2009. Available at: https://open.alberta.ca/dataset/a5d053f8-9dd4-4b60-92e4-432116ee558e/resource/8116da64-da5e-47c1-8a71-ebe231f3426e/download/sar-statusslendermouse-ear-cress-aug2009.pdf. Accessed January 2020.

Stantec Consulting Ltd. February 2020. SunAlta Solar PV1 Technical Data Report. Prepared for 1867559 AB Ltd.

Tajek, J. and Coote, D.R. 1993. Water Erosion Risk, Alberta. Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5292/B. Contribution Number 92-05.

3 Reclamation Planning

Executive summary

Reclamation planning is an important component of meeting the objectives of the REO C&R Plan (Section 1). Reclamation activities will occur throughout the Project lifecycle, including during interim and progressive reclamation following construction, and during final reclamation following decommissioning. At the time of this application, reclamation planning is conceptual and based on current desktop information and BMPs for reclamation activities. Reclamation planning objectives will be updated following the PDSA and IMSA, per the Directive.

The current land use within the Project area comprises tame pasture and is surrounded by agricultural land uses. Existing oil and gas infrastructure (pipelines and wells) are present within the Project area but are avoided by Project infrastructure. Following decommissioning of the Project, the Project area is planned to be reclaimed back to tame pasture land use.

Interim and progressive reclamation will be completed in areas no longer required for construction or operation of the Project. Stripped topsoil and subsoil will be stored separately onsite and stabilized for use during reclamation activities. Following decommissioning of above-ground infrastructure, final reclamation activities will be influenced by site conditions and BMPs to the meet reclamation criteria for cultivated land use and reach equivalent land capability (ESRD, 2013). Subsoil and topsoil will be replaced and seeded using a seed mix recommended by the EID for use on tame pasture. Reclamation success will be monitored until a reclamation criteria are met.

3.1 Consultation

IPG has developed a Participant Involvement Program (PIP) to notify and inform potentially affected parties of the Project. The PIP provides potentially affected parties an opportunity to provide feedback regarding any concerns or issues pertaining to the proposed development.

The following table details concerns specific to reclamation activities identified by a neighboring landowner (Table 3-1). For further details on consultation with landowners and other stakeholders, see the associated Facility Application. There are currently no outstanding concerns with respect to conservation and reclamation of the Project.

IPG will continue to retain records of any concerns or questions regarding reclamation and remediation of the Project and provide them in subsequent filings of the updated REO C&R Plan

Table 3-1 Summary of Stakeholder Consultation for Reclamation Activities

Comment/Concern	Communication	Response/Action	Date	REO C&R Plan Reference
Contamination to soils and water in neighboring property as a result of the Project. Liability of any resulting contamination.	Evans, K. Message to Smith, T. (IPG), Pigeon, J. (Scott Land), Brown, S (Scott Land), and AUC Consumer Relations. Solar Project on Range Road 174. November 27, 2019. Email	IPG is responsible for restoring the land to previous agricultural state through the decommissioning of infrastructure. IPG is required to conduct pre-disturbance soil testing, interim monitoring site assessments, and reclamation certificate site assessments. In the unlikely event that the Project impacts neighboring properties, the Project liability insurance will cover the damages. There is no expected contamination produced by this type of development. The primary source of potential contamination would be through vehicle use.	December 4, 2019	Section 3.3
Environmental contaminants or toxins used in Project components. Contamination from underground infrastructure.	Evans, K. Message to Smith, T. (IPG), Pigeon, J. (Scott Land), Brown, S (Scott Land), and AUC Consumer Relations. Solar Project on Range Road 174. December 4, 2019. Email	No heavy metals or environmental contaminants are used in Project infrastructure. Fluid used in transformers is not toxic and some options are fully biodegradable. There are no known releases from solar panels. The principal material of the panels is silicon in a solid state. Underground infrastructure includes wires and concrete which will not cause contamination to the soil. It is not expected that concrete will remain underground after reclamation. Only wires under 1 m may be left in the ground.	December 10, 2019	Section 3.3

3.2 Temporary and Progressive Reclamation

The majority of the Project is expected to be constructed using minimal disturbance techniques; solar panels will be installed and accessed by light machinery over existing vegetation (i.e., between rows of solar panels). Post-construction disturbance to vegetated areas will be limited as the panels are not expected to require regular access during operations. Soil handling is expected to be limited to the areas associated with the O&M building, laydown area, transformer pads, stormwater detention basins, installation of collector system, and the new access road.

The expected lifespan is expected to be a minimum of 25 years with the potential for a retrofit. Temporary reclamation, conducted in areas that are not used for active operations, allows a site to re-establish vegetation cover, reducing potential erosion of bare soils and preventing the establishment of weeds and invasive species. Progressive reclamation, conducted where no further disturbance is expected to soil and vegetation, allows these areas to be returned to pre-disturbance equivalent land capability, concurrent to operation of the Project, through the establishment of the desired final vegetation community.

Temporary and progressive soils and vegetation reclamation will be adapted based on the results of the PDSA and IMSA. Any changes to interim or progressive reclamation measures will be included in subsequent filings of the updated REO C&R Plan.

Additional areas of temporary and/or progressive reclamation may be determined following construction. Areas where temporary and/or progressive reclamation activities have been conducted will be incorporated in subsequent filings of the REO C&R Plan following the IMSA.

3.2.1 Temporary and Progressive Reclamation of Soil

Temporary reclamation activities may include alleviating soil compaction in areas where vegetation growth may have become limited as a result of movement of equipment and vehicles during construction activities. Decompaction will focus on areas that are not expected to require regular travel during operations and maintenance of the Project.

Topsoil and subsoil removed to install the collector system will be stored separately during trenching and replaced in the same order they were removed. The area will be recontoured to match the surrounding landscape and allow for natural drainage.

Following construction, the portion of the laydown area that is planned to be used as a parking lot will remain stripped. Progressive reclamation will be conducted within the portion of the laydown area that is not required for the parking lot. Topsoil will be re-contoured to match pre-existing conditions and allow for natural drainage.

Topsoil and subsoil will be stored in soil piles south of the laydown area. Piles will be separated by at least 3 m and labelled with proper signage. Stockpiling and storage of subsoil is not expected to be significant due to the minor amount of grading anticipated for leveling. Subsoil removal is expected to be limited to sites required for the transformer pads, water retention basins, or any leveling required for the parking lot, access road, and/or the base of the new Fortis line.

The high proportion of sand and silt expected to be contained within topsoil and subsoil may affect proper soil storage.Tackifiers will be used to stabilize the materials, as required. Soil piles may also be covered with a physical matting, such as coconut matting, to stabilize the soil pile while vegetation is establishing. If stored for over 6 months, vegetation through a combination of fall rye (Secale cereal) and flax (*Linum usitatissimum*) or Canada wild rye (*Elymus Canadensis*) and slender wheatgrass (*Agropyron trachycaulum*) is recommended, given the known success of these species for this purpose in the Dry Mixedgrass Natural Subregion (Gramineae, 2013). Subsoil pile stabilization may require further mitigation upon monitoring given the lack of expected growth medium

in the subsoil. Erosion of the soil piles should be monitored and, if required, appropriate and timely mitigation measures should be implemented to control erosion. If wind erosion is observed to be an issue, it may be necessary to apply water or additional tackifier to soil piles to stabilize the material.

If soils are determined to be unsuitable for reclamation objectives and long-term storage, as identified during the PDSA, IPG may remove all soils from onsite storage after interim reclamation and bring in topsoil additions at the time of final reclamation (Section 3.4.1).

3.2.2 Temporary and Progressive Reclamation of Vegetation

Temporary reclamation activities may include seeding in areas where the movement of equipment and vehicles has impacted vegetation growth during construction. Seeding will predominantly be applied where vehicles are not be expected to have regular access during operations and maintenance of the Project. The portion of the laydown area that is not planned to be used as a parking lot will be seeded for progressive reclamation. An appropriate seed mix of tame pasture species will be determined following an assessment of existing onsite species composition during the PDSA.

Vegetation growth will be monitored and assessed post seeding with consideration to final reclamation criteria (ESRD, 2013) after the first full growing season and annually for a minimum of three growing seasons. Measured outcomes will determine whether reclaimed areas are on a trajectory to meet the reclamation criteria for the desired end land use, if further assessments are required, and if additional mitigation measures should be applied to improve vegetation growth. Any soil constraints (e.g., pH, salinity, sodicity) influencing plant growth will be identified and managed. Any identified constraints and applied mitigation measures will be incorporated into subsequent filings of the updated REO C&R Plan.

3.2.3 Mapping

An as-built map will be provided in the updated REO C&R Plan that includes updated footprint boundaries, areas that were disturbed during construction, topsoil depths, salvaged soils and location, and any conditions requiring special handling procedures.

3.3 Decommissioning and Remediation

Final reclamation activities include decommissioning of Project infrastructure and identifying areas requiring remediation due to any potential onsite contamination during construction, operation, and decommissioning of the Project.

3.3.1 Decommissioning of Project Infrastructure

At the end of the Project lifecycle, infrastructure will be dismantled and decommissioned from the surface of the Project area including:

- The photovoltaic array including 30,680 solar panels and piles;
- Inverters;
- Perimeter fencing, wire, and security systems;
- New access roads;
- Laydown area/parking lot;
- Transformers and associated concrete pads that extend below surface;
- E-house building, including electrical controls, communication equipment and monitoring system;
- O&M building and associated equipment therein including office equipment, and maintenance parts;
- Canteen trailer; and,
- Radio tower.

While not currently planned, if any surface infrastructure is to be left in place, confirmation will be provided that infrastructure is an improvement to the landscape and will not result in adverse effects.

Subsurface equipment includes underground cables as part of the collector system. The cables are expected to be located within an excavated trench approximately 1 m to 1.5 m below surface. Any wiring greater than 1 m below surface may be left in the ground per the Directive, however, this will be determined at the time of decommissioning depending on the salvage value of this wiring (AEP, 2018). It is not expected that any concrete anchoring surface infrastructure will be left below surface during decommissioning, however, IPG will ensure that all concrete is removed to at least at a depth of 1.2 m. At depths below 1 m, any remaining infrastructure is not expected to affect natural infiltration or vegetation growth.

Infrastructure such as the access road, the base of the new Fortis line, stormwater detention basins, and the parking lot will be decommissioned and reclaimed at the time of soil restoration during final reclamation.

3.3.2 Potential Contamination

The Project components are not anticipated to be a source of contamination onsite or on adjacent lands to water or soils. Project facilities (i.e., E-house, O&M building, canteen) are not expected to contain any potential sources of contamination. Setbacks from waterbodies and spill prevention and response mitigation measures (e.g., secondary spill containment) are expected to be effective in preventing contamination of onsite and nearby waterbodies (Section 6).

Potential sources of contamination are construction vehicles and transformers. Liquids contained in the transformers will be natural and synthetic oils. Vehicles onsite that are not being used for operations or maintenance will remain in the padded parking lot, at a minimum of 100 m from any waterbodies. Soils will be assessed during operations for staining on any sites with the potential for contamination, including transformer pads and the parking lot. If applicable, any contamination will be remediated in accordance with Alberta Tier 1 or Tier 2 Soil and Groundwater Remediation Guidelines (AEP, 2019a; AEP, 2019b).

Active wellsites (Torxen 10-17 and Torxen 16-17), associated active pipelines (Torxen 12344-35, Torxen 12344-77, and Torxen 12344-175), and the abandoned wellsite (Torxen 02/10-17) within the Project area have low potential to be sources of existing or future contamination due to the product of transport (natural gas). However, active well 10-17 was spudded in 1979 and may have been drilled using mud additives that were not water-based and were potentially disposed of in an onsite sump. The potential for subsurface migration of sump fluid could result in subsurface contamination of the Project area. Soils around the wellsite will be assessed during the PDSA to test for any associated contamination and, if identified, will be delineated and managed with Torxen.

3.4 Final Reclamation

Final reclamation activities promote restoration of pre-disturbance soil and vegetation conditions within the Project area, consistent with landowner objectives, desired end land use, and reaching equivalent land capability.

At the time of final reclamation, the Project area will be returned to tame pasture. Under the 2010 Reclamation Criteria for Wellsites and Associated Facilities, the end land use of the Project area would fall under the criteria for cultivated lands (ESRD, 2013). The success of final reclamation will be monitored during the RCSA in accordance with the Directive (AEP, 2018).

The final reclamation plan for the Project corresponds to surrounding land uses including grazing, farming, and oil and gas development. Under the Land Use Bylaw 1892-17, the Project Area is zoned under “A-Agricultural” (Section 2.1.1). Returning the land to agricultural operations will fall under “Permitted Uses” for the municipal zoning and align with the Municipal Development Plan (Bylaw 1705-10).

Onsite infrastructure and vehicle use may result in soil compaction over time, potentially impairing water infiltration into the soil and associated vegetation growth. Reclamation activities will include restoration of soils, revegetation, and the management of weeds to pre-disturbance conditions within the Project area.

3.4.1 Soil Restoration (contouring/landscape)

Imported soils used to pad access or parking lot areas, if required during construction, will be removed from the Project area during decommissioning. Areas accessed by infrastructure and equipment, including access roads, buildings, and any minimal disturbance trails, may require decompaction prior to returning topsoil and/or seeding. Decompaction may be completed through the use rippers or breaking disc, which can fracture compacted soil without adversely affecting vegetation. Decompaction of the soils will improve water infiltration and promote revegetation of the Project area.

Soils salvaged and stored around the laydown area/parking lot area, if remaining onsite for the duration of the Project, will be replaced. Subsoils will be replaced in the areas of the stormwater detention basins and transformer pads, and as required in areas requiring grading including the new access road, base of the new Fortis line, and parking lot. Topsoil will be replaced over subsoils and recontoured to pre-construction conditions and natural drainage patterns present within the area. Topsoil replacement will be required in areas of the parking lot, base of the new Fortis line, transformer pads, stormwater detention basins, and new access road.

Depth and volume estimates of salvaged soils will be provided in subsequent filings of the updated REO C&R Plan after depths are delineated in the PDSA, along with confirmation of soil conditions that require special handling.

If soils are determined to be unsuitable for reclamation objectives and long-term storage, as identified during the PDSA, IPG may remove all soils from onsite storage and bring in topsoil additions at the time of final reclamation. Appropriate topsoil sources will be determined by a Qualified Environmental Professional. Imported topsoil will be as close as possible to the chemical and physical properties of the existing Project topsoil. The physical and chemical properties (i.e., texture, colour, salinity), will be characterized and the date, method, and area of their application will be documented.

3.4.2 Revegetation

Areas requiring soil handling at the time of final reclamation will be seeded with an appropriate seed mix of tame pasture species that will be determined following an assessment of existing onsite species composition during the PDSA (Section 3.3.2). The Project area covered by the solar array is expected to have altered vegetation growth due to changes in local climate resulting from the onsite infrastructure. Revegetation requirements will be assessed at the time of final reclamation to evaluate existing pasture health and desirable community establishment. Fertilization or manure may be used, based on recommended application rates, to improve growth, existing soil nutrients at the time of reclamation, and soil moisture content.

Should the existing vegetation conditions over the majority of the Project area exhibit poor growth or heavy infestation of weed species, the area may require drastic restoration measures to achieve the target vegetation community. In this case tillage and reseeding may be appropriate over the entire Project area, potentially resulting in a longer timeline to achieve target revegetation. The initial growing season would likely be seeded with annual or short-lived perennial species, followed by establishment of the target forage species in the second year.

Revegetation success will be measured for growth stage, plant height, density, health, and establishment of the desired plant species (ESRD, 2013). Seeding of an appropriate mix of tame pasture species may not be representative of the communities in adjacent properties. The use of professional judgement, rather than comparisons with offsite conditions, may be appropriate to evaluate reclamation criteria. Vegetation assessments will be conducted for four growing seasons following the completion of reclamation, per the requirements of the

Directive (AEP, 2018). Mitigation measures will be applied, as required, as a result of the measured outcomes of these assessments.

3.4.3 Weeds and Invasive Species Management

Weeds will be managed per the Alberta *Weed Control Act*. The County of Newell has developed a Weed Control Program that involves the control, eradication, and prevention of noxious and prohibited noxious weeds within the County. The program also assists landowners with weed identification services and control program assistance.

Weed growth and distribution may be influenced by onsite activities, travel between infrastructure, or poor growth conditions of existing pasture plant species. Weed species existing onsite will be documented during the PDSA. Undesirable and noxious weeds will be compared to offsite/surrounding areas and controlled while prohibited noxious weeds will be destroyed.

Weed species will be identified and monitored during the IMSA. If required, the updated REO C&R Plan will include georeferenced weed locations and include a Weed Management Plan. This will include annual monitoring and management until noxious weeds, prohibited noxious weeds, invasive species, and/or undesired weed species have been eradicated or controlled. Issues with weed management may be tied to soil and vegetation constraints that will be mitigated for should annual monitoring identify the associated limitations.

3.5 Post Construction Wildlife Monitoring

Post-construction wildlife monitoring will be conducted in accordance with the Directive (AEP, 2018) and the Wildlife Directive for Alberta Solar Energy Projects (AEP, 2017). A post-construction monitoring and mitigation plan was developed by Stantec and is included with the associated Project application package submitted to the AUC. The post-construction monitoring program has been approved by AEP.

3.6 References

AEP (Alberta Environment and Parks). 2017. Wildlife Directive for Alberta Solar Energy Projects. October 4, 2017. Available at: https://open.alberta.ca/dataset/6a71e752-8d72-4126-a347-e9f328279904/resource/527c6a99-4004-440c-8033-07872cb8adb0/download/wildlifedirective-albertasolarenergyprojects-oct4-2017.pdf. Accessed January 2020.

AEP. 2018. Conservation and Reclamation Directive for Renewable Energy Operations. September 14, 2018. Available at: https://open.alberta.ca/dataset/8c4e8ed9-a9bb-4a1e-8683-8136b33f8dff/resource/f1704d4c-78af-4de3-91da-d9873e9f50a4/download/direct-renewenerop-sep14-2018.pdf. Accessed January 2020.

AEP. 2019a. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. January 10, 2019. Available at: https://open.alberta.ca/dataset/842becf6-dc0c-4cc7-8b29-e3f383133ddc/resource/a5cd84a6-5675-4e5b-94b8-0a36887c588b/download/albertatier1guidelines-jan10-2019.pdf. Accessed February 2020.

AEP. 2019b. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. January 10, 2019. Available at: https://open.alberta.ca/dataset/842becf6-dc0c-4cc7-8b29-e3f383133ddc/resource/a5cd84a6-5675-4e5b-94b8-0a36887c588b/download/albertatier1guidelines-jan10-2019.pdf. Accessed February 2020.

AFPA/LFS (Alberta Forest Products Association/Land & Forest Service). 1994. Forest Soils Conservation. Available at: https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/formain15749/$file/ForestSoilsConservation-1994.pdf?OpenElement. Accessed January 2020.

Coder, K.D., 2007. Soil Compaction, Stress and Trees: Symptoms, Measures and Treatments. Warnell School of Forestry & Natural Resources University of Georgia. Warnell School Outreach Monograph WSFNR07-9. 99 pages.

County of Newell. 2010. Municipal Development Plan Bylaw No. 1705-10. September 2010. Available at: https://lfpublic.countyofnewell.ab.ca/WebLink/DocView.aspx?id=525929&dbid=0&repo=Newell8&cr=1. Accessed January 2020.

County of Newell. 2017. Land Use Bylaw No. 1892-17. September 2017. Available at: https://lfpublic.countyofnewell.ab.ca/WebLink/DocView.aspx?id=640527&dbid=0&repo=Newell8. Accessed January 2020.

ESRD (Environment and Sustainable Resource Development). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands. July 2013. Available at: https://open.alberta.ca/dataset/ee82f0ab-fef2-4b78-805d-8c6d341aabd2/resource/54dd817c-225a-483a-a3f1-09cab3136743/download/2013-2010-reclamation-criteria-wellsites-cultivated-lands-2013-07.pdf. Accessed February 2020.

Gramineae (Gramineae Services Ltd.). 2013. Recovery Strategies for Industrial Development in Native Prairie – the Dry Mixedgrass Natural Subregion of Alberta. Available at: https://open.alberta.ca/dataset/aa94fe69-9d11-4fe5-9772-b6dbeb282b4c/resource/2c4e4ffd-6938-4d4e-b69b-2fd42f59076c/download/recoverystrategiesdrymixedgrass-feb2013.pdf. Accessed February 2020.

Gysi M, A.Ott and H. Fluhler. .1999. Influence of Single passes with high wheel load on a structured, unploughed sandy loam soil. Soil Till Res 52:141 – 151.

MFRC (Minnesota Forest Research Council). 2011. Rutting Evaluation. Available at: http://mn.gov/frc/documents/council/site-level/GuidelineRevision/MFRC_SL_guideline-review_rutting_evaluation-info_2011.pdf. Accessed July 2018.

Nawaz M.F., B Guilhem, and F Trolard. 2013. Soil compaction impact and modelling – A review. Agronomy and Sustainable Development. Vol 33: 291 – 309. DOI 10.1007/s13593-011-0071-8.

NCASI (National Council for Air and Stream Improvement Inc.). 2004. Effects of heavy equipment on physical properties of soils and long-term productivity: A review of literature and current research. Technical Bulletin No. 887. Research Triangle Park, N.C. National Council for Air and Stream Improvement, Inc.

NRC (Natural Regions Committee). 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Swan J.B., J.F. Moncrief, and W.B. Voorhees. 1987. Soil Compaction: Causes, effects and Control. AG-BU 3115, Minnesota Extension Service, University of Minnesota, Minneapolis, Minnesota. 12 pp.

Taylor H.M. 1971. Effects of soil strength on seedling emergence, root growth and crop yield. In: Barnes K, Carleton W M, Taylor H M, Throckmorton R I, Van den Berg GE (eds) Compaction of agricultural soils. American society of Agricultural Engineers, St Joseph, pp 292 -305.

4 Adaptive Management

During construction, operation, and reclamation of the Project, adaptive management strategies will be incorporated, as required.

4.1 Objectives and Limitations

The Project area has been assessed using only desktop methods, which include coarse scale information databases (e.g., AGRASID) that are, on their own, not suitable for project-level planning.

Results from the PDSA may reveal differences from anticipated site characteristics. To meet the objectives of the REO C&R Plan, planned activities, mitigation measures, and BMPs may be adapted if onsite characteristics, conditions, or other ecological factors differ from those anticipated through the desktop assessment.

Despite best efforts and the precautionary use of mitigation measures and BMPs, it is possible that activities conducted during construction, operation, and/or reclamation may have unanticipated effects to land use, soils, vegetation, and wetlands within the Project area. Where unanticipated effects are observed, mitigation measures will be developed and/or adapted to reduce potential effects and meet the REO C&R Plan objectives.

4.2 Monitoring Programs

During the IMSA, areas that have undergone interim and progressive reclamation will be assessed to confirm they are on a trajectory to meet desired end land use, equivalent land capability, and reclamation criteria (ESRD, 2013). The IMSA will be conducted by a Qualified Environmental Professional or Competent Practitioner using methods consistent with direction provided by the Directive (AEP, 2018).

If progressively reclaimed areas are not on a trajectory to meet desired the end land use, equivalent land capability, and/or reclamation criteria, these areas may be assessed further, and reclamation strategies may be adapted to meet REO C&R Plan objectives.

Final reclamation outcomes may also change from planned outcomes due to amended regulations, BMPs, and due to the successes or limitations of interim and progressive reclamation.

The presence of noxious weeds, prohibited noxious weeds, invasive species, and/or undesirable species will be assessed during the PDSA and IMSA; if present, a Weed Management Plan will be developed, per the Directive (AEP, 2018). If the developed Weed Management Plan does not prove successful in the control or destruction of weeds and invasive species during annual assessments, the Weed Management Plan may be adapted.

Any changes to the Project footprint will be incorporated into the updated REO C&R Plan following the IMSA. Areas where construction and/or progressive reclamation activities have been conducted will be incorporated in the updated REO C&R Plan at this time.

4.3 Program for Updating the REO C&R Plan

All variances and adapted mitigation measures and BMPs, as described above, will be included in subsequent filings of the updated REO C&R Plan. Per the Directive, the updated REO C&R Plan will be submitted following the IMSA (AEP, 2018).

The Project will align with all applicable regulatory frameworks. All changes to applicable regulatory frameworks (e.g., the Directive) will be addressed in subsequent filings of the updated REO C&R Plan, as required, to maintain regulatory compliance.

4.4 References

AEP (Alberta Environment and Parks). 2018. Conservation and Reclamation Directive for Renewable Energy Operations. September 14, 2018. Available at: https://open.alberta.ca/dataset/8c4e8ed9-a9bb-4a1e-8683-8136b33f8dff/resource/f1704d4c-78af-4de3-91da-d9873e9f50a4/download/direct-renewenerop-sep14-2018.pdf. Accessed January 2020.

ESRD (Environment and Sustainable Resource Development). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands. July 2013. Available at: https://open.alberta.ca/dataset/ee82f0ab-fef2-4b78-805d-8c6d341aabd2/resource/54dd817c-225a-483a-a3f1-09cab3136743/download/2013-2010-reclamation-criteria-wellsites-cultivated-lands-2013-07.pdf. Accessed February 2020.

5 Potential Effects

5.1 Land Use

The Project will directly affect the current land use within the Project area through the alteration of tame pasture. These effects are anticipated to be reduced through the application of mitigation measures and BMPs (Section 6).

5.1.1 Loss or Alteration of Tame Pasture

Construction and operation of the Project will change the current land use from tame pasture to industrial renewable energy generation. Due to the presence of Project infrastructure and the removal of existing tame pasture vegetation, the Project area will no longer support grazing of livestock.

5.2 Soils

The Project has the potential to affect soil resources directly and indirectly through:

- Soil erosion;
- Soil compaction;
- Soil rutting;
- Soil admixing; and,
- Soil contamination.

These effects are anticipated to be reduced with the application of mitigation measures and BMPs (Section 6).

5.2.1 Soil Erosion

Wind and water erosion risk to soil piles is greatest during construction when soil is exposed in stockpiles, prior to stabilization. Soil erosion can result in a decline in soil volumes and may lead to reduced soil productivity and agricultural land suitability.

Soil material within the Project area is expected to be unsuitable for construction of roads and pads and have a high risk of wind and water erosion.

5.2.2 Soil Compaction

Soil compaction involves the removal of soil air, structural changes in the soil, and a macroscopic increase in the soil strength which results in poor root penetration, seedbed preparation and cultivation, reduced water infiltration, increased runoff, and decreased soil porosity. Soils with very low moisture content are generally less vulnerable than soils with high moisture content. Soil compaction risk also varies between soils with different textures.

Soils within the Project area are vulnerable to compaction due to the movement of construction equipment and vehicles associated with construction activities.

5.2.3 Soil Rutting

Soils are highly susceptible to rutting during construction due to repetitive traffic from various types of equipment and vehicles travelling through the Project area. The extent of damage or rutting disturbance will primarily depend on the soil texture, and soil moisture content. Rutting is more likely to occur in water-saturated soil because water is non-compressible, resulting in the displacement of soils and damage to soil structure. Additionally, water-saturated soil has weak load-bearing capacity and shear strength. Soils with fine-textured clays and silts are more susceptible to rutting than coarse-textured soils. Soil rutting often causes soil admixing where an upper soil horizon is mixed with a lower soil horizon.

Soils expected to be present within the Project area are moderately well to well drained, which will reduce the inherent risk of soil rutting. However, rutting risk will increase if soils become water-saturated during adverse weather conditions.

5.2.4 Soil Admixing

Admixing can occur during soil handling activities such as grading, soil salvage, soil replacement, and reclamation activities. Soils with indistinct transitions between the topsoil and upper subsoil horizons are difficult to distinguish and pose a greater risk for soil admixing during topsoil stripping. If upper subsoil horizons are unintentionally salvaged with topsoil, the quality of the topsoil has the potential to be negatively affected by physical and chemical qualities from the upper subsoil horizon. Soil admixing due to rutting may negatively affect reclamation success and revegetation.

5.2.5 Contamination

A potential spill or leak from equipment or vehicles in the Project area may directly affect the agricultural capability of soils contaminated, and indirectly though drainage from the contaminated area.

5.3 Vegetation

The Project has the potential to affect vegetation resources directly and indirectly through:

- Loss or alteration of vegetation communities, and
- Introduction and spread of non-native and weed species.

These effects are anticipated to be reduced with the application of mitigation measures and BMPs (Section 6).

5.3.1 Loss or Alteration of Vegetation and Communities and Wetland Habitat

Direct effects from vegetation removal and soils stripping during construction include the loss of vegetative cover, changes to vegetation communities and/or structure in the Project area, and habitat availability.

Vegetation may also be lost indirectly though contamination caused by vehicles and/or equipment, resulting in alteration of soil chemistry and productivity.

5.3.2 Introduction and Spread of Non-native Weed Species

Indirect effects from vegetation removal include the introduction and spread of non-native and invasive species via vehicles, equipment, and construction personnel carrying seeds or propagules.

The introduction and establishment of weeds may affect vegetation community diversity and composition which may affect wildlife habitat.

5.4 Wetlands

The Project has the potential to affect wetland resources indirectly through:

- Alteration of wetland hydrology, and
- Alteration of wetland water quality.

These effects are anticipated to be reduced with the application of mitigation measures and BMPs (Section 6).

5.4.1 Alteration of Wetland Hydrology

Construction and operation of the Project has the potential to affect wetland hydrological function including altering hydrologic flow by diversion or impoundment through modification of surrounding landscapes and natural

drainage. This may result in a wetland becoming drier and may affect the hydrological characteristics of any receiving waterbody downstream. Should water within a wetland become impounded due to the construction of the Project, the wetland may become more inundated, potentially altering the wetland's permanency. Alterations to a wetland's permanency may result in a change to the wetland's function.

5.4.2 Alteration of Wetland Water Quality

Construction near a wetland can result in an increase in the level of sediment suspended within the wetland. This increase in suspended sediment can result in increased turbidity levels within the water column which may affect the growth and composition of wetland vegetation and wildlife species using the wetland.

There is the potential for increased wind and water erosion of soil stockpiled during construction if soils are left unconsolidated. Construction activities near or within a wetland have the potential to increase sediment entering the wetland ecosystem, resulting in increased turbidity of the water column and potentially affecting wetland vegetation and wildlife species.

Accidental spills during construction can infiltrate the soil in or near a wetland which can have a negative effect on water quality. The size of the spill and substance spilled will determine the extent of the effect and remedial measures required to clean up the spill.

6 Mitigation Measures and Best Management Practices

Mitigation measures have been developed in line with BMPs to reduce potential Project effects to environmental resources. Any variances from these mitigation measures and BMPs will be included in subsequent filings of the updated REO C&R Plan.

6.1 Land Use

With the implementation of the mitigation measures provided below, the effects to land use are anticipated to be reduced (Table 6-1).

Table 6-1 Land Use Mitigation Measures

Potential Effect	Measure
Loss or alteration of tame pasture land use	Limit the removal of tame pasture vegetation and the stripping of topsoil to the extent practical. Prohibit vegetation removal and stripping of topsoil in areas where solar panels are installed, except where grading is required.
	Clearly identify all work areas prior to commencing vegetation removal and topsoil salvaging.
	Store salvaged soils at a designated location within the Project area.
	Restore the Project area to equivalent land use capability following decommissioning and reclamation. Progressively reclaim areas that will not be re-disturbed over the Project lifecycle.
	Seeding will follow as close as feasible to final clean-up and topsoil replacement pending seasonal or weather conditions.

6.2 Soils

With the implementation of the mitigation measures provided below, the effects to soils are anticipated to be reduced (Table 6-2).

Table 6-2 Soils Mitigation Measures

Potential Effect	Measure
Soil Erosion	Stabilize salvaged soil piles with seeding, tackifiers, coconut matting, hydromulch, or other means, as determined by the Environmental Inspector(s) or designate(s).
	If stockpiled for longer than 6 months, seed soil stockpiles with annual or short-lived perennial species to provide quick establishment of vegetation.
	Install erosion control structures (e.g., silt fencing), where required, to reduce potential erosion and loss of exposed or stockpiled soils. Biodegradable materials shall be utilized for installation of permanent sedimentation and erosion control measures, unless otherwise specified.
	Inspect and maintain erosion control structures regularly and following adverse weather events.
	Replace stockpiled soils in a timely manner, where possible, to reduce the amount of time soil is stockpiled (e.g., during collector system installation, areas of interim and progressive reclamation).
Soil compaction	Restrict the movement of vehicles and construction equipment to designated access roads and trails to reduce compaction.
	The Environmental Inspector(s) or designate(s) will determine the locations where subsoil compaction is an issue. Prior to topsoil replacement, rip compacted subsoils on the construction footprint with a multi-shank ripper or breaking disc to a depth of 30 cm

	or the depth of compaction, whichever is deeper. If soils are moist, postpone ripping of subsoils until soils dry to ensure that the soils fracture when ripped.
	In areas where the topsoil is in place, use special equipment such as a paratiller to relieve compaction with reduced potential for admixing at the discretion of the Environmental Inspector(s) or designate(s) in consultation with Construction Manager.
Soil rutting	Suspend construction activities during adverse weather conditions to prevent excessive compaction and rutting due to wet soils.
Soil admixing	Separate topsoil and subsoil stockpiles and maintain proper signage for the life of the Project. Where soil will be stockpiled for greater than 6 months, topsoil and subsoil must be stored at a minimum of 3 m apart.
	Install and maintain proper signage on topsoil and subsoil stockpiles.
	Strip to the depth identified in PDSA.
Contamination	Take precautions to prevent the release of fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals on the ground or into any waterbody.
	Monitor and maintain the Project area, collect any debris or garbage and properly store it in waste disposal bins onsite.
	Clean and maintain on-site vehicles and equipment to ensure they are clean and free of leaks.
	Make spill response materials available for on-site use, should a leak or accidental spill occur during construction.
	Use an impervious tarp when servicing equipment with the potential for accidental spills.
	Recover and dispose of contaminated materials at an appropriate facility.

6.3 Vegetation

With the implementation of the mitigation measures provided below, the effects to vegetation are anticipated to be reduced. Mitigation measures will be implemented to reduce the spread of weeds and invasive species to the extent practical (Table 6-3).

Table 6-3 Vegetation Mitigation Measures

Potential Effect	Measure
Loss or alteration of vegetation and communities and wetland habitat	Limit removal of vegetation, to the extent practical, to construct the Project components and associated infrastructure.
	Use existing access within the Project area, to the extent practical, to reduce areas of new disturbance.
	Limit the development of infrastructure within the Project area, to the extent practical, during Project construction and operation.
	Clearly identify all work areas prior to commencing vegetation removal.
	If rare plants or rare ecological communities are identified during field assessments, consult AEP to determine appropriate setbacks and mitigation measures prior to construction. Clearly mark the location of rare plants or rare ecological communities prior to construction.
	If a potentially rare plant or rare ecological community is identified during construction, immediately suspend activities within the immediate vicinity. Consult AEP to determine appropriate setbacks and mitigation measures, prior to continuing activities. Clearly mark the location of rare plants or rare ecological communities prior to continuing activities.
	Progressively reclaim areas no longer required for active operations (e.g., the portion of the laydown area not required for parking during operations) in a timely manner.

	Take precautions to prevent the release of fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals on the ground or into any waterbody.
	Clean and maintain on-site vehicles and equipment to ensure they are clean and free of leaks.
	Make spill response materials available for on-site use, should a leak or accidental spill occur during construction.
	Use an impervious tarp when servicing equipment with the potential for accidental spills.
	Recover and dispose of contaminated materials at an appropriate facility.
Introduction and spread of non-native and weed species	Ensure vehicles and equipment arrive onsite in a clean condition to reduce the potential spread of weeds to the Project area. Do not permit vehicles and equipment that arrive in a dirty condition to enter the Project area until they have been cleaned at a suitable location.
	Monitor weeds and invasive species growth during construction. Manage weeds and invasive species (e.g., spraying, picking) throughout construction, as deemed necessary. Only permit use of chemical application in accordance with the Pesticide Regulation and Environmental Code of Practice for Pesticides.
	Obtain and retain Certificates of Seed Analysis for all seed mixes to prevent growth of weeds and undesirable plant species.

6.4 Wetlands

With the implementation of the mitigation measures provided below, the effects to wetlands are anticipated to be reduced (Table 6-4).

Table 6-4 Wetlands Mitigation Measures

Potential Effect	Measure
Alteration of wetland hydrology	Prohibit vegetation removal within wetlands and the surrounding riparian habitat. Apply a setback of 15 m to wetlands.
	Direct grading away from wetlands. Prohibit placing of grading materials within the boundaries or setbacks of a wetland.
	Stockpile soils at a distance of 100 m or greater from all waterbodies.
	Where required, recontour the Project area to preconstruction grades and drainage channels.
Alteration of wetland water quality	Direct grading away from wetlands. Prohibit placing of grading materials within the boundaries or setbacks of a wetland.
	Stockpile soils at a distance of 100 m or greater from all waterbodies.
	Install erosion and sediment control structures (e.g., silt fencing) between construction activities and wetland habitat. Biodegradable materials shall be utilized for installation of permanent sedimentation and erosion control measures, unless otherwise specified.
	Ensure vehicles and equipment arrive onsite in a clean, leak-free condition to reduce potential contamination sources to wetlands.
	Make spill response materials available for on-site use, should a leak or accidental spill occur during construction.
	Conduct fueling and servicing of equipment and vehicles at least 100 m back from all waterbodies, where feasible. If refueling is required within 100 m of a water body, visually inspect all containers, hoses, and nozzles for leaks, equip all nozzles with emergency shut-off mechanisms, and station personnel at both ends of the hose.
	Where liquid storage containers placed within 100 m of a waterbody, install secondary containment that can hold at least 110% of the container's contents.
	Prohibit washing of vehicles and equipment within 100 m of wetland boundaries.