Appendix F
Land Impact Assessment

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ALTALINK

Land Impact Assessment

for the Nilrem Portion of the Proposed Hanna Area Transmission Development (HATD)

Presented to the

Alberta Electric System Operator (AESO)

in Support of the AESO Need Identification Document

Date: July 13, 2009

EXECUTIVE SUMMARY

The intent of this Land Impact Assessment (LIA) is for the transmission facility owner (TFO), AltaLink Management Ltd. (AltaLink), to provide the Alberta Electric Systems Operator (AESO) with the land-impact information it requires for the Needs Identification Document (NID) for the proposed Nilrem 240 kV Transmission Project (Nilrem). A map of the Nilrem Project Area can be found on page two of this report.

Nilrem is part of a broader system upgrade, the Hanna Area Transmission Development (HATD), which affects the Hanna Area. This LIA discusses the potential land impacts of Nilrem in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

The Nilrem project consists of three components:

1) A proposed Nilrem substation to be located within 3 km of the Tucuman Substation;

2) Connection of the proposed Nilrem substation to the Tucuman substation via a double circuit 138 kV transmission line; and,

3) Connection of the existing 240 kV transmission line 953L to the proposed Nilrem substation via a double circuit 240 kV line approximately 30 km in length

The assessment of Nilrem was driven by the major aspects of AUC Rule 007, Section 6, NID12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific considerations that require assessment in the LIA as per AUC Rule 007. The LIA focuses on those aspects and considerations for which indicators of impact could be developed based on information currently available and were relevant to the project.

The assessment of impacts of the Nilrem system plan includes the following:

- The Nilrem Substation has potential to impact agricultural lands, with the siting of the substation itself and the siting of future 240 kV lines and 138 kV lines on to the surrounding cropland; however, it has little potential for residential, visual or environmental impact.

- The proposed 138 kV line connecting Nilrem and Tucuman Substations has potential to impact agricultural lands if it needs to be sited on to the surrounding cropland; however it has little potential for residential, visual or environmental impact.

- There are tradeoffs between various impacts for the routing of a 240 kV transmission line from 953L to the proposed Nilrem substation:
    - Routing in the western portion of the project area carries higher potential environmental impact due to the presence of grassland features and proximity to the Battle River, but less agricultural impact.
    - Routing in the eastern portion of the project area has greater potential for agricultural impact, but less environmental impact.
    - The project area is mainly agricultural and rural residential and generally sparsely populated. There is some concentrated residential in the north around the Town of Haridisty, along Highway 13 near the Hamlet of Rosyth, and in the east near the Town of Amisk, giving these areas higher potential for visual and residential impact.
    - Routing in the central portion of the project area offers a balance between residential, visual and agricultural impact and has little potential for environmental impact.

ACRONYMS

AESO	Alberta Electric Systems Operator
AUC	Alberta Utilities Commission
ESA	Environmentally Significant Area
HATD	Hanna Area Transmission Development
LIA	Land Impact Assessment
NID	Need Identification Document
ROW	Right of Way
TFO	Transmission Facility Operator

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1. INTRODUCTION

1.1 Background

The AESO is responsible for planning the transmission system within the province of Alberta. AltaLink is responsible for siting, constructing and operating new transmission facilities as assigned by the AESO. Currently, AltaLink maintains and operates approximately 11,600 kilometres of transmission line and 260 substations in Alberta.

AESO has requested that AltaLink provide a Land Impact Assessment (LIA) for the proposed 240 kV Nilrem project as part of the Hanna Area Transmission Development (HATD). The AESO has identified potential future transmission requirements in the Hanna Area. This LIA discusses the potential land impacts of Nilrem in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

1.2 Nilrem System Plan

The Nilrem system plan consists of three components, as determined by the AESO:

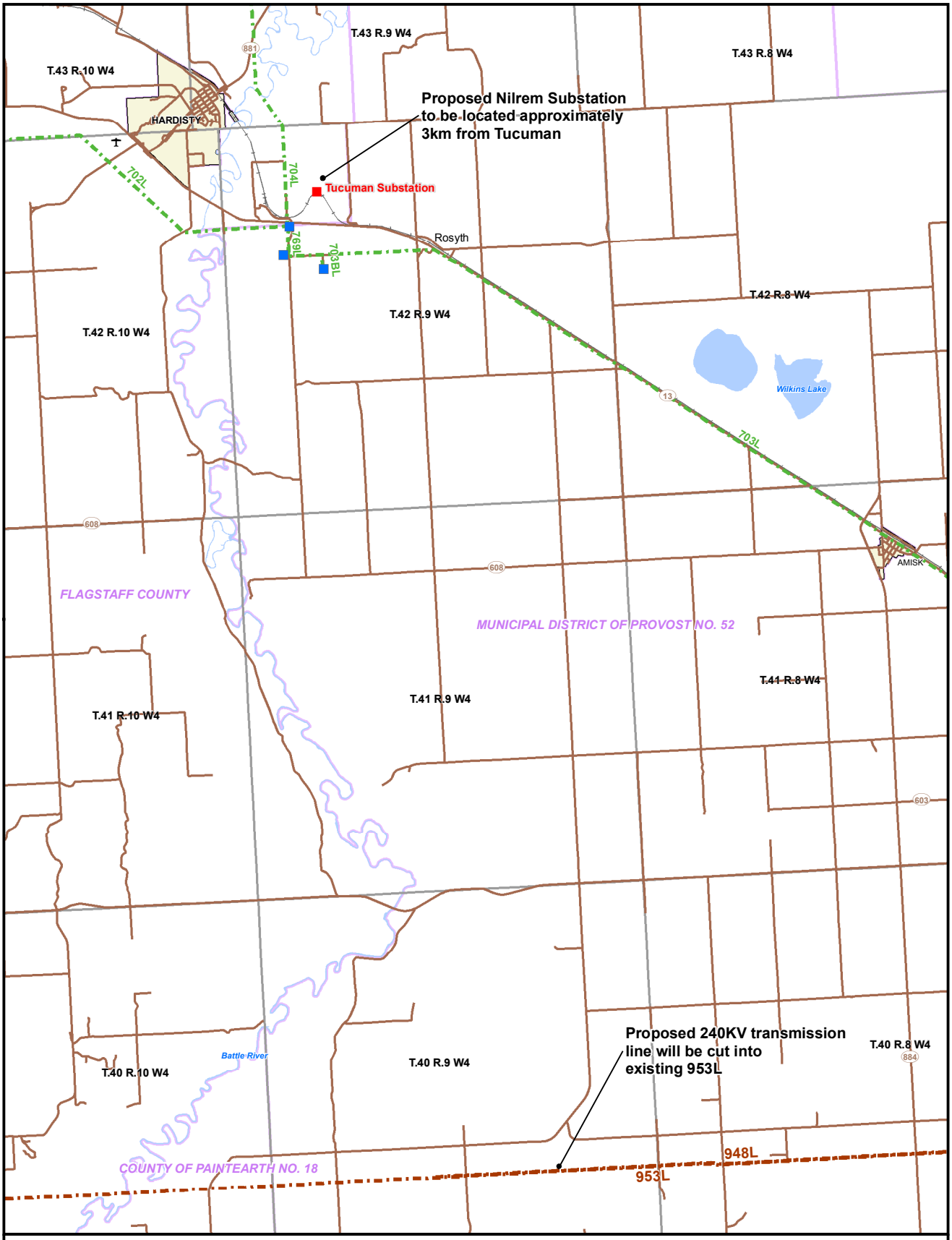
1) The proposed 240 kV Nilrem substation to be located within 3 km of the Tucuman substation;

2) Connection of the proposed Nilrem substation to a planned Tucuman substation via a new double circuit 138 kV transmission line; and,

3) Connection of the 240 kV transmission line 953L to the proposed Nilrem substation via a new 240kV double circuit transmission line approximately 30 km in length.

1.3 Scope of the LIA

The LIA focuses on the three components outlined above. The project area located south and east of Hardisty, Alberta was assessed for potential land impacts. This area is the basis for the qualitative assessment of potential land impacts of the proposed project. Specific routes within the area will be evaluated during the Facilities Application stage.



LEGEND

- PROPOSED SUBSTATION
- EXISTING SUBSTATION
- HAMLET

EXISTING TRANSMISSION LINE

- 138 VOLTAGE kV
- 240 VOLTAGE kV

- MUNICIPAL DISTRICT BOUNDARY
- ROADWAY
- RAILWAY
- URBAN AREA

N

APPROXIMATE SCALE

0 1 2 3 4 km

0 1 2 mi

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

ALTALINK

Figure 1

NILREM PROJECT AREA

HANNA AREA
TRANSMISSION DEVELOPMENT

WO: ES
DRAWN: MD
FILE NO.: 152537-001-03

REVISION: 3
DATE: 2009-06-16
PROJECT: NILREM

The LIA summarizes below the potential impacts associated with the components.

1.4 Project Components

The components considered in the LIA are the proposed Nilrem substation, and the related 138 kV lines and 240 kV lines.

1.4.1 Proposed Nilrem Substation

Presently, a specific location for the proposed Nilrem Substation has not been determined. For the purposes of this assessment, the AESO has suggested an area within 3 km of the Tucuman substation site as a general location for the Nilrem Substation where the new 240 kV line would terminate. The potential impact of a substation in this general area is discussed as part of the LIA.

1.4.2 138 kV Transmission Line

In general, 138 kV transmission lines are not considered in an LIA because the related impacts are low-level and common – i.e., they are typically sited on to road allowances, have little associated land impact and, therefore, have negligible effect on the variation in land impact.

The proposed connecting 138 kV line will be only about 3 km in length and, where it is sited on to cropland, it is still possible to farm the majority of the transmission line ROW. It is worth noting that the Tucuman substation site is located in the middle of a legal section of land so that a connecting 138 kV line will go through cropland to reach it.

1.4.3 240 kV Transmission Line

This component is a double circuit 240 kV transmission line from the existing 240 kV 953L to the proposed Nilrem Substation. For the purposes of this LIA, the western, central and eastern portions of the project area serve as general area descriptors for this routing component.

2. LAND IMPACT ASSESSMENT PROCESS

2.1 LIA Methodology

The LIA process allows the AESO to consider the potential land impacts associated with system plan components in their determination of need.

The assessment process was driven by the major aspects of AUC Rule 007, Section 6, NID 12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific

considerations that require assessment in the LIA as per AUC Rule 007. However, these considerations in many cases (e.g., reduced efficiency of field operations, psychological impact, noise and TV interference, visual impact of tree removal, etc.) are not readily comparable until detailed route and tower location and design has been undertaken by the TFO during the Facilities Application stage. The LIA focuses on those aspects and considerations that can be described using information currently available.

A description of each major aspect of AUC Rule 007 and associated considerations is presented in Section 2.2. An assessment of each component of the system plan is provided in Section 2.3.

2.2 Major Aspects of AUC Rule 007

The major aspects used in this land impact assessment conducted under AUC Rule 007 are described below, as are their relevance to the assessment of the Nilrem project. As well, the rationale for the information used in the LIA considerations is discussed.

2.2.1 Agricultural Impact

Agricultural impact refers to impact upon agricultural activities, which may include cultivation of crops, raising of livestock, and other commercial operations.

2.2.1.1 Specific Agricultural Variables

AltaLink has considered the specific agricultural considerations in AUC Rule 007 and how they impact the Nilrem system plan:

a) Loss of crops: This would include short-term loss caused by construction; longer-term losses possible from soil erosion, rutting, drainage, disturbance, and soil mixing; and permanent loss of crop under or adjacent to the tower base.

Short-term crop loss during construction is reduced with appropriate mitigation and construction practices. Such short-term losses are compensated through damage payments to landowners. Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific landowners during the Facility Application consultation, routing of the centerline relative to legal boundaries such as quarter lines, and compensated for by annual tower payments. The vast majority of the ROW can still be used by the landowner for crop production. Potential impacts may be further reduced by landowner input on tower placement.

b) Short-term disruption of farming and livestock grazing resulting from construction

These potential impacts are mitigated through appropriate construction practices and working with specific landowners to reduce any disruption.

c) Reduced efficiency of field operations

This potential impact is mitigated by determining tower placement that reduces or avoids impact. Long-term impacts are considered when determining annual structure payments for towers.

d) Restrictions on use of aircraft and high-pressure irrigation systems

The presence of a transmission line can potentially impact use of aircraft for agricultural operations, such as crop spraying. This is very landowner and route specific, and aerial spraying is being used less often as high-wheel crop sprayers are becoming more common. The impact on the operation of irrigation equipment can usually be reduced through consultation with affected landowners around the placement of towers and centerlines. Any unavoidable impacts are considered when determining compensation payments for mitigations (changes to irrigation systems) or impacts.

e) Risk of collision with tower; damage to equipment, lost time, liability for damage to tower and secondary liabilities

A landowner will not be held liable for tower damage unless it was deliberately caused by the landowner or his agents. If the transmission line is taken out of service by the damage, it is typically restored to service within 24 to 48 hours, so any disruption to farming activities due to repairs of the line and tower is short in duration. The potential of collision with a transmission tower is considered very low.

f) Reduction in yield adjacent to towers due to overlapping farming operations and added soil compaction

Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific stakeholders during the Facility Application consultation. The total area under the towers is relatively small for overhead transmission lines. It is addressed and compensated for through annual tower payments. Potential impacts are further reduced by landowner input to tower placement.

g) Added cost and inconvenience of weed control under towers

The added cost and inconvenience of weed control is compensated as part of the annual structure payments to landowners.

h) Impact of height restrictions on equipment during field operations.

All transmission lines in Alberta must provide a minimum clearance for equipment 4.3 m high on agricultural land.

i) Psychological impact of line

This is a subjective impact involving factors such as electric and magnetic fields (EMF) and visual impact. Provision of unbiased information around EMF research from national and international health and scientific agencies often helps address some people's concerns.

j) Loss of shelter belts

Impacts to shelter belts can be mitigated through routing offsets relative to legal boundaries, such as quarter lines, along which shelter belts may exist. In some cases only trimming may be required. Compensation for re-establishment of a shelter belt is also a possibility. All of these are site specific and determined in consultation with the potentially affected landowner at the Facility Application stage.

k) Shared use with other utilities and transmission lines

Utilization of existing linear disturbances is a factor in the final determination of routing during the Facility Application stage, as per the Alberta Guide for Transmission Lines and Alberta Transmission regulations. For the Nilrem project, there are no existing transmission lines with which to align.

l) Interference with citizen band radios

This is becoming less of an issue as Citizen Band (CB) radios are being replaced with newer technologies. However, CB radios operate at frequencies close to that of AM radios, neither of which are designed to be immune to power-line interference. The interference produced by power lines diminishes with distance from the power lines, making interference highly localized. All facilities will comply with federal guidelines related to radio interference.

2.2.1.2 Indicators of Agricultural Impact

Agricultural land use is represented by cropland and forage. Cropland is most abundant in the east portion of the project area while forage lands, including pasture, are mostly concentrated in the central portion. This data can be used to indicate potential impact on agricultural land.

Agricultural land suitability was not used as an indicator of potential agricultural impact in the assessment as there is little difference in suitability class throughout the project area.

2.2.2 Residential Impact

Reducing the potential for residential impact is an important consideration in the routing of transmission lines, particularly in areas of high residential density. The presence of built-up (urban) areas, as well as rural residential areas, can provide an indication of the potential residential impacts associated with the proposed system development plan. The Nilrem project

area contains rural residential, with the most concentrated residential areas potentially affected being in the north along Highway 13 in or south of the Hamlet of Rosyth and the Town of Amisk.

2.2.2.1 Specific Residential Considerations

AltaLink has considered the specific residential considerations in AUC Rule 007 and how they may impact the proposed Nilrem system:

a) Loss of developable lands and constraints on development

Development tends to happen in proximity to existing developed (urban) areas. Loss of developable land is not a concern at this stage, as the Nilrem project area contains rural residential.

b) Relocation or removal of residences

Given that the area contains rural residential and is relatively sparsely populated, house relocation or removal is not anticipated.

c) Psychological impact of the line

This is a subjective impact involving factors such as electric and magnetic fields (EMF) and visual impact. Provision of unbiased information on EMF research from national and international health and scientific agencies often helps address some people's concerns. Given that the area contains rural residential and is relatively sparsely populated, numerous concerns around this issue are not expected.

d) Noise and TV interference

TV reception problems related to high-voltage transmission lines are unlikely. Transmission lines are designed to meet allowable audible noise and TV interference.

e) Windbreak and other vegetation removal

This is an issue where the removal or trimming of trees or other vegetation may be required when establishing a new right-of-way.

f) Conflict with recreational use of land holdings

There are parks and protected areas, environmentally significant areas, and other recreational installations within the project area. There is a potential for conflict with recreational land use if routes are in close proximity to these features.

g) Public versus private land

The use of public land is generally viewed by landowners as a preferable alternative to using private lands. About 10% of the project area is public land, therefore it is expected that this project will occupy private lands almost exclusively.

2.2.2.2 Indicators of Residential Impacts

The Town of Hardisty is located north and west of Tucuman and would be avoided in the siting of the Nilrem substation and potential routes connecting Nilrem with transmission line 953L in the south. Routes from Nilrem to the west, across Battle River and near the Town of Hardisty would not be considered as these would result in relatively higher and unnecessary levels of residential impact.

2.2.3 Environmental Impact

Reducing potential environmental impacts is a consideration when assessing the components at the LIA stage.

2.2.3.1 Specific Environmental Considerations

AltaLink has considered the specific environmental considerations in AUC Rule 007 and how they may impact the proposed Nilrem system.

a) Increased public accessibility to wildlife areas

This is typically an issue for treed or forested areas where there is currently little access. Given the low amount of treed areas, this is not applicable to the project area.

b) Alteration of natural areas and interference with outdoor educational opportunities

There is a higher potential to alter natural areas and interfere with outdoor educational opportunities where new disturbances must be created.

c) Use of Restricted Development Area

The system development plan does not include use of a Restricted Development Area.

d) Effect on erosion

There is potential to affect erosion if areas near surface water are disturbed.

e) Unique ecological areas

There is a major river, Battle River, and areas of native vegetation within the project area. The Battle River can be avoided. There is potential to encounter some native grassland particularly in the southwest portion of the project area.

2.2.3.2 Indicators of Environmental Impact

Surface water bodies (rivers, streams), wetlands, ESAs and native grassland were considered. The major lakes in the vicinity (Taylor and Wilkins Lakes) are to the north and east of Highway 13 and would be avoided in the siting of a transmission line heading south. Similarly other wetlands to the west of Battle River would be avoided in the siting of potential routes connecting Nilrem with 953L. The Battle River, is an ESA of provincial significance and will be avoided.

There are differences in abundance of native grassland within the project area.

2.2.4 Electrical Considerations

While the technical considerations, such as transfer capability, system flexibility, system reliability and losses are considered by the AESO separately, some land impacts related to electrical considerations can be identified.

2.2.4.1 Specific Electrical Considerations

AltaLink has considered the specific electrical considerations outlined in AUC Rule 007 and how they relate to the Nilrem system plan:

a) Ease of connections to future load areas

The AESO has identified the existing Tucuman substation site, as well as an area within 3 km of the Tucuman substation, within which the proposed Nilrem substation must be located to enable system operation.

b) Reliability and repairability of the line

Wet soil conditions can present difficulties for future maintenance and repair activities. Detailed identification of wet areas can be determined during the more detailed Facility Application processes that may occur in the future.

c) Access for construction and maintenance of the line

Paralleling major roads or existing transmission lines can assist with construction and reduce some of the potential access constraint considerations associated with new facilities. There are no transmission lines in this area that provide an opportunity to parallel.

2.2.4.2 Electrical Indicators

Right of way length and paralleling existing transmission lines are high-level indicators of electrical factors. Length of the transmission line is a key cost driver and can be used by the AESO in electrical line loss calculations.

Given the fixed southern terminus and narrowly-defined northern terminus (within 3 km of the Tucuman substation), the length of the new 240 kV line does not vary much. The proposed 240 kV line will be approximately 30 km (+/- 5km).

2.2.5 Visual Impact

Visual impacts depend on stakeholder views. These impacts are typically influenced by visibility of transmission lines from residences. Visual impact may also be perceived from roads and highways, as well as by users of recreational areas (i.e., hikers, fishermen, hunters, golfers).

There are some general assumptions that can be made for all overhead transmission lines:

- The closer the line is to a residence, the more likely a visual impact will be perceived.
- The higher the residential density, the more likely a visual impact will be perceived.
- Paralleling similar, existing transmission facilities has a lower visual impact than a greenfield route where there is no existing line.
- Close proximity to parks, natural areas and other recreational areas can be viewed as creating a higher degree of visual impact than in other areas.
- Clearing of mature-treed areas increases the potential level of visual impact by removing what is generally considered an aesthetically pleasing feature on the landscape and potential screening of the transmission line.

2.2.5.1 Specific Visual Considerations

AltaLink has considered the specific visual considerations outlined in AUC Rule 007 and how they relate to the Nilrem system plan:

a) Visual impact of tree removal as seen from roads and recreational installations

Many stakeholders view the removal of trees as a visual impact. The project area is primarily cleared land. Potential impacts on shelter belts will be considered during the route evaluation process by the TFO leading to the Facility Application.

b) Visual impact on dispersed recreational users such as hikers, fishermen, hunters, scenic viewers, and cross-country skiers

Areas commonly used by recreational users can be identified using existing data sources.

c) Visual impact of towers and lines as seen from residences, farms, roads, and recreational installations

The type of residential areas can provide an indication of the potential visual impact.

2.2.5.2 Indicators of Visual Impact

Visual considerations described in Section 2.2.5.1 are closely related to residential development, the presence of existing transmission lines and the distribution of recreational areas in the project area.

Residential development is rural residential throughout the project area, offering opportunity to avoid residences. It is therefore expected that visual impact will be low. The primary urban area in the vicinity is the Town of Hardisty which would be avoided in the siting of the Nilrem substation and the 240 kV lines.

It is assumed that the main recreational area in the Nilrem project area is the Battle River valley. The Nilrem project will avoid this feature therefore avoiding the potential visual impact on recreationists.

2.2.6 Special Constraints

Special constraints are issues or factors that are unique to the specific project area being assessed. Using existing sources of available data, several potential special constraints were identified for further evaluation.

2.2.6.1 Specific Special Constraints

AltaLink has considered the one specific concern in AUC Rule 007. Additional special constraints that relate to the project are also discussed.

a) Electrical interference with radio transmitting stations, and other telecommunication equipment (from AUC Rule 007)

There is the potential for transmission facilities to impact radio and other telecommunication equipment. The intent is to work with affected facility owners to ensure appropriate routing and mitigation methods are employed to minimize or eliminate any potential impact. Following the construction of the proposed facilities, radio frequency interference (RFI) measurements will be taken to ensure that federal guidelines are not exceeded. Any interference problems caused by the new facilities will be mitigated by AltaLink.

b) Proximity to Historical Resources

Historical resources are specific sites that have been identified within the province that hold particular archaeological significance. The province maintains a registry of known locations and, depending on the significance of a particular site, there may be constraints placed on nearby planned development or disturbance.

c) Proximity to Major and Minor Airports

The presence of airports, airstrips, and aerodromes present a challenge for routing since each has a specific setback. The potential conflicts range from collision hazards to interference with radio and navigational equipment. Transport Canada maintains a list of all registered airports, airstrips, and aerodromes.

d) Oil and gas

Oil and gas is a major land use in this area of the province. Oil and natural gas wells and pipelines are therefore common features in the project area. Conflicts with oil and gas facilities on transmission routes can be mitigated by avoidance. Well sites are common throughout the project area.

2.2.6.2 Indicators of Special Constraints

No special constraints of concern have been identified in the project area. Review of available data indicates there are potential historic resource sites east of the Battle River and north of the Tucuman substation. These areas would be avoided in the siting of the proposed Nilrem substation and related 240 kv lines. Well sites are common throughout the project area and can be avoided.

There is an airstrip to the west of the Town of Hardisty that will not be affected by any potential routes from Nilrem substation which will be located south and east of the town.

2.3 Assessment of Components

This section assesses the Nilrem system components according to indicators derived from the major land impact aspects of AUC Rule 007. A discussion of the major aspects and the selected indicators were presented in Section 2.2. Those representative indicators are used below to characterize the potential impacts of each component of the system plan.

2.3.1 Proposed Nilrem Substation

The AESO has given direction to evaluate an area within 3 km of the Tucuman substation for the potential location of the proposed Nilrem Substation. Siting the Nilrem substation to the west

of Tucuman results in more potential for impacts as the Battle River and the Town of Hardisty are located within 3 km of Tucuman.

South of Tucuman may provide opportunities for siting the Nilrem substation as it is already industrialized and occupied by tank farms, gas storage facilities and pipeline infrastructure. The area east of Tucuman does have agricultural land use, specifically cropland, but the amount of land taken out of operation, and overall agricultural impact, is minimal. The area is comprised of entirely rural residential, offering opportunity to avoid residences, and reducing potential for residential and visual impacts. Environmentally, native grassland, is not found in the proposed substation siting area.

2.3.2 138 kV Transmission Line

Another consideration in the assessment of the potential area for Nilrem Substation is the impact of the transmission lines connecting to the substation rather than the substation location itself. As with the specific substation location, a 138 kV line between the Nilrem and Tucuman substations will result in some impact on cropland; however, it is still possible to farm the majority of the right-of-way under the transmission line.

2.3.3 240 kV Transmission Line

This component consists of about 30km double circuit 240 kV transmission line connecting the 953L at the south end of the project area to the proposed Nilrem Substation in the north. The western, central and eastern portions of the project area were assessed for potential impact.

Potential for agricultural impact is highest in the eastern portions of the project area where cropland is most abundant. Forage lands, including pasture, are concentrated in the central portion. Residential impact is most likely along Highway 13, in or south of the Hamlet of Rosyth or Town of Amisk, the most densely-populated areas that could potentially be impacted by routes from the new Nilrem substation. As previously mentioned routes from Nilrem to the northwest, towards the Town of Hardisty, would not be considered. The remaining project area contains rural residential. Potential environmental impact, to native grassland, is highest in the western portion and increasingly less moving east. Routes from Nilrem to the west crossing the Battle River, would not be considered. Visual impact, as related to residential impact, has the highest potential in the north portion of the area, particularly within proximity to the Hamlet of Rosyth.

3. CONCLUSION

Upon review of available data, application of suitable indicators and assessment of the Nilrem components, the assessment of impacts of the Nilrem system plan includes the following:

- The Nilrem Substation has potential to impact agricultural lands, with the siting of the substation itself and the siting of future 240 kV lines and 138 kV lines on to the surrounding cropland; however, it has little potential for residential, visual or environmental impact.
- The proposed 138 kV line connecting Nilrem and Tucuman Substations has potential to impact agricultural lands if it needs to be sited on to the surrounding cropland; however it has little potential for residential, visual or environmental impact.
- There are tradeoffs between various impacts for the routing of a 240 kV transmission line from 953L to the proposed Nilrem substation:
    - Routing in the western portion of the project area carries higher potential environmental impact due to the presence of grassland features and proximity to the Battle River, but less agricultural impact.
    - Routing in the eastern portion of the project area has greater potential for agricultural impact, but less environmental impact.
    - The project area is mainly agricultural and rural residential and generally sparsely populated. There is some concentrated residential in the north around the Town of Haridisty, along Highway 13 near the Hamlet of Rosyth, and in the east near the Town of Amisk, giving these areas higher potential for visual and residential impact.
    - Routing in the central portion of the project area offers a balance between residential, visual and agricultural impact and has little potential for environmental impact.

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ALTALINK

Land Impact Assessment for the Hansman Lake - Pemukan Portion of the Proposed Hanna Area Transmission Development (HATD)

Presented to the

Alberta Electric System Operator (AESO)

in Support of the AESO Need Identification Document

Date: July 13, 2009

EXECUTIVE SUMMARY

The intent of this Land Impact Assessment (LIA) is for the transmission facility owner (TFO), AltaLink Management Ltd. (AltaLink), to provide the Alberta Electric Systems Operator (AESO) with the land impact information it requires for the Needs Identification Document (NID) for the proposed Hansman Lake - Pemukan project.

It is important to note that this project falls within AltaLink service territory and that of ATCO Electric. This LIA addresses only the portion of the project that falls within AltaLink service territory ("the project"). ATCO has prepared a LIA for the portion of the project occurring within its service territory. A map of the Hansman Lake - Pemukan Project Area within AltaLink territory (Figure 1) can be found on page 2 of this report.

Hansman Lake - Pemukan is part of a broader system upgrade, the Hanna Area Transmission Development (HATD), which affects the Hanna Area. This LIA discusses the potential land impacts of Hansman Lake - Pemukan within the AltaLink service territory in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

The Hansman Lake - Pemukan project consists of two components:

1) A proposed Pemukan substation to be located in the vicinity of SW29-34-4-W4M, as indicated by AESO; and,

2) Connection of the existing Hansman Lake Substation to the proposed Pemukan Substation via a single circuit 240 kV transmission line, approximately 60 km in length.

The proposed Pemukan Substation and approximately 40 km of the 60 km transmission line occur outside AltaLink service territory. This LIA therefore assesses land impacts associated with the approximate 20 km of transmission line from the Hansman Lake Substation southward to the AltaLink service territory boundary.

The assessment of Hansman Lake - Pemukan was driven by the major aspects of AUC Rule 007, Section 6, NID12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific considerations that require assessment in the LIA as per AUC Rule 007. The LIA focuses on those aspects and considerations for which indicators of impact could be developed based on information currently available and where relevant to the project.

The assessment of impacts of the Hansman Lake - Pemukan project indicates there are tradeoffs between various potential impacts for the routing of a 240 kV transmission line from Hansman Lake Substation south to the AltaLink service territory boundary. The trade-offs include the following:

- Routing in the western portion of the project area carries higher potential environmental impact due to ESAs and grassland features, but less agricultural impact.
- Routing in the eastern portion of the project area has greater potential for agricultural impact, but less environmental impact.
- The project area is mainly agricultural and rural residential and generally sparsely populated. There are some concentrations of residences in the central portion in the vicinity of the hamlet of Metiskow and in the eastern portion near the hamlet of Cadogan. These areas carry higher potential for visual and residential impact.
- Routing in the central portion of the project area offers a balance between residential, visual and agricultural impact, but carries potential for environmental impact due to numerous ESAs.

ACRONYMS

AESO	Alberta Electric Systems Operator
AUC	Alberta Utilities Commission
ATCO	ATCO Electric
ESA	Environmentally Significant Area
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LIA	Land Impact Assessment
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1.1 Background

The AESO is responsible for planning the transmission system within the province of Alberta. AltaLink is responsible for siting, constructing and operating new transmission facilities as assigned by the AESO. Currently, AltaLink maintains and operates approximately 11,600 kilometres of transmission line and 260 substations in Alberta.

AESO has requested that AltaLink provide a Land Impact Assessment (LIA) for the portion of the proposed 240 kV Hansman Lake - Pemukan project within AltaLink service territory. This project is part of the Hanna Area Transmission Development (HATD) proposed by the AESO to meet potential future transmission requirements in the Hanna Area. This LIA discusses the potential land impacts of Hansman Lake - Pemukan in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

1.2 Hansman Lake - Pemukan Project

The Hansman Lake - Pemukan project consists of two components, as determined by the AESO:

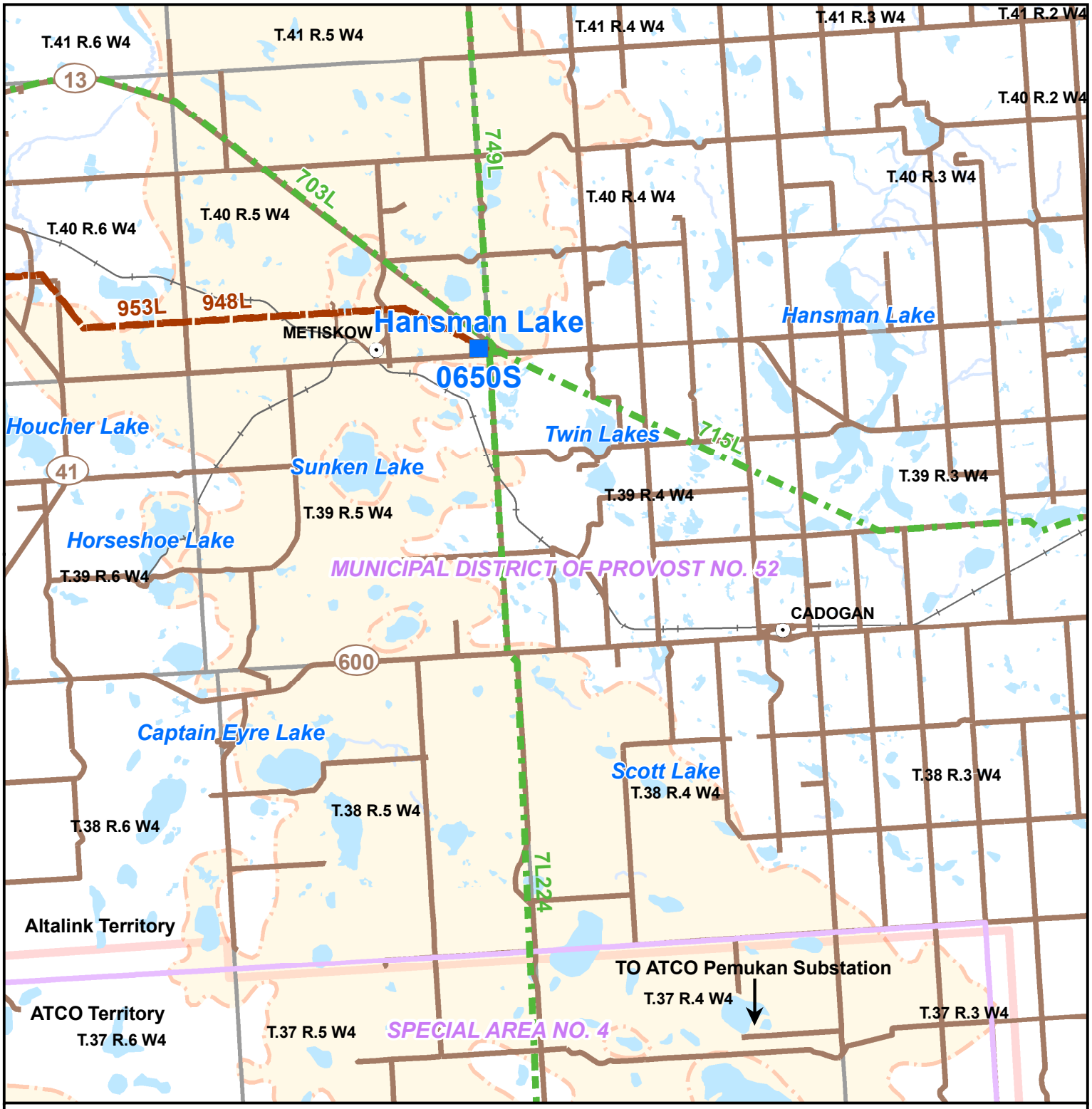
1) A proposed Pemukan Substation to be located approximately at SW29-34-4-W4M, as indicated by AESO; and,

2) Connection of the existing Hansman Lake Substation to the proposed Pemukan Substation via a single circuit 240 kV transmission line approximately 60 km in length.

The proposed Pemukan Substation (component 1, above) and approximately 40 km of the 60 km transmission line (component 2, above) occurs outside AltaLink service territory. This LIA pertains only to the AltaLink service territory; therefore, it assesses land impacts associated with approximately 20 km of 240 kV transmission line from the Hansman Lake Substation southward to the AltaLink service territory boundary.

1.3 Scope of the LIA

The LIA focuses on approximately 20 km of 240 kV transmission line from Hansman Lake Substation to the AltaLink service territory boundary. The project area located generally south of the Hansman Lake substation was assessed for potential land impacts within AltaLink service territory (Figure 1, p. 2). This area is the basis for the qualitative assessment of potential land impacts of the proposed project. Specific routes within the area will be evaluated during the Facilities Application stage.



LEGEND

- EXISTING SUBSTATION
- HAMLET

EXISTING TRANSMISSION LINE

- 138 VOLTAGE kV
- 240 VOLTAGE kV
- HIGHWAY/MAJOR ROAD
- SECONDARY ROAD
- RAILWAY
- ESA
- MUNICIPAL BOUNDARY
- TOWNSHIP LINES
- WATER BODIES

N

APPROXIMATE SCALE

0 1 2 3 4 km

0 1 2 mi

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

ALTALINK

Figure 1

HANSMAN LAKE TO PEMUKAN PROJECT AREA

HANNA AREA
TRANSMISSION DEVELOPMENT

WO: ES
DRAWN: DH
FILE NO.: 1052537_008

REVISION: 0
DATE: 2009-07-20
PROJECT: HANSMAN LAKE

2. LAND IMPACT ASSESSMENT PROCESS

2.1 LIA Methodology

The LIA process allows the AESO to consider the potential land impacts associated with system plan components in their determination of need.

The assessment process was driven by the major aspects of AUC Rule 007, Section 6, NID 12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific considerations that require assessment in the LIA as per AUC Rule 007. However, these considerations in many cases (e.g., reduced efficiency of field operations, psychological impact, noise and TV interference, visual impact of tree removal, etc.) are not readily comparable until detailed route and tower location and design has been undertaken by the TFO during the Facilities Application stage. The LIA focuses on those aspects and considerations that can be described using information currently available.

A description of each major aspect of AUC Rule 007 and associated considerations is presented in Section 2.2. An assessment of each component of the system plan is provided in Section 2.3.

2.2 Major Aspects of AUC Rule 007

The major aspects used in this land impact assessment conducted under AUC Rule 007 are described below, in the context of the Hansman Lake - Pemukan project. As well, the rationale for the data used to represent LIA considerations is discussed.

2.2.1 Agricultural Impact

Agricultural impact refers to impact upon agricultural activities, which may include cultivation of crops, raising of livestock, and other commercial operations.

2.2.1.1 Specific Agricultural Variables

AltaLink has considered the specific agricultural considerations in AUC Rule 007 and how they impact the Hansmans Lake-Pemukan project:

a) Loss of crops: This would include short-term loss caused by construction; longer-term losses possible from soil erosion, rutting, drainage, disturbance, and soil mixing; and permanent loss of crop under or adjacent to the tower base.

Short-term crop loss during construction is reduced with appropriate mitigation and construction practices. Such short-term losses are compensated through damage payments to

landowners. Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific landowners during the Facility Application consultation, routing of the centerline relative to legal boundaries such as quarter lines, and compensated for by annual tower payments. The vast majority of the ROW can still be used by the landowner for crop production. Potential impacts may be further reduced by landowner input on tower placement.

b) Short-term disruption of farming and livestock grazing resulting from construction

These potential impacts are mitigated through appropriate construction practices and working with specific landowners to reduce any disruption.

c) Reduced efficiency of field operations

This potential impact is mitigated by determining tower placement that reduces or avoids impact. Long-term impacts are considered when determining annual structure payments for towers.

d) Restrictions on use of aircraft and high-pressure irrigation systems

The presence of a transmission line can potentially impact use of aircraft for agricultural operations, such as crop spraying. This is landowner and route specific, and aerial spraying is being used less often as high-wheel crop sprayers become more common. The impact on the operation of irrigation equipment can usually be reduced through consultation with affected landowners around the placement of towers and centerlines. Any unavoidable impacts are considered when determining compensation payments for mitigations (changes to irrigation systems) or impacts.

e) Risk of collision with tower; damage to equipment, lost time, liability for damage to tower and secondary liabilities

A landowner will not be held liable for tower damage unless it was deliberately caused by the landowner or his agents. If the transmission line is taken out of service by the damage, it is typically restored to service within 24 to 48 hours, so any disruption to farming activities due to repairs of the line and tower is short in duration. The potential of collision with a transmission tower is considered very low.

f) Reduction in yield adjacent to towers due to overlapping farming operations and added soil compaction

Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific stakeholders during the Facility Application consultation. The total area under the towers is relatively small for overhead transmission lines. It is addressed and compensated for

through annual tower payments. Potential impacts are further reduced by landowner input to tower placement.

g) Added cost and inconvenience of weed control under towers

The added cost and inconvenience of weed control is compensated as part of the annual structure payments to landowners.

h) Impact of height restrictions on equipment during field operations.

All transmission lines in Alberta must provide a minimum clearance for equipment 4.3 m high on agricultural land.

i) Psychological impact of line

This is a subjective impact involving factors such as electric and magnetic fields (EMF) and visual impact. Provision of unbiased information around EMF research from national and international health and scientific agencies often helps address some people's concerns.

j) Loss of shelter belts

Impacts to shelter belts can be mitigated through routing offsets relative to legal boundaries, such as quarter lines, along which shelter belts may exist. In some cases only trimming may be required. Compensation for re-establishment of a shelter belt is also a possibility. All of these are site specific and determined in consultation with the potentially affected landowner at the Facility Application stage.

k) Shared use with other utilities and transmission lines

Utilization of existing linear disturbances is a factor in the final determination of routing during the Facility Application stage, as per the Alberta Guide for Transmission Lines and Alberta Transmission regulations. The 7L224 transmission line operated by ATCO originates at Hansman Lake substation and runs southward towards Pemukan substation. The proposed 240 kV line from Hansman Lake substation could potentially align with this existing line.

l) Interference with citizen band radios

This is becoming less of an issue as Citizen Band (CB) radios are being replaced with newer technologies. However, CB radios operate at frequencies close to that of AM radios, neither of which are designed to be immune to power-line interference. The interference produced by power lines diminishes with distance from the power lines, making interference highly localized. All facilities will comply with federal guidelines related to radio interference.

2.2.1.2 Indicators of Agricultural Impact

Agricultural land use is represented by cropland, including pasture, and forage. Agricultural lands are mainly in the east portion of the project area, consisting primarily of cropland. There is also some cropland in the central portion around the Twin Lakes and northwest of the Hansman Lake substation, as well as an area of forage north of Highway 600. There is a negligible amount of agricultural land use in the western portion of the project area. This data can be used to indicate potential impact on agricultural land.

Agricultural land suitability will not be used as an indicator of agricultural impact in the assessment as it is not a differentiating factor between the different portions of the project area. Agricultural land use data is sufficient to capture the impact on agricultural land.

2.2.2 Residential Impact

Reducing the potential for residential impact is an important consideration in the routing of transmission lines, particularly in areas of high residential density. The presence of built-up (urban) areas, as well as rural residential areas, can provide an indication of the potential residential impacts associated with the proposed project. The Hansman Lake - Pemukan project area contains rural residential, with most residential development being in the eastern portion, particularly in and around the hamlet of Cadogan. Residential development is least concentrated in the western portion, mainly in the hamlet of Metiskow. Routing through these residential areas would not be considered as these would result in relatively higher and unnecessary levels of residential impact. Additional residence identification will take place during the Facilities Application stage.

2.2.2.1 Specific Residential Considerations

AltaLink has considered the specific residential considerations in AUC Rule 007 and how they may impact the proposed Hansman Lake - Pemukan project:

a) Loss of developable lands and constraints on development

Development tends to happen in proximity to existing developed (urban) areas. Loss of developable land is not a concern at this stage, as the project area is predominately rural residential.

b) Relocation or removal of residences

Given that the area is predominately rural residential and relatively sparsely populated, house relocation or removal is not anticipated.

c) Psychological impact of the line

This is a subjective impact involving factors such as electric and magnetic fields (EMF) and visual impact. Provision of unbiased information on EMF research from national and international health and scientific agencies often helps address some people's concerns. Given that the area is predominately rural residential and relatively sparsely populated, concerns around this issue are not expected.

d) Noise and TV interference

TV reception problems related to high-voltage transmission lines are unlikely. Transmission lines are designed to meet allowable audible noise and TV interference.

e) Windbreak and other vegetation removal

This is an issue where the removal or trimming of trees or other vegetation may be required when establishing a new right-of-way. This is site specific and determined in consultation with the potentially affected landowner at the Facility Application stage.

f) Conflict with recreational use of land holdings

There are environmentally significant areas and other recreational installations within the project area. There is a potential for conflict with recreational land use if routes are in close proximity to these features.

g) Public versus private land

The use of public land is generally viewed by landowners as a preferable alternative to using private lands. There is Crown and private land within the project area.

2.2.2.2 Indicators of Residential Impacts

The hamlets of Mestikow and Cadogan would be avoided in the potential routing from Hansman Lake south to the AltaLink service territory boundary.

2.2.3 Environmental Impact

Reducing environmental impacts is a consideration when assessing the components at the LIA stage.

2.2.3.1 Specific Environmental Considerations

AltaLink has considered the specific environmental considerations in AUC Rule 007 and how they may impact the proposed project.

a) Increased public accessibility to wildlife areas

This is typically an issue for treed or forested areas where there is currently little access. Given the low amount of treed areas, this is not applicable to the project area.

b) Alteration of natural areas and interference with outdoor educational opportunities

There is a higher potential to alter natural areas and interfere with outdoor educational opportunities where new disturbances must be created.

c) Use of Restricted Development Area

The system development plan does not include use of a Restricted Development Area.

d) Effect on erosion

There is potential to affect erosion if areas near surface water are disturbed.

e) Unique ecological areas

There are major lakes, important bird areas, ESAs and areas of native vegetation within the project area. Numerous lakes within the project area are provincially and nationally significant breeding and staging grounds for piping plover and other shorebirds. It is not unusual for transmission lines to be sited in this type of area, and will be taken into account as the TFO consults with Alberta Sustainable Resource Development (SRD) during the detailed route selection process.

2.2.3.2 Indicators of Environmental Impact

Surface water bodies (rivers, lakes), wetlands, ESAs and native grassland were considered. An ESA and or grassland area could potentially be impacted. Waterbodies such as the major lakes in the vicinity would be avoided in the siting of the transmission line. Similarly, wetlands would be avoided in the siting of the potential route.

There are nine ESAs within the project area, seven of which form a contiguous network of ESAs, occurring mostly in the western and centre portions of the project area. There are also differences in abundance of native grassland within the project area.

2.2.4 Electrical Considerations

While the technical considerations, such as transfer capability, system flexibility, system reliability and losses are considered by the AESO separately, some land impacts related to electrical considerations can be identified.

2.2.4.1 Specific Electrical Considerations

AltaLink has considered the specific electrical considerations outlined in AUC Rule 007 and how they relate to the project:

a) Ease of connections to future load areas

This is for AESO to determine and is not considered in this LIA.

b) Reliability and repairability of the line

Wet soil conditions can present difficulties for future maintenance and repair activities. Detailed identification of wet areas can be determined during the more detailed Facility Application processes that may occur in the future.

c) Access for construction and maintenance of the line

Paralleling major roads or existing transmission lines can assist with construction and reduce some of the potential access constraint considerations associated with new facilities. There is an opportunity to potentially align the proposed 240 kV line with an existing ATCO line from Hansman Lake southward to Pemukan substation.

2.2.4.2 Electrical Indicators

Length of the transmission line is a key cost driver and can be used by the AESO in electrical line loss calculations.

Given the fixed northern terminus (Hansman Lake substation) and narrowly-defined southern terminus (a new Pemukan substation at approximately SW29-34-4-W4M), the length of the new 240 kV line will not considerably vary. The portion of the proposed 240 kV line within AltaLink territory will be approximately 20 km (+/- 5km).

2.2.5 Visual Impact

Visual impacts depend on stakeholder views. These impacts are typically influenced by visibility of transmission lines from places of residence. Visual impact may also be perceived from roads and highways, as well as by users of recreational areas (i.e., hikers, fishermen, hunters, golfers).

There are some general assumptions that can be made for all overhead transmission lines:

- The closer the line is to a residence, the more likely a visual impact will be perceived.
- The higher the residential density, the more likely a visual impact will be perceived.
- Paralleling similar, existing transmission facilities has a lower visual impact than a greenfield route where there is no existing line.
- Close proximity to parks, natural areas and other recreational areas can be viewed as creating a higher degree of visual impact than in other areas.
- Clearing of mature-treed areas increases the potential level of visual impact by removing what is generally considered an aesthetically pleasing feature on the landscape and potential screening of the transmission line.

2.2.5.1 Specific Visual Considerations

AltaLink has considered the specific visual considerations outlined in AUC Rule 007 and how they relate to the project:

a) Visual impact of tree removal as seen from roads and recreational installations

Many stakeholders view the removal of trees as a visual impact. The project area is primarily cleared land. Potential impacts on shelter belts will be considered during the route evaluation process by the TFO leading to the Facility Application.

b) Visual impact on dispersed recreational users such as hikers, fishermen, hunters, scenic viewers, and cross-country skiers

Areas commonly used by recreational users can be identified using existing data sources.

c) Visual impact of towers and lines as seen from residences, farms, roads, and recreational installations

The type of residential areas can provide an indication of the potential visual impact.

2.2.5.2 Indicators of Visual Impact

Visual considerations described in Section 2.2.5.1 are closely related to residential development, the presence of existing transmission lines and the distribution of recreational areas in the project area.

Residential development is rural residential throughout the project area. The nature of this development offers more opportunity for avoidance of residences than compared to routing in more urban areas. It is expected that visual impact can be minimized.

It is a reasonable assumption that the main recreational areas in the project area are within the ESAs. Visual impact on recreational users is therefore correlated with proximity to ESAs. The project will minimize routing through ESAs to reduce the potential visual impact on recreationists.

2.2.6 Special Constraints

Special constraints are issues or factors that are unique to the specific project area being assessed. Using existing sources of available data, several potential special constraints were identified for further evaluation.

2.2.6.1 Specific Special Constraints

AltaLink has considered the one specific concern in AUC Rule 007. Additional special constraints that relate to the project are also discussed.

a) Electrical interference with radio transmitting stations, and other telecommunication equipment (from AUC Rule 007)

There is the potential for transmission facilities to impact radio and other telecommunication equipment. The intent is to work with affected facility owners to ensure appropriate routing and mitigation methods are employed to reduce or eliminate any potential impact. Following the construction of the proposed facilities, radio frequency interference (RFI) measurements will be taken to ensure that federal guidelines are not exceeded. Any interference problems caused by the new facilities will be mitigated by AltaLink.

b) Proximity to Historical Resources

Historical resources are specific sites that have been identified within the province that hold particular archaeological significance. The province maintains a registry of known locations and, depending on the significance of a particular site, there may be constraints placed on nearby planned development or disturbance.

c) Oil and gas

Oil and gas is a major land use in this area of the province. Oil and natural gas wells and pipelines are therefore common features in the project area. Conflicts with oil and gas facilities on transmission routes can be mitigated by avoidance. Well sites are common throughout the project area.

2.2.6.2 Indicators of Special Constraints

No special constraints of concern have been identified in the project area. Review of available data indicates there are potential historic resource sites in the western portion of the project area. These areas would be avoided in the siting of the proposed 240 kV line. Well sites are common throughout the project area and can be avoided.

2.3 Assessment of 240 kV Transmission Line

This section assesses the potential impact of approximately 20 km of 240 kV line from the Hansman Lake substation southward to the AltaLink service territory boundary according to indicators derived from the major land impact aspects of AUC Rule 007. A discussion of the major aspects and the selected indicators were presented in Section 2.2. The western, central and eastern portions of the project area were assessed for potential impact.

Potential for agricultural impact is highest in the eastern portions of the project area where cropland is most abundant. Residential impact is most likely in and around the hamlets of Metiskow and Cadogan, and is generally more likely in the eastern portion of the project area. Potential environmental impact, as determined by occurrence of ESAs and native grassland, is highest in the western and central portions and increasingly less moving east. Visual impact, as related to residential impact, has the highest potential in the east portion of the project area, particularly within proximity to the hamlet of Cadogan, as well as within proximity to the hamlet of Metiskow in the west-central portion of the area.

3. CONCLUSION

Upon review of available data within AltaLink service territory, the assessment of impacts of the Hansman Lake - Pemukan project indicates there are tradeoffs between various impacts for the routing of a 240 kV transmission line from Hansman Lake Substation south to the AltaLink service territory boundary. The trade-offs include the following:

- Routing in the western portion of the project area carries higher potential environmental impact due to ESAs and grassland features, but less agricultural impact.
- Routing in the eastern portion of the project area has greater potential for agricultural impact, but less environmental impact.
- The project area is mainly rural residential and generally sparsely populated. There are some concentrations of residences in the central portion in the vicinity of the hamlet of Metiskow and in the eastern portion near the hamlet of Cadogan. These areas carry higher potential for visual and residential impact. Overall, the eastern portion has the highest relative potential for impacts of this nature.
- Routing in the central portion of the project area offers a balance between residential, visual and agricultural impact, but carries potential for environmental impact due to numerous ESAs.

4. INFORMATION SOURCES

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ALTALINK

Land Impact Assessment for the West Brooks to Ware Junction Portion of the Proposed Hanna Area Transmission Development (HATD)

Presented to the

Alberta Electric System Operator (AESO)

in Support of the AESO Need Identification Document

Date: July 27, 2009

EXECUTIVE SUMMARY

The intent of this Land Impact Assessment (LIA) is for the transmission facility owner (TFO), AltaLink Management Ltd. (AltaLink), to provide the Alberta Electric Systems Operator (AESO) with the land-impact information it requires for the Needs Identification Document (NID) for the proposed West Brooks to Ware Junction 240 kV Transmission Development (West Brooks-Ware Junction). A map of the West Brooks-Ware Junction Project Area can be found on page two of this report (Figure 1).

West Brooks-Ware Junction is part of a broader system upgrade, the Hanna Area Transmission Development (HATD), which affects the Hanna Area. This LIA discusses the potential land impacts of West Brooks-Ware Junction in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

The West Brooks-Ware Junction project consists of one component. It involves a new double circuit 240 kV transmission line from the new West Brooks Substation northward to the ATCO service territory boundary via the existing Ware Junction Substation. The line will be approximately 45 km in length.

The assessment of West Brooks-Ware Junction was driven by the major aspects of AUC Rule 007, Section 6, NID12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific considerations that require assessment in the LIA as per AUC Rule 007. The LIA focuses on those aspects and considerations for which indicators of impact could be developed based on information currently available and were relevant to the project.

The assessment of a 240 kV transmission line from West Brooks northward to the ATCO service territory boundary via the Ware Junction substation includes the following:

- Native grassland and irrigation are common and generally equally distributed throughout the project area and will therefore be key considerations in the Facilities Application stage;
- The option to parallel the new 240 kV line with the existing 240 kV line may have greater agricultural and residential impact due to the close proximity of irrigation facilities and residences in several locations along the line.
- There are tradeoffs between various impacts:
    - Routing in the western portion of the project area carries higher potential for agricultural impact given the cropland and irrigation in the area, but has lower potential for environmental impact and less special constraints to consider;

- Routing in the central portion carries lower potential for agricultural impact, but higher potential for residential, environmental and visual impact, and has airports and historic resources to consider;
- Routing in the eastern portion carries lower potential for agricultural, residential, environmental and visual impact, but has the majority of historic resources in the project area.

ACRONYMS

AESO	Alberta Electric Systems Operator
AUC	Alberta Utilities Commission
ESA	Environmentally Significant Area
HATD	Hanna Area Transmission Development
LIA	Land Impact Assessment
NID	Need Identification Document
ROW	Right-of-Way
TFO	Transmission Facility Operator

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LIST OF FIGURES

1. INTRODUCTION

1.1 Background

The AESO is responsible for planning the transmission system within the province of Alberta. AltaLink is responsible for siting, constructing and operating new transmission facilities as assigned by the AESO. Currently, AltaLink maintains and operates approximately 11,600 kilometres of transmission line and 260 substations in Alberta.

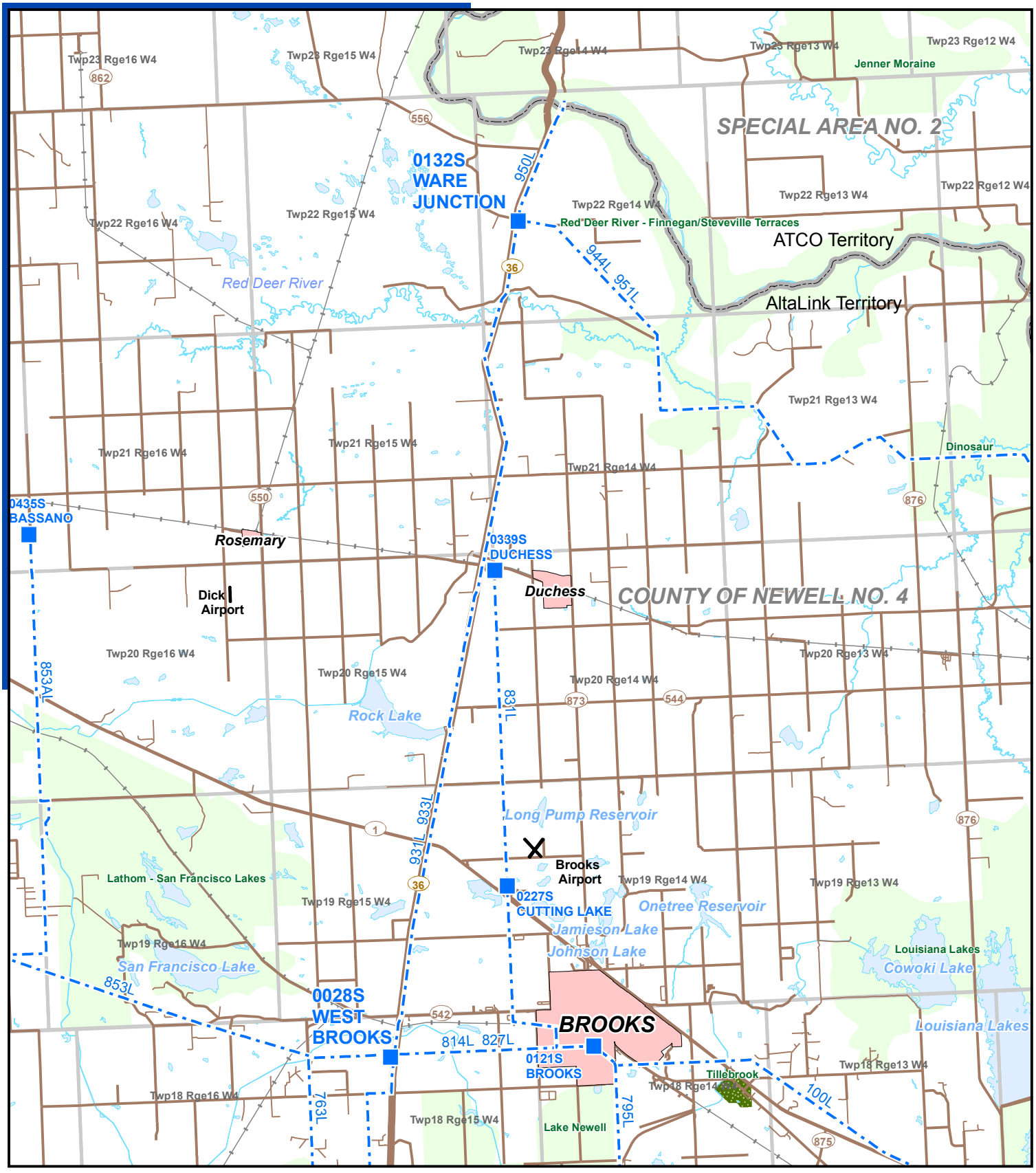
The AESO has requested that AltaLink provide a Land Impact Assessment (LIA) for the proposed 240 kV West Brooks to Ware Junction project as part of the Hanna Area Transmission Development (HATD). The AESO has identified potential future transmission requirements in the Hanna Area. This LIA discusses the potential land impacts of West Brooks-Ware Junction in the context of AUC Rule 007, Section 6, and the Need Identification Document (NID) developed by the AESO.

1.2 West Brooks-Ware Junction 240 kV Transmission Development

The West Brooks-Ware Junction project consists of one component, as determined by the AESO. It involves a new double circuit 240 kV transmission line, approximately 45 km in length, from the new West Brooks Substation northward to the ATCO service territory boundary via the existing Ware Junction Substation. The Red Deer River demarcates the territory boundary (Figure 1).

1.3 Scope of the LIA

The project area located north and west of Brooks, Alberta and south of the Red Deer River that comprises the AltaLink/ATCO service territory boundary (see Figure 1) was assessed for potential land impacts. This area is the basis for the qualitative assessment of potential land impacts of the proposed project. For the purposes of this LIA, the western, central and eastern portions of the project area serve as general descriptors for discussing the impact of siting a new transmission line. Specific routes within the area will be evaluated during the Facilities Application stage.



LEGEND

- Existing Substation
- Existing Transmission Line
- Highway/Major Road
- Secondary Road
- Railway
- Airport
- Environmentally Significant Area
- Municipal or County Boundary
- Township
- Urban Area
- Water Body
- Provincia Park

N

WO:
DRAWN: DH
FILE NO.: 1054256-001
REVISION: 0
DATE: 2009-07-27
PROJECT: West Brooks To Ware Junction

0 1 2 3 4 5 Kilometres

0 1 2 3 4 5 Miles

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

LAND IMPACT ASSESSMENT **LIA1**

ALTALINK

PROPOSED
240kV TRANSMISSION LINE: XXXL
From West Brooks Substation: 0028S to
Ware Junction Substation: 0132S

2. LAND IMPACT ASSESSMENT PROCESS

2.1 LIA Methodology

The LIA process allows the AESO to consider the potential land impacts associated with project components in their determination of need.

The assessment process was driven by the major aspects of AUC Rule 007, Section 6, NID 12 (i.e., agricultural impact, residential impact, environmental impact, electrical considerations, visual impact and special constraints). Associated with each major aspect are several specific considerations that require assessment in the LIA as per AUC Rule 007. However, these considerations in many cases (e.g., reduced efficiency of field operations, psychological impact, noise and TV interference, visual impact of tree removal, etc.) cannot be assessed in great detail until the Facilities Application stage, when route and tower location and design is undertaken by the TFO. The LIA focuses on those aspects and considerations that can be described using information currently available.

A description of each major aspect of AUC Rule 007 and associated considerations is presented in Section 2.2. An assessment of West Brooks-Ware Junction is provided in Section 2.3.

2.2 Major Aspects of AUC Rule 007

The major aspects used in this land impact assessment conducted under AUC Rule 007 are described below, as are their relevance to the assessment of the West Brooks-Ware Junction project.

2.2.1 Agricultural Impact

Agricultural impact refers to impact upon agricultural activities, which may include cultivation of crops, raising of livestock, and other commercial operations.

2.2.1.1 Specific Agricultural Variables

AltaLink has considered the specific agricultural considerations in AUC Rule 007 and how they impact the West Brooks-Ware Junction project:

a) Loss of crops: This would include short-term loss caused by construction; longer-term losses possible from soil erosion, rutting, drainage, disturbance, and soil mixing; and permanent loss of crop under or adjacent to the tower base.

Short-term crop loss during construction is reduced with appropriate mitigation and construction practices. Such short-term losses are compensated through damage payments to

landowners. Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific landowners during the Facility Application consultation, routing of the centerline relative to legal boundaries such as quarter lines, and compensated for by annual tower payments. The majority of the ROW can still be used by the landowner for crop production. Potential impacts may be further reduced by landowner input on tower placement.

b) Short-term disruption of farming and livestock grazing resulting from construction

These potential impacts are mitigated through appropriate construction practices and working with specific landowners to reduce any disruption.

c) Reduced efficiency of field operations

This potential impact is mitigated by determining tower placement that reduces or avoids impact. Long-term impacts are considered when determining annual structure payments for towers.

d) Restrictions on use of aircraft and high-pressure irrigation systems

The presence of a transmission line can potentially impact use of aircraft for agricultural operations, such as crop spraying. This is landowner and route specific, and aerial spraying is being used less often as high-wheel crop sprayers are becoming more common. The impact on the operation of irrigation equipment can usually be reduced through consultation with affected landowners regarding the placement of towers and centerlines. Any unavoidable impacts are considered when determining compensation payments for mitigations (changes to irrigation systems) or impacts.

e) Risk of collision with tower; damage to equipment, lost time, liability for damage to tower and secondary liabilities

A landowner will not be held liable for tower damage unless it was deliberately caused by the landowner or his agents. If the transmission line is taken out of service by the damage, it is typically restored to service within 24 to 48 hours, so any disruption to farming activities due to repairs of the line and tower is short in duration. The potential of collision with a transmission tower is considered very low.

f) Reduction in yield adjacent to towers due to overlapping farming operations and added soil compaction

Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific stakeholders during the Facility Application consultation. The total area under the towers is relatively small for overhead transmission lines. It is addressed and compensated for

through annual tower payments. Potential impacts are further reduced by landowner input on the placement of towers.

g) Added cost and inconvenience of weed control under towers

The added cost and inconvenience of weed control is compensated as part of the annual tower payments to landowners.

h) Impact of height restrictions on equipment during field operations.

All transmission lines in Alberta must provide a minimum height clearance for equipment of 4.3 m on agricultural land.

i) Psychological impact of line

This is a subjective impact involving factors such as electromagnetic fields (EMF) and visual impact. Provision of unbiased information about EMF research from national and international health and scientific agencies is available to the public.

j) Loss of shelter belts

Impacts to shelter belts can be mitigated through routing offsets relative to legal boundaries, such as quarter lines, along which shelter belts may exist. In some cases only trimming may be required. Compensation for re-establishment of a shelter belt is also a possibility. All of these are site specific and determined in consultation with the potentially affected landowner at the Facility Application stage.

k) Shared use with other utilities and transmission lines

Utilization of existing linear disturbances is a factor in the final determination of routing during the Facility Application stage, as per the Alberta Guide for Transmission Lines and Alberta Transmission regulations. For the West Brooks-Ware Junction project, there is an existing 240 kV transmission line with which the new line could parallel.

l) Interference with citizen band radios

This is becoming less of an issue as Citizen Band (CB) radios are being replaced with newer technologies. However, CB radios operate at frequencies close to that of AM radios, neither of which are designed to be immune to power-line interference. The interference produced by power lines diminishes with distance from the power lines, making interference highly localized. All facilities will comply with federal guidelines related to radio interference.

2.2.1.2 Indicators of Agricultural Impact

Agricultural land use, agricultural land suitability and paralleling with existing lines were evaluated as potential indicators of agricultural impact.

Agricultural land use is represented by cropland and forage. In the project area, agricultural land mainly consists of forage, including pasture. Cropland is mostly concentrated within the vicinity of Rosemary in the western portion and sparse throughout the central and eastern portions of the project area.

Agricultural land suitability was not used as an indicator of potential agricultural impact in the assessment as there is little difference in suitability class throughout the project area.

There is an existing 240 kV line, 931L/933L, in the central portion of the project area. While paralleling existing lines is a generally supported practice, in this case, aligning the new line with the existing line would have an agricultural impact within the vicinity of Duchess. The new line would be offset into nearby irrigation and agricultural lands in that particular area.

2.2.2 Residential Impact

Reducing the potential for residential impact is an important consideration in the routing of transmission lines, particularly in areas of high residential density.

2.2.2.1 Specific Residential Considerations

AltaLink has considered the specific residential considerations in AUC Rule 007 and how they may impact the proposed West Brooks-Ware Junction system:

a) Loss of developable lands and constraints on development

Development tends to happen in proximity to existing developed (urban) areas. Loss of developable land is not a concern at this stage, as the project area contains mostly rural residential lands and the siting of the transmission line would avoid the urban areas, including Duchess, Rosemary and Brooks.

b) Relocation or removal of residences

Given that the area is largely rural residential and is relatively sparsely populated, house relocation or removal is not anticipated.

c) Psychological impact of the line

This is a subjective impact involving factors such as EMF and visual impact. Provision of unbiased information about EMF research from national and international health and scientific agencies is

available to the public. Given that the area contains rural residential and is relatively sparsely populated, numerous concerns around this issue are not expected.

d) Noise and TV interference

TV reception problems related to high-voltage transmission lines are unlikely. Transmission lines are designed to meet allowable audible noise and TV interference standards.

e) Windbreak and other vegetation removal

This is an issue where the removal or trimming of trees or other vegetation may be required when establishing a new right-of-way.

f) Conflict with recreational use of land holdings

There are environmentally significant areas and a provincial park within the project area. Assuming these areas are used for recreational purposes, there is potential for conflict with recreational land use if routes are in close proximity to these features.

g) Public versus private land

The use of public land is generally viewed by landowners as a preferable alternative to using private lands. It is expected that this project will occupy private lands almost exclusively.

2.2.2.2 Indicators of Residential Impacts

The presence of built-up (urban) areas, as well as rural residential areas, can provide an indication of the potential residential impacts associated with the proposed project.

2.2.3 Environmental Impact

Reducing potential environmental impacts is a consideration when assessing the components at the LIA stage.

2.2.3.1 Specific Environmental Considerations

AltaLink has considered the specific environmental considerations in AUC Rule 007 and how they may impact the proposed West Brooks-Ware Junction system.

a) Increased public accessibility to wildlife areas

This is typically an issue for treed areas where there is currently little access. Given the low amount of treed areas, this is not applicable to the project area.

b) Alteration of natural areas and interference with outdoor educational opportunities

There is a higher potential to alter natural areas and interfere with outdoor educational opportunities where new disturbances must be created.

c) Use of Restricted Development Area

The system development plan does not include use of a Restricted Development Area.

d) Effect on erosion

There is potential to affect erosion if areas near surface water are disturbed.

e) Unique ecological areas

There are ESAs and areas of native vegetation within the project area.

2.2.3.2 Indicators of Environmental Impact

Surface water bodies (lakes, rivers, streams), wetlands, ESAs and native grassland were considered as indicators of environmental impact. The major lakes in the vicinity, some of which are also ESAs, would be avoided in the siting of the transmission line. Similarly, routing within the vicinity of wetlands would be minimized or avoided in the siting of potential routes.

The Red Deer River is an ESA of provincial significance, which will need to be crossed in order to bring the line into ATCO service territory as required.

Native grassland is abundant throughout and generally equally distributed between the western, central and eastern portions.

2.2.4 Electrical Considerations

While the technical considerations, such as transfer capability, system flexibility, system reliability and losses are considered by the AESO separately, some land impacts related to electrical considerations can be identified.

2.2.4.1 Specific Electrical Considerations

AltaLink has considered the specific electrical considerations outlined in AUC Rule 007 and how they relate to the West Brooks-Ware Junction project:

a) Ease of connections to future load areas

This is for the AESO to consider.

b) Reliability and repairability of the line

Wet soil conditions can present difficulties for future maintenance and repair activities. Detailed identification of wet areas can be determined during the more detailed Facility Application Stage that may occur in the future.

c) Access for construction and maintenance of the line

Paralleling major roads or existing transmission lines can assist with construction and reduce some of the potential access constraint considerations associated with new facilities. There is a transmission line in this area that provides an opportunity to parallel.

2.2.4.2 Electrical Indicators

Right-of-way length and paralleling existing transmission lines are high-level indicators of electrical factors. Length of the transmission line is a key cost driver and can be used by the AESO in electrical line loss calculations.

Given the fixed northern terminus and the narrowly-defined southern terminus, the length of the new 240 kV line does not vary considerably. The proposed 240 kV line will be approximately 45 km in length.

2.2.5 Visual Impact

Visual impacts depend on stakeholder views. These impacts are typically influenced by visibility of transmission lines from residences. Visual impact may also be perceived from roads and highways, as well as by users of recreational areas (i.e., hikers, fishermen, hunters, golfers).

There are some general assumptions that can be made for all overhead transmission lines:

- The closer the line is to a residence, the more likely a visual impact will be perceived.
- The higher the residential density, the more likely a visual impact will be perceived.
- Paralleling similar, existing transmission facilities has a lower visual impact than a greenfield route where there is no existing line.
- Close proximity to parks, natural areas and other recreational areas can be viewed as creating a higher degree of visual impact than in other areas.
- Clearing of mature-treed areas increases the potential level of visual impact by removing what is generally considered an aesthetically pleasing feature on the landscape and potential screening of the transmission line.

2.2.5.1 Specific Visual Considerations

AltaLink has considered the specific visual considerations outlined in AUC Rule 007 and how they relate to the West Brooks-Ware Junction project:

a) Visual impact of tree removal as seen from roads and recreational installations

Many stakeholders view the removal of trees as a visual impact. The project area is primarily cleared land. Potential impacts on shelter belts will be considered during the route evaluation process by the TFO leading to the Facility Application.

b) Visual impact on dispersed recreational users such as hikers, fishermen, hunters, scenic viewers, and cross-country skiers

Areas commonly used by recreational users can be identified using existing data sources.

c) Visual impact of towers and lines as seen from residences, farms, roads, and recreational installations

The type of residential areas can provide an indication of the potential visual impact.

2.2.5.2 Indicators of Visual Impact

Visual considerations described in Section 2.2.5.1 are closely related to residential development, the presence of existing transmission lines and the distribution of recreational areas in the project area.

Residential development is rural residential throughout the project area, offering the opportunity to avoid residences. It is therefore expected that visual impact will be low. The primary urban areas are Rosemary, Duchess and Brooks, which would be avoided in the siting of the 240 kV line.

It is assumed that the main recreational areas in the West Brooks-Ware Junction project area are the Tillebrook Provincial Park south of Brooks and the Red Deer River valley. The project will likely avoid Tillebrook Provincial Park entirely, and mitigate exposure to the Red Deer River valley by using an existing crossing, or avoiding significant viewsheds, thereby minimizing the potential visual impact on recreationists.

2.2.6 Special Constraints

Special constraints are issues or factors that are unique to the specific project area being assessed. Using existing sources of available data, several potential special constraints were identified for further evaluation.

2.2.6.1 Specific Special Constraints

AltaLink has considered the one specific concern in AUC Rule 007. Additional special constraints that relate to the project are also discussed.

a) Electrical interference with radio transmitting stations, and other telecommunication equipment (from AUC Rule 007)

There is the potential for transmission facilities to impact radio and other telecommunication equipment. The intent is to work with affected facility owners to ensure appropriate routing and mitigation methods are employed to minimize or eliminate any potential impact. Following the construction of the proposed facilities, radio frequency interference (RFI) measurements will be taken to ensure that federal guidelines are not exceeded. Any interference problems caused by the new facilities will be mitigated by AltaLink.

b) Proximity to Historical Resources

Historical resources are specific sites that have been identified within the province that hold particular archaeological significance. The province maintains a registry of known locations and, depending on the significance of a particular site, there may be constraints placed on nearby planned development or disturbance.

c) Proximity to Major and Minor Airports

The presence of airports, airstrips, and aerodromes present a challenge for routing since each has a specific setback. The potential conflicts range from collision hazards to interference with radio and navigational equipment. Transport Canada maintains a list of all registered airports, airstrips, and aerodromes.

d) Oil and gas

Oil and gas is a major land use in this area of the province. Oil and natural gas wells and pipelines are therefore common features in the project area. Conflicts with oil and gas facilities on transmission routes can be mitigated by avoidance.

e) Irrigation areas

The project area falls within the Eastern Irrigation District.

2.2.6.2 Indicators of Special Constraints

Review of available data indicates there are historic resource sites along the Red Deer River, west of Highway 36 and east of Brooks. These areas would be avoided in the siting of the proposed 240 kV line.

While well sites are common throughout the project area, they can be avoided.

There are two airports in the project area, one immediately north of Brooks and another south of Rosemary. These have associated airport runway setbacks which will have to be considered if routing through the central portion of the project area.

Irrigation operations are common throughout the project area, particularly within the vicinity of Rosemary and Duchess.

2.3 Assessment of West Brooks-Ware Junction

This section assesses West Brooks-Ware Junction according to indicators derived from the major land impact aspects of AUC Rule 007. A discussion of the major aspects and the selected indicators were presented in Section 2.2. Those representative indicators are used to characterize the potential impacts of the project.

Potential for agricultural impact is highest in the western portion of the project area where cropland is most abundant. Residential impact is most likely in the central portion, along Highway 36, within the vicinity of Duchess, and surrounding Brooks. Potential environmental impact is related mostly to major lakes, which are most common in the central portion north of Brooks. Visual impact has the highest potential in the central portion of the project area. Electrically, there is the opportunity to parallel with an existing 240 kV line, but this carries potential residential and agricultural impacts due to residences in proximity to the existing line and adjacent irrigation operations. In terms of special constraints, irrigation operations are primarily an issue in the western and central portions, and airports occur in the western and central portions. Potential impact on historic resources is mainly a concern for the central and eastern portions.

3. CONCLUSION

The assessment of a 240 kV transmission line from West Brooks northward to the ATCO service territory boundary via the Ware Junction substation includes the following:

- Native grassland and irrigation are common and generally equally distributed throughout the project area and will therefore be key considerations in the Facilities Application stage;
- The option to parallel the new 240 kV line with the existing 240 kV line may have greater agricultural and residential impact due to the close proximity of irrigation facilities and residences in several locations along the line.
- There are tradeoffs between various impacts:
    - Routing in the western portion of the project area carries higher potential for agricultural impact given the cropland and irrigation in the area, but has lower potential for environmental impact and less special constraints to consider;
    - Routing in the central portion carries lower potential for agricultural impact, but higher potential for residential, environmental and visual impact, and has airports and historic resources to consider;
    - Routing in the eastern portion carries lower potential for agricultural, residential, environmental and visual impact, but has the majority of historic resources in the project area.

4. INFORMATION SOURCES

Alberta Culture & Community Spirit. 2009. Listing of Historic Resources: Instructions for Use. March 2009. Alberta Government.

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Alberta Sustainable Resource Development. 2009. Land Use Framework. Alberta Government. Available online at: http://www.landuse.alberta.ca/

Alberta Utilities Commission. 2009. AUC Rule 007: Rules Respecting Applications for Power Plants, Substations, Transmission Lines, and Industrial System Designations. Version 3, April 21, 2009. Calgary, Alberta. Available online at: http://www.auc.ab.ca/acts-regulations-and-auc-rules/rules/Pages/Rule007.aspx

Sweetgrass Consultants. 1997. Environmentally Significant Areas of Alberta. Calgary, Alberta. Available online at: http://www.tpr.alberta.ca/parks/heritageinfocentre/environsigareas/default.aspx

LAND IMPACT ASSESSMENT

for the

Proposed Hanna Area Transmission Development (HATD)

Prepared for the
Alberta Electric System Operator (AESO)
in Support of the
AESO Needs Identification Document (NID)

July 20, 2009

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EXECUTIVE SUMMARY

The intent of this Land Impact Assessment (LIA) is for transmission facility owner (TFO) ATCO Electric Ltd. (ATCO) to provide the Alberta Electric System Operator (AESO) with land impact analysis information required for the proposed Hanna Area Transmission Development Project Need Identification Document (NID).

This LIA was achieved by conducting comparative assessments of AESO's three system development plans ("Alternatives"). The objective of this LIA study was to define and compare potential route concepts for each Alternative using measurable indicators to quantify and qualify the major aspects of impacts as identified by the Alberta Utilities Commission (AUC) Rule 007 (NID12, Section 6.1, April 2009). This LIA does not consider cost, technical details, or electrical aspects, as per scope of work agreed to on May 29, 2009.

This LIA was conducted within the Right-of-Way Planning group of ATCO Electric in Edmonton, Alberta. A variety of digital land information data, digital data analysis methods and cadastral mapping techniques were used to generate impact assessment summary statistics ("metrics") and maps. ATCO conducted and developed the LIA using the following direction from the AESO:

- All three system-development plans (i.e. Alternatives 1, 2, and 3) are to be assessed;
- The LIA is to focus exclusively on those impacts defined in Rule 007;
- Cost is out of scope and therefore is not included in this study;
- Electrical consideration assessments are to be limited to land-related impacts; and
- LIA analyses are to ignore ATCO and AltaLink service area boundaries.

To facilitate the comparative assessment of the three AESO Alternatives at this stage of project development, representative routing scenarios (i.e. "route concepts") were based on, among other factors, the location of existing transmission lines and substations. Route concepts were then formulated for each Alternative, which took into account existing facilities and proposed facilities, and were then compared in terms of their impact metrics.

LIA Findings

It is important to consider that from an LIA perspective, none of the three system-development plans pose a degree of potential impact that completely excludes either of them from consideration as a viable solution, based on the impact criteria studied. No specific routing scenarios are being recommended at this time.

For more precise comparisons, detailed, field-level siting and routing research is required. Additionally, Public Consultation (Stakeholder / Land Owner, Agency and First Nations) is required to identify specific routing options for more detailed comparisons. Field-level assessment and public consultation on the key impact factors (per AUC Rule 007) were not undertaken at this level of LIA study. It is highly recommended that detailed field-level studies be undertaken as part of the intensive route-planning process, prior to TFO Public Consultation activities, for determining viable preliminary routing options.

Spatial analysis methods were applied to a variety of digital data sets to quantitatively determine impacts ("metrics") for measurable indicators. Results are presented in Sections 5 and 6 and include metrics summaries for each Alternative.

For purposes of broad-based comparisons of routing concepts for the three design **Alternatives**, **Alternative 3** potentially has the lowest overall impact for the majority of the measurable indicators assessed. **Alternative 3** has the shortest overall length as based on route concept comparisons (approximately 410 km), and thus the lowest overall value for land area required (potentially 1,220 ha) for potential right-of-ways. **Alternative 1** has the potential for the longest overall length (580 km) and the largest area (1,730 ha) of lands required for potential right-of-ways. In comparison, **Alternative 2** has the mid-range of route length (approximately 490 km) and land area required (1,470 ha).

Alternative 3 takes up more environmentally sensitive land than **Alternative 2**, but has the lowest ranking for proximity to and potential impacts to surface water. **Alternative 3** also has the lowest potential to impact oil and gas facilities. **Alternative 3** takes up the least amount of native grasslands, and the least amount of Special Areas and privately-owned lands. Additionally, **Alternative 3** impacts the least amount of Historical Resources relative to **Alternatives 2 and 3**. None of the three Alternatives cross rivers, military bases, airfields, or Indian Reserves. **All three Alternatives** are equivalent in the amount of infrastructure and linear features (e.g. transmission lines, highways, railway lines, and pipelines) paralleled. **Alternatives 1 and 2** have potential for impacting urban centres, whereas **Alternative 3** does not.

Social impact is a more qualitative type of assessment, but may be considered as a combination of the impacts related to residential, visual, and special constraints. Using these criteria, **Alternative 3** can be viewed as having the least potential for social impact, whereas **Alternative 1** can be viewed as having the greatest potential for social impact.

1 INTRODUCTION & OVERVIEW

1.1 Background

The Alberta Electric System Operator (AESO) requested ATCO Electric Ltd. (ATCO) to provide a Land Impact Assessment (LIA) for the proposed Hanna Area Transmission Development (HATD) Project ("the Project"), in the Hanna region of southern Alberta. This LIA is to be used by the AESO in support of the Needs Identification Document (NID) for this transmission development project. This LIA report considers three potential system development alternatives and associated route concepts for each Alternative and serves as a comparative assessment of the AESO's three proposed system-development plans: **Alternative 1, Alternative 2, and Alternative 3.**

The proposed route concepts for each of the three Alternatives are detailed below, in terms of component transmission lines and substations. Existing and proposed lines, and existing and proposed substations are described in the text below. Proposed lines are described by "start point – end point" substation sequences, based on existing and proposed (future) substations in the descriptive tables provided in Section 3.

1.2 Study Area

The HATD study area is characterized by a wide range of level to rolling topography, with occasional coulees and terraces associated with rivers and river beds. Water bodies are either permanent or ephemeral. The Red Deer River and the Battle River are the only major river systems within the study area. Several named and unnamed creeks occur within the region. Primary land use is agricultural (cereal, forages, hay) and ranching (pasture, grazing leases and community pastures). Some irrigation farming is done in the southernmost portion of the area. Oil and gas exploration and development is very common throughout the region, as is related infrastructure (well sites, pipelines, pump stations and compressor stations).

Native grasslands predominate in the undisturbed (uncultivated) areas. The dominant forest type (northern parts of area) is a transitional Aspen Parkland to intermediate low-shrub - Mixed Prairie grassland. The predominant vegetation types of the native prairie regions are fescue grassland and mixed grasslands, interspersed with willow (*Salix spp.*) and aspen and poplar (*Populus spp.*) clusters.

Small towns, villages, and hamlets are scattered throughout the region and provide services to the local agricultural community and also support oilfield activities. Population centres include Hanna, Oyen, Consort, Coronation, Veteran, Stettler and Drumheller. Airstrips are associated with larger population centres, and telecommunications towers are distributed throughout the landscape.

Land ownership is a combination of Municipal Government (MD, County, and Special Areas Board) and private (freehold), as well as Crown (Provincial Government). There are no National Parks or Provincial Parks within this study region, however there are several designated Environmentally Significant Areas (ESAs) in the region.

Refer to Figures 1.1 and 1.2 for Regional and Study Area maps.

Figure 1.1 – Regional Map

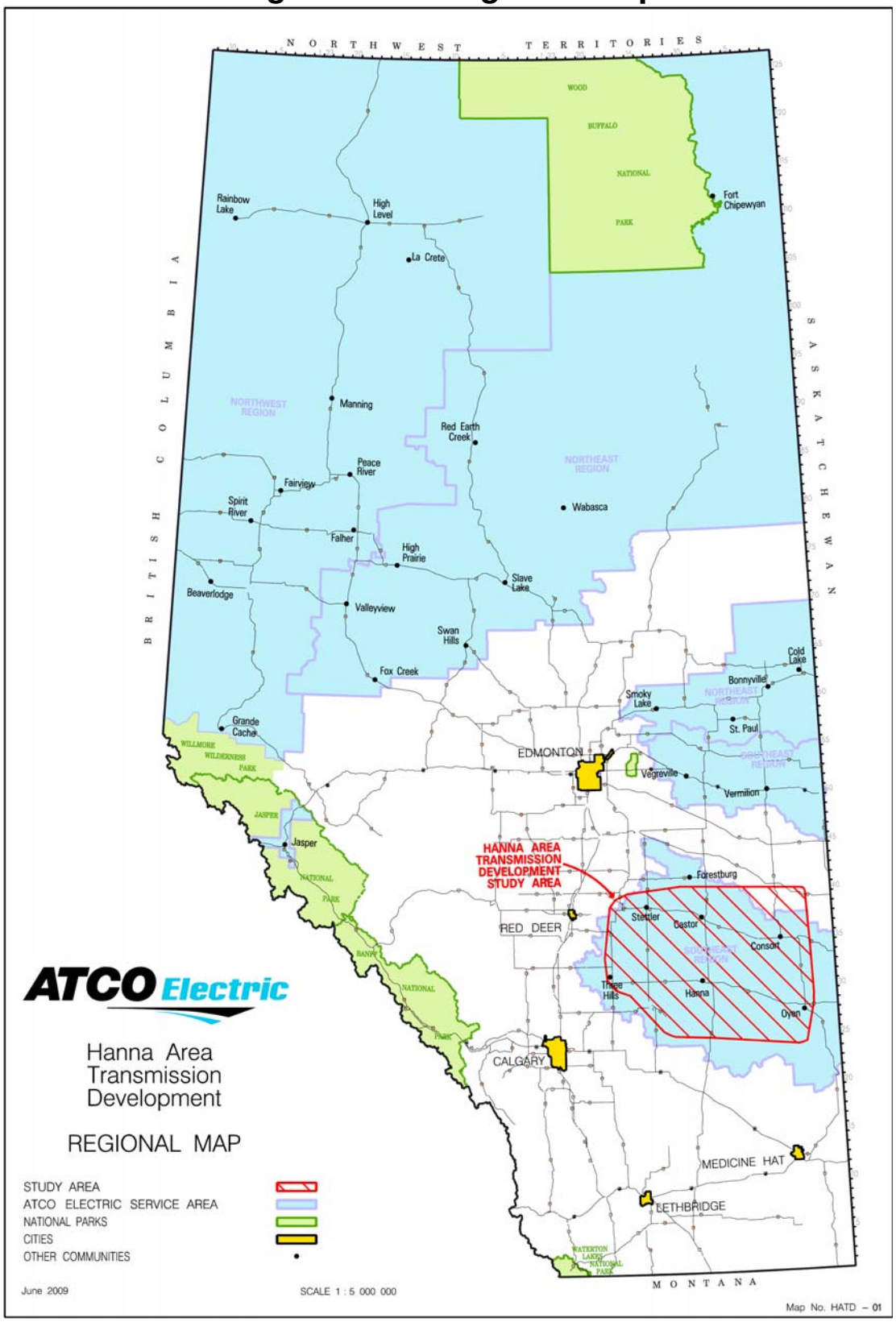
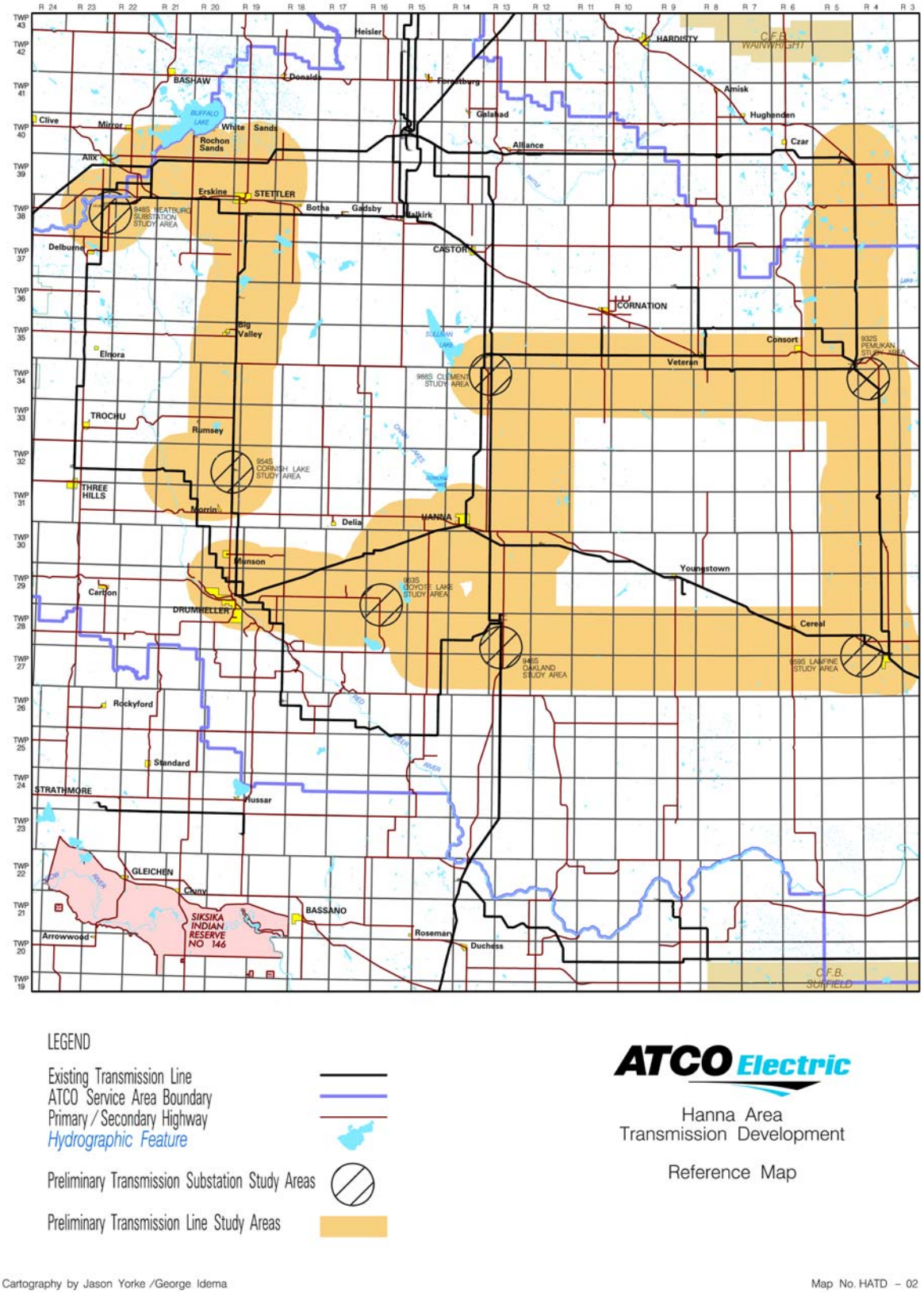


Figure 1.2 – Study Area Map



LEGEND

Existing Transmission Line
ATCO Service Area Boundary
Primary / Secondary Highway
Hydrographic Feature

Preliminary Transmission Substation Study Areas

Preliminary Transmission Line Study Areas

ATCO Electric

Hanna Area
Transmission Development

Reference Map

Cartography by Jason Yorke /George Idema

Map No. HATD – 02

Primary environmental concerns involve the conservation of native grasslands and agricultural soils, the protection of bird migration corridors and nesting grounds as defined by presence of water bodies, and the overall protection and conservation of wildlife and associated habitat.

1.3 Route Concepts for the Alternatives

The route concepts for the three "Alternatives" proposed by the AESO are referred to as **Alternative 1, Alternative 2, and Alternative 3.** Each is comprised of combinations of single and double circuits of 144 kV and 240 kV transmission lines, as well as existing and proposed substations, with some line and substation components common to all three Alternatives. Details on the system components comprising the three AESO HATD Alternatives are presented in Sections 3, and drawings of these Alternatives are presented as Figures 2.1, 2.2, and 2.3, respectively.

1.4 Report Organization

This document is organized to provide an understanding of the:

- Background and need for this Transmission Development Project;
- Transmission lines and substation components for each of the three Alternatives being considered;
- Limitations in assessing land impacts of these Alternatives;
- Assumptions made and criteria used to identify impacts as per AUC Rule 007;
- Factors that influence the proponents and stakeholders response to these Alternatives; and
- Rationale for how the LIA findings (metrics data) were attained.

Section 1 (Introduction and Overview) provides background information on the need and focus for the LIA. Section 2 (Methods) provides a summary of methods and data used in this LIA, and insight into the assessment process associated with each system-development Alternative.

Section 3 (System Development Plans & Design Alternatives) provides descriptions of representative route concepts for each Alternative, including summary tables for each Alternative in terms of existing and proposed line and substation components.

Section 4 (Land Impacts & Measurable Indicators) provides insight into the major aspects of transmission line impacts as defined by the AESO Rule 007, and how the measurable indicators can be determined and used to gauge specific concerns for each of the proposed Alternatives. The measurable indicators are then used to conduct a broad comparison and to establish potential differences in impact factors between each of the proposed Alternatives.

Section 5 (Results & Discussion) contains the LIA findings. Section 6 (Summary & Conclusions) provides summary and conclusions, based on the evaluation of the overall determined impacts for each of the three route Alternatives.

Sections 7 (Acronyms) provides a list of Abbreviations and Acronyms, and Section 8 (Glossary of Terms) provides an explanation of terms used within this report.

2 METHODS

2.1 Requirements of AUC Rule 007

AUC Rule 007 requires that specific impact criteria be examined in the assessment of routing alternatives for proposed transmission development projects. This necessitates that an impact assessment be undertaken that considers seven impact categories, as defined in Section 6, NID 12, of Rule 007.

These include:

(1) Agricultural Impact;
(2) Residential Impact;
(3) Environmental Impact;
(4) Cost;
(5) Electrical Considerations;
(6) Visual Impact; and
(7) Special Constraints.

These impact categories are described in terms of their respective components and measurable indicators in Section 4 of this report. Item 6 "Cost" was excluded from the LIA, per request of the AESO.

2.2 Delineation of Regional Study Area

The HATD study area boundaries for this LIA were defined in response to three system development plans and the associated components identified by the AESO. Refer to maps of the Study Area (Figures 1.1 and 1.2), and the three Alternatives' route concepts (Figures 2.1, 2.2, and 2.3). These three different transmission development plans or "Alternatives" were put forth by the AESO (Figures 2-4). Each of these is characterized by common and unique combinations of proposed 144 kV and 240 kV component transmission lines. The termination points for the proposed transmission lines are either existing or proposed substations. Refer to Section 3 for additional details on these Alternatives.

The new transmission system components, together with a variety of landscape features, existing transmission lines, highways, and populated centres, helped to define the study area boundaries as follows:

- The southern boundary was determined by the location of the existing Anderson and Oyen 767S substations and future Oakland 946S and Lanfine 959S substation locations, as well as the Coyote Lake 963S substation, and associated local wind generation facilities.

- The eastern boundary of the study area was determined by the Oyen substation and proposed Excel 910S substation, transmission lines 7L796 and 7L224, leading from the proposed Pemukan 903S substation (ATCO territory,) to the existing Hansman Lake 605S substation (AltaLink territory). Additionally, the area between Empress and Bindloss were included,

pending potential interconnections and future projects related to pipeline and wind generation industries.

- A northern boundary was determined by the corridors of transmission lines 9L948, 9L27, and 9L20. This includes the Hansman Lake 650S and Nevis 766S substations.

- The western boundary of the study area was delimited by the existing Delburne 760S and Three Hills 770S, and Michichi Creek 802S substations and the proposed Delburne II / Heatburg substations, a potential Ghost Pine wind farm and transmission lines 7L25, 7L16, and 7L85.

- Route concepts excluded areas viewed as "no-go areas". These areas included heavily populated urban centres, provincial and national parks and protected areas, military bases, Indian Reserves, major water crossings, and other areas with significant constraints.

Refer to Figures 2.1 – 2.3 for additional details on the individual AESO Alternatives. Refer to Figure 1.2 for additional details on potential location of proposed substations and route concepts.

Figure 2.1 – Alternative 1

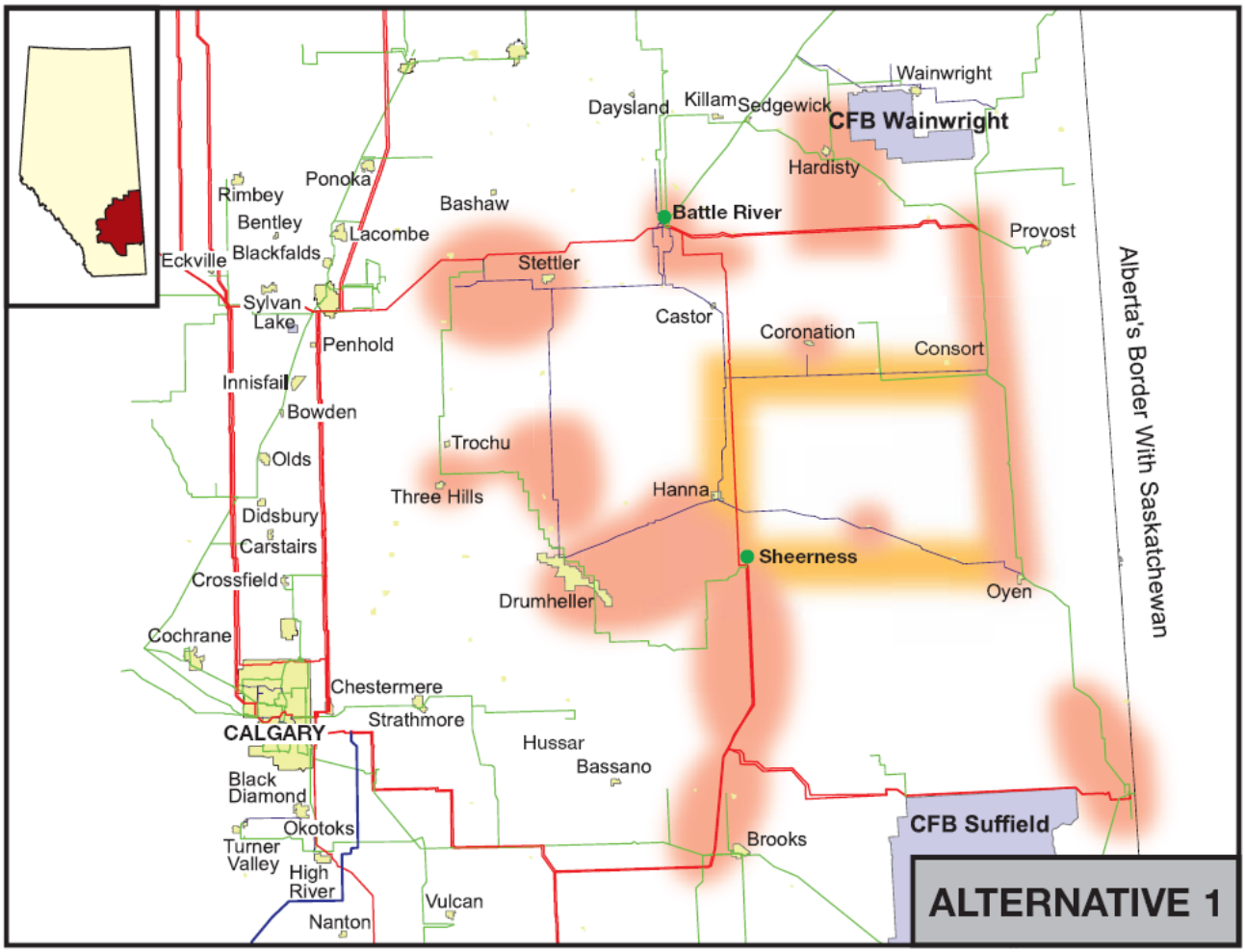


Figure 2.2 – Alternative 2

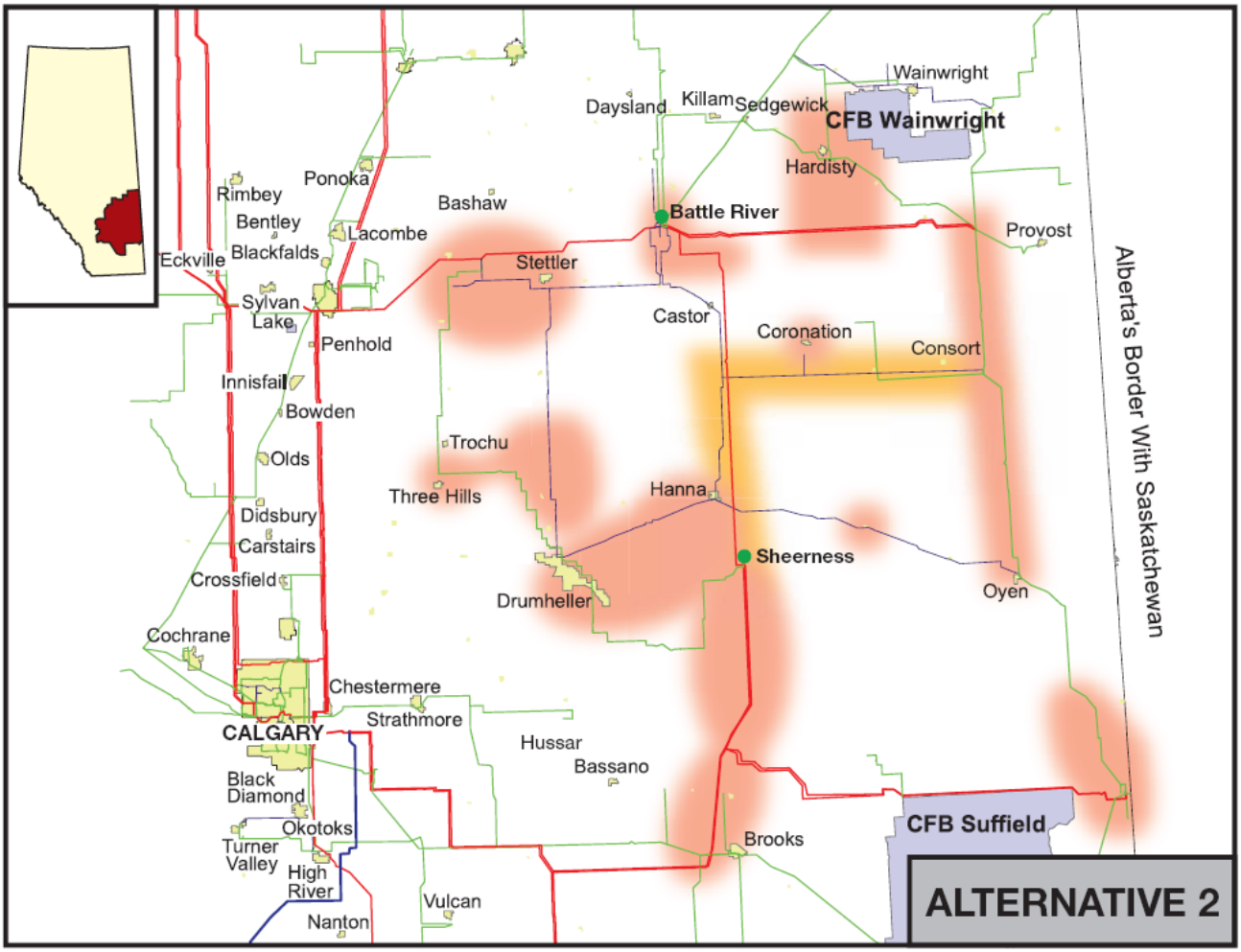
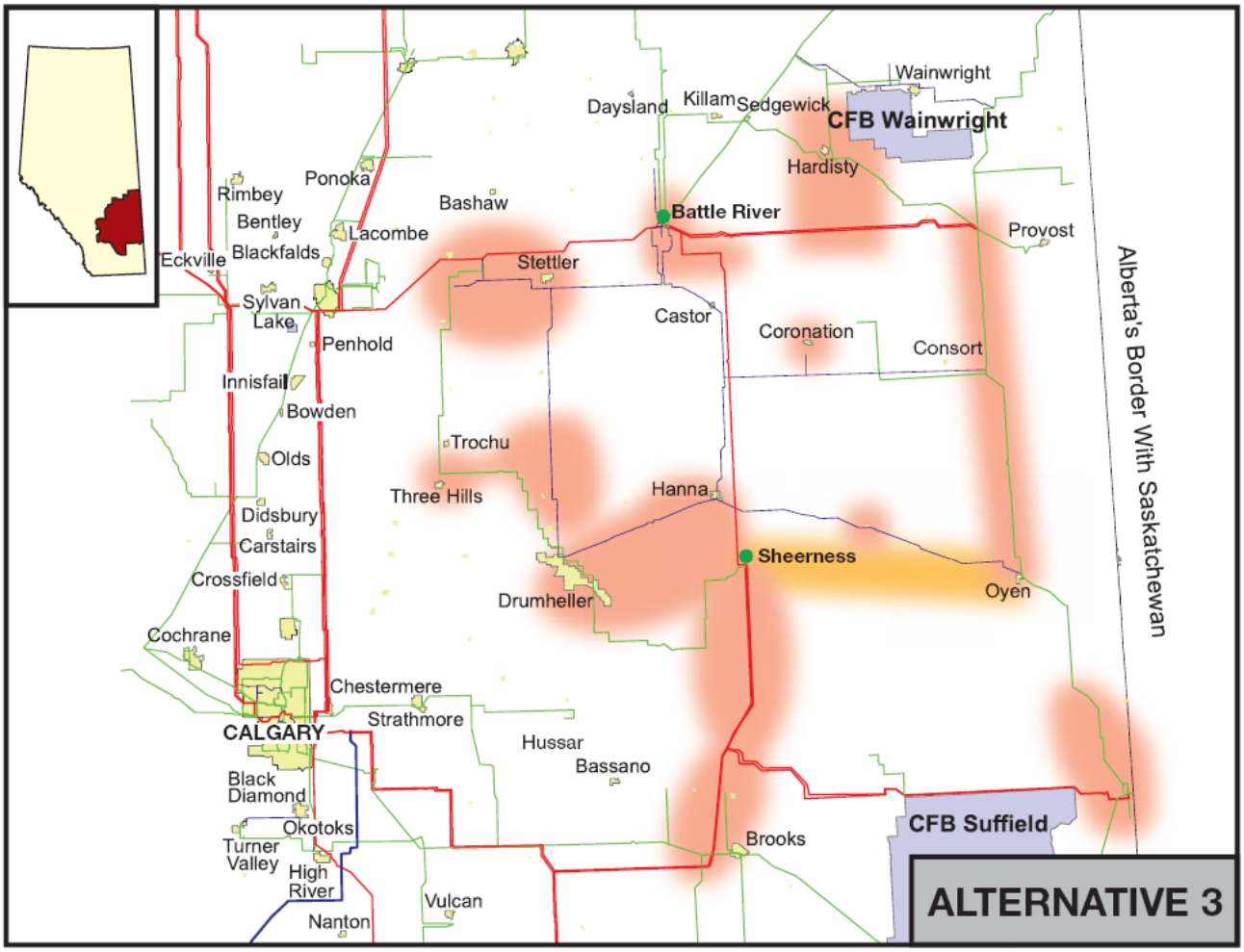


Figure 2.3 – Alternative 3



2.3 Data Utilized

The following data were utilized in the generation of metrics for this study:

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Agriculture and Agri-Food Canada, **"PFRA's Generalized Landcover,"** Prairie Farm Rehabilitation Administration - Agriculture Agri-Food Canada, 2001, Regina, SK, Canada, <http://www.agr.ca/pfra/gis/index.htm>

2.4 The LIA Assessment Process

The Land Impact Assessment (LIA) process allows the AESO to conduct a comparative assessment of the potential impacts for the AESO's three proposed system-development plans for the Hanna Area Transmission Development, to support submission of their NID.

To ensure consistent data for all plans, the land impact assessment process was driven by common criteria. The AUC Rule 007 "major aspects for land assessments", with associated measurable indicators and concerns were considered for all plans. All plans required representative routing concepts to generate the measurable indicators, as well as consistent technical assumptions (i.e. using a 30 metre right-of-way (ROW) for both 144 kV and 244 kV transmission route concepts).

This section offers a detailed look at the criteria used in the LIA process, provides an understanding of how the LIA was conducted and metrics were developed, and how findings were reached. The LIA evaluated the relative land impacts of transmission line developments within the geographic areas associated with the respective system-development plans portrayed as route concepts (Figures 1.2, 2.1, 2.2, and 2.3).

Each system-development plan is comprised of several individual components, including new transmission lines, new substations, or upgrades to existing facilities, all of which are described in Section 3, for each Alternative.

The LIA uses the "major aspects of land impact", with the exception of cost and certain electrical aspects, as identified within AUC Rule 007 (NID 12, Section 6.1) as basis for identifying specific land-impact concerns. These include:

- Agricultural Impact;
- Residential Impact;
- Environmental Impact;
- Electrical Considerations;
- Visual Impact; and
- Special Constraints.

(Note that AUC's "Item 6 - Cost" was not part of the scope of this impact assessment)

Through the analysis of available digital data sources (Section 2.3), for each technical alternative, representative route concepts were determined for each of the three system-development plans and analyzed for potential impacts. These route concepts were derived from reconnaissance level assessments of available digital data and were evaluated for comparative purposes. No detailed route determinations (e.g. on which side of a paralleled transmission line a new line would be located.) were utilized in evaluation of route concepts, as this requires a subsequent narrowing down of route options with detailed field work to facilitate local landscape level comparisons, as well as the TFO's Public Consultation on proposed route options, all which will help determine the most feasible routing given actual conditions at the local landscape level.

The LIA was derived using the best available digital map information including, but not limited to, various land-use and land-feature maps and included:

- Satellite imagery;
- Hydrographic data;
- Wildlife data;
- Environmentally Sensitive Areas (ESA) data;
- Canada Land Inventory (CLI) – Soil capability for Agriculture, and Forestry;
- Cadastral land-base classification data (Alberta Township Survey, Zones, Municipal Boundaries, Crown Lands); and
- Historical and Archaeological Resource data.

In addition to analysis of these data for reconnaissance level evaluation of the AESO's proposed three Alternatives, a field tour and photo collection were undertaken in January 2009 to familiarize project team members with the study region and to identify any major landscape impediments or industrial developments not portrayed on the other data considered.

ATCO's experience with respect to routing transmission lines in Alberta, including existing and proposed 144 kV and 240 kV transmission lines and substations, and prior knowledge of the study area, were incorporated into selection of the route concepts for each of the three Alternatives. For application of these reconnaissance level LIA findings on the proposed Alternatives and associated route concepts, there is also a need for Public, Agency, and First Nations consultation by TFOs, detailed environmental assessment fieldwork, visual assessments, historical and archaeological resource impact assessments, a land-titles search, and other route-siting activities that will help determine more specific routing scenarios for the Facilities Applications.

3 SYSTEM DEVELOPMENT PLANS & DESIGN ALTERNATIVES

3.1 System Development Plans and Alternatives

Three "Alternatives" were proposed by the AESO, as options for the Hanna Area Transmission Development. These Alternatives are portrayed as route concepts (Figures 1.2, and 2.1-2.3). Summary tables of the transmission lines and substations associated with each of these three Alternatives are presented within (Tables 3.1 to 3.6).

In general terms, each Alternative consists of a minimum of 12 line configurations (single circuit and double circuit, for a total of 18 individual lines) as the basic framework common to the overall transmission development plan for the area. Each Alternative is then characterized with additional lines and substations that are unique to the full Alternative design. Refer to Sections 3.1.1, 3.1.2 and 3.1.3 for additional details on each Alternative.

3.1.1 Alternative 1

Alternative 1 can be generally described as a "4-sided, closed-loop" system, with major components extending from four new proposed substations as follows:

Clement → Oakland → Lanfine → Pemukan → Clement (i.e. to close the loop),

and then extending from Pemukan substation via line 9L966 to Hansman Lake substation in AltaLink territory. This also includes an extension from Oakland to Coyote Lake via 9L29 and 9L31, and Coyote Lake to Hanna via 7L108, and inclusion of the proposed Halkirk 401S switching station via 9L49 from the Cordel 775S substation. Note that these features are common to all three Alternatives.

Unique features of Alternative 1 include line 9L06, extending between Oakland and Clement substations, line 9L24 extending between Oakland and Lanfine substations, and line 9L14 extending between Clement and Pemukan substations. These lines are highlighted in Table 3.1.

Refer to Tables 3.1 and 3.2 for summaries of the specific line and substation components associated with Alternative 1.

Table 3.1 Line Details for Alternative 1

***Note*: Black font denotes "existing" substation, Red font denotes "new substation". Yellow highlight indicates line configurations unique to this Alternative.**

AE #	SLD Future Line#	kV	Approx. Line Length (km)	S/C or D/C	Start Point	End Point	Comment
1	**7L143**	144	35	S/C	Stettler 769S	Nevis 766S	
2	**7L128**	144	42	S/C	Michichi Creek 802S	**Coyote Lake 963S**	
3	**7L108**	144	40	S/C	**Coyote Lake 963S**	Hanna 763S	
4	**7L159 (Three Hills to Delburne) & / Existing 7L16 (Delburne to Nevis)**	144	1.6 1.6 "in/out"	D/C	Three Hills 770S **/ Delburne II (Heatburg)**	**Delburne II (Heatburg)** / Nevis 766S	"in/out" via new **"Delburne II"/ "Heatburg"**
5	**7L137 /7L25**	144	12	D/C	Three Hills 770S	Rowley 768S	
6	**7L116**	144	8	S/C	Excel 910S	**Lanfine 959S**	replaces 7LA98 to Excel
7	**7L132 / 7L141**	144	6	D/C	Oyen 767S	**Lanfine 959S**	
8	**7L127 / 7L151**	144	6	D/C	Monitor 774S	**Pemukan 932S**	
9	**9L97 / 9L70**	240	7	D/C	Anderson 801S	**Oakland 946S**	
10	**9L29 / 9L31**	240	38	D/C	**Oakland 946S**	**Coyote Lake 963S**	
11	**9L06**	240	81	S/C	**Oakland 946S**	**Clement 988S**	unique to Alternative 1
12	**9L24**	240	87	S/C	**Oakland 946S**	**Lanfine 959S**	unique to Alternative 1
13	**9L14**	240	90	S/C	**Clement 988S**	**Pemukan 9332S**	unique to Alternative 1
14	**9L966**	240	60	S/C	**Pemukan 9332S**	**Hansman Lake 650S (AltaLink)**	
15	**9L46**	240	68	S/C	**Lanfine 959S**	**Pemukan 932S**	

Table 3.2 Substation Details for Alternative 1

Future Substations	Tentative ISD	Comment
Lanfine 959S	**2012**	
Pemukan 932S	**2012**	
Oakland 946S	**2012**	
Coyote Lake 963S	**2012**	
Clement 988S	**2012**	
Delburne II / Heatburg	**2012**	replaces existing Delburne 760S
Upgrades to Existing Substations		
Anderson 801S		
Delburne 760S		will be replaced with construction of Delburne II / Heatburg
Excel 910S	**2009**	currently under construction, ISD December 2009
Hanna 763S		
Michichi Creek 802S		
Monitor 774S		
Nevis 766S		
Oyen 767S		
Stettler 769S		
Rowley 768S		
Three Hills 770S		
Hansman Lake 650S		AltaLink substation

3.1.2 Alternative 2

Alternative 2 can be generally described as a "3 sided, open-loop" system, with major components extending from four new proposed substations as follows:

Clement → Oakland → Lanfine, and Clement → Pemukan → (such that the basic framework is 3-sided)

This Alternative also includes line components that extend from Pemukan substation via line 9L966 (single circuit) to Hansman Lake 650S substation in AltaLink territory, an extension from Oakland to Coyote Lake via 9L29 and 9L31, and Coyote Lake to Hanna via 7L108, and inclusion of the proposed Halkirk 401S switching station via 9L49. Note that these features are common to all three Alternatives.

The unique features of Alternative 2 include a double circuit line design (9L06/9L52) that extends between the proposed Oakland and Clement substations and a double circuit line design (9L14 / 9L25) that extends between the proposed Pemukan and Clement substations.

Refer to Tables 3.3 and 3.4 for summaries of the specific line and substation components associated with Alternative 2. The unique components of Alternative 2 are highlighted in Table 3.1.

Table 3.3 Line Details for Alternative 2

Note: Black font denotes "existing" substation, Red font denotes "new substation". Yellow highlight indicates line configurations unique to this Alternative.

AE #	SLD Future Line#	kV	Approx. Line Length (km)	S/C or D/C	Start Point	End Point	Comment
1	**7L143**	144	35	S/C	Stettler 769S	Nevis 766S	
2	**7L128**	144	42	S/C	Michichi Creek 802S	**Coyote Lake 963S**	
3	**7L108**	144	40	S/C	**Coyote Lake 963S**	Hanna 763S	
4	**7L159 (Three Hills to Delburne) / Existing 7L16 (Delburne to Nevis)**	144	1.6 1.6 "in/out"	D/C	Three Hills 770S / Delburne 760S	Delburne 760S / Nevis 766S	"in/out" via new **Delburne II / Heatburg**
5	**7L137 / 7L25**	144	12	D/C	Three Hills 770S	Rowley 768S	
6	**7L116**	144	8	S/C	Excel 910S	**Lanfine 959S**	
7	**7L141 / 7L132**	144	6	D/C	Oyen 767S	**Lanfine 959S**	
8	**7L127 / 7L151**	144	6	D/C	Monitor 774S	**Pemukan 932S**	
9	**9L97 / 9L70**	240	7	D/C	Anderson 801S	**Oakland 946S**	
10	**9L29 / 9L31**	240	38	D/C	**Oakland 946S**	**Coyote Lake 963S**	
18	**9L06 / 9L52**	240	81	D/C	**Oakland 946S**	**Clement 988S**	unique to Alternative 2
19	**9L14 / 9L25**	240	90	D/C	**Clement 988S**	**Pemukan 9332S**	unique to Alternative 2
14	**9L966**	240	60	S/C	**Pemukan 9332S**	**Hansman Lake 650S AltaLink**	
15	**9L46**	240	68	S/C	**Lanfine 959S**	**Pemukan 932S**	

Table 3.4 Substation Details for Alternative 2

Future Substations	Tentative ISD	Comment
Lanfine 959S	**2012**	
Pemukan 932S	**2012**	
Oakland 946S	**2012**	
Coyote Lake 963S	**2012**	
Clement 988S	**2012**	
Delburne II / Heatburg	**2012**	replaces existing Delburne 760S
Halkirk 401S switching station	**2012**	
Upgrades to Existing Substations		
Anderson 801S		
Delburne 760S		will be replaced with construction of Delburne II / Heatburg
Hanna 763S		
Michichi Creek 802S		
Monitor 774S		
Nevis 766S		
Oyen 767S		
Stettler 769S		
Rowley 768S		
Three Hills 770S		
Hansman Lake 650S		AltaLink substation

3.1.3 Alternative 3

Alternative 3 may be described as a 2-sided, open system, with major components extending from four new proposed substations as follows:

Coyote Lake → Oakland → Lanfine → Pemukan

This Alternative also includes line components that extend from Pemukan substation via line 9L966 (single circuit) to Hansman Lake substation in AltaLink territory, an extension from Oakland to Coyote Lake via 9L29 and 9L31, and Coyote Lake to Hanna via 7L108, and inclusion of the proposed Halkirk 401S switching station via future 9L49. Note that these features are common to all three Alternatives.

The unique feature of Alternative 3 is a double circuit 240 kV line design (9L24 / 9L65) that extends between the proposed Oakland and Lanfine substations.

Refer to Tables 3.5 and 3.6 for additional details on the specific line and substation components associated with Alternative 3. The unique components of Alternative 3 are highlighted in Table 3.5.

Table 3.5 Line Details for Alternative 3

AE #	SLD Future Line #	kV	Approx. Line Length (km)	S/C or D/C	Start Point	End Point	Comment
1	**7L143**	144	35	S/C	Stettler 769S	Nevis 766S	
2	**7L128**	144	42	S/C	Michichi Creek 802S	**Coyote Lake 963S**	
3	**7L108**	144	40	S/C	**Coyote Lake 963S**	Hanna 763S	
4	**7L159 (Three Hills to Delburne) / Existing 7L16 (Delburne to Nevis)**	144	1.6 1.6 "in/out"	D/C	Three Hills 770S / **Delburne II / Heatburg**	**Delburne II / Heatburg** / Nevis 766S	"in/out" via **Delburne II / Heatburg**
5	**7L137 / 7L25**	144	12	D/C	Three Hills 770S	Rowley 768S	
6	**7L116**	144	8	S/C	Excel 910S	**Lanfine 959S**	
7	**7L141 / 7L132**	144	6	D/C	Oyen 767S	**Lanfine 959S**	
8	**7L127 / 7L151**	144	6	D/C	Monitor 774S	**Pemukan 932S**	
9	**9L97 / 9L70**	240	7	D/C	Anderson 801S	**Oakland 946S**	
10	**9L29 / 9L31**	240	38	D/C	**Oakland 946S**	**Coyote Lake 963S**	
25	**9L24 & / 9L65**	240	87	D/C	**Oakland 946S**	**Lanfine 959S**	unique to Alternative 3
14	**9L966**	240	60	S/C	**Pemukan 9332S**	**Hansman Lake 650S (AltaLink)**	
15	**9L46**	240	68	S/C	**Lanfine 959S**	**Pemukan 932S**	

Table 3.6 Substation Details for Alternative 3

Future Substations	Tentative ISD	Comment
Coyote Lake 963S	**2012**	
Delburne II / Heatburg	**2012**	replaces existing Delburne 760S
Halkirk 401S switching station		Greengate (wind generation)
Lanfine 959S	**2012**	
Pemukan 932S	**2012**	
Oakland 946S	**2012**	
Upgrades to Existing Substations		
Anderson 801S		
Delburne 760S		will be replaced with construction of Delburne II / Heatburg
Excel 910S	**2009**	currently under construction, ISD 2009
Hanna 763S		
Michichi Creek 802S		
Monitor 774S		
Nevis 766S		
Oyen 767S		
Stettler 769S		
Rowley 768S		
Three Hills 770S		
Hansman Lake 650S		AltaLink substation

3.2 Development of Route Concepts for the Alternatives

Representative route concepts were developed for the three AESO determined Alternatives in order to provide defined study areas (Figure 1.2) for the collection and analysis of land-impact data. However, no specific routing is being recommended at this time.

To identify representative routes, a network of potentially viable transmission line routes were delineated consistent with criteria employed in transmission line routing projects. The representative route concepts and associated study areas were developed with consideration for environmental features, populated areas, and traverses that would impact the lowest potential number of residences.

In siting the representative route Alternatives several factors, with the intent to minimize potential impacts, were considered. These factors included, but were not limited to:

1. Minimizing impact to residences;
2. Minimizing number of private landowners directly impacted;
3. Minimizing impact on existing, approved, and planned developments;
4. Paralleling of existing transmission lines (*Alberta Environment's Guide for Transmission Lines*, Nov., 1994, and *Alberta Transmission Regulations Section 15, AR255/2007 s7*);
5. Paralleling other linear features (e.g., pipelines, highways);
6. Utilizing quarter lines where there is less development and less visual impact;
7. Addressing 6 out of 7 major aspects (i.e. excluding cost) in AUC Rule 007; Section 6.1, NID 12, subsections 1 to 7;
8. Following the considerations in *Alberta Environment's Guide for Transmission Lines*, Nov., 1994; and
9. Following the considerations of the Alberta Transmission Regulations (Section 15, AR255/2007 s7).

Through consideration of the above factors, representative route concepts were then identified for each of the three system development plans (Alternatives) proposed by AESO. Refer to Section 3.1 for route concepts and component summaries associated with each Alternative.

The level of assessment presented in this LIA focuses only on the landscape and general criteria, as these can be applied to the representative routing concepts associated with the three Alternatives being considered. More site-specific field work and detailed route reconnaissance studies are required prior to selection of viable routing alternatives for the preparation of a Facility Application. Detailed assessment of the individual Alternatives, and the site-specific impacts associated with each Alternative's routing concepts and associated potential right-of-ways is required in order to determine specific, feasible routing options, alternate routing options, and/or rejected routes.

Detailed field level route evaluation would include the following:

- Field reconnaissance of routing concepts by helicopter, and on the ground;
- Determination of access to private lands; followed by site visits;
- Route-specific public and agency notification and consultation;
- A historical and archaeological resource impact overview, with potential need for detailed historical resources impact assessments (HRIA's) ;
- Environmental assessments (including wildlife surveys) of local conditions through field work;
- Consideration of Environmentally Significant Areas (ESA's) and their specific conservation requirements;
- Determination of extent and intensity of oil and gas and other industrial activities in the potential right-of-ways;
- Consultation with First Nations on Traditional Land Use interests; and
- A determination on the technical and electrical component solutions by the AESO.

3.3 Right-of-Way Width and Tower Footprint

It should be noted that a standard right-of-way width of 30 m was used in land area metrics determinations and is a general assumption at this preliminary planning stage. The numerical measures used for ROWs may change during route selection processes for the Facility Application, given that additional information specific to local areas and potential deviations from the current route concepts remains to be determined. This may include route design variations due to local factors such as topography, local weather history (e.g. wind), major river or coulee crossings, forest cover, native grasslands, water bodies, oil and gas infrastructure, farming and ranching practices, irrigation facilities, existing local infrastructure, air strips and communication towers, and proximity to population centres and residence locations, amongst other factors. While the majority of these factors were considered in this study, there is also potential for new residences and new infrastructure and developments that were not depicted on the data sets utilized in this study.

Because the primary purpose of this LIA report is to provide information that can be used by the AESO to compare three system-development plans, the exact size of the right-of-way and tower footprints have little impact on the metrics at this stage. To standardize calculations for all Alternatives, a typical right-of-way width and tower footprint size that covers all the tower types and right-of-way widths being considered for all the system-development plans were chosen. The right-of-way width used for this LIA report is 30 m for both 144 kV and 240 kV lines. Footprint areas for proposed future substations were not included in the metrics calculated for this study. These data can only be determined at the line design stage, once a route concept has been finalized.

3.4 Paralleling Existing Linear Features

Linear features of interest include existing transmission lines, telephone lines, pipelines, highways, and railways.

3.4.1 Existing Transmission Lines

The Alberta Transmission Regulations (Section 15.1, AR255/2007 s7) outlines the requirement for siting transmission lines as follows:

> *(1) In preparing plans and making arrangements for new transmission facilities or for enhancements or upgrades to existing transmission facilities, the AESO must take into consideration geographic separation for the purposes of ensuring reliability of the transmission system.*
>
> *(2) When considering the location of new transmission facilities or of enhancements or upgrades to existing transmission facilities, the AESO must consider*
>
> *(a) wires solutions that reduce or mitigate the right of way, corridor or other route required, and*
>
> *(b) maximizing the efficient use of rights-of-way, corridors or other routes that already contain or provide for utility or energy infrastructure.*

(3) The AESO must consider the measures described in subsections (1) and (2) notwithstanding that those measures may result in additional costs.

(4) In subsection (2)(a), "wires solutions" includes, without limitation,

(a) providing new, higher capacity transmission facilities in combination with the salvage of lower capacity transmission facilities, or

(b) providing staged transmission capacity increases that reduce the need to access rights of way for subsequent capacity increases.

In developing representative preliminary route concepts for the Alternatives, ATCO included route segments within each Alternative that paralleled existing 240 kV and 144 kV transmission lines wherever possible, and allowed options for future double circuit (D/C) design.

3.4.2 Other Linear Facilities

In developing these route concepts, ATCO included route segments that were adjacent to existing roads, railways and major pipelines where possible. This is particularly important in forested areas where following existing disturbances reduce the impacts to wildlife habitat and forest fragmentation, in the province's "Green Area". In the "White Area" however, the tendency is to route high voltage transmission lines along quarter section lines rather than along road allowances. Given that the study area is located in the White Area, the latter routing criteria were adopted in determination of the route concepts for each Alternative.

An order of preference for paralleling features was used during the analysis, to reflect the reality that existing transmission lines of greater than 138 kV create limitations with regards to how close they can be located to certain linear disturbances. The potential for induction, ground fault, obstruction, and other factors may result in large transmission lines (138 kV and larger) requiring set-backs of certain distances to mitigate some of these issues.

While a line may technically parallel an existing linear development, the associated necessary set-backs may increase the overall impacts to the adjacent lands on which the new line must be located. For transmission lines of 240 kV or higher voltage, the trend is to route the right-of-ways on quarter section or blind lines to avoid use of road allowances.

Other linear features that may require mitigation, as well as associated formalized crossing permissions, include primary and secondary highways, railways, pipelines, telephone lines and buried fibre-optic cables.

3.5 Existing and Future Substations

This LIA does not include impact metrics for substations; however, the following tabular summary and comments are presented for AESO's consideration:

There are potentially 20 substations that could be utilized in the various Alternatives, depending on the specific design and components plan selected. These include both existing and proposed substations as follows:

3.5.1 Substations for Alternative 1

Existing Substations that may Require Upgrades	Proposed (New) Substations / (Proposed ISD)
Anderson 801S	Clement 988S / (2012)
Cordel 955S	Coyote Lake 963S / (2012)
Delburne 760S	Delburne II / Heatburg (2012)
Excel 910S (currently under construction)	Pemukan 903S / (2012)
Hanna 763S	Lanfine 959S / (2012)
Michichi Creek 802S	Oakland 946S / (2012)
Monitor 774S	Pemukan 903S / (2012)
Nevis 766S	
Oyen 767S	
Stettler 769S	
Rowley 768S	
Three Hills 770S	
Hansman Lake 605S (AltaLink)	

3.5.2 Substations for Alternative 2

Existing Substations that may Require Upgrades	Proposed (New) Substations / (Proposed ISD)
Anderson 801S	Clement 988S / (2012)
Cordel 955S	Coyote Lake 963S / (2012)
Delburne 760S	Delburne II / Heatburg (2012)
Excel 910S	Pemukan 903S / (2012)
Hanna 763S	Lanfine 959S / (2012)
Michichi Creek 802S	Oakland 946S / (2012)
Monitor 774S	Pemukan 903S / (2012)
Nevis 766S	
Oyen 767S	
Stettler 769S	
Rowley 768S	
Three Hills 770S	
Hansman Lake 605S (AltaLink)	

3.5.3 Substations for Alternative 3

Existing Substations that may Require Upgrades	Proposed (New) Substations / (Proposed ISD)
Anderson 801S	Clement 988S / (2012)
Cordel 955S	Coyote Lake 963S / (2012)
Delburne	Delburne II / Heatburg (2012)
Excel 910S	Pemukan 903S / (2012)
Hanna 763S	Lanfine 959S / (2012)
Michichi Creek 802S	Oakland 946S / (2012)
Monitor 774S	Pemukan 903S / (2012)
Nevis 766S	
Oyen 767S	
Stettler 769S	
Rowley 768S	
Three Hills 770S	
Hansman Lake 605S (AltaLink)	

3.5.4 Future Substations for Industrial Projects

There are currently 4 new substations in early stages of construction in the eastern portions of the study region. These substations will be constructed within the TransCanada Keystone Pipeline pump station (PS) sites, with ISD's scheduled between October and December 2009. They will support the TransCanada Keystone pipeline, and are named as follows:

- Lakesend 508S (in AltaLink territory)
- Loyalist 903S (in ATCO territory)
- Excel 910S (in ATCO territory)
- Bindloss 914S (in ATCO territory)

Furthermore, there may also be 4 more new substations, to be constructed for the TransCanada Keystone KXL Pipeline, ISD's not yet determined, as follows:

- Eyre 558S (KXL#2)
- Currant Lake 896S (KXL#3)
- Armitage 949S (KXL#4)
- Cavendish 893S (KXL#5)

3.5.5 Future High Voltage Transmission Projects

An Edmonton to Calgary 500 kV transmission project is a proposed 500 kV transmission line project that may involve significant transmission line infrastructure and related facilities construction within this study area.

A proposed central east transmission development project involves 240 kV developments that may encroach into the current HATD LIA study area.

3.6 Potential Amendments to the Alternatives

There may be a future need for alterations to a few transmission lines in the proposed study region. Although these lines were not part of the original HATD LIA project scope, they are included here for consideration as potential amendments to the three Alternatives evaluated in this LIA. They include:

3.6.1 Lines 9L59 / 9L63 & Clement Substation

It is currently being assumed that proposed Clement 988S substation will be located east of existing 240 kV line 9L59. If this new substation is located east of this existing line, the line lengths for 9L59/9L63 (i.e. an "in/out" configuration to Clement) can be determined by subtraction of their length from the proposed 240 kV lines 9L06 / 9L14.

3.6.2 Line 9L49 & Halkirk & Cordel Substations

This proposed 240 kV line (Halkirk 401S switching station to Cordel 755S) will likely follow the alignment of existing 240 kV Line 9L59. Currently, there are unresolved questions regarding the future location of the proposed Halkirk 401S switching station (owned by Greengate wind generation facilities) which could significantly alter the metrics associated with impacts of this line, depending upon line location and length.

3.6.3 Line 7L79 (Salvage / Rebuild)

The proposed new portion of the 144 kV transmission line 7L79 does not have metrics calculated thus far, as ATCO identifies the possibility of rebuilding a portion of the existing 144 kV transmission line 7L98 which is scheduled to be salvaged. As an alternative route concept and construction option, ATCO may choose to use the existing right–of–way currently occupied by 7L98. The location and line length of a potential line 7L79 will then determine new metrics for this particular option.

3.6.4 Oakland to Brooks

On June 12th, the AESO provided ATCO with Alternative maps that include a proposed line between Sheerness and Brooks. Another new 240 kV line may be required to accommodate wind farms greater than 700 MW. This line was not part of the original scope of this LIA, and thus will need to be included in subsequent scope change undertakings. This potential route is illustrated in the AESO's Alternative maps (Figures 2.1 -2.3).

3.7 Determination of Land Impact Metrics

Cadastral mapping and geographic information systems (GIS) (overlay and spatial analysis) techniques were used to determine numerical impact assessment values ("metrics") for the various land impacts under consideration in this LIA study. Impact metrics were determined for each line (i.e. single circuit line) or line pair (i.e. double circuit) combination for each Alternative. Summary metrics are presented at the end of Section 4 for each impact category, and each Alternative in Tables 4.1 through 4.3 (Section 4). Additional summary metrics are presented (Tables 5.1 to 5.7) and are discussed in Section 5.

4 LAND IMPACTS & MEASURABLE INDICATORS

The LIA uses the "major aspects", with the exception of cost and certain electrical factors, identified in the AUC Rule 007 (Section 6.1, NID12) as direction in identifying measurable indicators and specific concerns that can be used to determine levels of potential land-related impacts associated with the three development plans being considered. These measurable indicators are calculated and evaluated based on experience in routing transmission lines in Alberta.

The following provides a definition of the specific measurable indicators used in this LIA and how they were used to provide land-impact information.

The major impact categories under Rule 007 are Agricultural Impact, Residential Impact, Environmental Impact, Cost, Electrical Considerations, Visual Impact, and Special Constraints. Under each aspect in Rule 007 are a list of concerns that are discussed in the following sections.

4.1 Agricultural Impact

Agricultural impacts refer to agricultural activities associated with rural lands, which may include cultivation of crops and livestock, and also includes ranching.

Agricultural impacts will be significant factors in this project, as the majority of the study area is located in the "White Area" [1] of the province. The White Area contains most of the land suitable for cultivation. The majority of this land is either privately owned, or managed under the jurisdictional authority of the Special Areas Board (SAB) (i.e. Special Area 2, Special Area 3 and Special Area 4). The provincial government has retained a few parcels of land for protection given environmental sensitivity and natural resource management outside of the SAB land area. Some of the land is undesirable from an agricultural perspective, in terms of the Canada Land Inventory (CLI) capability ratings for Agriculture, and as such is not cultivated. Considerable land areas, often native prairie, are utilized for ranching and grazing, production of hay and forage crops, as well as for recreational purposes.

4.1.1 Specific Concerns

The TFO has considered the agricultural concerns outlined in AUC's Rule 007. These concerns are listed below with commentary provided on some mitigation strategies for the potential impacts identified for this project.

a. Loss of Crops – (***This includes short-term loss caused by construction; longer-term losses possible from soil erosion, rutting, drainage, disturbance, and soil mixing, and permanent loss of crop area under or adjacent to the tower base***)

Short-term crop loss during construction is kept to a minimum with appropriate mitigation and construction practices. Any such short-term losses are compensated through damage payments to

[1] The White Area and Green Area are defined in the *Public Lands Operational Handbook*, December 2004, published by Alberta Sustainable Resource Development.

landowners. Any permanent loss of crop under or adjacent to the tower base is mitigated through working with specific landowners during the Facility Application consultation, routing of the centerline relative to legal boundaries such as quarter-lines, and compensated for by annual tower payments.

Potential impacts may be further reduced by landowner input on tower placement. The vast majority of the right-of-way can still be used by the landowner for crop production. Quantifying the amount of cropland and forage lands in the study area provides an indication of the potential level of impact, and can be used as an indicator of the potential level of impact, with cropland being the most significant indicator. Identification of the Agricultural Capability Class (CLI rating) of the land in the study area also provides an indication of the agricultural suitability of the land, and thus constructing transmission line infrastructure on less-suitable lands may be viewed as preferable.

b. Short-term disruption of farming and livestock grazing resulting from construction

These potential impacts are mitigated through appropriate construction practices and working with specific landowners to minimize any disruption. Quantifying the amount of cropland and forage lands affected can be used as an indicator of the potential level of impact.

c. Reduced efficiency of field operations

This potential impact is mitigated through strategic tower placement. Long-term impacts are considered when determining annual structure payments for towers. Quantification of the amount of cropland and forage lands can be used as an indicator of the potential level of impact, with cropland being the most significant indicator. Identification of the CLI Agricultural Capability Class of the land in the study area also provides an indication of the agricultural quality of the land, such that impacting less-desirable lands may be viewed as preferable.

d. Restrictions on use of aircraft and high-pressure irrigation systems

The presence of a transmission line potentially impacts agricultural aircraft use, such as crop spraying. This, however, is landowner and route specific, and aerial spraying is being used less often as high-wheel crop sprayers are becoming more common. The impact on the operation of irrigation equipment can usually be minimized through consultation with affected landowners around the placement of towers and centerlines. Any unavoidable impacts are considered when determining compensation payments for mitigations (e.g., changes to irrigation systems) or impacts.

e. Risk of collision with tower; damage to equipment, lost time, liability for damage to tower and secondary liabilities

A landowner is not held liable for tower damage unless it was deliberately caused by the landowner or his agents. If the transmission line is taken out of service by the damage, it is typically restored to service within 24 to 48 hours, so any disruption to farming activities due to repairs of the line and tower is short in duration. The potential of collision with a transmission tower is considered very low.

f. Reduction in yield adjacent to towers due to overlapping farming operations and added soil compaction

Permanent loss of crop under or adjacent to the tower base is mitigated through working with specific stakeholders during the Facility Application consultation. The total basal area under the towers may be considered relatively small (i.e. 10 m x 10 m) for overhead transmission lines. This is addressed and compensated for through annual tower payments. Potential impacts are further reduced by landowner input to tower placement. Quantifying the amount of cropland and forage lands can be used as an indicator of the potential level of impact with cropland being the most significant indicator.

g. Added cost and inconvenience of weed control under towers

The added cost and inconvenience of weed control is compensated as part of the annual structure payments to landowners.

h. Impact of height restrictions on equipment during field operations

All transmission lines in Alberta provide clearance for equipment 4.3 metres high on agricultural lands. Any proposed power lines will be designed to meet or exceed any clearance requirements, including consideration of any unique clearance requirements identified by affected landowners.

i. Psychological impact of line

This is a subjective impact involving factors such as visual impact, electric and magnetic fields (EMF), land values, and other issues, all of which are incorporated in the LIA and will be addressed in the Facility Application. Provision of unbiased information around EMF research from national and international health and scientific agencies often helps address stakeholders' concerns.

j. Loss of shelter belts

Impacts to shelter belts can be mitigated through routing offsets relative to legal boundaries such as quarter-lines along which shelter belts may exist. In some cases only trimming may be required. Compensation for re-establishment of a shelter belt is also an option. All of these are site specific and determined in consultation with the potentially affected landowner during the Consultation process prior to the Facility Application.

k. Shared use with other utilities and transmission lines

Utilization of existing linear disturbances is a factor in the final determination of routing during the Facility Application stage, as per the Alberta Environment's Transmission Planning Guidelines, and Alberta Transmission Regulations. At this conceptual stage, potential opportunities to parallel existing transmission lines have been identified in the representative route concepts. Paralleling existing linear disturbances is often preferred by government agencies and local jurisdictional authorities (e.g. Special Areas Board, Counties, MD) in order to minimize fragmentation of the landscape.

l. Interference with citizen band radios

This is becoming less of an issue as Citizen Band (CB) radios are being replaced with newer technologies. However, CB radios operate at frequencies close to those of AM radios, neither of which are designed to be immune to power line interference. The interference produced by power lines

diminishes with distance from the power lines, therefore interference highly localized. All facilities will comply with federal guidelines related to radio interference.

Telecommunications towers must also be considered in the development of route plans.

4.1.2 Measurable Indicators

There are several high-level indicators that can be assessed at this conceptual stage and can be measured for each of the representative routes in each of the four study areas. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the study areas. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for agricultural impacts are:

a. Amount of Cultivated Land Crossed

Using existing land cover data, the approximate amount of affected agricultural land (cropland lands) can be determined. This can then be directly related to potential impacts on agricultural activities and associated concerns. These impacts also include those associated with crossing irrigated lands.

The most significant indicator for potential agricultural impact is amount of cultivated land crossed or otherwise impacted, and taken up the transmission line ROW.

b. Total Amount of Agricultural Land Crossed

This includes the cultivated land crossed plus forage lands including pasture. Using existing land cover data, the approximate amount of affected forage land can be determined. This can then be added to the cultivated lands and directly related to potential impacts on agricultural activities and associated concerns.

c. Agricultural Land Crossed

This measures the suitability of the lands from an agricultural perspective. CLI Class 1 through 3 lands are considered suited for cultivation, and classes 4 through 7 are lands that require increasingly intensive management for them to be productive.

4.2 Residential Impact

Minimizing residential impact is an important consideration in the routing of transmission lines. There are sources of information that can be used to provide an indication of the potential residential impacts associated with the proposed system-development plans. These can include Municipal District (MD), County, and Special Areas Board maps, and aerial photo and satellite image interpretation.

Residential impact is a significant factor in routing for all transmission projects. This holds true for both rural and urban environments and residential properties. Some portions of the study area are highly settled when compared to other areas within the study area. This includes local towns such as Castor, Coronation, Consort, Oyen, Cereal, and Hanna, as well as villages or hamlets such as Veteran, Monitor,

and Empress. In addition to the urban areas, there are a several country residential subdivisions (acreages) present, under construction, and in the planning stages in these rural areas.

4.2.1 Specific Concerns

ATCO has considered the specific residential concerns outlined in Rule 007 which are listed below with commentary provided on mitigation strategies and the identification of potential impacts for this project.

a. Decrease of property values

This is a very site-specific impact. A preliminary determination of potential residences within 150 m and 800 m has been completed and applied to representative routes to provide an indication of potential number of residences that may be affected.

b. Loss of developable lands and constraints on development

Development tends to happen in proximity to existing developed (urban) areas, i.e., residential density is a measure of potential impact. Therefore, minimizing routing in areas of existing residential density may help avoid areas with the highest development potential.

c. Relocation or removal of residences

A preliminary determination of potential residences within 150 m of the representative routes can be used as a general indicator of the potential level of impact. However, at this preliminary stage of evaluation this is difficult to assess, as the specific routes will not be determined until the Facility Application stage.

d. Psychological impact of the line

This is a subjective impact involving factors such as visual impact, EMF, land values and other issues, all of which are incorporated in the LIA and are addressed in the Facility Application. Provision of unbiased information around EMF research from national (e.g. Canadian Electricity Association) and international health and scientific agencies (e.g. World Health Organization) often helps address some stakeholders' concerns.

e. Noise and TV interference

TV reception problems related to high-voltage transmission lines are unlikely. If interference does occur, it can often be resolved by relocating the TV or changing the antennae. The transmission lines are designed to meet allowable audible noise and TV interference. Where individual landowners are concerned, measurements will be taken before and after construction so that signal interference beyond allowable levels can be identified and mitigated. As these types of concerns tend to be associated with residences, the number of residences within 150 m can be used as an indicator of the potential level of impact.

f. Windbreak, Shelterbelts, and other vegetation removal

This is an issue where the removal or trimming of trees or other vegetation may be required when establishing a new right-of-way. It is also important to note that the overall impact is considered in making compensation payments for towers and land rights. This is site-specific and determined in consultation with the potentially affected landowner at the Facility Application stage.

g. Conflict with recreational use of land holdings

The proximity of known recreational areas, such as parks and natural areas, can be determined in relation to representative routes. This can be used as a preliminary indicator of potential impacts.

h. Public versus Private Land

Landowners may view the use of public land as a preferable alternative to using private lands. Existing data sources can provide a general indication of the amount of public ("Crown") versus private land, providing an indicator of the potential level of impact. The majority of public land is located within the Green Area of the province, while the majority of private lands are located within the White Area. This project is located in the White Area, where predominant agricultural land use is farming and ranching.

Large areas of public land (e.g. Federal or Provincial Parks) and protected areas were identified and avoided during this stage. Further determination of smaller parcels of public land within the White Area is to be completed during the more detailed route evaluations and land title searches used for the Facilities Application. In addition, Environmentally Significant Areas (ESAs) must also be considered in route planning and in mitigation strategies.

4.2.2 Measurable Indicators

There are several high-level indicators that can be assessed at this preliminary stage and measured for each of the proposed plans. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the plans. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for residential impacts are:

a. Number of residences

It is generally accepted that the closer residences are to a transmission line and the higher the number of residences, the more residents that will feel they are impacted. The categories assessed in this LIA include:

- Residences within 150 m of the right-of-way centerline; and
- All residences within 800 m of the right-of-way.

For the purpose of this LIA, it is assumed that there is a greater potential for residential impact on those residing within 150 m of the centerline, as there is a higher potential for direct impact to existing homes and buildings. This is distance established through landowner consultation during the route selection in previous Facilities Applications. In urban areas, it is the first-row of residences that are assumed to have

the highest potential for residential impact. The most significant indicator for potential residential impact is the total number of residences within 150 m.

4.3 Environmental Impacts

Existing environmental information was used to define route concepts for representative route options or alternatives. Use of this data provided a generalized indication of the potential environmental issues and relative impacts that may occur along the representative routes associated with each of the system-development plans. These impacts will need to be assessed in greater detail as the project moves forward, and as additional information becomes available.

The potential environmental impacts from transmission lines are a concern for a variety of stakeholders and efforts to minimize such environmental impacts factor into the assessment of the potential routing and the technologies associated with transmission lines.

With respect to this project area, portions of the study area are more settled when compared to other areas, resulting in differential levels of landscape utilization for urban and agricultural purposes. Several parks, natural areas, and other environmentally significant areas that exist within the study area have also been considered during evaluation of the plans.

One thing to note is that all of the three system-development plans can be built almost anywhere within the study area and all of them will have some level of environmental impact. While some will have a lower or higher potential level when compared to others, on a factor by factor basis, almost all identified environmental impacts can be mitigated using various planning, routing, and construction techniques to eliminate, mitigate, or lower the overall potential impact.

4.3.1 Specific Concerns

ATCO has considered the specific environmental concerns outlined in AUC Rule 007. These concerns are listed below with commentary provided on mitigation strategies and the identification of potential impacts for this project.

a. Increased public accessibility to wildlife areas

Typically this is an issue for treed/forested areas where there is currently little access. Access along the right-of-way on private land is managed in consultation with the landowner. One method of controlling access involves using locked gates. The proximity of representative routes to known wetlands and large treed areas can be determined using existing data sources, and can provide a general indication of the potential for an increase in the level of public access. The identification of the Forest Capability Class can also provide an indication of the general quality of the land in relation to forest growth. Forest Capability Classes 1-3 generally represent the larger, older forest types, while classes 4-7 would be smaller, younger or less productive areas from a forest growth perspective. This is applied in forested areas, known as the "Green Area". The project area under consideration in this study is located in the "White Area", and as such, wildlife and recreation access are of different accessibility constraints due to private land ownership.

b. Alteration of natural areas and interference with outdoor educational opportunities

The number of protected or designated areas that could be crossed by each plan can be determined using existing data sources. This can provide a general indication of the potential level of this impact.

c. Use of Restricted Development Area (TUC)

While the utilization of existing areas set aside for utility developments such as transmission lines is preferable, the closest Transmission Utility Corridors (TUCs) are located around the cities of Edmonton and Calgary. The location of the TUCs in relation to the routing concepts associated with the HATD plan removes TUC's from consideration as components of the routing concepts associated with the three Alternatives.

4.3.2 Measurable Indicators

There are several high-level indicators that can be assessed and measured at this preliminary stage for each of the five proposed plans. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the plans. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for environmental impacts are:

a. ***Forest Land Crossed (km)***

Using existing Canada Land Inventory (CLI) data, the approximate amount forestlands crossed can be determined. This data can provide further indication of the type of forests present through use of the CLI Forest Capability Classification system. Forest capability classes 4-8 are considered lower quality and generally involve poor or Organic soil types.

b. Amount of Environmentally Significant Areas Crossed (km)

Environmentally Significant Areas (ESAs) are areas identified as significant by municipal, provincial, or federal governments, and have been subsequently designated as areas requiring additional consideration. In the study area, there have been several ESAs identified.

c. Number of Protected or Designated Areas in or within 800 m of ROW Edge (# count)

Identified protected or designated areas can be associated with wildlife and potential recreational activities. Lines constructed in close proximity to these areas may pose a potential impact.

d. Wildlife Habitat Crossed (km)

Any non-urban land area crossed could be interpreted as a potential wildlife impact. However, wildlife species in the regional area, whether ungulate, mammal, or avian, would necessitate wildlife surveys to determine the prevalence of individual species and potential for impacts to populations and habitat once preferred route corridors have been selected. The assistance of local area Alberta Sustainable Resource

Development (ASRD) Fish and Wildlife biologists would be requested in determining the extent and scope of such wildlife studies.

e. Major River Crossings (# count)

Major river crossings have the potential to create environmental impacts as they generally involve use of larger structures to facilitate crossings, as well as consideration of the actual conductor span. There are no major rivers that need to be crossed in this project area. However, the ESA called the Brostem Reservoir (water bodies) will need to be considered in greater detail during selection of routing options.

f. Wetlands and Peatlands Crossed (km)

The Alberta Wetland Inventory is often used to identify peatlands, which are generally more organic soil types (CLI class O), often associated with wetlands and riparian areas. In southern Alberta peatland areas are very rare. In this project area, there are no defined peatland areas that will be crossed, however riparian areas will need to be considered in greater detail when preferred routes are being selected.

g. Distance Through Provincial White Areas (km)

The study area lies within the provincial designated "White Area", and as such, the majority of the lands crossed are either native grasslands or cultivated lands. Site specific determinations of route options and amounts of these lands crossed can only be undertaken at the time of route option development.

4.4 Cost

The information and findings in this LIA do not consider the influence of cost and associated issues.

4.5 Electrical Considerations

Electrical considerations play an important role when assessing potential impacts associated with the proposed plans. While the technical considerations, such as transfer capability, system flexibility, system reliability and losses are considered by the AESO separately, some land impacts related to electrical considerations can be identified. Technical requirements and the other electrical considerations associated with the plans can affect the presence or level of impacts on the land. Existing sources of data can be used to estimate the potential impacts associated with the proposed plans.

4.5.1 Specific Considerations

ATCO has considered the specific electrical concerns outlined in AUC Rule 007. These concerns are listed below with commentary provided on mitigation strategies and the identification of potential impacts specific to the Alternatives.

a. Ease of connections to future load areas

This relates to electrical capacity, location of the facilities and the type of technology used (overhead vs. underground). This specific concern does not have a direct land impact for purposes of this study and will be considered by the AESO separately.

b. Reliability and maintenance of the line

The reliability and maintenance of a line as it relates to the specific technology being considered does not have any impact from a land perspective. However, paralleling certain existing linear developments can provide better access, thus improving the ability to repair the line in a timely fashion. Paralleling certain linear developments can also potentially reduce impacts associated with the amount of adjacent trees, resulting in increased transmission line reliability as the potential for tree-fall faults is reduced.

c. Access for construction and maintenance of the line

Paralleling major roads or existing transmission lines can reduce some of the potential access concerns associated with access to new facilities, as these developments can provide existing access.

4.5.2 Measurable Indicators

There are several high-level indicators that can be measured for each of the components and their associated system-development plans being considered. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the components and their associated system-development plans. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for electrical impacts are:

a. Amount of Existing Disturbances Paralleled (km)

Paralleling existing linear disturbances can be an effective way to reduce the amount of new linear disturbance and fragmentation on the landscape. Four typical linear developments are identified and considered for paralleling; existing transmission lines (>138kV), Primary/Secondary Highways, Railways, and large pipelines (>/= 16" diameter). Distances are calculated for each of these linear developments.

b. Total Amount of Existing Disturbances Paralleled (km)

This metric combines all four of the individual linear development types identified above.

4.6 Visual Impacts

Visual impacts are generally considered a social impact dependant on individual stakeholder opinion. A general assumption is that underground transmission lines have a minimal impact when compared to overhead lines, but the issue of cost is often overlooked when making comparisons.

Visual impacts are closely related to residential impacts as they are typically influenced by similar factors – with aesthetics of transmission lines and tower structures being a common concern. However, visual and other impacts may be experienced by other stakeholder groups, such as recreational users (hikers, fishermen, hunters, etc.), recreational installations, and back-country access roads.

There are some general assumptions regarding visual impacts that are relevant to all overhead transmission lines:

- The closer the line is to a residence, the more likely a visual impact will be perceived.
- The higher the residential density, the more likely a visual impact will be perceived.
- Paralleling similar, existing transmission facilities has a lower visual impact than a new greenfield route where there is no existing line. Double-circuiting on tower structures helps to reduce impacts to land base and aesthetic considerations.
- Close proximity to parks, natural areas, and other recreational areas, can be viewed as creating a higher degree of visual impact than in other less frequented areas.
- Avoiding hilltops, ridges, and other topographic features, reduces the potential level for visual impact, particularly when these features serve as local vistas.
- Significant clearing of mature-treed areas in the White Area of the province, and particularly in southern Alberta where treed areas are few, tends to increase the visual impacts and raise public concern, by removing what is generally considered an aesthetically pleasing feature on the landscape.

4.6.1 Specific Concerns

ATCO has considered the specific visual concerns outlined in AUC Rule 007. These concerns are listed below with commentary provided on mitigation strategies and the identification of potential impacts for this project.

a. Visual impact of tree removal as seen from roads and recreational installations

Many stakeholders, particularly in the White Area of the province, view the removal of trees as a visual impact. The study area for this project involves the White Area of the province. While the White Area represents the predominantly cultivated lands, and can be used as a general indicator of where cultivated lands are, the Canada Land Inventory (Soil Capability) data can also provide an indication of where forested lands occur. The amount of White Area and associated agricultural lands crossed by a particular system development plan may be considered a potential indicator of visual impact.

b. Visual impact on dispersed recreational users such as hikers, fishermen, hunters, scenic viewers, and cross-country skiers

Areas commonly used by recreational users can be identified using existing data sources. These can then be compared with the various routes associated with each of the plans to provide a general indication of the potential level of impact. This would also involve consideration of Parks and Protected Areas in the study area.

c. Visual impact of towers and lines as seen from residences, farms, roads, and recreational installations

The number and type of residences and landowners near representative routes can provide an indication of potential visual impact. The type of tower being proposed can also impact the potential level of visual impact.

4.6.2 Measurable Indicators

There are several high-level indicators that can be measured for each of the components and associated system-development plans being considered. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the system-development plans. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for visual impacts are:

a. Number of Residences

While the context in which the results are considered may differ, the metrics developed for the "Residential Impacts" section can be referred to in relation to Visual Impacts.

b. Proximity to Protected or Designated Areas

While the context in which the results are considered may differ, the metric "Number of Protected or Designated Areas in or within 800 m of ROW Edge" developed for the "Environmental Impacts" section can be referred to in relation to Visual Impacts.

c. Distance Through Provincial Green Area

While the context in which the results are considered may differ, the metric "Distance Through Provincial Green Area" developed for the "Environmental Impacts" section can be referred to in relation to Visual Impacts.

d. Forest Lands Crossed

While the context in which the results are considered may differ, the metric "Forest Lands Crossed" developed for the "Environmental Impacts" section can be referred to in relation to Visual Impacts. In this study area, there are no forested lands crossed.

4.7 Special Constraints

Special constraints are issues or factors that may impact potential routing options for the study area being assessed. Using existing sources of available data, there are several special constraints that have been identified and incorporated for the project study area.

4.7.1 Specific Concerns

The TFO has considered the one specific concern in AUC Rule 007 that can be associated with special constraints (i.e. Historical Resources), as well as identified several additional special constraints that relate to the project study region.

a. Proximity to Historical Resources

Historical resources are specific sites (given an associated Historical Resource Value - HRV) which have been identified within the province and hold particular archaeological, or historical and cultural

significance. Alberta Culture and Community Spirit (ACCS) maintains a registry of known locations and depending on the significance of a particular site, there may be constraints placed on nearby planned developments or disturbances.

4.7.2 Measurable Indicators

There are several high-level indicators that can be measured for each of the plans being considered. These measurable indicators can be used to conduct a broad comparison and establish potential differences between the plans. The measurable indicators, some of which may relate to one or more of the specific concerns identified in the AUC Rule 007, developed for special constraints include proximity to Historical Resources. ATCO has elected to also consider proximity to Indian Reserves and Military Bases.

a. Proximity to Historical Resources

This utilizes data provided by ACCS to determine the presence of any identified historical resources within 800 m of the ROW of route options (route concepts) for these system-development plans.

b. Proximity to Indian Reserves and Metis Settlements

This involves determination of the proximity or likelihood of routes crossing through Indian Reserves. ATCO has considered this factor in this LIA.

c. Proximity to Military Bases and Military Lands

This involves determination of the proximity or likelihood or routes crossing through Military Bases in the project area. ATCO has considered this factor in this LIA.

d. Proximity to Cemeteries

This involves determination of the proximity or likelihood or routes crossing through cemeteries in the project area. ATCO has considered this factor in this LIA.

In addition to the above, other "Special Constraint" indicators may include:

- Parks and Protected Areas (local, provincial and national);
- World Heritage Sites (e.g. UNESCO designated sites);
- Special wildlife habitat area designations under the Species at Risk Act (SARA);
- Community Pastures;
- Local Airports and Airstrips;
- Military Bases and Associated Facilities;
- First Nations Traditional Lands (e.g. ceremonial areas, hunting and gathering areas, camping areas, burial sites); and
- Unlisted historical features, such that Historical Resources Overviews (HROs) or Historic Resources Impact Assessments (HRIAs) could be required.

4.8 LIA Metrics

Summary results for the LIA analyses are presented in Tables 4.1 to 4.3, and include:

- Total values (km) for land categories and features crossed or paralleled (Table 4.1) and % of these totals (Table 4.2), for each impact category evaluated for the three Alternatives; and
- Ranges of values (minimum and maximum) (Table 4.3) for each impact category evaluated for the three Alternatives.

Additional summary tables for selected impact classes, and associated discussion are presented in Section 5 (Results and Discussion - Tables 5.1 to 5.8). These serve as the basis for comparing the three Alternatives with respect to specific impact categories, as well as for determining lands taken up, both in km of line length, and in hectare values of potential lands taken up, for select impact categories.

Table 4.1 - Metrics Summary as Kilometres Crossed (km) per Alternative

Major Aspects and Considerations		Technical Components		
		Alternative 1	Alternative 2	Alternative 3
		7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L06, 9L24, 9L14, 9L966, 9L46	7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L06/9L52, 9L14/9L25, 9L966, 9L46	7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L24/9L65, 9L966, 9L46
		Total	Total	Total
ROW Length (km)		**578**	**491**	**406**
Agricultural Impact				
Agricultural Land Crossed (km)	Crop land	140	127	117
	Forage Land	20	20	9
	Total	160	147	126
Land Capability for Agriculture (km crossed)	Agricultural Capability Class 1	4	4	4
	Agricultural Capability Class 2	48	48	48
	Agricultural Capability Class 3	49	49	37
	Agricultural Capability Class 4	231	185	164
	Agricultural Capability Class 5	197	164	114
	Agricultural Capability Class 6	44	37	35
	Agricultural Capability Class 7	4	4	3
	Agricultural Capability Class 8	0	0	0
	Agricultural Capability Class O	0	0	0
Residential Impacts				
Residences (#)	Within 150 m of centreline	8	7	7
	Within 800 m of ROW	119	112	104
Environmental Impacts				
Amount of Environmentally Significant Areas Crossed (km)		137	98	120
Number of Protected or Designated Areas in or within 800m of ROW edge		0	0	0
Number of Grazing Reserves, Community Pastures within 800m ROW edge		5	4	4
Native Grasslands Crossed (km)		249	189	160
Major River Crossings (#)		0	0	0
Surface Water (hectares) in or within 800m of ROW edge		2739	1943	1898
Electrical Considerations				
Amount of Existing Linear Disturbances Paralleled (km)	Existing Transmission Lines >= 240 kV	6	6	6
	Existing Transmission Lines = 144 kV	26	26	26
	Primary / Secondary Highways	2	2	2
	Railways	0	0	0
	Pipelines	3	3	3
Total Amount of Existing Disturbances (km)		37	37	37
Number of Telecommunications Towers (>25m) within 800m of ROW (#)		5	5	5
Number of Gas Facilities Within 800m of ROW (#)		3	3	1
Number of Wells within 40m of ROW (#)		61	59	50
Visual Impacts				
see "*Residences (#)*" *in Residential Impacts*				
see "*Proximity to Protected or Designated Areas in or within 800 m of ROW edge (#)*" *in Environmental Impacts*				
Special Constraints				
Proximity to Historical Resources in or within 800 m of ROW (#)		107	106	73
Urban Areas within 800m of ROW (#) (Cities, Towns, Villages, Hamlets,		4	4	0
Cemeteries within 800m of ROW (#)		3	3	3
Airfields within 800m of ROW (#)		2	2	2
Special Area Lands Crossed (km)		221	161	141
Municipal Lands Crossed (km)		0	0	0
Crown Lands Crossed (km)		13	13	13
Private Lands Crossed (km)		343	316	252

Table 4.2 - Metrics Summary as % of Total Kilometres Crossed per Alternative

Major Aspects and Considerations		Technical Components		
		Alternative 1	Alternative 2	Alternative 3
		7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L06, 9L24, 9L14, 9L966, 9L46	7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L06/9L52, 9L14/9L25, 9L966, 9L46	7L143, 7L128, 7L108, 7L159/7L16, 7L137/7L25, 7L116, 7L141/7L132, 7L151/7L127, 9L97/9L70, 9L29/9L31, 9L24/9L65, 9L966, 9L46
		Total	Total	Total
R-O-W Length (% of Total)		100	100	100
Agricultural / Silvicultural Impact (% of Total ROW length)				
Agricultural Land Crossed (%)	Crop land	24	26	29
	Forage Land	3	4	2
	Total	28	30	31
Land Capability for Agriculture (%)	Agricultural Capability Class 1	1	1	1
	Agricultural Capability Class 2	8	10	12
	Agricultural Capability Class 3	9	10	9
	Agricultural Capability Class 4	40	38	40
	Agricultural Capability Class 5	34	33	28
	Agricultural Capability Class 6	8	7	9
	Agricultural Capability Class 7	1	1	1
	Agricultural Capability Class 8	0	0	0
	Agricultural Capability Class O	0	0	0
Residential Impacts				
Residences (#)	Within 150 m of centreline	0	0	0
	Within 800 m of ROW	0	0	0
Environmental Impacts				
Amount of Environmentally Significant Areas Crossed (%)		24	20	30
includes: Parks (Municipal, Provincial)		0	0	0
Number of Grazing Reserves, Community Pastures within 800m of ROW		0	0	0
Native Grasslands Crossed (%)		43	38	39
Major River Crossings (%)		0	0	0
Surface Water (ha) in or within 800m of ROW edge		0	0	0
Electrical Considerations				
Amount of Existing Linear Disturbances Paralleled (%)	Existing Transmission Lines >= 240 kV	1	1	2
	Existing Transmission Lines = 144 kV	4	5	6
	Primary / Secondary Highways	0	0	0
	Railways	0	0	0
	Pipelines >= 16"	1	1	1
Total Amount of Existing Disturbances (%)		6	8	9
Number of Telecommunications Towers (>25m) within 800m of ROW		0	0	0
Number of Gas Facilities Within 800m of ROW (#)		0	0	0
Number of Wells within 40m of ROW (#)		0	0	0
Visual Impacts				
see "*Residences (#)*" *in Residential Impacts*				
see "*Proximity to Protected or Designated Areas in or within 800 m of ROW edge (#)*" *in Environmental Impacts*				
Special Constraints				
Proximity to Historical Resources in or within 800 m of ROW (%)		19	22	18
		0	0	0
Cemeteries within 800m of ROW (%)		0	0	0
Airfields within 800m of ROW (%)		0	0	0
Special Area Lands Crossed (%)		38	33	35
Municipal Lands Crossed (%)		0	0	0
Crown Lands Crossed (%)		2	3	3
Private Lands Crossed (%)		59	64	62

Table 4.3 - Metrics Summary as Minimum and Maximum Values per Alternative

Major Aspects and Considerations		Technical Components		
		Alternative 1	Alternative 2	Alternative 3
		Min - Max	Min - Max	Min - Max
ROW Length (km) per component line		**2 - 90**	**2 - 90**	**2 - 87**
Agricultural Impact				
Amount Agricultural Land Crossed (km)	Crop land	0 - 22	0 - 22	0 - 22
	Forage Land	0 - 9	0 - 9	0 - 6
	Total	**0 - 26**	**0 - 26**	**0 - 26**
Land Capability for Agriculture (km)	Agricultural Capability Class 1	0 - 4	0 - 4	0 - 4
	Agricultural Capability Class 2	0 - 23	0 - 23	0 - 23
	Agricultural Capability Class 3	0 - 13	0 - 13	0 - 13
	Agricultural Capability Class 4	0 - 46	0 - 42	0 - 46
	Agricultural Capability Class 5	0 - 43	0 - 43	0 - 33
	Agricultural Capability Class 6	0 - 15	0 - 15	0 - 15
	Agricultural Capability Class 7	0 - 2	0 - 2	0 - 2
	Agricultural Capability Class 8	0 - 0	0 - 0	0 - 0
	Agricultural Capability Class O	0 - 0	0 - 0	0 - 0
Residential Impacts				
Residences (#)	Within 150 m of centreline	0 - 4	0 - 4	0 - 4
	Within 800 m of ROW	0 - 33	0 - 33	0 - 33
Environmental Impacts				
Amount of Environmentally Significant Areas Crossed (km)		0 - 39	0 - 37	0 - 39
Number of Protected or Designated Areas in or within 800m		0 - 0	0 - 0	0 - 0
Number or Grazing Reserves, Community Pastures within 800m		0 - 1	0 - 1	0 - 1
Native Grasslands Crossed (km)		0 - 60	0 - 52	0 60
Major River Crossings (#)		0 - 0	0 - 0	0 - 0
Surface Water (ha) in or within 800m of ROW edge		0 - 796	0 - 502	0 - 796
Electrical Considerations				
Amount of Existing Linear Disturbances Paralleled (km)	Existing Transmission Lines >= 240 kV	0 - 6	0 - 6	0 - 6
	Existing Transmission Lines = 144 kV	0 - 17	0 - 17	0 - 17
	Primary / Secondary Highways	0 - 2	0 - 2	0 - 2
	Railways	0 - 0	0 - 0	0 - 0
	Pipelines	0 - 3	0 - 3	0 - 3
Total Amount of Existing Disturbances (km)		0 - 17	0 - 17	0 - 17
Number of Telecommunications Towers (>25m) within 800m (#)		0 - 2	0 - 2	0 - 2
Number of Gas Facilities Within 800m of ROW (#)		0 - 1	0 - 1	0 - 1
Number of Wells within 40m of ROW (#)		0 - 22	0 - 22	0 - 22
Visual Impacts				
see "*Residences (#)*" *in Residential Impacts*				
see "*Proximity to Protected or Designated Areas in or within 800 m of ROW edge (#)*" *in Environmental Impacts*				
Special Constraints				
Proximity to Historical Resources in or within 800 m of ROW (#)		0 - 39	0 - 39	0 - 39
Urban Areas within 800m of ROW (#) (Cities, Towns, Hamlets)		0 1	0 1	0 0
Cemeteries within 800m of ROW (#)		0 - 1	0 - 1	0 - 1
Airfields within 800m of ROW (#)		0 - 1	0 - 1	0 - 1
Special Area Lands Crossed (km)		0 - 60	0 - 42	0 - 60
Municipal Lands Crossed (km)		0 - 0	0 - 0	0 - 0
Crown Lands Crossed (km)		0 - 6	0 - 6	0 - 6
Private Lands Crossed (km)		2 - 52	2 - 52	2 - 38

5 RESULTS & DISCUSSION

5.1 Interpretation of LIA Findings

It is important to consider that from an LIA perspective, none of the three system-development plans pose a degree of potential impact that completely excludes any from consideration as a viable solution, based on the impact criteria evaluated. For more precise comparisons, detailed route and site-specific research is required. Additionally, detailed field work (i.e. routing reconnaissance) and Stakeholder / Land Owner, Agency and First Nations Consultation by the TFO is required to identify more specific and locally viable routing concepts for detailed comparisons. Additionally, the key impact factors (per AUC Rule 007) as well as the terms of overall costs, were not considered at a site specific or field level detail in the scope of this LIA. Consequently, the metrics and resulting comparisons for each Alternative are to be kept in context of a reconnaissance level study only.

Summaries of the overall LIA metrics determined for each Alternative (i.e. potential route concepts) were presented in Section 4, Tables 4.1 to 4.3.

Tables 5.1 to 5.7 below provide summarized information for each Alternative as basic measures of kilometers (km) of land crossed, and hectares (ha) of land area required for right-of-ways for each Alternative for "major categories" of impact per Rule 007.

5.1.1 Route Concepts and Land Categories Impacted

Tables 5.1, 5.2, and 5.3 provide comparative summaries of base values as "totals" for each route option in kilometers (km) of lands crossed, and potential lands required for right-of-ways in hectares (ha). The base values have been rounded to the nearest 10, upon request of the AESO. For small values relating to specific counts, rounding was not applied.

Additionally, ranges for the base values associated with various land impact factors were derived using an approach of (-5%) and (+10%) calculated for each base value. This established a level of variance that may account for specific, local conditions that may either reduce or extend a proposed route. Given that landscape variables and stakeholder concerns most often result in increases to overall route length to enable mitigations, a +10% variance was deemed reasonable for estimation purposes, and therefore applied to define the maximum range values presented below. Range values were rounded to the nearest 10 km.

Table 5.1 Route Concepts by Length and Area

Route Concept	Total Line Length* (km)	Total Land Area* (ha)
Alternative 1	**580*** (550 – 640)**	**1,730** (1,650 – 1,910)*
Alternative 2	**490** (470 – 540)	**1,470** (1, 400 – 1,620)
Alternative 3	**410** (390 – 450)	**1,220** (1,160 – 1,340)

Note:
***Rounded to the nearest 10.**
****Ranges of values were calculated using a (-5%) and (+10%) variance, and rounded to the nearest 10.**

Table 5.2 provides a comparative summary of major categories of land area potentially taken up by the route concepts for each Alternative, presented in kilometers (km). The (-5%) to (+10%) variance approach was applied to the base values (i.e. totals for each category, per Alternative) for a definition of ranges.

Table 5.2 Major Land Categories Crossed in Kilometres (km)

Alternative	Env. Sensitive Areas (ESAs)	Grazing Reserves & Community Pastures	Native Grasslands	Special Areas Board Lands	Municipal Lands	Crown Lands	Privately Owned Lands
1	**140*** (130-150)**	**5**	**250** (240-270)	**220** (210-240)	**0**	**13**	**340** (330-380)
2	**100** (90-110)	**4**	**190** (180-210)	**160** (150-180)	**0**	**13**	**320** (300-350)
3	**120** (110-130)	**4**	**160** (150-180)	**140** (130-160)	**0**	**13**	**250** (240-280)

Note:
***Rounded to the nearest 10.**
****Ranges of values were calculated using a (-5%) and (+10%) variance, and rounded to the nearest 10.**

Table 5.3 provides a comparative summary of major categories of land area potentially taken up by right-of-ways for the route concepts for each Alternative, presented in hectares (ha). The (-5%) to (+10%) variance approach was applied to the base values (i.e. totals for each category, per Alternative) for determination of associated ranges.

Table 5.3 Major Land Categories Potentially Taken Up (ha)

Alternative	Environ. Sensitive Areas (ESAs)	Grazing Reserves & Community Pastures	Native Grasslands	Special Areas Board Lands	Municipal Lands	Crown Lands	Privately Owned Lands
1	**420*** (400-460)**	**15**	**750** (710-830)	**660** (630-730)	**0**	**39**	**1,020** (970-1,120)
2	**300** (290-330)	**12**	**570** (540-630)	**480** (460-530)	**0**	**39**	**960** (910-1,056)
3	**360** (340-400)	**12**	**480** (460-530)	**420** (400-460)	**0**	**39**	**750** (710-830)

Note:
***Rounded to the nearest 10.**
****Ranges of values were calculated using a (-5%) and (+10%) variance, and rounded to the nearest 10.**

Table 5.4 provides a summary of potential river crossings and the amount of surface water (hectares) that lies within the potential right-of-ways, or within 800 m of the edge of the potential right-of-ways, for each Alternative.

Table 5.4 Summary of Water Crossings

Alternative	Major River Crossings	Surface Water (ha) in or within 800m of ROW edge
1	**0**	**2,740*** (2,600-3,010)**
2	**0**	**1,940** (1,850 – 2,140)
3	**0**	**1,900** (1,800 – 2,090)

***Note:**
***Numerical values from LIA summary were rounded to nearest 10.**
****Ranges of values were calculated using a (-5%) and (+10%) variance, and rounded to the nearest 10.**

Tables 5.5 and 5.6 summarize Electrical Considerations for each Alternative.

Table 5.5 Electrical Considerations – Amount of Linear Features Paralleled

Alternative	Existing 240 kV Lines*	Existing 144 kV Lines*	Primary & Secondary Highways*	Railways*	Pipelines*	Total km Linear Features Paralleled*
1	6	26	2	0	3	37
2	6	26	2	0	3	37
3	6	26	2	0	3	37

***Note: Values are the actual numeric counts (i.e. not rounded).**

Table 5.6 Electrical Considerations – Industrial Structures and Facilities

Alternative	TeleCom Towers >25m tall & within 800 m of ROW*	Gas Facilities within 800 m of ROW*	Wells within 40 m of ROW*
1	5	3	61
2	5	3	59
3	5	1	50

***Note: Values are the actual numeric counts (i.e. not rounded).**

Table 5.7 provides a summary of special constraints that are located within 800 m of the potential right-of-ways for each Alternative.

Table 5.7 Special Constraints within 800 m of ROW

Route Concept "Alternative"	Historical Resources*	Urban Centres*	Cemeteries*	Airfields*	Indian Reserves / Metis Settlements*
1	**107**	**4**	**3**	**2**	**0**
2	**106**	**4**	**3**	**2**	**0**
3	**73**	**0**	**3**	**2**	**0**

***Note: Values are the actual numeric counts (i.e. not rounded).**

The findings of this LIA, which considered a variety of impact factors representative of those aspects defined in AUC Rule 007, may be summarized comparatively for the three Alternatives as follows:

Alternatives 3 has the shortest overall length (approximately 410 km) and thus the lowest value for overall land area required for right-of-ways (potentially 1,220 ha). **Alternative 1** has potentially the longest overall length (578 km) and the largest area (1,730 ha) of lands taken up for right-of-ways overall. In comparison, **Alternative 2** has the mid-range of route length (approximately 490 km) and land area taken up (1,470 ha). Refer to Tables 5.1 and 5.2 for details.

5.2 Comparison of Alternatives

The three Alternatives were compared with respect to their potential impacts as determined by the metrics for each route concept associated with each Alternative. The following summary of specific impacts was derived from analysis of the LIA metrics, comparative evaluation of numeric counts, determination of potential amount of lands crossed and lands taken up for each Alternative, on the basis of a 30 m right-of-way, for each respective route concept.

5.2.1 Agricultural Impacts

Potential agricultural impacts were determined through analysis of provincial and Special Areas Board (SAB) maps for land use, and the Canada Land Inventory (Soil Capability for Agriculture).

- **Alternative 1** takes up the most agricultural land (crops and forages combined) (approximately 160 km / 480 ha), while **Alternative 3** takes up the least (approximately 126 km / 380 ha) for potential right-of-ways. Refer to **Tables 4.1 to 4.3** (Summary Totals and Ranges) for additional details on all categories examined.

- For **all three Alternatives**, the majority of agricultural lands taken up are those of CLI Capability Classes 3, 4, and 5, Soil Capability for Agriculture. Equivalent amounts of Class 1 and Class 2 lands are taken up by all of the Alternatives (Class 1: 4 km crossed, approximately 12 ha taken up) and (Class 2: 48 km crossed, approximately 15 ha taken up). No CLI-classified Organic soils are taken up by any of the Alternatives, as determined through analysis of the CLI data.

- **Alternative 1** affects five community pastures, while **Alternative 2 and 3** each affect four community pastures.

- Native grasslands are affected the most by the routing concept associated with **Alternative 1** (249 km crossed, approximately 750 ha taken up). **Alternative 3** affects the least amount of native grasslands (160 km crossed, approximately 480 ha taken up). **Alternative 2** affects a mid-range (189 km crossed, approximately 570 ha taken up).

5.2.2 Residential Impacts

- **Alternative 3** has the least potential impact to residences within both distance measures of 150 m and 800 m (7# count and 104# count, respectively), of the potential right-of-way. **Alternative 1** affects the greatest number of residences within both distance measures (9# count and 119# count, respectively).

- **Alternatives 1, 2 and 3** may be considered comparable with respect to residences affected within 150 m of centre line of the potential ROW.

- **Alternative 3** affects the least number of residences within 800 m of the right-of-way (104# count), while Alternative 1 affects the greatest (119# count).

- **Alternative 1** poses the highest potential combined impact with respect to residences both within 150 m (8# count) and 800m (119# count) of the right-of-way for the associated route concept.

5.2.3 Environmental Impacts

Potential environmental impacts were determined through analysis of Environmentally Significant Area (ESA) maps, in addition to consideration of grazing reserves and community pastures, major river crossings, and surface water located within 800 m of the potential ROW.

- In terms of the amount of ESA land crossed, **Alternative 2** (100 km crossed, 300 ha potentially taken up) affects the least amount of land area classed as being environmentally sensitive, according to the ESA data analyzed. Refer to Table 5.2 and 5.3 for associated ranges of values in terms of approximate amounts of ESA crossed and potential lands taken up for each Alternative.

- **Alternative 1** takes up the most ESA land area (potentially 140 km crossed, 420 ha taken up) relative to the other two Alternatives. Refer to Tables 5.2 and 5.3 for comparative ranges of values.

- **None of the Alternatives** cross any major rivers, but all will likely cross named and unnamed creeks locally. The extent of this can only be determined through site-specific field studies during selection of routes.

- **Alternative 1** has the highest ranking in terms of proximity to water bodies, (2,740 ha of water within 800 m of the ROW). Refer to Table 5.4 for comparison of the three Alternatives.

- **Alternative 3** has the lowest ranking in terms of proximity to water bodies (1,900 ha of water within 800 m of the ROW). See Table 5.4 for comparison of the three Alternatives.

Refer also to Tables 5.2 and 5.3 for additional information on the amount of land taken up in by each Alternative

Additional research is required at a more site-specific level for each Alternative to better determine potential local environmental impacts (e.g. Species at Risk Act (SARA), to identify locally protected areas, land areas of high erosion potential) and to identify conservation concerns at local levels.

5.2.4 Electrical Considerations

Transmission line maps, road network maps, and railway network maps, were used to determine the electrical considerations. Refer to Tables 5.6 and 5.7 for related summary data. Based upon the information analyzed:

- **All three Alternatives** have similar potential for paralleling existing linear disturbances and existing transmission lines (144 kV and 240 kV). Each Alternative has potential to parallel six existing 240 kV lines, and 26 existing 144 kV lines.

- **Each Alternative** has the potential to cross two highways, three pipelines, and no railways.

- **All three Alternatives** have similar potential for telecommunications towers (a count of five each) to be present within 800 m of the right-of-way.

- **Alternative 3** has the lowest potential to impact oil and gas facilities, with one gas facility within 800 m of the right-of-way, and approximately 50 wells within 40 m of the right-of-way for the associated route concept. **Alternative 1** has the highest potential for impacting oil and gas facilities, with 3 gas facilities within 800 m of the right-of-way and approximately 61 wells within 40 m of the right-of-way associated with the route concept.

5.2.5 Visual Impacts

The potential for visual impacts was deduced from analysis of residential data and the determination of proximity to protected or designated areas in or within 800 m, of the right-of-way associated with the route concept for each Alternative.

- No route concepts for the **three Alternatives** were within 800 m of protected or designated protected areas, although they each did cross Environmentally Sensitive Areas (ESAs) (see Section 5.2.3 for Environmental Impacts).

- **Alternative 3** has the lowest potential visual impact, when considering the number of residences impacted overall.

- **Alternative 1** can be considered to have the highest potential visual impact, when considering the number of residences impacted.

Additional, detailed field work will be required to gauge visual impacts using "line of sight" methodology to obtain a better understanding of local topography and scenic view-points.

5.2.6 Social Impacts

Social impacts can be considered as a combination of those impacts related to residential, visual and special constraints. Within this realm, **Alternative 3** can be viewed as having the least potential for social impacts, whereas **Alternative 1** can be viewed as having the greatest potential for social impact, when these impact factors are considered together.

5.2.7 Special Constraints

Special constraints included consideration of Historical Resources, Indian Reserves, Special Areas lands, military facilities, cemeteries and airfields.

- **Alternative 1** has the greatest potential for impacting special constraints overall, and **Alternative 3** has the least overall.

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- **Alternative 1** has the greatest potential for impacting Historical Resources, while **Alternative 3** has the least.

- **All three Alternatives** are equivalent in their potential for impacting cemeteries and airfields, with three cemeteries and two airfields within 800 m of the route concepts associated with each Alternative.

- **Alternative 1** crosses the largest amount of Special Areas land, while **Alternative 3** crosses the least.

- **None of the Alternatives** cross military lands or facilities, airfields, Indian Reserves or Municipal lands.

- **Alternatives 1 and 2** have potential for coming within 800 m of urban areas with their respective route concepts.

- **All three Alternatives** have the same potential to cross crown (provincially owned) lands (13 km each).

- **Alternative 3** crosses the lowest amount of privately-owned land (approx 250 km) and **Alternative 1** crosses the most (approximately 340 km).

6 SUMMARY & CONCLUSIONS

This LIA provides both qualitative and quantitative analysis of the three design Alternatives AESO has put forth for the Hanna Area Transmission Development (HATD) project.

These three Alternatives were compared quantitatively through use of GIS overlay techniques to determine the amount of lands and features impacted by route concepts associated with each Alternative. Extensive quantitative data were generated through this process, and are presented in various formats in within the report as summary tables. Several summary tables were also presented for specific impact categories.

Of the three Alternatives studied, **Alternative 3** has the lowest potential for overall land impact, in consideration of total lands crossed (km) and land area taken up (ha). **Alternative 1** has the greatest potential for overall land impacts in this regard. **Alternative 2** maintains mid-range values for these land impacts.

Of the multiple land impact factors examined, comparatively **Alternative 3** tends to demonstrate the least amount of impacts overall. However, this does not eliminate consideration of **Alternatives 1 and 2** as viable options**,** given that site specific information for each Alternative is required to provide a more representative assessment of the potential local impacts associated with each Alternative.

Additionally, extensive stakeholder consultation must be undertaken by the TFO prior to the Facility Application, to determine the extent of concerns and objections to preliminary routes associated with each Alternative, and to further identify potentially feasible route options and associated mitigations.

7 ACRONYMS

AESO	Alberta Electric System Operator
AltaLink	AltaLink Management Ltd.
ACCS	Alberta Culture and Community Spirit
ASRD	Alberta Sustainable Resource Development
ATCO	ATCO Electric Ltd.
AUC	Alberta Utilities Commission
CLI	Canada Land Inventory (Land Capability for Agriculture, Forestry, Wildlife or Recreation)
DC (D/C)	Double Circuit
DFO	Distribution Facility Owner
DND	Department of National Defense
EIA	Environmental Impact Assessment
ESA	Environmentally Significant Area
EU Act	Electrical Utilities Act
ha	Hectare
HEE Act	Hydro and Electrical Energy Act
HRV	Historical Resource Value
HVDC	High Voltage Double Circuit
km	Kilometre
kV	Kilovolt
LIA	Land Impact Assessment
m	Metre
MER	Meridian, as per Alberta Township Survey
NID	Need Identification Document
QTR SEC	Quarter section, per Alberta Township Survey
RGE	Range, per Alberta Township Survey
R/W	Right-of-Way
ROW	Right-of-Way
SARA	Species at Risk Act
SC (S/C)	Single Circuit
SEC	Section, per Alberta Township Survey
TFO	Transmission Facility Owner
TWP	Township, per Alberta Township Survey

8 GLOSSARY OF TERMS

Aspect — The seven major aspects that the AESO must have regard for in determining technical options. These include: Costing, Agricultural Impact, Residential Impact, Environmental Impact, Visual Impact, Electrical Considerations, and Special Constraints. Consult AUC Rule 007 (Section 6.1 NID12, for further details.)

AUC Rule 007, or Rule 007 — Alberta Utilities Commission Rule 007 (formerly EUB Directive 028): Rules respecting applications for power plants, transmission lines and industrial system designations (January 2, 2008).

Facility Application — The Facility Application is developed and submitted by the TFO to the AUC once final route and site selections have been made. These final selections are based on the direction provided by the AESO. It also involves an extensive public consultation program, detailed field surveys, and other related activities in the route selection process.

Green Area (of Alberta) — Geographically, the "green area" represents about 69% of the province's land area of forested lands located in northern Alberta, and in the mountains and foothills. Nearly all these lands are publicly (provincially) owned. Main land uses are timber productions, oil and gas development, tourism and recreation, conservation of natural spaces, watershed protection, and fish and wildlife habitat.

Need Identification Document (NID) — The need identification document is developed and submitted by the AESO to the AUC once a technical solution has been recommended.

Right-Of-Way — (ROW, R/W) The right-of-way refers to the width of a segment of land required to build a proposed transmission line. The width considers several factors to ensure safe and reliable operation of the line, which includes adequate clearance distances, access for maintenance, and other factors.

Route Concept — A schematic representation of a potential route option, which is supported at a reconnaissance level of assessment, by its favorable characteristics relative to other options. The route concept is not an indication of a final route or ROW, as it is only a potential consideration in a reconnaissance level study.

Study Area — The study area refers to the general area in which the proposed developments could be located. This is the land area that is considered for potential routing scenarios and the subsequent land impact assessment.

White Area (of Alberta) — Geographically, the "white area" covers about 39% of Alberta, and is comprised of land owned by individuals and groups. Main land uses are settlements, agriculture, tourism and recreation, oil and gas development and conservation of natural spaces and wildlife habitat.