

## **6.0 Project Routing**

### **6.1 Overview**

In general, transmission line routing represents a powerful mitigation tool in limiting potential effects to people and the environment. The challenge is that there are typically competing perspectives on concerns or priorities for any given area requiring a structured, iterative process to balance multiple perspectives and limit overall Project effects.

The routing methods used for this Project are based on those developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Corporation (GTC) for overhead electric transmission line siting (EPRI-GTC 2006). Manitoba Hydro selected the EPRI-GTC methodology for the St. Vital to Letellier and Manitoba-Minnesota Transmission Projects because it has been successfully applied to more than 200 linear projects across North America, and because the tools used in the methodology provide a structured and transparent way to represent the trade-offs between competing stakeholder interests and land uses, along with the decisions made in a transmission line routing process.

The routing process involved a multi-phase decision-making approach that incorporates feedback from internal discipline experts and external (public, Indigenous and regulatory) parties at key milestones. It incorporates the consideration of the environment, opportunities and constraints for transmission line development, and the interests and concerns that influence the use of the land or could be affected by the route. The primary goal is to limit the overall effect of the transmission line by considering and balancing the effect across various key perspectives. A detailed Project-specific discussion of the routing process and methodologies can be found in Appendix A.

The routing process involves the use of GIS-based mapping and models to evaluate the suitability of an area for locating new transmission lines. The models and sequential steps in the process provide a structured and transparent way to represent the trade-offs between competing stakeholder interests and land uses. The process includes steps to provide opportunities for stakeholder, public and Indigenous feedback. As indicated, feedback from the public, Indigenous communities and organizations and key stakeholders is used in a process with associated decision-making tools that produces decisions that balance perspectives among competing land use values, while respecting the various physical, technical and regulatory constraints on the landscape.

The routing process involved the following general steps:

1. Characterize the Project region;
2. Establish border crossing zones;
3. Establish the Project route planning area;
4. Generate alternate corridors within the Project route planning area;
5. Develop and analyze alternate routes within the alternate corridors; and
6. Select and finalize the preferred route.

Each step involves a process of narrowing and refining the geographic area under consideration to get to a specific preferred route.

## 6.2 Characterizing the Project region

Manitoba Hydro's System Planning Department typically begins all of its transmission line projects with assessing the need for the Project, developing alternative concepts to completing the Project from an electrical transmission system perspective, and identifying a preferred concept. Various departments within the Transmission Business Unit at Manitoba Hydro then carry out further planning activities, including defining the start and end points as well as initial design concepts such as tower design and right-of-way width.

An initial planning step was to characterize the general region (e.g., southern or southwestern Manitoba) in terms of suitability for transmission lines. This involved compiling and sourcing existing desktop data such as satellite imagery, land use/ownership, buildings and protected areas, and existing infrastructure. It also involved reconnaissance field trips, as well as initial public and Indigenous engagement planning; including the identification of potential stakeholders and Indigenous communities in the region and very preliminary contact to gather initial information about the region (see chapters 3 and 4).

As described in Appendix A, the Project was able to take advantage of a previous process where those that held regional geo-spatial information were invited to participate in a process of determining the best factors to use to characterize the region from a transmission line routing perspective. Information needs were updated based on a Project-specific workshop. Based on the spatial data they were responsible for managing, participants were organized into groups representing one of the following perspectives:

- Engineering environment perspective, involving issues relating to technical constraints such as constructability, cost and system reliability;

- Built environment perspective, involving issues relating to the socio-economic environment; and
- Natural environment perspective, involving issues relating to the biophysical environment.

It is noteworthy that these three perspectives generally reflect the three pillars of sustainable development: social/people (built), environment (natural) and economy (engineering).

Based on this process landscape features were organized into the following list of factors that best represented the key factors within each group that influence transmission line suitability for the general region:

- Engineering:
  - Linear infrastructure;
  - Spannable waterbodies;
  - Geotechnical issues (e.g., floodplains/wetlands);
  - Mining operations/quarries; and
  - Slope.
- Natural:
  - Aquatics;
  - Special features (e.g., managed woodlots, conservation lands);
  - Land cover (e.g., agriculture, grassland, forests); and
  - Wildlife habitat (e.g., waterfowl, ungulate).
- Built:
  - Proximity to buildings;
  - Building density;
  - Proposed developments;
  - Soil capability/agricultural use;
  - Land use (e.g., livestock, crops);
  - National, Provincial and Municipal Historic Sites;
  - Proximity to heritage, archaeological sites and centennial farms;
  - Landscape character (e.g., residential, campgrounds); and
  - Edge of field (e.g., road allowances, quarter section).

In addition to ranking the relative importance of each factor, one or more measurable features were established for each factor (e.g., slope class, distance to residences, building density class, wildlife habitat type, etc.). These lists of features were based on a review of the data available and the experience of the participants in the data-holder workshops, and each was assigned a suitability value ranking its relative suitability in the group. The process also established areas of least preference where routing may

not be feasible due to physical barriers and administrative regulations, and/or locations where substantial regulatory approvals issues/delays would be expected (e.g., national/provincial parks, mines and quarries, historic sites, etc.) These areas of least preference were removed from the transmission corridor selection process, and would only be brought back in, during development of alternate routes, under special circumstances (e.g., when the only option for a route is through one of these areas and there is mitigation available to deal with the effects).

### 6.3 Establishing the border crossing zones

As Manitoba Hydro is responsible for the Manitoba portion of the transmission line and SaskPower is responsible for the Saskatchewan portion, it was necessary to have a coordinated decision-making process to determine zones where the transmission line could feasibly connect at the border. Initial phases in this step occurred concurrently with work to establish the route planning area (described in the next section). In order to coordinate the process several meetings and workshops between Manitoba Hydro and SaskPower were used to discuss the respective routing process methods and key routing criteria, and then share outputs of preliminary constraint mapping and potential border crossing zones, with rationale.

As described in Appendix A, the initial step involved establishing potential border crossing zones and screening them down to the most feasible candidates for both Manitoba Hydro and SaskPower based on aspects such as line length, constructability (based on issues such as topography, soil type/stability), and environmental issues. The process involved screening five potential zones into two candidate zones: a north zone and a south zone. The south zone offered options for a more direct route between the two stations, but crossed through the Spy Hill-Ellice Community Pasture and environmental sensitivities associated with native prairie habitat and important rare grassland bird species. The north zone allowed the development of routes that could avoid the Community Pasture, but would result in a substantially longer route for the line in Manitoba (more than 50 km), as well as the presence of several steep slopes and associated soil stability issues in the ravines that would need to be crossed. While SaskPower had an overall preference for the north zone as routes would be several kilometers shorter than those to south zone for them, they also had some constructability issues for routes to this location. After sharing perspectives, Manitoba Hydro and SaskPower agreed to carry both options forward into the routing process.

## 6.4 Establishing the route planning area

With the border crossing zones established the next step was to define the outer boundaries of the area that encompass the start and end points of the transmission line. A route planning area was established through the development of feasible macro corridors from Birtle South Station to each border crossing based on satellite imagery. As discussed in Appendix A, using a GIS-based model, the satellite imagery was assessed in terms of suitability for transmission line development, with each cell of the image ranked for suitability based on aspects such as land cover/use and distance to existing roads and transmission lines and then plotting optimal paths between the start and end points. The outside borders of the top 5% form the route planning area.

## 6.5 Developing alternate corridors

In the next phase of the routing process, several alternate corridors were developed within the route planning area using GIS modelling (as described in Appendix A). In this phase more detailed spatial data was used than previous steps, including more fine-scale digital data for the various characteristics of each relevant feature (e.g., for wetlands, floodplains, and land use/land cover) from the GIS database. In some cases additional field data was gathered, such as building type/purpose, or type of agricultural land use.

In order to facilitate discussion and analysis by discipline experts in the routing team separate corridors were developed to represent the three perspectives discussed previously, based on the input received from the stakeholder process, including the built environment perspective (protecting people, places and cultural resources), the natural environment perspective (protecting water resources, plants and animals) and the engineering perspective (minimizing costs and schedule delays). Each of the three perspectives included all criteria, but additional weighting was applied to emphasise built, natural, or engineering criteria, respectively. In addition, a simple combined perspective was developed, where each of the three perspectives was weighted equally, and finally all four perspectives were combined in a composite corridor. The composite corridor, representing the top 3% (the most suitable 3%) of the landscape, formed the overall guidance for routing from this point forward.

## 6.6 Developing alternate routes

Once the alternate corridors were identified, the next step was to develop initial alternate routes or centerlines within them, determined by a route siting team. This

step in the process built on the types of criteria developed previously for the three perspectives, but focused on those criteria that can discriminate among route options within a corridor, such as distance to buildings or livestock operations, percent length in floodplains or steep slopes, or intactness of natural habitat. Criteria were assigned weights based on their relative importance, again building on the work done in the previous stakeholder process.

The GIS model (alternate route evaluation model – see Appendix A) was used to produce segment/route statistics to assist in the route selection process. Statistics were calculated for all criteria in the model for each of the alternate route segments in order to facilitate comparisons of route segments or complete routes by the routing team. Outputs were generated for criteria such as the number of relocated residences, or the percent length of the route passing through natural forests. The routes were ranked based on the route statistics, with the purpose of determining the top routes, from each perspective, based on the statistical data.

Once the various segments for alternate routes were developed sufficiently a map of the output (Map 6-1) was used during Round 1 of the public and Indigenous engagement process initiated in November 2016 (described in chapters 3 and 4). Input was collected on route/segment preferences, issues and concerns, including any potential new segments proposed during the engagement process to avoid areas of concern not previously identified. As indicated, the GIS model was used to develop segment/route statistics to assist in making decisions regarding any proposed adjustments to routes or line segments gathered through the stakeholder engagement process. The routing team used the statistics developed for the new proposed segments to assess their viability and effect on the various routing options. Viable segments are then brought into the alternate route evaluation step at the conclusion of the engagement round.

## 6.7 Selecting the preferred route and border crossing

### 6.7.1 Overview

After the first round of public and Indigenous engagement process was concluded in the fall of 2016 (described in chapters 3 and 4) the input was brought into the final step in the evaluation process. The routing team applied expert judgment to this information for ranking the top alternate routes and selecting a preferred route. While computation models generate useful data, these data must be considered by individuals with experience and expertise in the process of route selection. Information pertaining to features, land uses and perspectives are typically difficult to quantify geospatially and must also be considered. As indicated previously, Manitoba Hydro and SaskPower had

agreed to develop preferred routes to each of the two border crossing zones, and then meet to get consensus on the preferred border crossing.

## 6.7.2 Manitoba Hydro process

In order to provide guidance to the decision-making process a group of senior Manitoba Hydro managers developed a list of key considerations and assigned each a weight based on relative importance for this Project. Weightings are based on technical experience and familiarity with the key issues in the Project area related to its geographical and sociological makeup and input from public and Indigenous engagement processes. The list of preference criteria and weightings developed for the Project is as follows:

- Cost (40%);
- Community concerns (35%);
- Natural environment concerns (7.5%);
- Socioeconomic concerns (7.5%);
- Risk of schedule delays (5%); and
- Impacts to system reliability (5%).

In the preference determination step, the ‘finalists’ from the alternate route evaluation step were considered in a comparative fashion in a January 2017 workshop using the weighting criteria listed above (See Appendix A for details). Participants in the workshop included members of the Project team representing the three perspectives (i.e., built, engineering, and natural) as well as staff involved in public and Indigenous engagement. Team members responsible for engineering, technical design, construction and maintenance represented the engineering perspective, discipline specialists responsible for assessing the potential effect on the biophysical environment represented the natural perspective, and socio-economic discipline specialists represented the built perspective. In addition, team members responsible for the public and Indigenous engagement processes attended to represent feedback received from participants. Team members with expertise in the analytical software also attended so that “real time” collaborative routing decisions could be made.

Considerable research and data analysis occurred prior to the workshop to enable Project team members to be in a position to discuss, debate and evaluate the information collectively, and arrive at a group decision regarding the selection of the preferred route. The workshop facilitated discussion and examination of the statistical results of the alternate route evaluation model, and consensus-building on results. For

each alternate route the statistical output depicted the overall scores from each perspective (engineering, natural, built, and simple average) and assisted in considering the strengths and weaknesses of each route and in determining the top scoring routes. Lower values indicated relatively more suitable routes, and higher scores indicated relatively less suitable routes. Routes with a less favorable score in most categories could be screened out, and rationale was available for including routes, which included information obtained through public engagement, review of the statistical analysis and the histogram outputs.

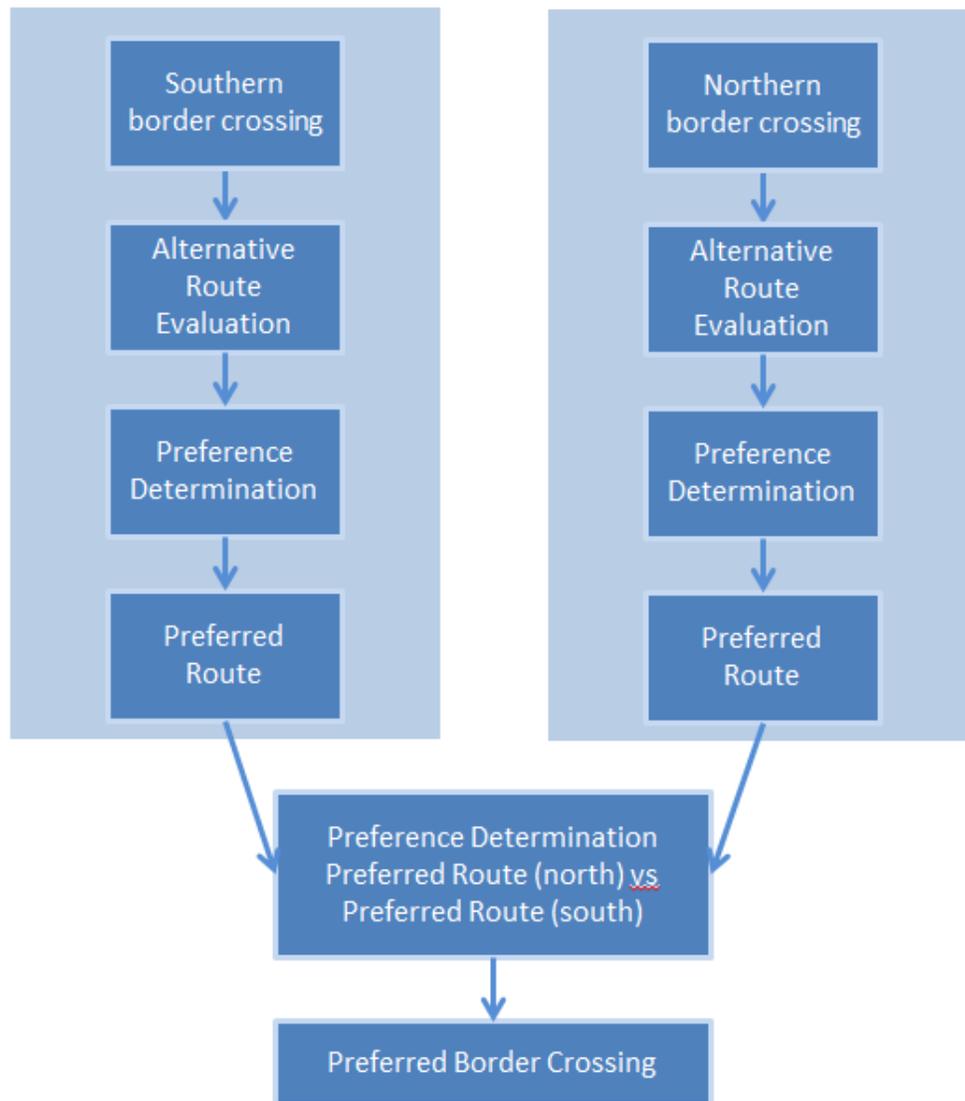
The output of the first phase of the January 2017 workshop was a single preferred route to the north crossing zone (NS-4147), and two routes to the southern crossing zone – one passing north outside the community pasture and then travelling west through its centre (S1-385), and one travelling west and then northwest around the southern boundary of the pasture (S2-28; Map 6-2).

The next step of the workshop was to run the preferred routes from each border crossing through the preference determination process, in order to determine a relative preference between the two border crossing options, as shown in Table 6-1. Using the steps of the methodology to guide the decision-making, a preferred crossing point was selected by first selecting a preferred route to each possible crossing point, and then comparing the strongest routes to each crossing against each other. The statistics generated by the models gave Manitoba Hydro a clear understanding of the strengths and weaknesses associated with each border crossing and the routes used to connect the crossing to the Project start point. The highest ranking routes from each border crossing were then compared against each other to determine overall route preferences and then use those outputs to determine the preferred border crossing (Figure 6-1). The top route(s) from each border crossing then moved into a final preference determination step to flesh out the strengths and weaknesses of the border crossings as illustrated by alternate routes deemed most ideal to reach these crossings.

**Table 6-1: Preference determination scores**

Feature	%	NS-4147	S1-385	S2-28
		north	south1	south2
Cost	40%	3	1.1	1
<i>Weighted</i>		1.2	0.44	0.4
System Reliability	5%	3	2	1
<i>Weighted</i>		0.15	0.1	0.05
Risk To Schedule	5%	1	3	2.5

Feature	%	NS-4147	S1-385	S2-28
		north	south1	south2
<i>Weighted</i>		0.05	0.15	0.125
Environment (Natural)	7.5%	1	3	3
<i>Weighted</i>		0.075	0.225	0.225
Environment (Built)	7.5%	3	1	2
<i>Weighted</i>		0.225	0.075	0.15
Community	35%	1	1.5	3
<i>Weighted</i>		0.35	0.525	1.05
Total	100%	2.05	1.52	2.00
Rank		3	1	2



**Figure 6-1: Alternate route evaluation flow chart**

In terms of costs, both southern routes were substantially preferred over the northern route for this criterion. Project costs are primarily related to construction and line length, and the northern route is substantially longer than the routes to the southern crossing (northern route = 59.4 km; southern routes = 46.2 km/41.7 km). The northern route also introduces additional construction risk associated with ravine crossings and increased foundation installation challenges. While there was limited geotechnical information available, previous recent distribution line construction projects in the area have encountered boulders/cobbles and low tills, creating challenges for drilling. Costs for S1 (385) and S2 (28) would be very similar to one another (within hundreds of thousands), but considerably less than the northern route (several millions).

In terms of system reliability, both southern routes were preferred to the northern route. Length was the main driver due to the risk of damage to the line from adverse weather—more length results in more towers and more exposure to extreme events (wind/ice/tornados, etc.). In terms of risk to schedule, the northern route was somewhat preferred, although there are several potential technical issues and uncertainties. Risk to schedule scores were based on proportion of Crown land (routes that have more Crown land can trigger interests from a variety of different departments in the government and increase the need for other approvals or influence the duration and level of effort required in those processes have a greater risk to schedule).

In terms of natural environment, the northern route was substantially preferred over the southern routes. The southern routes cross the community pasture, a region with national profile as prairie grassland, supporting several rare grassland bird species. While the north route is longer than the south routes the natural environment effects should all be readily mitigable and it avoids issues associated with the community pasture. Feedback during the public engagement process (chapter 3) includes considerable concern from some environmental organizations and Manitoba Sustainable Development's Wildlife and Fisheries Branch about routes through the pasture.

In terms of built environment, the southern routes were slightly preferred over the northern route based on this criterion. All routes were generally very good from a built perspective because of the overall avoidance of residences and buildings. Agricultural differences were the main factor in differentiating between the routes. The north route was the least preferred of the three routes because as the longest route it crosses the greatest amount of agricultural lands, and through more developed areas. S1 was ranked higher as it mostly avoids residences, building and development permits. It is the most compatible of the three routes from the built perspective as it crosses the least amount of agricultural lands. S2 was the second most compatible of the three routes from the built perspective as it crosses more agricultural lands than the S1 but is still less than the north route. Potential agricultural impacts were less on S2 but that was overridden by the potential residential implications.

In terms of community, the northern route was somewhat preferred than the southern routes, but the community category represents competing views from interest groups, landowners, members of the public and Indigenous communities. These included opposing views related to the potential for the transmission line to affect natural landscapes versus agricultural land and/or crown land versus private land, and which should be avoided. The scores aimed to balance the differing interests through understanding how individual concerns/ impacts can or cannot be mitigated or whether the concern is tangible or a perceived impact. The Northern route avoids community

pastures, follows mile lines and existing roadways and would affect fewer private landholdings and agricultural management units. During the public engagement process (chapter 3) landowners and agricultural organizations had expressed considerable concerns that routing should be through pastures to avoid more private agricultural land, whereas concerns that were raised through the Indigenous engagement process (chapter 4) focused more on issues with routes within the pasture.

In conclusion, the southern routes through the community pasture were substantially preferred to the northern route, primarily driven by line length (13-18 km difference) and substantial associated costs. Some participants in the engagement process voiced strong opposition to impacting prime private agricultural land along the northern route and urged routing through the pastures; others expressed strong concerns about the southern routes and potential impacts to rare and endangered grassland/species and important areas in the pasture. While this is a very important consideration, Manitoba Hydro was of the opinion that additional studies to identify and characterize the area, combined with monitoring, mitigation and adaptive management measures, could address risks of impacts in the pasture. Therefore, the primary driver was the high cost difference between the routes.

### 6.7.3 SaskPower process

Like Manitoba Hydro, SaskPower completed its own routing and engagement processes to determine preference related to border crossing locations. SaskPower summarized the advantages and challenges of the best route to the north crossing compared to the best route to the south crossing.

Advantages in a route to the north crossing were primarily a shorter line length (approximately 2.4 km), with associated savings on capital costs. In addition, the north route does not run parallel to a CN rail line as the south route does, and avoids adverse potential effects and associated costs to mitigate electrical interference on railway systems. This route also crosses less agricultural land and fewer areas of native prairie. Challenges in a route to the north crossing include a requirement for a crossing of a wide creek with extensive seasonal flooding issues, and nearly twice as much tree clearing as the south option, with associated costs and environmental issues. The north option would also result in a lower percentage of the route being adjacent to existing road or transmission infrastructure, resulting in reduced accessibility to the line for construction maintenance and emergency repairs, as well as affecting slightly more private landowners.

In assessing the route to the south crossing SaskPower determined that advantages would include a requirement for substantially less tree clearing on the ROW, compared

to the north option, and there are also fewer waterbodies and seasonally flooded areas crossed, resulting in slightly less effects to areas natural habitat overall. The greater use of community pasture for the south option would result in fewer private landowners being impacted, and it would avoid the crossing of the creek and flooding issues compared to the north option. The south option also had substantially greater length of route being adjacent to existing road or transmission infrastructure resulting in much better access to structure sites for construction, maintenance and emergency repair. SaskPower described the challenges with the south option as including a requirement for an additional 2.4 km of construction (Tantallon Station to Sakatchewan-Manitoba border), with associated additional capital costs. In addition, the south route would require paralleling an existing CN Rail line for approximately 7.7 km, in which may require additional mitigation measures and associated costs. In addition, the south route would have a greater impact on the community pasture, including the location in an area of the pasture strongly opposed by the current lease of the community pasture. SaskPower's process resulted in a preference for the north border crossing, primarily due to costs associated with line length and rail mitigation work.

#### 6.7.4 Selecting a common border crossing

In January 2017, SaskPower and Manitoba Hydro met to share details describing the rationale for their respective preferences, with the objective of determining a mutually acceptable border crossing location that would serve the needs of both parties. As described above, both parties listed cost as the primary factor, but SaskPower selected the north border and Manitoba Hydro selected the south border. The difference was that the Manitoba Hydro costs for the north crossing were several times greater than the SaskPower costs savings for the south route, based primarily on line length. The process required compromises by both parties but through discussion there was consensus on a selection of a south border crossing.

#### 6.8 Developing a final route

With the south border crossing selected there was a need to select a single Manitoba route to this crossing. As indicated previously, the modelling exercise selected S1 as the best overall route. The Manitoba Hydro routing team met again in February 2017 to confirm that S1 was the best route, based on further analysis and the discussions with SaskPower.

In general, results for engineering and natural environment were similar for both routes, but S1 was ranked higher than S2 based on built environment and community. This

was primarily because it would cross more agricultural land, followed a road allowance for part of its length, and would be located farther from the community of St. Lazare than S2. Details are provided in Appendix A.

Prior to developing the materials for the second round of public and Indigenous engagement Manitoba Hydro met with representatives of Manitoba Department of Sustainable Development's Wildlife and Fisheries Branch to discuss issues associated with the route through the pasture. Based on the first round of engagement the Branch had expressed concerns about a transmission line corridor intersecting Spy Hill Community Pasture due to large tracts of intact mixed-grass prairie and populations of rare grassland songbird species. During the meeting Manitoba Hydro presented the output of the routing process and the substantial difference in line length and the rationale for routing through the pasture. Several alternate segments in the pasture were discussed that would route away from prairie areas and associated songbird habitat.

The preferred route was presented in a second round of public and Indigenous engagement (chapters 3 and 4) in April 2017. In order to provide flexibility in discussing specific route segments within the pasture, the second round of public/Indigenous engagement included a map of the preferred route with a rectangular Ongoing Route Discussion Area identified within the pasture (Map 6-3). The Wildlife and Fisheries Branch expressed further concern about the route traversing the pasture, but also proposed amendments to the preferred route to lessen the Project's impact on high quality mixed-grass prairie habitat and grassland bird species, as well as partially following a previously cleared linear feature within the pasture and lessening the amount of disturbance to forested habitats.

Manitoba Hydro met with the Wildlife and Fisheries Branch again to discuss a biophysical field program to gather detailed information in the vicinity of the proposed pasture route segments and provided a summary report to them at the end of the 2017 spring/summer field program. The Branch acknowledged Manitoba Hydro's efforts to lessen the Project effects on grassland habitat and recommended a series of mitigation and monitoring requirements. Based on this information the final preferred route was established. The final preferred route selected therefore represents a consideration of multiple perspectives and inputs accounting for diverse interests and objectives. Criteria representing the natural, built and technical perspectives were used for route comparisons to arrive at a balanced decision on routing.

The result of the transmission line routing process is the selection of a final preferred route based on a robust and transparent methodology that included extensive engagement through the public and Indigenous engagement processes. The route

selection process considered a broad range of environmental, socio-economic, technical, and stakeholder information and feedback from the public and Indigenous engagement processes in stepping through the stages listed above to determine a route that balanced these factors. The objective of the process was to determine the location of a route that limits overall effect through the balancing of perspectives categorized as built, natural and environmental, as described above.

### Birtle Transmission Project

#### Project Infrastructure

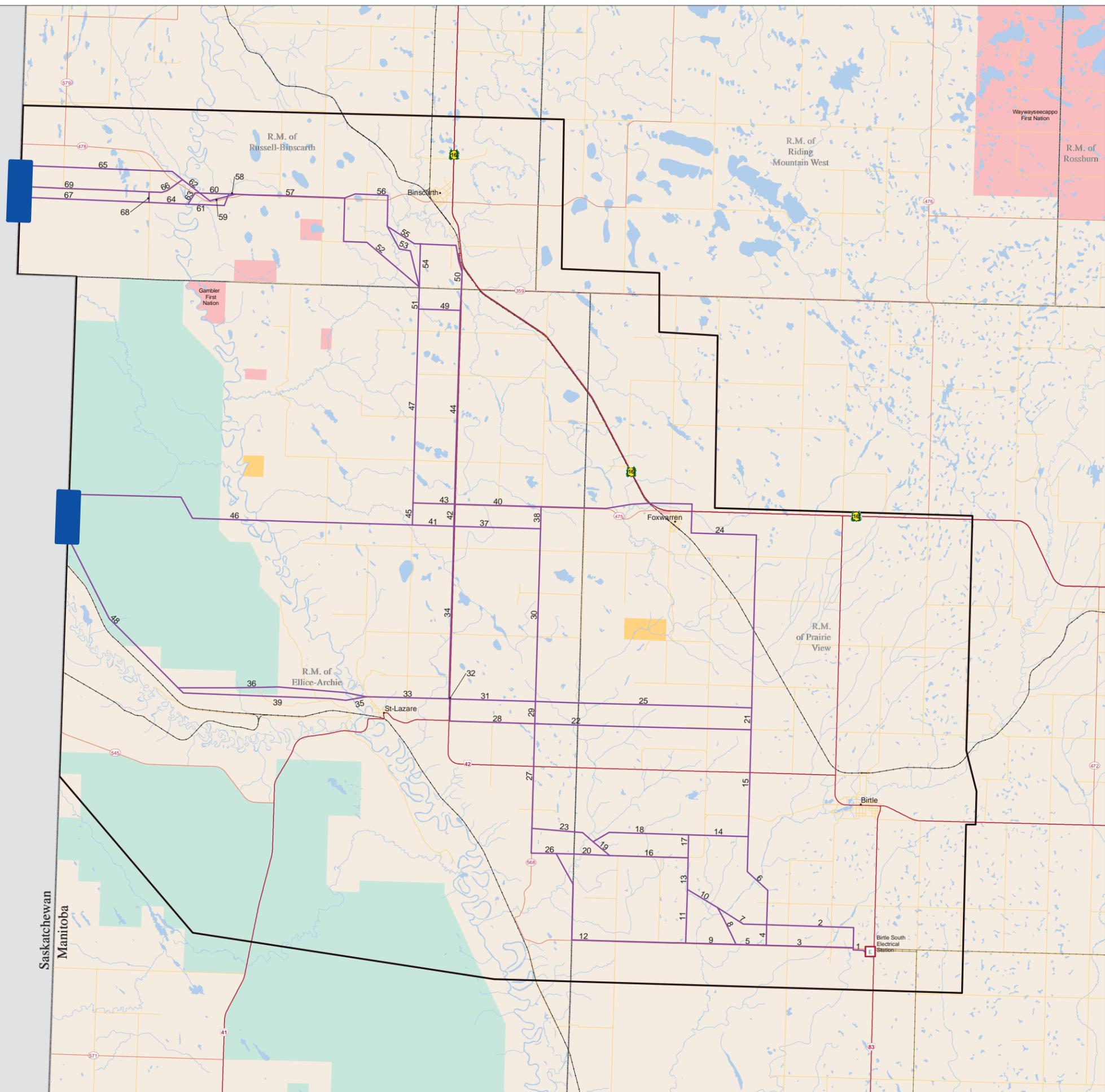
- Alternative Route Segments
- Border Connection Zone
- Route Planning

#### Infrastructure

- E Birtle South Electrical Station
- Transmission Lines

#### Landbase

- Community
- Provincial Trunk Highway
- Provincial Road
- Road (Other)
- Rail
- Rural Municipality
- First Nation
- Wildlife Management
- Community Pastures
- Waterbody
- Watercourse



Coordinate System: UTM Zone 14N NAD83  
 Data Source: MBHydro, ProvMB, NRCAN  
 Date Created: Friday, November 04, 2016



### Alternate Routes





