

**APPENDIX E TFO'S LAND IMPACT ASSESSMENT UNDER RULE
007, s.6.1. NID7(9)**



Rycroft Transmission Reinforcement (RTR)
AESO Project No. 1784

ENVIRONMENTAL & LAND USE EFFECTS
A DESKTOP EVALUATION FOR AUC RULE 007
(NID7(9) Report)

Prepared for the
Alberta Electric System Operator
in Support of the
Needs Identification Document

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NID7(9) Report Information Requirements Per AUC Rule 007

NID7(9) Report Information Requirements (Short Description)	
	To analyze and compare specified alternatives for “environmental and land use effects by way of a desktop evaluation within a development area defined by the ISO to identify areas where the development of transmission facilities may be prohibited, and to evaluate the effects of the options considered.” Including:
a	Land assessment: public and private, federal, First Nations’ reserve land, and transportation utility corridor considerations
b	Agricultural and other land use features including native grassland
c	Environmental features such as: (i) wildlife sensitivity areas that may be assessed from AEP wildlife sensitivity maps; (ii) provincially-protected areas such as provincial parks, wilderness areas, ecological reserves, wildland parks, Willmore Wilderness Park, provincial recreation areas, heritage rangelands and natural areas; (iii) provincially-designated environmentally-significant areas where maps are available from AEP; (iv) federally-protected areas such as national parks, wilderness areas and areas subject to special orders such as the Emergency Order for the Protection of Greater Sage-Grouse
d	Applicable regional land use plans adopted under the <i>Alberta Land Stewardship Act</i> and whether the proposed development meets the requirements of the plans

ENVIRONMENTAL & LAND USE EFFECTS

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1.0 INTRODUCTION AND OVERVIEW

1.1 RYCROFT TRANSMISSION REINFORCEMENT PROJECT

On December 19, 2016, the Alberta Electric System Operator (AESO) directed ATCO Electric Ltd. (ATCO) to prepare a NID7(9) Report that meets the requirements of the Alberta Utilities Commission (AUC) *Rule 007*, Section 6.1, NID7(9) for each of the specified alternatives for the Rycroft Transmission Reinforcement (RTR) project (AESO Project No. 1784). On May 16, 2017, the AESO issued a scope addendum, updating the alternatives for consideration. This report is to be used by the AESO in support of a Needs Identification Document (NID) for the forthcoming RTR project.

The AESO has directed ATCO to prepare this report in accordance with Section 39 of the *Electric Utilities Act*.

1.2 REQUIREMENTS OF AUC RULE 007 NID7(9)

Section 6.1, NID 7(9) of AUC *Rule 007* outlines the requirement for a review of environmental and land use effects of a project through a desktop evaluation to identify areas where the development of transmission facilities may be prohibited, and to assess the effects that the options considered may have in relation to the stated environmental and land use elements. These elements include:

- (a) land assessment: public and private, federal, First Nations' reserve land, and transportation utility corridor considerations;
- (b) agricultural and other land use features including native grassland;
- (c) environmental features such as:
 - (i) wildlife sensitivity areas that may be assessed from Alberta Environment and Parks (AEP) wildlife sensitivity maps;
 - (ii) provincially-protected areas such as provincial parks, wilderness areas, ecological reserves, wildland parks, Willmore Wilderness Park, provincial recreation areas, heritage rangelands and natural areas;
 - (iii) provincially-designated environmentally-significant areas where maps are available from AEP;
 - (iv) federally-protected areas such as national parks, wilderness areas and areas subject to special orders such as the Emergency Order for the Protection of Greater Sage-Grouse;
- (d) applicable regional land use plans adopted under the *Alberta Land Stewardship Act* and whether the proposed development meets the requirements of the plans.

The alternatives presented by the AESO in the RTR NID Specification (Version 1, December 14, 2016) and updated in the scope addendum (May 16, 2017) are to be evaluated with consideration to potential impacts on the above listed elements, within respective areas of development (study areas). The report must also identify where development of facilities would be prohibited.

The effects of presented alternatives on environmental and land use elements are evaluated at a coarse scale, using readily available datasets, and are not comparable in detail until facility routing and siting, as well as design, has been undertaken for the Facility Application preparation phase. This report focuses on those aspects and considerations that can be described at a study area level.

1.3 EVALUATION METHODOLOGY

The alternatives considered in this report are limited to the components of the RTR, all of which are within ATCO Electric's service territory. The key datasets used in the evaluation of alternatives is listed below.

Spatial Datasets:

- Geoadmin Layers – Alberta Data Partnerships 2017
- Pipelines & Wells Data – IHS 2017
- Historic Resource Value Listing – Government of Alberta 2015
- Digital Integrated Dispositions System – Government of Alberta 2017
- Hydro Polygon – Alberta Data Partnerships 2017
- Canadian Wetland Classification System Merged Wetland – Alberta Environment & Parks 2015
- Fish & Wildlife Management Information System – Alberta Environment & Parks 2017
- Environmentally Significant Areas – Alberta Environment & Parks 2014
- VALTUS ortho imagery mosaic (2012-2013)
- Residences – ATCO (plotted from VALTUS imagery 2012-2013)

The desktop evaluation of existing datasets does not preclude the need for detailed assessment during Facility Application preparation. Consultation with the regulatory bodies and agencies overseeing the management of the considered features should be undertaken during the detailed routing and siting phase of the Facility Application preparation phase.

1.3.1 Limitations of Assessment

The assessments and conclusions in this report with respect to the potential impacts of the proposed developments within the project study areas are subject to availability of various data sets. The study areas assessed were defined based on scope assumptions outlined in the AESO's specification. Detailed routing and siting activities within the study areas have not been completed. As part of the Facility Application process, the Transmission Facility Owner (TFO) should undertake a comprehensive assessment as defined in section 7.1.1 of AUC *Rule 007* for the proposed development. Once preliminary routing and siting activities have been undertaken and project-specific impacts are defined, options for mitigation and avoidance can be explored.

2.0 DESCRIPTION OF ALTERNATIVES

2.1 REGIONAL CONTEXT

The RTR Project Reference Area [Dwg. No. RS-Rycroft-LIA-01] is partially located within the County of Grande Prairie No.1, Birch Hills County, Municipal District of Spirit River No. 133, and Saddle Hills County. The Project Reference Area is partially located within three Natural Regions/Subregions of Alberta; the east portion is located mainly within the Peace River Parkland Subregion of the Parkland Natural Region, the central and west portion is located within the Lower Foothills Subregion of the Foothills Natural Region, and the north is located mainly within the Dry Mixedwood Subregion of the Boreal Forest Natural Region.

The Peace River Parkland Subregion of the Parkland Natural Region is characterized by broad, gently rolling plains containing solonetzic and luvisolic soils, and deeply-incised, steep-sided river valleys. The Parkland Natural Region is the most densely populated region in Alberta, with farming and municipal development causing extensive alteration to natural vegetation.

The Lower Foothills Subregion of the Foothills Natural Region is characterized by rolling and undulating till-covered plateaus containing orthic gray luvisolic soils, located along the western edge of the interior plains. The Lower Foothills Subregion contains some of the most productive timber areas in Alberta, as well as intensive oil and gas exploration and recreational use.

The Dry Mixedwood Subregion of the Boreal Forest Natural Region is characterized by low relief landforms and undulating terrain consisting typically of Gray Luvisolic soils.

The Boreal Forest Natural Region is the largest region in Alberta and is sparsely populated with land use relying mainly on resource extraction (forestry and mining)¹.

The applicable regional land use plan for the Project Reference Area is the Upper Peace Regional Plan (UPRP), which has not yet been started².

2.2 RYCROFT TRANSMISSION REINFORCEMENT: THE ALTERNATIVES

There were three potential development alternatives outlined in the *Rycroft Transmission Reinforcement NID Specification* as presented by the AESO [Options Single Line Diagram, Dwg. No. RS-Rycroft-LIA-02]:

2.2.1 Option 1: Reactive Power Support at Rycroft and Ksituan River Substations

Option 1 consists of four alternative configurations to add reactive power support to Rycroft 730S substation and Ksituan River 754S substation. Modifications to Rycroft substation associated with this option are expected to require more space than is currently available within the existing fenced area, and will require site and property expansion, or obtaining a new alternative site. Although the current configuration at Rycroft substation meets permissible sound level expectations as per AUC *Rule 012*, noise impacts resulting from the additional proposed equipment may exceed the permissible sound level. This increased sound level could be mitigated through the installation of an appropriate sound attenuation wall, or through relocation of the proposed substation components to a new location further away from local receptors.

Additional reactive power support and associated equipment modifications are also required at Ksituan River substation, including expansion of the fenced area; however, no additional land or change to the property boundary is anticipated. These modifications are not anticipated to affect overall noise levels; nor will they significantly alter the visual impact of the Ksituan River substation site.

For the purposes of this report, Option 1 consists of two alternatives to address the need for additional land at Rycroft substation: expansion of the existing site with added noise attenuation (Option 1A), or relocation of the proposed substation components to a new site further away from local receptors (Option 1B). Although neither alternative requires new land at Ksituan River, both alternatives require acquisition of new land for Rycroft.

¹ 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.

² Alberta Environment and Parks, Land-Use Framework, *Regional Plans*, website <https://landuse.alberta.ca/RegionalPlans/UpperPeaceRegion/Pages/default.aspx>

2.2.2 Option 2: Rycroft to Clairmont Lake Study Area

Option 2 consists of a new 144-kV single circuit transmission line connecting Rycroft substation to Clairmont Lake 811S substation. The typical transmission line structure is assumed to be single-pole davit arm for the 144-kV single circuit transmission line. Both Rycroft and Clairmont Lake substations will also require the addition of equipment to reliably terminate the new 144-kV circuit (e.g.: circuit breakers) and will require expansion of the fenced area at Rycroft substation to accommodate the additional equipment. No change to the fenced area or property boundary of Clairmont Lake substation is anticipated.

Option 2 also consists of adding reactive power support and associated equipment modifications to Ksituan River and Eureka River 861S substations. No change to the fenced area or property boundary of Eureka River substation is anticipated. Modifications to Ksituan River substation will necessitate expansion of the fenced area; however, no additional land or change to the property boundary is anticipated. Equipment modifications at both substations are not anticipated to affect overall noise levels, nor will they significantly alter the visual impact of each site.

All substation modifications contemplated under Option 2 do not require the acquisition of new land. For the purposes of this report, only the new 144-kV transmission line between Rycroft substation and Clairmont Lake substation will be fully described in the following sections as part of the potential land impact of Option 2.

2.2.3 Option 3: Mowat to Saddle Hills Study Area

Option 3 consists of a new 144-kV single circuit transmission line connecting Saddle Hills 865S substation to Mowat 2033S substation. The typical transmission line structure is assumed to be single-pole davit arm for the 144-kV single circuit transmission line. Both Saddle Hills and Mowat substations will also require the addition of equipment to reliably terminate the new 144-kV circuit (e.g.: circuit breakers) and will require expansion of each fenced area to accommodate the additional equipment. No change to the overall property boundaries of either substation is anticipated.

As with Option 2, Option 3 also consists of adding reactive power support and associated equipment modifications to Ksituan River and Eureka River substations, including expansion of the fenced area at Ksituan River substation. No change to the fenced area of Eureka River substation is required.

Option 3 also consists of adding reactive power support and associated equipment modifications to the Rycroft substation, involving similar design implications as contemplated under Option 1 regarding expansion of Rycroft substation or relocation of equipment to a new site. For the purposes of this report, only the new 144-kV transmission line between Saddle Hills substation and Mowat substation will be fully described in the following sections as part of the potential land impact of Option 3.

2.3 METHODOLOGY

ATCO Electric's evaluation process began with the identification of study areas [Study Areas Mosaic Map, Dwg. RS-Rycroft-LIA-03] that met the technical requirements of the AESO's specification and accounted for large-scale geographic, environmental, and social constraints. A sufficient geographic area was selected to ensure that sensitive environmental features and land constraints were identified. Two study areas were selected to cover Options 2 and 3; the alternatives requiring acquisition of additional land for Rycroft substation proposed under Option 1 are located fully within the northern extent of the study area for Option 2.

Geographic Information System (GIS) analysis was completed for each of the study areas, utilizing currently available data sets, to examine the environmental and land use elements laid out in AUC *Rule 007*, Section 6.1, NID7(9). The resultant mapping and metrics were assessed to determine qualitative land impacts and to identify potential constraint areas for future transmission development within each study area.

2.4 COMMON REGIONAL FEATURES

Routing and siting for the alternative configurations are encompassed in an overall Project Reference Area and are represented by the combination of both study areas [Study Areas Mosaic Map, Dwg. RS-Rycroft-LIA-03]. As such, the alternative configurations consider several common features and constraints within this broad area.

Development near small residential centres (towns, hamlets, and subdivision communities) is considered a constraint to routing and siting. In addition to residential areas, there are several watercourses within the Project Reference Area flowing out of the Saddle Hills. The Saddle Hills extend across the Project Reference Area and contain largely forested uplands. The remainder of the Project Reference Area consists primarily of agricultural lands, which are undulating though far less so than the Saddle Hills region.

2.4.1 Land Assessment

The Project Reference Area contains extensive private land, with a large swath of Crown land bisecting it from west to east, containing the Saddle Hills.

There are no National Parks, Provincial Parks, Wildland Parks, Natural Areas, Wilderness Areas, Ecological Reserves, Indian Reserve lands or Métis settlements in the Project Reference Area [Provincial & Federal Protected Areas Mosaic Map, Dwg. RS-Rycroft-LIA-07].

There are no regionally identified Transportation Utility Corridors. Local highways exist within the study areas, but often present limited opportunities for close collocation, due to imposed setbacks to transmission line development and proximity of residential development. However, these areas also represent some of the best opportunities for

routing transmission infrastructure to minimize impacts to agricultural activities. Routing along highway plans should be considered and discussed with the appropriate agencies.

There are areas of listed Historic Resource Value (HRV) in each of the study areas [Provincial & Federal Protected Areas Mosaic Map, Dwg. RS-Rycroft-LIA-07]. These were examined and assessed for each study area.

The numerical HRV ratings are defined as follows:

- HRV 1: designated under the Act as a Provincial Historic Resource
- HRV 2: designated under the Act as a Municipal or Registered Historic Resource
- HRV 3: contains a significant historic resource that will likely require avoidance
- HRV 4: contains a historic resource that may require avoidance
- HRV 5: high potential to contain a historic resource

2.4.2 Agriculture

Both study areas contain extensive private land, where land uses consist primarily of agricultural activities (cultivation and pasture). Crown agricultural dispositions, typically for grazing activities, are located sporadically throughout both study areas.

There are no listings under the provincial Grassland Vegetation Inventory (GVI) dataset for the northwest portion of the province, including the Project Reference Area.

2.4.3 Environmental Features

There are numerous watercourses and few waterbodies in the Project Reference Area with noted fish habitat³. As both study areas include fish-bearing watercourses, it should be considered that any water crossing may require mitigations suitable for the protection of fish habitat. Large waterbodies are excluded from the study areas, however there is potential to encounter small waterbodies and/or wetlands, and care should be taken to avoid or minimize routing and siting within these areas, to the extent reasonably practicable.

The Project Reference Area is intersected by four Special Access Zones, designated for wildlife refugia and consisting of relatively undeveloped areas of the Saddle Hills. These areas bisect both study areas for Options 2 and 3, but do not include the area near Rycroft substation (Option 1) [Wildlife Map, Dwg. RS-Rycroft-LIA-05].

There are no other features associated with federally or provincially-protected wilderness areas, ecological reserves, wildland parks, heritage rangelands or natural areas in the study areas, nor any areas subject to special order.

³ Fish and Wildlife Management Information System (FWMIS) accessed using the Fish and Wildlife Internet Mapping Tool (FWIMT), <http://aep.alberta.ca/fish-wildlife/fwmis/access-fwmis-data.aspx>

There is coverage of the provincial Environmentally Significant Areas (ESAs) sensitivity ranking throughout the Project Reference Area, with areas ranked as Environmentally Significant [Environmentally Significant Areas Map, Dwg. RS-Rycroft-LIA-04]. These were assessed for each study area.

2.4.4 Regional Land Use Plan Considerations

Although drafting of the Upper Peace Regional Plan (UPRP) has yet to be started, it is prudent to apply similar strategies as other planning jurisdictions for the routing and siting of transmission infrastructure. The existing North Saskatchewan Regional Plan (NSRP) and the Lower Athabasca Regional Plan (LARP) both include strategic development directions with directives toward integrated management and stewardship of Crown and private land, with the intention of minimizing impacts of newly built infrastructure. The focus for electrical transmission development in the NSRP and LARP is on the amalgamation of utilities and transportation infrastructure to reduce land fragmentation and environmental impact of development⁴. These considerations are applicable to each of the RTR alternatives in a broad sense, as they support the criteria used for routing and siting of transmission facilities.

In addition to the UPRP area, the study areas intersect several different municipalities including Saddle Hills County, County of Grande Prairie No. 1, Birch Hills County, and Municipal District of Spirit River No. 133. Consultation with each affected municipality, with respect to municipal development plans, area structure plans, etc., will be required for the RTR project.

2.5 OPTION 1 – EVALUATION OF REACTIVE POWER SUPPORT AT RYCROFT AND KSITUAN RIVER SUBSTATIONS

Under all three options, expansion of the fenced areas at Rycroft substation and Ksituan River substation is required. These modifications at Rycroft and Ksituan River substations are not limited to Option 1 but applicable to all three. Further expansion of Rycroft substation, including additional land or relocation of the proposed substation components to a new site, are required under all alternative configurations of Options 1 and 3. Therefore, since all three options involve expansion of the Rycroft and Ksituan River substations, a thorough comparative analysis of land impacts has only been completed for Options 2 and 3, where significant new transmission line routing is required. The two alternatives to address the need for additional land at Rycroft substation under Option 1 (Option 1A and 1B) will be discussed briefly in the remainder of this section.

⁴ Alberta Environment and Parks, Land-Use Framework, *Regional Plans*, website <https://landuse.alberta.ca/RegionalPlans/LowerAthabascaRegion/Pages/default.aspx>

2.5.1 Option 1A (Expansion of Existing Rycroft Substation)

Expansion of the existing Rycroft substation site is constrained by the village of Rycroft immediately to the north, where nearby residences would be exposed to increased noise levels produced by the proposed reactive power equipment. There is sufficient physical space to expand the substation and feasibly meet the technical scope of this alternative configuration; however, due to the proximity of the village across the road, obtaining the necessary land rights for expansion of the existing site could be problematic. The area where substation expansion could occur is privately owned, undeveloped agricultural land. There is a man-made dugout nearby, but no significant environmental features in the immediate vicinity.

2.5.2 Option 1B (Relocation of Proposed Rycroft Substation Components)

Selection of a new site for the proposed additional substation equipment is constrained by the village of Rycroft immediately to the north, and by the need to maintain connectivity to existing electrical infrastructure near the substation (e.g. transmission and distribution lines). The land in the vicinity to the south of the existing Rycroft substation (within 5 km) is relatively flat agricultural land, with sparse residential development; there are few constraints to substation siting in this area. This alternative configuration would require some new transmission line to connect to the grid, however the amount is expected to be insignificant (< 2 km) with proper siting close to existing transmission lines. Noise levels are not anticipated to be an impact, provided the new substation is sited further away from local receptors than the existing Rycroft substation.

The study area for both alternatives of Option 1 is located entirely within the northern extent of the Rycroft to Clairmont Lake Study Area (Option 2), as described in the section below. The area in the vicinity of the Rycroft substation (within 5 km) is privately owned agricultural land, primarily used for cultivation. There are no significant environmental features in the immediate vicinity, and few constraints to substation siting.

2.6 OPTION 2 – EVALUATION OF RYCROFT TO CLAIRMONT LAKE STUDY AREA

The Rycroft to Clairmont Lake Study Area encompasses an area of approximately 690 km² across portions of Saddle Hills County, County of Grande Prairie No. 1, Birch Hills County, and Municipal District of Spirit River No. 133 [Study Areas Mosaic Map, Dwg. RS-Rycroft-LIA-03]. The study area is approximately 12-13 km wide from an area northeast of the hamlet of Clairmont, where existing Clairmont Lake substation is located, up to the village of Rycroft where the Rycroft substation is located.

The assessment of this study area considers that an acceptable routing solution could follow existing electrical transmission infrastructure (e.g. 7L68) and/or existing roadways and other linear disturbance to the extent reasonably practicable, to reduce potential impacts to agricultural activities and to environmental features such as the Saddle Hills.

Routing into Rycroft substation is constrained by the village of Rycroft to the north and some existing rural residential development and transmission facilities in the area. Routing into Clairmont Lake substation is primarily constrained by other existing transmission facilities in the area. In both cases, there are viable options for aligning new transmission infrastructure into either substation.

2.6.1 Land Assessment

Throughout the study area, the predominant land use is agricultural, with scattered rural residential throughout. There is significant residential development within the town of Sexsmith, village of Rycroft, and the hamlet of Woking; however, these communities are located at or near the boundaries of the study area and are not anticipated to significantly limit routing opportunities. Established infrastructure associated with and development near Highway 2 will need to be considered in routing [Road & Residences Mosaic Map, Dwg. RS-Rycroft-LIA-09].

The study area contains oil and gas infrastructure, including wells and pipelines [Pipelines & Wells Map, Dwg. RS-Rycroft-LIA-08], with the highest concentration of both located in the northwest and southern portions of the study area.

There is a band of HRV areas located along the Saddle River with ratings of 4 and 5, as well as in isolated pockets in the south half of the study area, south of the Saddle Hills [Provincial & Federal Protected Areas Mosaic Map, Dwg. RS-Rycroft-LIA-07]. Routing can avoid some of these HRV occurrences; however, HRV rated areas within the Saddle River valley cannot be avoided. Appropriate permitting will need to be obtained for routing in this area, and potential features will need to be identified for avoidance or other acceptable mitigation.

2.6.2 Agriculture

The land base in the study area comprises approximately 83% private land. Majority of the private land base is cultivated cropland interspersed with pasture lands, making up approximately 46% and 18% of the study area, respectively. There are several PNTs in the study area, which are held to protect localized areas of grazing lands.

2.6.3 Environmental Features

The study area contains a relatively low proportion of wetlands and waterbodies scattered throughout the study area [Wetland & Waterbodies Map, Dwg. RS-Rycroft-LIA-06]. In cases where structures may be placed within wetlands, appropriate permitting will need to be obtained.

The study area shows a moderate amount of coverage for the provincial ESAs sensitivity ranking, with approximately 13% being classified as Environmentally Significant [Environmentally Significant Areas Map, Dwg. RS-Rycroft-LIA-04]. These classified

significant quarter sections are concentrated along the Saddle Hills in the middle of the study area, and around small waterbodies and wetland systems scattered throughout the study area. Areas of least environmental significance are located throughout the study area and correlate to where cultivated crop and/or industrial activity are prevalent.

The most significant environmental feature in the study area is the Saddle Hills, a band of hills which extend across the middle section of the study area. Associated with the Saddle Hills are several PNTs, ESAs, and three Special Access Zones designated for wildlife refugia. It is possible to avoid two of the Special Access Zones located along the east boundary of the study area; however, the Special Access Zone across the middle of the study area spans its entire width and is therefore unavoidable. The necessity for routing across this area creates a considerable constraint to this alternative. Appropriate consultation with AEP will be required to cross this area.

The study area is also bisected by the Saddle River valley, diagonally across the northern portion of the study area. This area is characterized by sloping valley topography and ravines down to the river.

The study area contains a few areas of Key Wildlife and Biodiversity Zone (KWBZ) and Trumpeter Swan waterbodies [Wildlife Map, Dwg. RS-Rycroft-LIA-05]; however, these areas are generally isolated to the outer edges of the study area boundary, and are not expected to present a significant constraint to routing.

2.7 OPTION 3 – EVALUATION OF MOWAT TO SADDLE HILLS STUDY AREA

The Mowat to Saddle Hills Study Area encompasses an area of approximately 460 km² across portions of Saddle Hills County, County of Grande Prairie No. 1, and Municipal District of Spirit River No. 133 [Study Areas Mosaic Map, Dwg. RS-Rycroft-LIA-03]. The study area is approximately 13 km wide located approximately 5 km west of the Rycroft to Clairmont Lake Study Area, extending from Mowat substation to the southern edge of the Saddle Hills.

The assessment of this study area considers that an acceptable routing solution would be to follow existing roadways and field edges to the extent reasonably practicable, to reduce potential impacts to agricultural activities and to environmental features such as the Saddle Hills.

Routing into Saddle Hills substation and Mowat substation is largely unconstrained, and there are viable options for aligning new transmission infrastructure into either substation.

2.7.1 Land Assessment

Private land in the study area comprises approximately 63% of the land base. The predominant land use in the northern portion of this study area is agricultural, with

sparse residential development also primarily located in the northern half of the study area. The southern portion of the study area is predominantly Crown land with most of the area south of Saddle River being part of the Saddle Hills.

The study area contains a significant amount of oil and gas infrastructure scattered throughout [Pipelines & Wells Map, Dwg. RS-Rycroft-LIA-08]. There are no towns, hamlets, or other agglomerated residential communities in the study area.

There is a band of HRV areas located along the Saddle River with ratings of 4 and 5, as well as in a few isolated pockets elsewhere in the study area [Provincial & Federal Protected Areas Mosaic Map, Dwg. RS-Rycroft-LIA-07]. Routing can avoid most of these HRV occurrences; however, HRV rated areas within the Saddle River valley cannot be avoided. Appropriate permitting will need to be obtained for routing in this area, and potential features will need to be identified for avoidance or other acceptable mitigation.

2.7.2 Agriculture

Agriculture is localized to the northern portion of the study area and is split between cultivated cropland and pasture lands, making up approximately 23% each of the study area (46% total). The Crown land located in the southern and northwestern portions of the study area comprises approximately 37% of the land base.

2.7.3 Environmental Features

The study area contains a relatively low proportion of wetlands and waterbodies scattered throughout the study area [Wetland & Waterbodies Map, Dwg. RS-Rycroft-LIA-06]. In cases where structures may be placed within wetlands, appropriate permitting will need to be obtained. The study area is also bisected by the Saddle River valley, crossing diagonally across the northern portion of the study area.

The study area shows a moderate amount of coverage for the provincial ESAs sensitivity ranking, with approximately 21% being classified as Environmentally Significant [Environmentally Significant Areas Map, Dwg. RS-Rycroft-LIA-04]. These classified significant quarter sections are concentrated primarily in the Saddle Hills regions of the study area, and in small pockets throughout the study area. Areas of least environmental significance are located throughout the study area and correlate to where cultivated crop and/or industrial activity are prevalent.

The most significant environmental feature in the study area is the Saddle Hills, which extend across the southern third of the study area, as well as in the northwest. Associated with the Saddle Hills are several PNTs, ESAs, and two Special Access Zones designated for wildlife refugia. It is possible to avoid the Special Access Zone in the south by routing along the west side of Highway 724; however, the Special Access Zone in the north portion of the study area spans its entire width and is therefore

unavoidable. The necessity for routing across this area creates a considerable constraint to this alternative. Appropriate consultation with AEP will be required to cross this area.

3.0 ASSESSMENT OF CONSTRAINTS

The options described in the NID specification all present constraints to the development of electrical facilities within the Project Reference Area. However, none of the constraints identified result in an overall preclusion of any one option. All options are viable.

Since all three options involve a similar degree of substation expansion and associated land impacts as contemplated under Option 1, with only a small amount of potential land expansion, the following tabular assessment of constraints has only been presented for Options 2 and 3, where significant new transmission line routing is required. The following tables outline the constraints and risks associated with Options 2 and 3.

TABLE 1: Option 2 - Constraints and Risks

Connection Option	Constraints	Risks
<p>Rycroft to Clairmont Lake</p> <ul style="list-style-type: none"> Single circuit 144-kV transmission line from Rycroft 730S substation to Clairmont Lake 811S substation 	Avoidance of densely populated rural residential areas in southern portion of study area.	Routing around residential communities may limit routing avoidance options, requiring the TFO to mitigate or offset direct impacts to intersected features.
	High proportion of cultivated crop land.	Potential for moderate impacts to agriculture, due to line & structure footprint.
	Low proportion of wetlands and waterbodies (shallow lakes).	Potential for impacts to wetlands and waterbodies.
	Trumpeter Swan habitat associated with designated waterbodies in the area, including a 500 m permanent development setback requirement.	Low risk. Routing around buffered areas not expected to significantly limit routing options and avoidance opportunities.
	Low proportion of Protective Notation's (PNTs), generally associated with grazing lands.	Low risk. Routing around PNT areas may limit routing options; consult with AEP to determine if avoidance is required.
	Unavoidable crossing of Saddle River valley.	May limit structure placement options at watercourse crossing, and due to sloping valley topography.
	Moderate proportion of Provincial Environmentally Significant Areas (ESA) associated with Saddle Hills area.	Moderate risk of intersecting significant areas.
	Unavoidable Historic Resource Value areas associated with Saddle River valley.	Low risk. Possible impact to Historic Resource Value features.
	Unavoidable Special Access Zone associated with Saddle Hills.	Unavoidable impact to wildlife refugia habitat.

TABLE 2: Option 3 - Constraints and Risks

Connection Option	Constraints	Risks
<p>Mowat to Saddle Hills Single circuit 144-kV transmission line from Mowat 2033S substation to Saddle Hills 865S substation</p>	Moderate proportion of cultivated crop land.	Potential for moderate impacts to agriculture, due to line & structure footprint.
	Low proportion of wetlands and waterbodies (shallow lakes).	Potential for impacts to wetlands and waterbodies.
	Low proportion of Protective Notation's (PNTs), generally associated with grazing lands.	Low risk. Routing around PNT areas may limit routing options; consult with AEP to determine if avoidance is required.
	Unavoidable crossing of Saddle River valley.	May limit structure placement options at watercourse crossing, and due to sloping valley topography.
	Highest proportion of Provincial Environmentally Significant Areas (ESA) associated with Saddle Hills area.	High risk of intersecting significant areas.
	Unavoidable Historic Resource Value areas associated with Saddle River valley.	Low risk. Possible impact to Historic Resource Value features.
	Unavoidable Special Access Zone associated with Saddle Hills.	Unavoidable impact to wildlife refugia habitat.

4.0 COMPARISON OF ALTERNATIVES

Options 2 and 3 share several common constraint features and risks at a study area level. Both are constrained in some way by rural residential development within the respective study areas; however, routing around these areas is feasible, with opportunities for avoidance. Option 3 has fewer residences and lower overall residential density than Option 2, particularly when considering the south half of Option 2 study area south of the Saddle Hills, where there is relatively high residential density and many quarter sections contain two or more residences. This is largely due to the presence of several subdivision communities scattered throughout the southern portion of Option 2 study area, whereas there are no subdivision communities within Option 3 study area. Residential density is low in the vicinity of Rycroft substation (within 5 km), with the exception of the village of Rycroft across the road to the north; residences are therefore not expected to be a significant constraint to expansion or relocation of Rycroft substation as per Option 1, aside from potential noise impacts which may require additional mitigation.

Both study areas cover mostly private land, with prominent agricultural land use, which implies that impacts to private land and agricultural use are chiefly attributable to line length. Option 2 study area has approximately three times more cultivated land and slightly more pasture land than Option 3, largely due to the overall difference in size of each study area. Regardless of final routing, it is expected that Option 2 will result in greater overall impact to agricultural land than Option 3, due to the added line length. Consideration will need to be given to structure placement and other mitigation measures to reduce impacts to agricultural use to the extent reasonably practicable. In any case, Option 1 is vastly favoured over Options 2 and 3 from an agricultural use perspective, due to the small overall footprint.

Majority of the Project Reference Area is private land, except for the bands of Crown land through the Saddle Hills areas. Routing is possible through these areas of Crown land, however there will be impacts to regional environmental features as these areas contain the highest density of environmental features (ESAs, Special Access Zones, trees, and wetland areas). The comparison of private and Crown land, in this case, does not favour either Option 2 or 3. There is no Crown land in the vicinity of Rycroft substation, therefore additional land required for Option 1 will need to be obtained through purchase or lease agreement as appropriate.

Oil and gas infrastructure is scattered throughout both study areas. Given the deep sub-surface nature of oil and gas development in the region, these developments are not susceptible to localized sterilization. Transmission facilities can occupy lands adjacent to these developments. Therefore, it is unlikely that any routing options will have a great impact on oil and gas infrastructure. Option 3 has a greater density of pipelines and wellsites than Option 2, and consideration will need to be given to ensure routing

maintains appropriate setback distances from all oil and gas infrastructure. Oil and gas activity is relatively low in the vicinity of Rycroft substation; these features are not expected to be a significant constraint to Option 1.

The alternatives presented in the NID specification are all capable of meeting the requirements of the RTR. The study areas evaluated include some degree of existing linear disturbance that will allow for detailed routing and siting with a focus on integration and minimizing disturbance from developments. Option 2 contains more existing linear disturbance than Option 3, as it contains a major highway (Highway 2) and existing transmission line (7L68) running south from Rycroft substation for the length of the study area. Although this would serve as a reasonable routing opportunity through the Saddle Hills area, beyond that it may not be as advantageous due to the concentration of residential and other development along the Highway 2 corridor. Option 3 has a secondary highway (Highway 724) in the southern portion of the study area, providing a reasonable linear disturbance to follow through the Saddle Hills area.

All options require modification of various substations, and some degree of expansion or relocation of facilities at Rycroft substation. Option 2 is the only option that would require only a minor expansion of Rycroft substation without the addition of noise-producing equipment, and therefore does not necessitate consideration of relocation to a new site. Options 2 and 3 are the only options that require a significant amount of additional new transmission line.

Both study areas contain ESAs and Special Access Zones associated with the Saddle Hills, and both study areas are bisected by a common river valley. Despite Option 2 having more wetland and water area, Option 3 has a greater area of ESA quarter sections, representing a higher percentage of its overall study area than Option 2. A high risk of intersecting ESA quarter sections does not necessarily mean there will be a high risk of impact, as any potential impact to wet areas or other environmental features can either be avoided through proper routing and siting, or reduced through other mitigation measures. Regardless, both study areas have a relatively low amount of waterbody or wetland area when compared to other parts of the province. Within the Project Reference Area, most of the water tends to be associated with streams and watercourses flowing out of the Saddle Hills.

Option 3 contains more treed area, and the likelihood that a significant proportion of routing through this area will require tree removal. However, due to the greater length of routing required through Option 2, it is possible that routing through that study area may result in greater overall tree removal than Option 3. Regardless, in the absence of final routing, it cannot be determined at this time which option would be favourable over the other with respect to tree removal. The area in the vicinity of Rycroft substation (within 5 km) is largely devoid of trees, and it is expected that appropriate site selection would result in minimal or no tree removal required for Rycroft substation under Option 1.

Both study areas have relatively low amounts of HRV lands, and both are traversed by the Saddle River valley which contains an unavoidable swath of HRV lands.

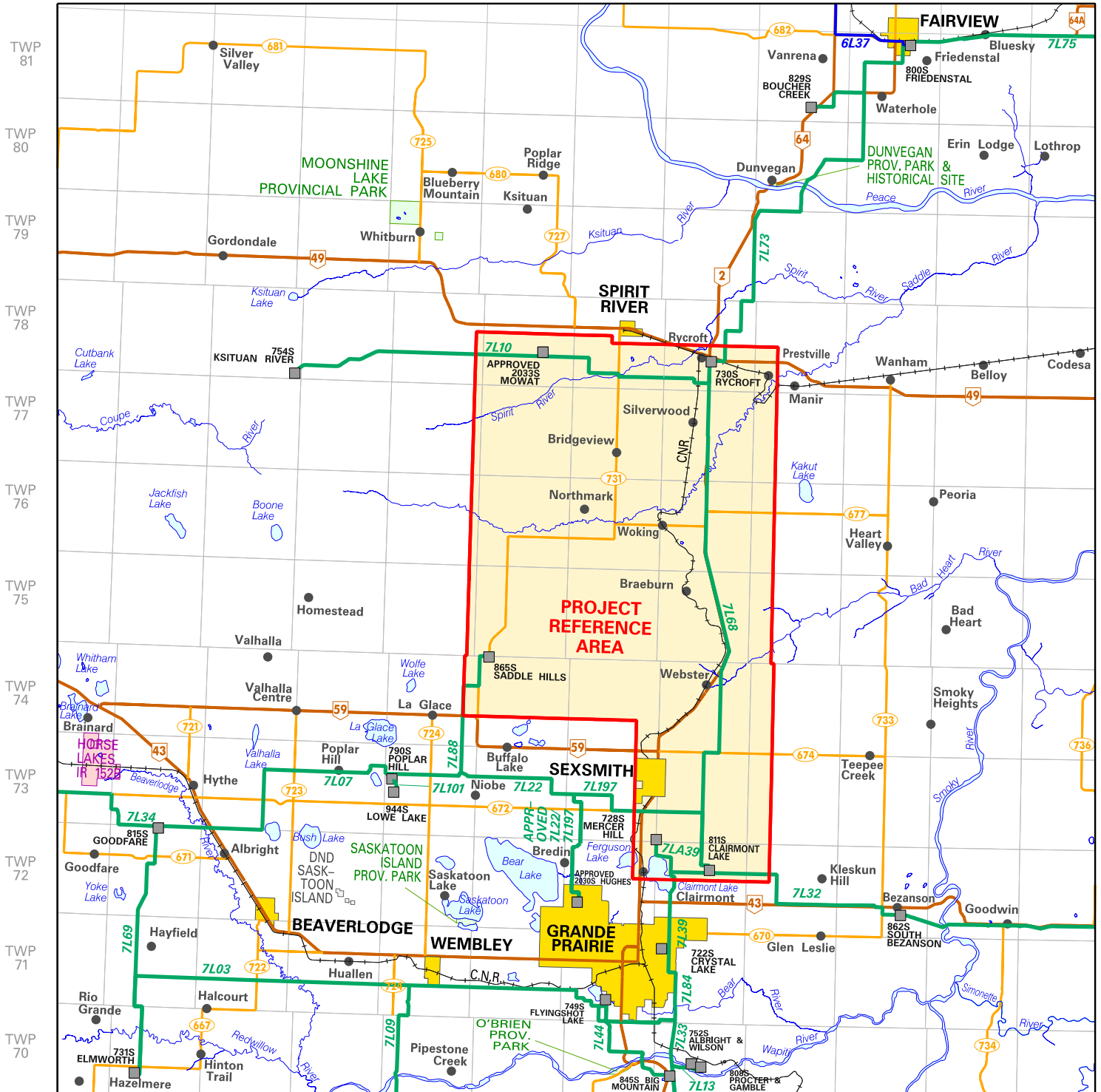
5.0 SUMMARY

All three options are found to be feasible from a land impacts perspective; however, based on the criteria for evaluation laid out in AUC *Rule 007 NID7(9)*, Option 1 (1A and 1B, inclusive) is found to be significantly more favourable than Option 2 or Option 3. This is primarily because Options 2 and 3 require approximately 40 and 60 km of additional transmission line, whereas Option 1A does not, and Option 1B would potentially only require a very short (< 2 km) new transmission line to maintain connectivity of a relocated Rycroft substation to the grid. Regardless of which alternative configuration of Option 1 is selected, both Options 2 and 3 will result in significantly greater land impacts. Option 2 will result in greater impacts than Option 3, due to the significant increase in line length, greater overall project footprint, and higher residential density.

Option 1 has the least potential for environmental and land use impact for the following reasons:

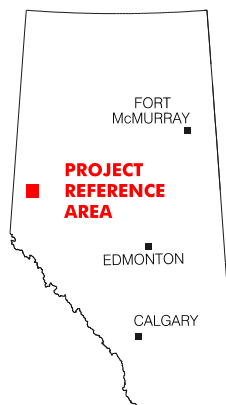
- Least required length of new transmission line and new substation area, therefore lowest potential for permanent footprint;
- Least density of rural residential development and agglomerated acreage communities;
- Least potential for impact to wetlands, waterbodies and wildlife habitat;
- Greatest avoidance of Environmentally Significant Areas;
- Least potential for impact to Protective Notations;
- Least potential for impact to Historic Resource Values; and
- Avoidance of the Saddle River valley and Saddle Hills areas.

While Option 1B reduces the incremental site expansion impact on nearby residences located in the village of Rycroft, Option 1A is marginally favourable to Option 1B from an environmental and land use perspective, due to the smaller incremental footprint of the existing site expansion compared to an entirely new site required to be developed for Option 1B.



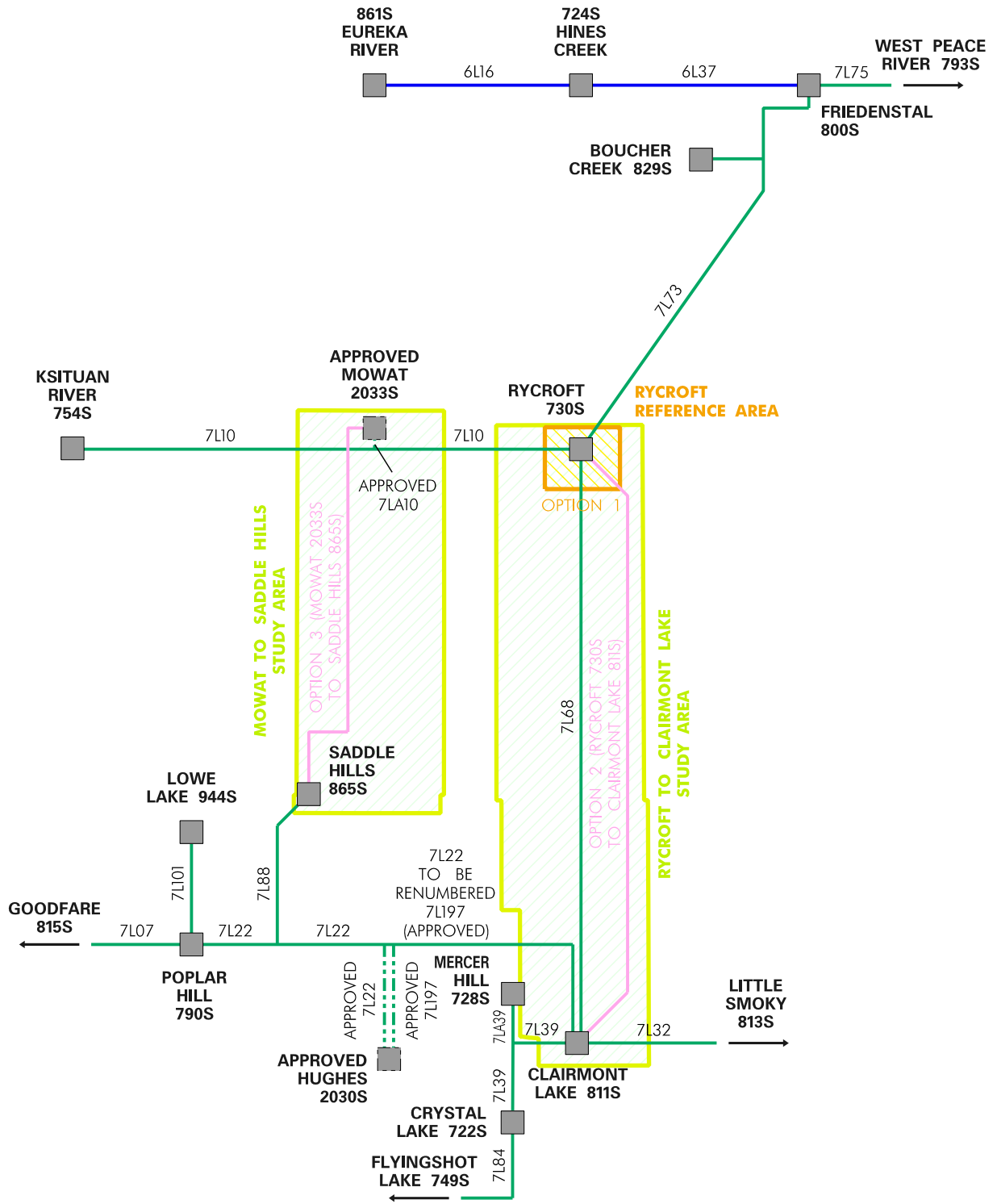
LEGEND

- Project Reference Area
- Existing Substation
- Existing 144 kV Transmission Line
- Existing 72 kV Transmission Line









Rycroft Transmission Reinforcement
Land Impact Assessment

REGIONAL MAP



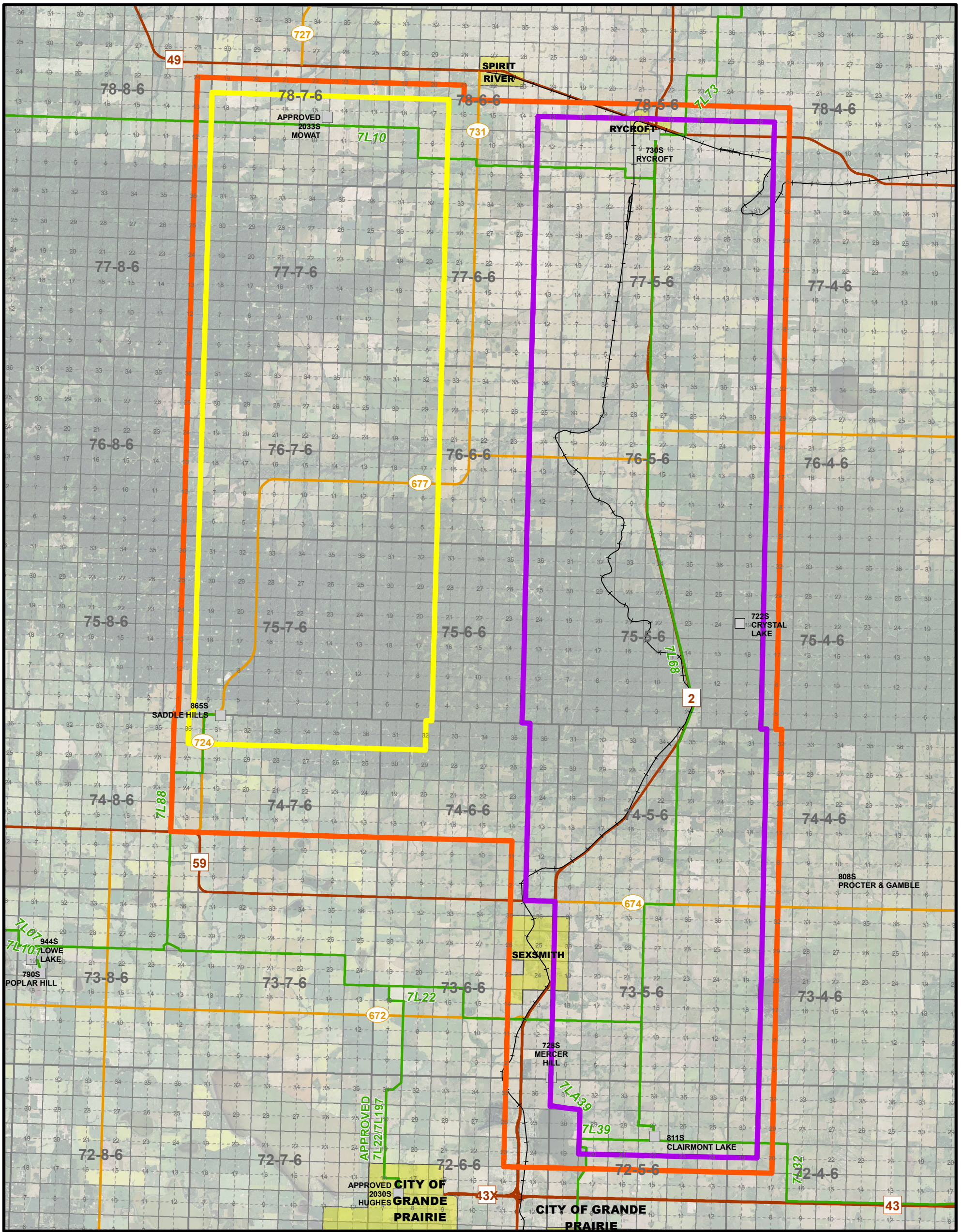
LEGEND

-  Route Study Area
-  Substation Reference Area
-  Future 144 kV Circuit
-  Existing 144 kV Circuit
-  Existing 72 kV Circuit
-  Existing 144 kV Substation









Rycroft Transmission Reinforcement
Land Impact Assessment



OPTIONS
SINGLE LINE DIAGRAM



LEGEND

-  Project Reference Area
-  Existing 144 kV Transmission Line
-  Existing Substation
-  Railway
-  Primary Highway
-  Secondary Highway

Study Areas

-  Rycroft to Clairmont Lake
-  Mowat to Saddle Hills

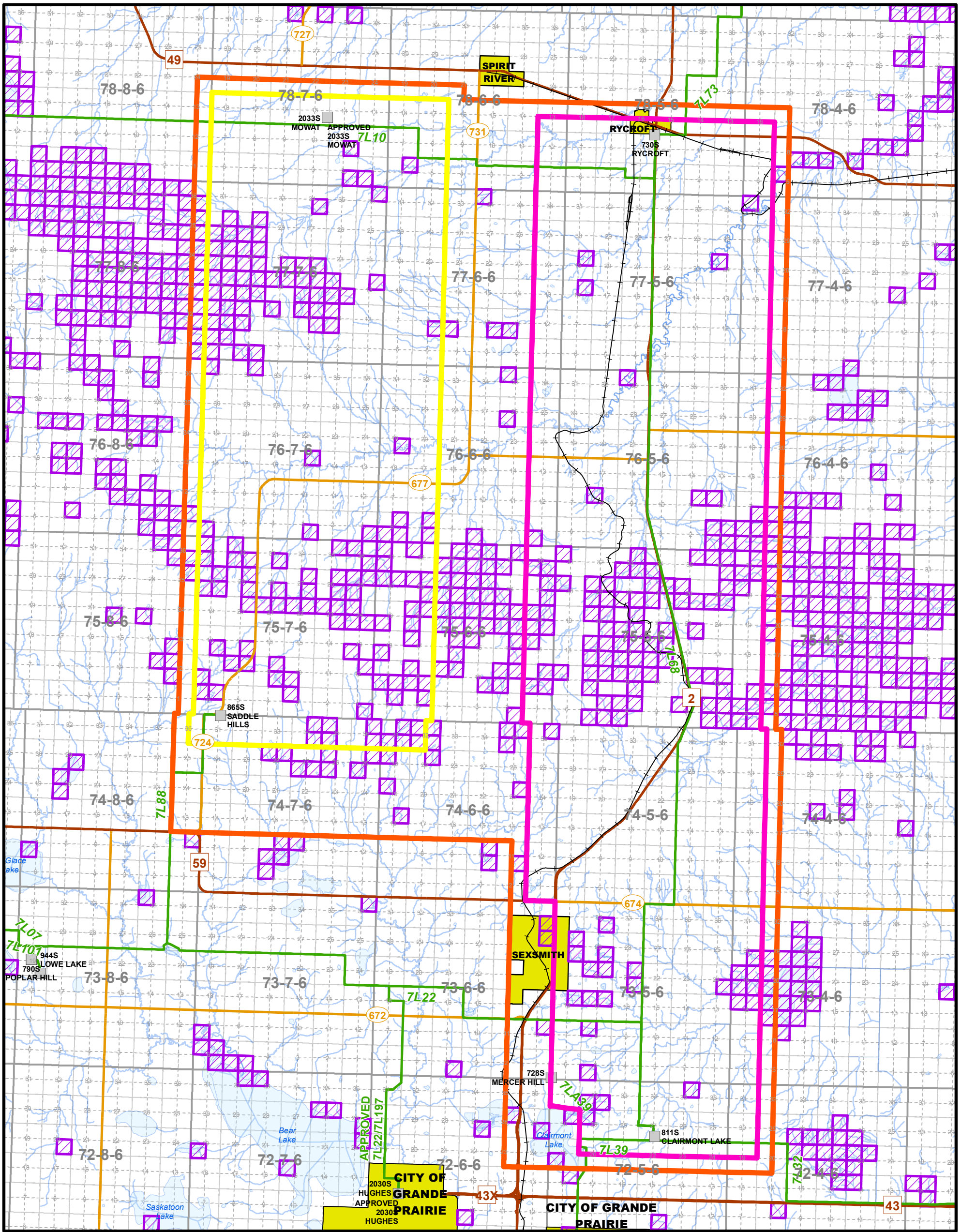


NOTES:
- Noted scale is for the base features only. All other features are not to scale



**Rycroft Transmission Reinforcement
Land Impact Assessment**

**STUDY AREAS
MOSAIC MAP**



LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway
- Environmentally Significant Areas (>0.189)

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills



Rycroft Transmission Reinforcement
Land Impact Assessment



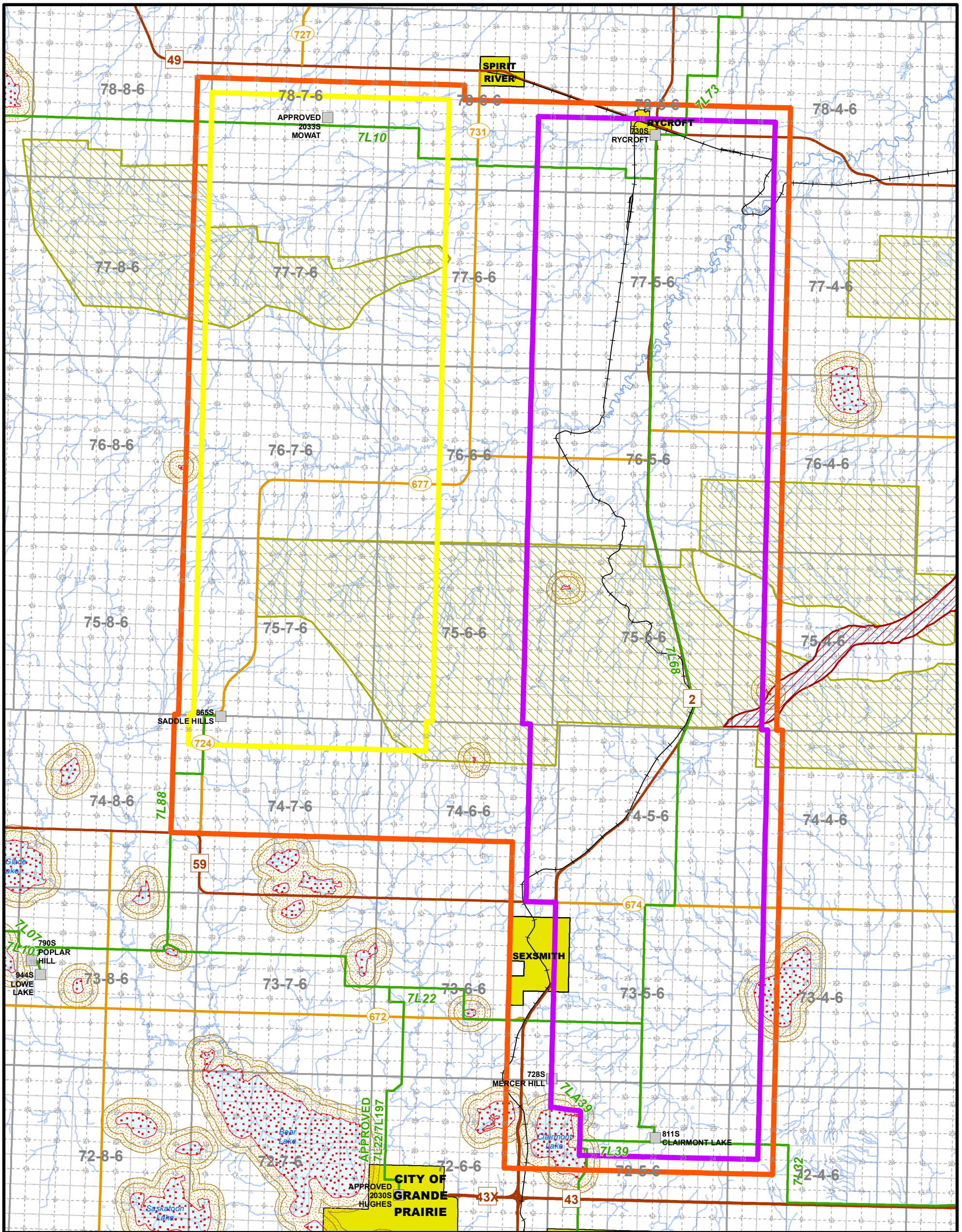
NOTES:
- Noted scale is for the base features only. All other features are not to scale

ENVIRONMENTALLY SIGNIFICANT AREAS MAP

CREDITS
Project Reference Area: ATCO 2017, Electrical System: ATCO 2017, Base Data: Alberta Data Partnerships 2017, ESA: GOA 2014, Study Areas: ATCO March 2017

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LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills

Wildlife

- Trumpeter Swan Buffers (500m & 800m)
- Trumpeter Swan Waterbodies / Courses
- Key Wildlife and Biodiversity Zone
- Provincial Special Access Zone

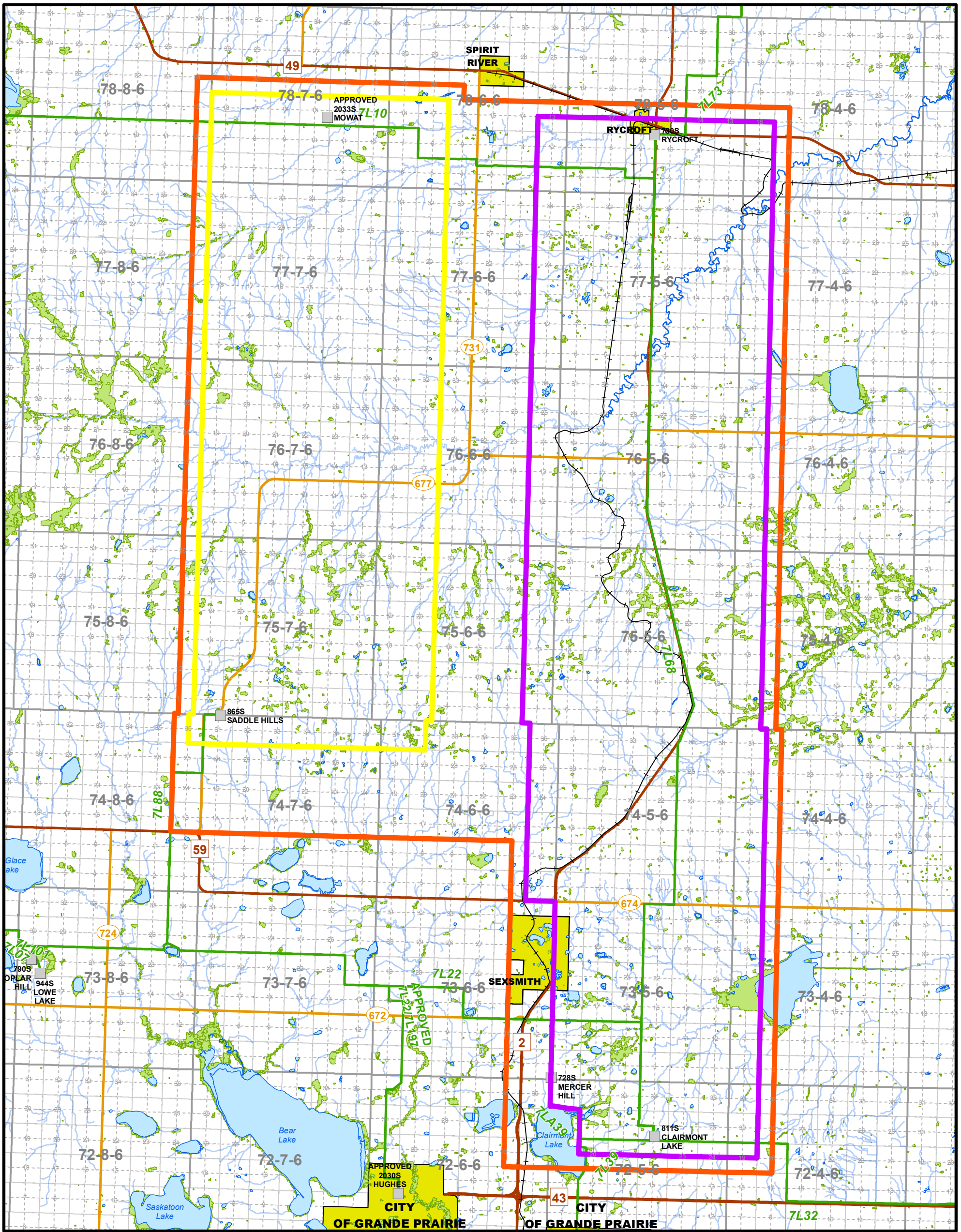


**Rycroft Transmission Reinforcement
Land Impact Assessment**



NOTES:
- Noted scale is for the base features only. All other features are not to scale

**WILDLIFE
MAP**



LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills

Wetlands & Waterbodies

- Wetlands
- Waterbodies



Rycroft Transmission Reinforcement
Land Impact Assessment



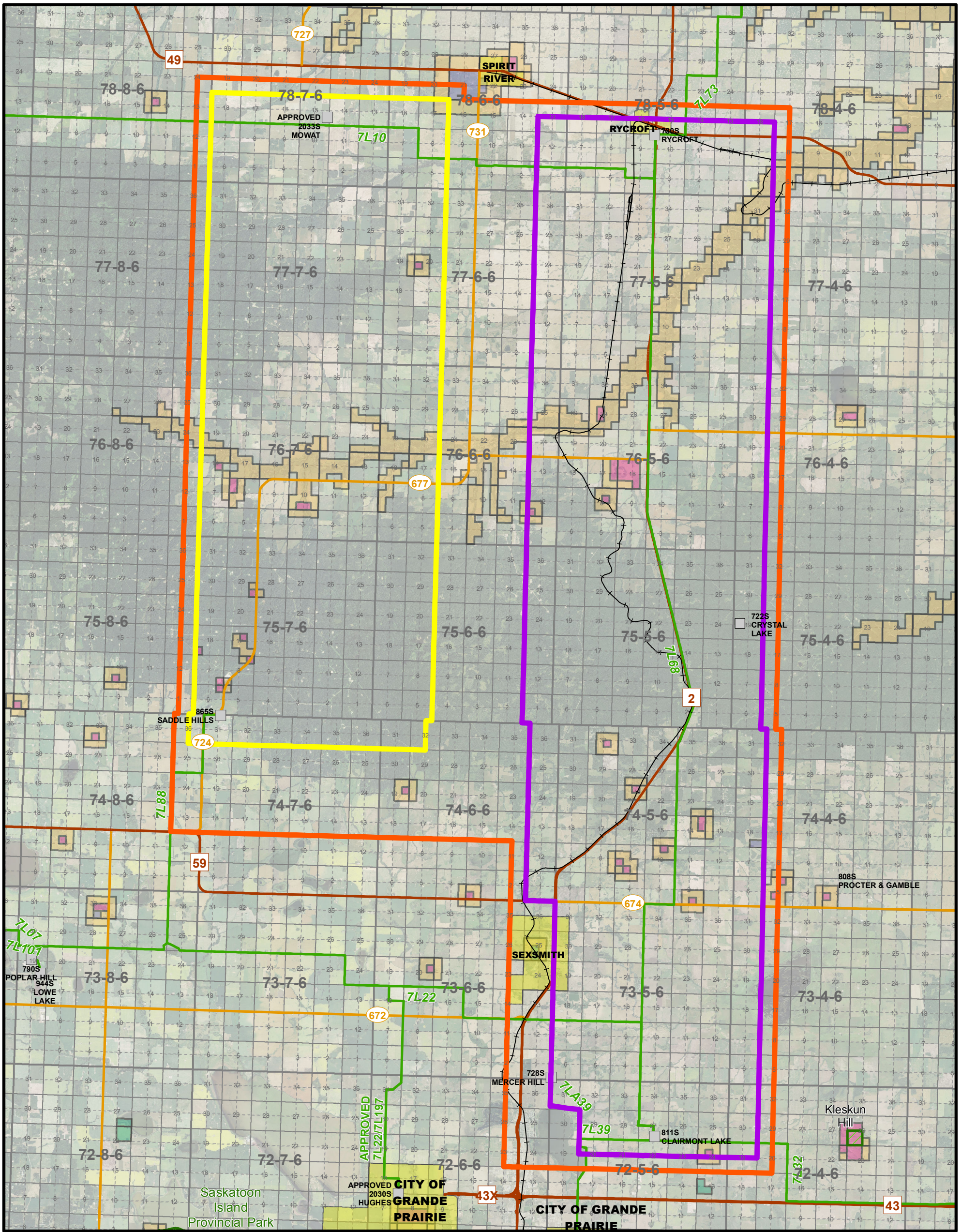
NOTES:
- Noted scale is for the base features only. All other features are not to scale

**WETLAND & WATERBODIES
MAP**

CREDITS
Project Reference Area: ATCO 2017, Electrical System: ATCO 2017, Base Data: Alberta Data Partnerships 2017, Wetlands: Alberta Merged Wetland Inventory (GOA) 2015, Study Areas: ATCO October 2017

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LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills

Provincial & Federal Protected Areas

- Provincial Park
- Natural Area

Historical Resources Value

- HRV 1
- HRV 2
- HRV 3
- HRV 4
- HRV 5



NOTES:
- Noted scale is for the base features only. All other features are not to scale



Rycroft Transmission Reinforcement
Land Impact Assessment

PROVINCIAL & FEDERAL
PROTECTED AREAS
MOSAIC MAP

CREDITS

Project Reference Area: ATCO March 2017, Electrical System: ATCO 2017, Base Data: Alberta Data Partnerships 2017, Imagery: Valtus Services 2012 - 2013, Study Areas: ATCO February 2017, Provincial & Protected Areas: Alberta Data Partnership 2017, Historic Resources Listing: GOA 2015

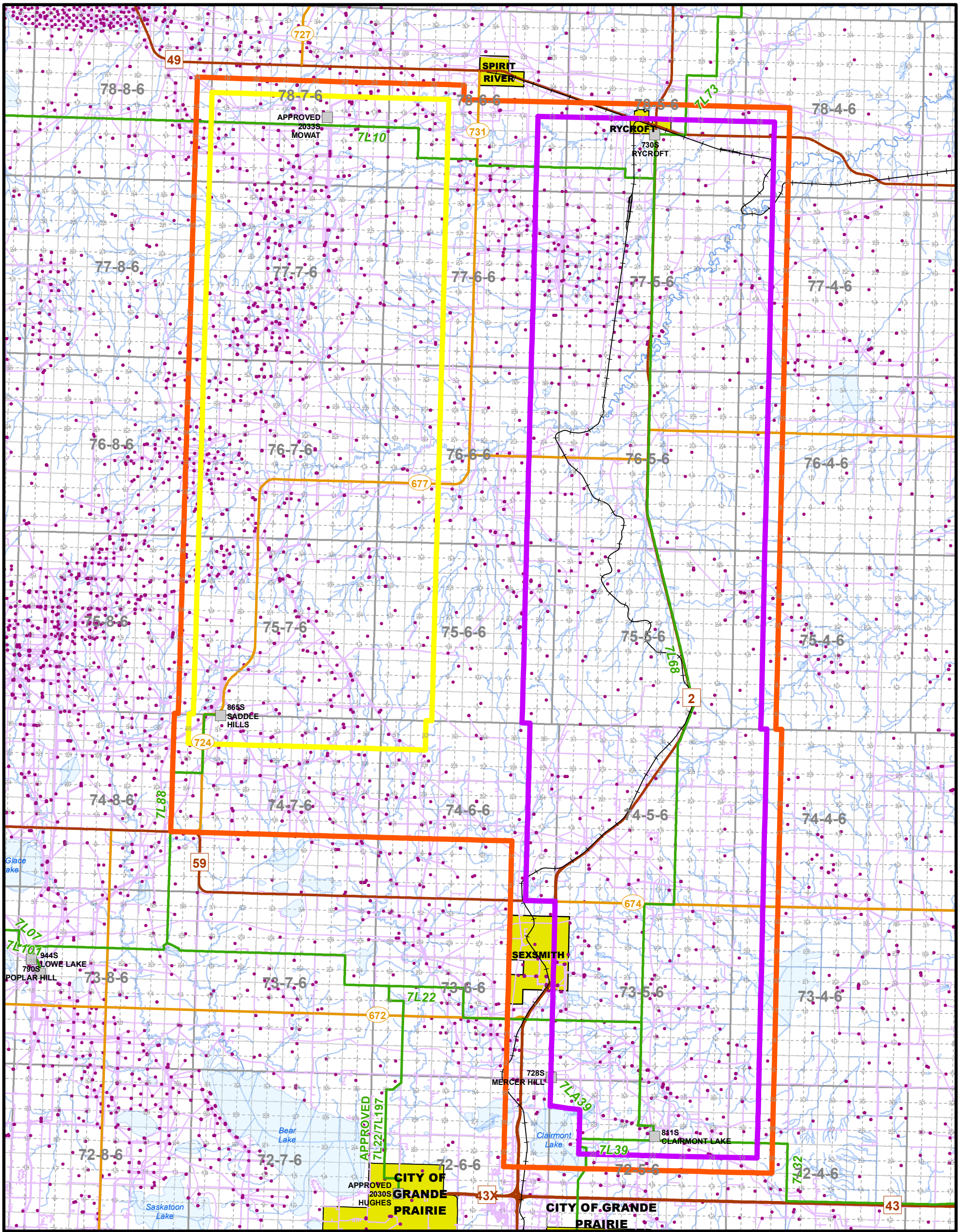
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Cartography By: TO

Approved By: NJ

April 2017



LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills

Pipelines & Wells

- Wells
- Pipelines



Rycroft Transmission Reinforcement
Land Impact Assessment



NOTES:
- Noted scale is for the base features only. All other features are not to scale

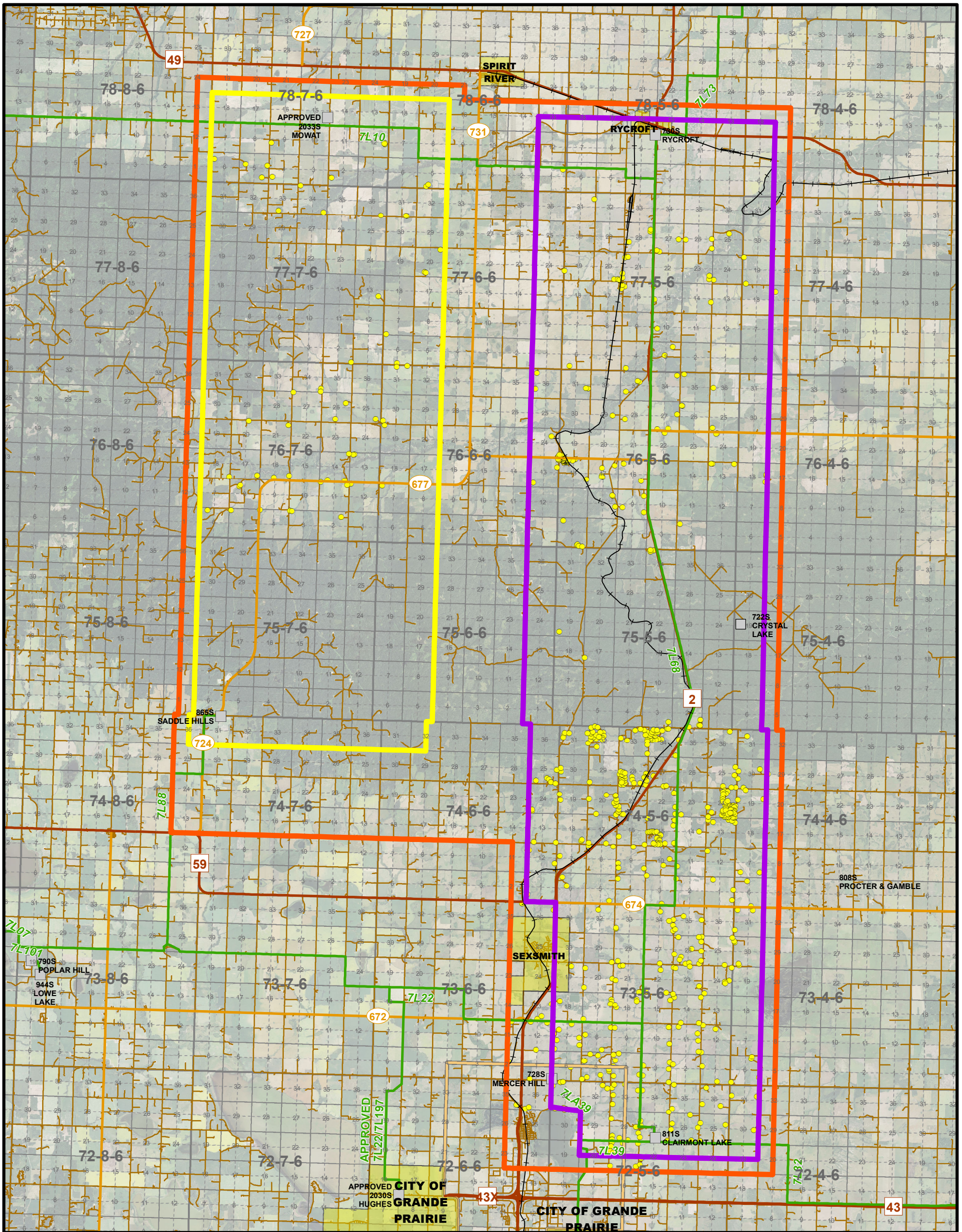
**PIPELINES & WELLS
MAP**

CREDITS

Project Reference Area: ATCO 2017, Electrical System: ATCO 2017, Base Data: Alberta Data Partnerships 2017, Pipelines & Wells: IHS 2017, Study Areas: ATCO March 2017

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LEGEND

- Project Reference Area
- Existing 144 kV Transmission Line
- Existing Substation
- Railway
- Primary Highway
- Secondary Highway

Study Areas

- Rycroft to Clairmont Lake
- Mowat to Saddle Hills

Roads & Residences

- Residences
- Other Roads



NOTES:
- Noted scale is for the base features only. All other features are not to scale



Rycroft Transmission Reinforcement
Land Impact Assessment

**ROAD & RESIDENCES
MOSAIC MAP**