# APPENDIX J

**Basin Electric Power Cooperative**
**Big Bend to Witten 230-kV Transmission Project**

# ROUTING REPORT

December 29, 2011

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# 1.0 INTRODUCTION

## 1.1 Project Description and Need

Basin Electric Power Cooperative (Basin Electric) is proposing to construct and operate a new single-circuit 230-kilovolt (kV) transmission line in south-central South Dakota that would extend from a new substation (Lower Brule Substation) south of the Big Bend Dam on Lake Sharpe approximately 74 miles south-southwest to the existing Witten Substation located south of U.S. Highway 18. In addition to the new 230-kV transmission line, Western Area Power Administration (Western) is proposing to convert an existing single-circuit 230-kV transmission line structure, located on the south side of the Big Bend Dam, to a double-circuit structure and construct approximately 2.2 miles of double-circuit 230-kV transmission line from the new structure to the new Lower Brule Substation. The approximate 76-mile Big Bend to Witten 230-kV Transmission Project (Project) consists of the aforementioned elements. The Project is located within Lyman and Tripp counties in south-central South Dakota. Figure 1-1 illustrates the Project study area.

The design characteristics for the proposed line between the new Lower Brule Substation and existing Witten Substation, including right-of-way (ROW) requirements, structure spacing and height, and assumed disturbance and clearance assumptions, are summarized in Table 1-1. These assumptions were used in the routing analysis and also were used during the initial Macro-Corridor Study referenced below. The proposed transmission structures would be steel single-poles and would be designed to support three conductors and an overhead optical ground wire. Tangent structures would be directly embedded into the soil and angle and dead-end structures would be constructed using concrete foundations. No guy wires are proposed. The design criteria for the portion of the line between the Big Bend Dam and the Lower Brule Substation are expected to be similar.

The proposed Lower Brule Substation would be located on the Lower Brule Indian Reservation on the east side of State Highway 47 and would occupy approximately 16 acres of land (Figure 2-1). The substation location would be determined via consultation with tribal representatives. The existing Witten Substation would be expanded immediately to the northeast to accommodate the new 230-kV connection. The new part of the substation would have a separate access road and would be separated by a fence from the existing Witten Substation.

The need for the Project is driven by two key factors: 1) serve proposed short-term load growth on the 115-kV system between Basin Electric's Mission and Fort Randall Substations, including electric service demands from pump stations for the proposed TransCanada Keystone XL Pipeline; and 2) provide an additional source of power at the Witten Substation to improve regional system reliability and voltage stability.

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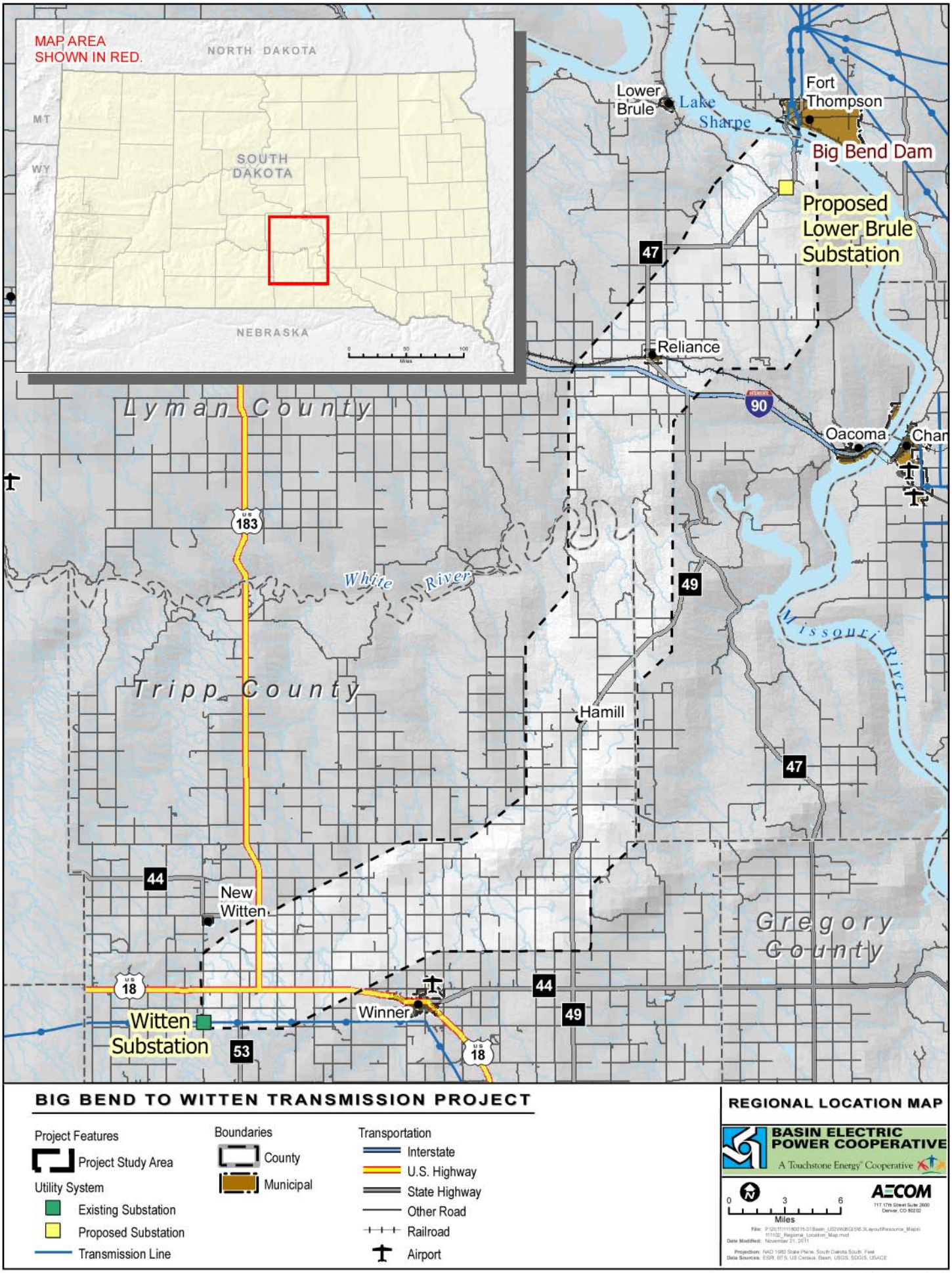
MAP AREA
SHOWN IN RED.
NORTH DAKOTA
MT
WY
SOUTH
DAKOTA
NEBRASKA
Lower
Brule
Lake
Sharpe
Fort
Thompson
Big Bend Dam
Proposed
Lower Brule
Substation
47
Reliance
90
Oacoma
Lyman County
183
White River
49
Missouri River
Tripp County
Hamill
47
44
New
Witten
Gregory
County
18
44
Winner
49
Witten
Substation
53
18
BIG BEND TO WITTEN TRANSMISSION PROJECT
Project Features
Project Study Area
Utility System
Existing Substation
Proposed Substation
Transmission Line
Boundaries
County
Municipal
Transportation
Interstate
U.S. Highway
State Highway
Other Road
Railroad
Airport
REGIONAL LOCATION MAP
BASIN ELECTRIC
POWER COOPERATIVE
A Touchstone Energy® Cooperative
0
3
6
Miles
AECOM
717 17th Street Suite 2600
Denver, CO 80202

FIGURE 1-1

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Table 1-1
Lower Brule-Witten Transmission Line Characteristics

| Description of Design Component | Values |
|---|---|
| Voltage (kV) | 230 |
| Conductor Diameter (inches) | 1.345 |
| Right-of-Way Width (feet) | 125 |
| Typical Minimum and Maximum Span Distances Between Structures (feet) | 650 - 950 |
| Average Span (feet) | 800 |
| Minimum and Maximum Structure Height (feet) | 70 - 115 |
| Average Height of Structures (feet) | 95 |
| Average Number of Structures (per mile) | 6.6 |
| Temporary Disturbance per Structure (square feet)<br>(approximately 125-foot x 100-foot area) | 12,500 |
| Permanent Disturbance per Structure (acre)<br>(approximately 3-foot diameter per structure leg) | <0.0002 |
| Minimum Conductor-to-Ground Clearance to Agricultural Land at 100 degrees Celsius (°C) (feet) | 26 |
| Minimum Conductor-to-Ground Clearance to Rural Roads at 100°C (feet) | 28 |
| Minimum Conductor-to-Ground Clearance to Paved Highways at 100°C (feet) | 31 |
| Circuit Configuration | Vertical |

## 1.2 Purpose of the Routing Report

RUS guidance regarding NEPA implementation (RUS Bulletin 1794A-603) requires that a Macro-Corridor Study (MCS) and an Alternative Evaluation Study (AES) be prepared by the project proponent and accepted by RUS prior to the start of the official NEPA process. Basin Electric published the Big Bend to Witten 230-kV Transmission Project Alternative Evaluation and Macro-Corridor Study (hereinafter referred to as the AE/MCS; available at http://www.rurdev.usda.gov/UWP-BigBendToWitten_SD.html) in April 2011, to evaluate the system alternatives that best meet the purpose and need of the Project, as well as to identify corridors and preliminary routes for the transmission line. This Routing Report evaluates route alternatives in more detail, and identifies the final three routes that will be carried forward into the Environmental Assessment. The Routing Report identifies Basin Electric's (Applicant) Preferred Route, as well as two alternative routes.

# 2.0 PROJECT BACKGROUND

## 2.1 Definition of the Study Area

The Project study area for the Routing Report is defined in the AE/MCS. The extent of a study area for a transmission line project is primarily determined by the project endpoints, the purpose and need, and the electric system requirements and components that best meet the purpose and need. As noted previously under Project Description and Need, Basin Electric and Western determined that a new double-circuit 230-kV transmission line from the Big Bend Dam to the proposed Lower Brule Substation, and a single-circuit 230-kV transmission line from the Lower Brule Substation to the Witten Substation offered the best way to meet the purpose and need for the Project. In addition to the knowing the two project endpoints, West Central Electric Cooperative (West Central) requested a 230-kV/69-kV interconnection to the proposed transmission line approximately 10 miles southwest of the Big Bend Switchyard near the town of Reliance. The limited number of reasonable crossing locations of the White River and the need to provide an interconnection with West Central ultimately helped define the Project study area boundary. The resulting 6-mile-wide macro-corridor generally trends north-south through Lyman County and into Tripp County south of the unincorporated town of Hamill. At a point approximately 6 miles south of Hamill, the macro-corridor turns southwest to the Witten Substation. The Project study area is shown in Figure 1-1 in this report. The study area encompasses approximately 391.2 square miles.

## 2.2 Summary of Alternative Evaluation and Macro-Corridor Study

The AE/MCS provides additional detail regarding the Project purpose and need, as well as regional transmission system studies and analyses. That study is incorporated by reference into this Routing Report. The AE/MCS defined the study area, summarized the resource data collection, and included a constraints and opportunities analysis, defining the resource attributes that would affect routing the proposed transmission line. Resource data were gathered from local municipalities, counties, and state and federal agencies, primarily consisting of existing Geographic Information System (GIS) data bases. These data included: existing linear transportation and utility corridors; land use and jurisdiction information; cultural resources; wetlands and water resources (e.g., water bodies, floodplains); geologic hazards; and biological resources. Aerial photography was also used as a base map to verify the existing conditions within the study area, and limited field reconnaissance was conducted to ground-truth some of the desktop data. Other resources considered but not used in the AE/MCS process included soils, slope, agriculture, and oil and gas wells. These resources were not used in the opportunity and constraints analysis since the resources were either determined to be absent or nearly ubiquitous across the entire study area and therefore, would not be useful in discriminating among various routes.

The opportunities and constraints analysis was based on criteria associated with the resources previously noted. Specifically, the categories of criteria included opportunity areas, avoidance areas and exclusion areas. Opportunity areas were limited primarily to areas along existing road or utility rights-of-way (ROW), as well as rural rangeland, croplands, and open space. Avoidance areas were identified for resources that should be avoided if possible, but that could be crossed by the proposed transmission line under certain conditions (limited crossing or implementation of design measures or mitigation measures would avoid adverse effects). Exclusion areas were identified as those areas that should be excluded from

transmission line crossing and include: reservoirs; strip mines; center-pivot irrigation; areas within 150 feet of occupied residences; areas within 150 feet of schools, cemeteries, parks, and recreation areas; areas within 50 feet of a Federal Communications Commission (FCC) structure; areas within 100 feet of a documented cultural resource site; and areas within 0.25 mile of active sharp-tailed grouse leks.

Based on the GIS database information, a composite map was produced identifying the opportunities and constraints within the macro-corridor. The opportunities and constraints information was used by Basin Electric to identify alternative routes and route segments that would potentially meet the routing objectives: connect the two substations; maximize the opportunities and minimize the constraints; and be cost-effective. In addition to gathering resource data and developing an opportunities and constraints map, the early phase of routing also included public participation, which is described further in the EA and Scoping Report. Figure 2-1 illustrates the route segments presented at the public scoping meetings, as well as the initial route proposed by Basin Electric and Western ("Applicant-Preferred Route").

## 2.3 Public and Agency Participation

The RUS NEPA process included pre-scoping activities, agency and tribal consultation, and public scoping meetings. The data gathered from the public and agency outreach efforts were used in the initial identification of potential routes. A detailed description of the scoping process is provided in Chapter 2 of the Big Bend to Witten 230-kV Transmission Project Environmental Assessment Scoping Report, July 2011, with a summary of scoping comments compiled in Appendix C of that document. The public scoping meetings were held within the study area on April 26 and 27, 2011. At these meetings, Basin Electric and Western provided an opportunity for the public to understand the proposed Project and the NEPA process, as well as provide their comments both verbally and in written form. A number of visual aids (e.g., poster boards) were used to graphically show the study area and the initial set of route segments developed by Basin Electric and Western. Figure 2-1 illustrates the route segments presented at the public scoping meetings, as well as the initial route proposed by Basin Electric and Western ("Applicant-Preferred Route").

Scoping comments covered a variety of topics including: agriculture, wildlife, construction/maintenance concerns, grazing, lands/realty, public health and safety, reclamation, socioeconomics, transportation and visual resources. A number of comments were also made specific to the Project purpose and need, or to a particular route segment that crossed or was in close proximity to a landowner's property.

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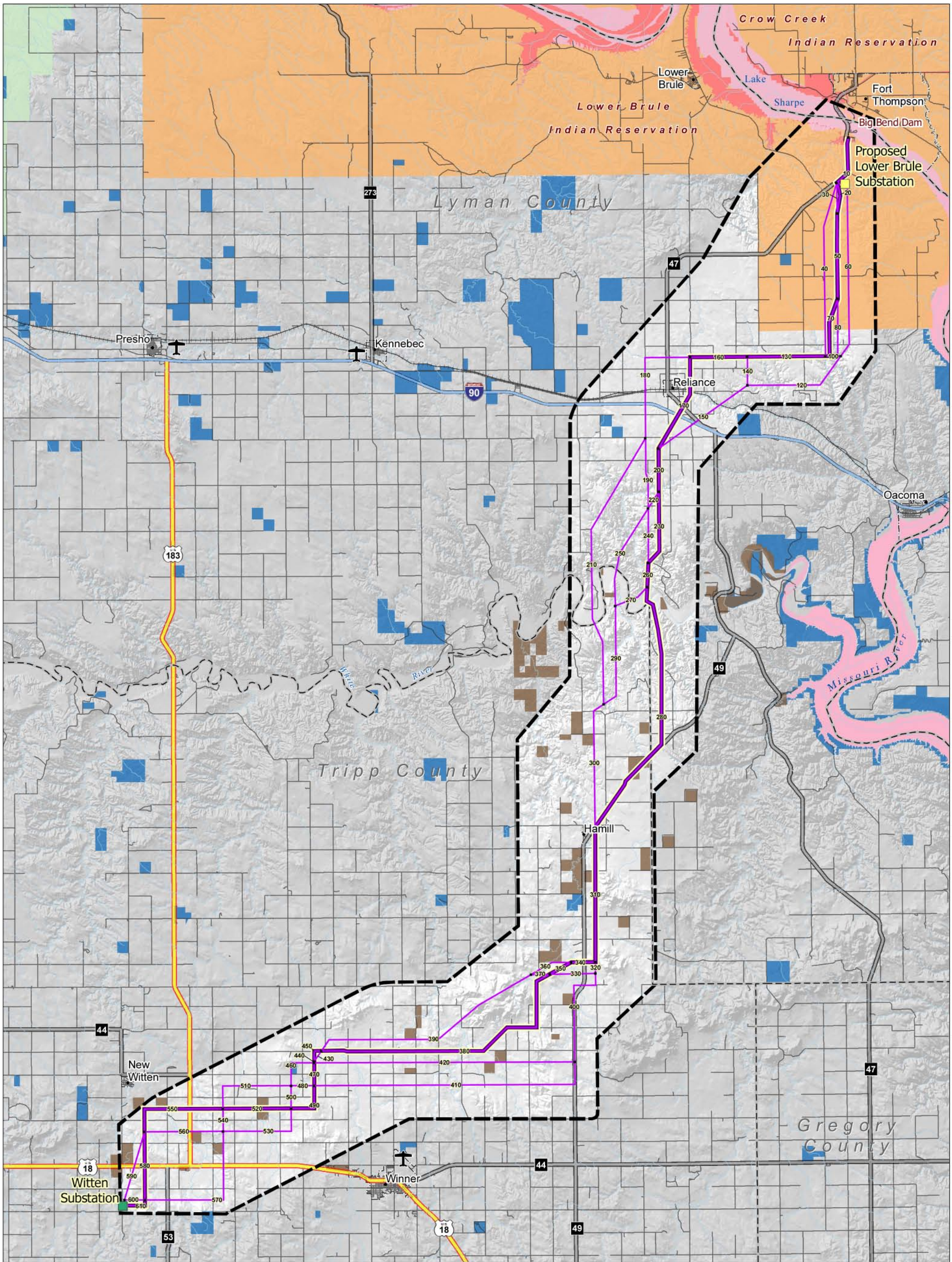


# BIG BEND TO WITTEN TRANSMISSION PROJECT

**Project Features**
- Project Study Area
- 100 Alternative Route Segment
- Proposed Route Presented At Scoping

**Jurisdiction**
- DOD - Army Corps of Engineers
- Recreation Areas
- BIA - Indian Reservation
- USFS - National Grassland
- State of South Dakota
- Indian Trust Land

**Transportation**
- Interstate
- U.S. Highway
- State Highway
- Other Road
- Railroad
- Airport

**Boundaries**
- County
- Municipal

**Utility System**
- Existing Substation
- Proposed Substation

## SEGMENTS PRESENTED AT PUBLIC SCOPING

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

AECOM
717 17th Street Suite 2600
Denver, CO 80202

0 2.5 5
Miles

File: P:\2011\11180015.01Basin_LB2W\06GIS\6.3Layout\Resource_Maps\111121_Public_Scoping_Segments.mxd
Date Modified: November 21, 2011

Projection: NAD 1983 State Plane, South Dakota South, Feet
Data Sources: ESRI, BTS, US Census, Basin, USGS, SDGIS, USACE

FIGURE 2-1

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## 2.4 Adjustments to Route Segments

Based on public comments, several route segments were eliminated from the original set presented at the scoping meetings. In addition, Basin Electric made additional refinements to the Applicant-Preferred Route based on input from landowners and member cooperatives, or to avoid other types of sensitive features.

The following five route segments were eliminated based on information gathered during preparation of the AE/MCS, field reconnaissance, and public scoping meetings:

- Segment 80: This segment had multiple crossings over the North Fork American Creek.
- Segment 380: This segment had a relatively large number of residences within 500 feet of the centerline, a greater number of Class I archaeological resource sites than other segments, substantial wetlands crossings and impacts to surface waters.
- Segment 420: The segment crossed Indian Trust land, had a number of residences within 500 feet, and crossed a large number of wetlands and surface waters.
- Segment 520: Similar to Segment 420, this segment crossed Indian Trust land, had a number of residences within 500 feet, and crossed a large number of wetlands and surface waters.
- Segment 550: This segment had the greatest impact to surface waters.

Following the public scoping meetings, Basin Electric made the following adjustments to the Applicant-Preferred Route:

- Near Reliance, the original route was located south and east of Reliance and followed Segments 170, 200, and 230. The Applicant-Preferred Route was shifted to the north and west of Reliance to accommodate West Central's request for a tap site in this location and landowner concerns regarding the location of the original route.
- South of the White River, the original route followed Segment 280. The Applicant-Preferred Route was shifted 0.5 mile west to accommodate a landowner request, and the route continued south of Highway 49 for approximately 1.25 miles to avoid crossing Indian Trust land in Section 13.
- North of Winner, the original route followed Segment 380. The Applicant-Preferred Route was moved 0.5 mile north along a portion of Segment 390 to accommodate potential future development along 272nd Street and to avoid a large wetland area.
- The last 10 miles of the original route into the Witten Substation followed Segments 490, 520, 550, 580, and 610. Routing in this area was shifted to avoid farmland and to follow ½-section lines or parallel to section lines to minimize disturbance to farming activities. In addition, the route along Segment 520 was shifted 0.5 mile north to avoid Indian Trust land.

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# 3.0 ALTERNATIVE ROUTE SCREENING ANALYSIS

## 3.1 Overview of Alternative Route Identification

The Project consists of a series of potential routes (consisting of 63 route segments) between the Big Bend Dam, proposed Lower Brule Substation, and existing Witten Substation. The potential route segments were presented at the public scoping meetings, along with an Applicant-Preferred Route proposed by Basin Electric and Western. As noted in Section 2.3, some segments were removed from further consideration.

As part of the routing study, the remaining route segments were combined into 16 potential alternative routes. The 16 potential alternative routes were identified through an iterative process that considered all of the segments presented at the public scoping meetings, as well as constraints within the Project study area identified during the AE/MCS. The vast majority of segments presented during scoping were used in at least one of the 16 potential alternative routes or the Applicant-Preferred Route.

During the AE/MCS process and before formal public scoping, Basin Electric identified a preliminary proposed route that minimized environmental and land use constraints, and minimized project costs and engineering constraints. After public scoping , the Applicant-Preferred Route was refined in response to input from the public and West Central regarding the interconnection near Reliance. These modifications are described in Section 2.3.

To identify the routes proposed for analysis in the EA, the 16 alternative routes and the Applicant-Preferred Route were narrowed down to three routes (the Applicant-Preferred Route and two alternatives) through a screening process that included both quantitative and qualitative metrics.

The quantitative metrics include output from a computerized GIS analysis that tabulates potential constraints within the Project study area and summarizes the data in matrix format. The specific quantitative metrics (criteria) that were used and evaluated in the matrix are described in more detail in Section 3.2. The comparative matrix quantifies the potential effects for each criterion, ranks each criterion (where lowest generally is best depending on the criterion), and then tallies the rankings are to represent an overall total for a relative comparison between alternative routes. To preserve an objective analysis, the criteria were not weighted, since weighting introduces a subjective element regarding the relative importance of various criteria. For this analysis, all criteria were treated equally. The ranks for each criterion were summed to create an overall total score for each route and the overall total scores for each route were ranked to determine the overall rank of each route. In addition to the qualitative metrics described below, the overall rank was used to help identify potential alternative routes for evaluation in the EA. Table 3-1 depicts the summary matrix of quantitative data by route.

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## Table 3-1 Comparative Matrix – 17 Alternative Routes

| CATEGORY | ROUTES | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 Applicant-Preferred Route |
| ***Route Length*** | | | | | | | | | | | | | | | | | |
| Route Length (feet) | 405,000 | 405,326 | 385,713 | 387,603 | 396,939 | 397,265 | 377,651 | 379,542 | 396,959 | 397,285 | 377,672 | 379,562 | 400,754 | 401,080 | 381,467 | 383,357 | 399,714 |
| Route Length (miles) | 77 | 77 | 73 | 73 | 75 | 75 | 72 | 72 | 75 | 75 | 72 | 72 | 76 | 76 | 72 | 73 | 76 |
| RANK (LOW BEST) | 5 | 5 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 4 | 4 | 1 | 2 | 4 |
| **TOTAL SCORE** | **5** | **5** | **2** | **2** | **3** | **3** | **1** | **1** | **3** | **3** | **1** | **1** | **4** | **4** | **1** | **2** | **4** |
| **TOTAL RANK (LOW BEST)** | **5** | **5** | **2** | **2** | **3** | **3** | **1** | **1** | **3** | **3** | **1** | **1** | **4** | **4** | **1** | **2** | **4** |
| ***Engineering*** | | | | | | | | | | | | | | | | | |
| Length Within 200 feet of Existing Transmission or Distribution Lines (feet) | 8,952 | 14,057 | 8,952 | 8,952 | 8,918 | 14,022 | 8,918 | 8,918 | 8,952 | 14,057 | 8,952 | 8,952 | 9,718 | 14,822 | 9,718 | 9,718 | 7,825 |
| Length Within 200 feet of Existing U.S. and State Highways (feet) | 29,402 | 29,402 | 8,798 | 8,798 | 53,269 | 53,269 | 32,665 | 32,665 | 29,013 | 29,013 | 8,409 | 8,409 | 29,008 | 29,008 | 8,404 | 8,404 | 16,144 |
| Length within 0.25 mile of Scenic Byways (feet) | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 15,000 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| Length within 200 feet of County Roads (feet) | 36,570 | 36,570 | 29,223 | 29,163 | 47,528 | 47,528 | 40,181 | 40,121 | 26,168 | 26,168 | 18,821 | 18,761 | 44,858 | 44,858 | 37,511 | 37,451 | 66,626 |
| Length within 200 feet of Section Lines (feet) | 78,186 | 79,412 | 64,099 | 54,692 | 99,823 | 101,049 | 85,736 | 76,329 | 69,604 | 70,830 | 55,517 | 46,110 | 98,629 | 99,855 | 84,542 | 75,135 | 133,855 |
| Total Length Adjacent All Linear Features | 153,110 | 159,441 | 111,072 | 101,605 | 209,537 | 215,868 | 167,499 | 158,032 | 133,737 | 140,067 | 91,699 | 82,232 | 182,213 | 188,543 | 140,175 | 130,708 | 224,450 |
| Total % Adjacent to Linear Features | 38% | 39% | 29% | 26% | 53% | 54% | 44% | 42% | 34% | 35% | 24% | 22% | 45% | 47% | 37% | 34% | 56% |
| RANK (HIGH BEST) | 5 | 5 | 7 | 7 | 2 | 2 | 4 | 4 | 6 | 5 | 8 | 8 | 3 | 3 | 5 | 6 | 1 |
| **TOTAL SCORE** | **7** | **7** | **9** | **9** | **4** | **4** | **6** | **6** | **8** | **7** | **10** | **10** | **5** | **5** | **7** | **8** | **2** |
| **TOTAL RANK (LOW BEST)** | **5** | **5** | **7** | **7** | **2** | **2** | **4** | **4** | **6** | **5** | **8** | **8** | **3** | **3** | **5** | **6** | **1** |
| ***Jurisdiction*** | | | | | | | | | | | | | | | | | |
| Length Crossing Indian Trust Land (feet) | 0 | 0 | 0 | 0 | 7,235 | 7,235 | 7,235 | 7,235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,614 |
| RANK (LOW BEST) | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **TOTAL SCORE** | **1** | **1** | **1** | **1** | **3** | **3** | **3** | **3** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **2** |
| **TOTAL RANK (LOW BEST)** | **1** | **1** | **1** | **1** | **3** | **3** | **3** | **3** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **2** |
| ***Land Use/Land Cover*** | | | | | | | | | | | | | | | | | |
| Length Crossing Reservoirs and Strip Mines (feet) | 379 | 379 | 379 | 379 | 0 | 0 | 0 | 0 | 379 | 379 | 379 | 379 | 0 | 0 | 0 | 0 | 0 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Communication Facilities Within 150 feet (number) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| **TOTAL SCORE** | **4** | **4** | **4** | **4** | **3** | **3** | **3** | **3** | **4** | **4** | **4** | **4** | **3** | **3** | **3** | **3** | **2** |
| **TOTAL RANK (LOW BEST)** | **3** | **3** | **3** | **3** | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **2** | **2** | **2** | **2** | **1** |
| ***Residential*** | | | | | | | | | | | | | | | | | |
| Number of Residences within 250 Feet of Centerline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Number of Residences between 251- 500 Feet of Centerline | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| RANK (LOW BEST) | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **TOTAL SCORE** | **3** | **3** | **3** | **3** | **4** | **4** | **4** | **4** | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **3** |
| **TOTAL RANK (LOW BEST)** | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **1** | **1** | **1** | **1** | **2** | **2** | **2** | **2** | **2** |
| ***Wetlands and Water Resources*** | | | | | | | | | | | | | | | | | |
| Number of Crossings of Perennial Streams (number) | 6 | 6 | 6 | 6 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 3 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 |
| Length within 100 ft of Perennial/Intermittent Streams (feet) | 28,000 | 28,000 | 25,000 | 25,000 | 28,000 | 28,000 | 25,000 | 25,000 | 32,000 | 32,000 | 30,000 | 29,000 | 32,000 | 32,000 | 30,000 | 29,000 | 28,000 |
| RANK (LOW BEST) | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 5 | 5 | 4 | 3 | 5 | 5 | 4 | 3 | 2 |
| Length Crossing Waterbodies (feet) | 1,200 | 1,200 | 1,200 | 1,200 | 1,600 | 1,600 | 1,600 | 1,600 | 1,500 | 1,500 | 1,500 | 1,500 | 1,200 | 1,200 | 1,200 | 1,200 | 1,600 |
| RANK (LOW BEST) | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 3 |
| Length Crossing NWI Wetlands (feet) | 5,000 | 5,000 | 6,000 | 6,000 | 4,000 | 4,000 | 5,000 | 5,000 | 5,000 | 5,000 | 6,000 | 6,000 | 3,000 | 3,000 | 4,000 | 4,000 | 6,000 |
| RANK (LOW BEST) | 3 | 3 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 1 | 1 | 2 | 2 | 4 |
| **TOTAL SCORE** | **8** | **8** | **8** | **8** | **8** | **8** | **8** | **8** | **13** | **13** | **13** | **12** | **10** | **10** | **10** | **9** | **10** |
| **TOTAL RANK (LOW BEST)** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **5** | **5** | **5** | **4** | **3** | **3** | **3** | **2** | **3** |
| ***Cultural and Historic Resources*** | | | | | | | | | | | | | | | | | |
| Other Class I sites within 500 feet (number) | 7 | 7 | 7 | 7 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **TOTAL SCORE** | **2** | **2** | **2** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** |
| **TOTAL RANK (LOW BEST)** | **2** | **2** | **2** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** |
| ***Biological Resources*** | | | | | | | | | | | | | | | | | |
| Length within known prairie dog towns (feet) | 1,628 | 1,628 | 1,628 | 1,628 | 260 | 260 | 260 | 260 | 1,445 | 1,445 | 1,445 | 1,445 | 260 | 260 | 260 | 260 | 1,097 |
| Raptor Nests within 0.25 mile (number) | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| RANK (LOW BEST) | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| Sharp-tailed grouse leks within 0.25 mile (number) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| RANK (LOW BEST) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **TOTAL SCORE** | **4** | **4** | **3** | **3** | **3** | **3** | **2** | **2** | **3** | **3** | **2** | **2** | **3** | **3** | **2** | **2** | **3** |
| **TOTAL RANK (LOW BEST)** | **3** | **3** | **2** | **2** | **2** | **2** | **1** | **1** | **2** | **2** | **1** | **1** | **2** | **2** | **1** | **1** | **2** |
| ***Totals*** | | | | | | | | | | | | | | | | | |
| **OVERALL TOTAL SCORE** | **34** | **34** | **32** | **32** | **29** | **29** | **28** | **28** | **35** | **34** | **34** | **33** | **30** | **30** | **28** | **29** | **27** |
| **TOTAL RANK (LOW BEST)** | **7** | **7** | **5** | **5** | **3** | **3** | **2** | **2** | **8** | **7** | **7** | **6** | **4** | **4** | **2** | **3** | **1** |

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In addition to the quantitative metrics depicted in Table 3-1, the following qualitative metrics were applied during selection of the three routes from the field of 17 potential alternative routes:

One of the three routes will represent the Applicant-Preferred Route.

The alternative routes should use segments that are not duplicative of segments used by the Applicant-Preferred Route to the greatest extent possible.

The alternative routes should follow direct paths between the Project endpoints and meet the Applicant's purpose and need.

1) To the extent feasible, alternative routes should avoid major constraints including residences, Indian Trust land, cultural and historical resources, and known sensitive biological resources.

## 3.2 Criteria Used to Evaluate Potential Routes

The following criteria were used to develop quantitative metrics to evaluate the 16 alternative routes and the Applicant-Preferred Route in a GIS-based model and output matrix. During the analysis process, some of these criteria were subsequently removed from the comparative ranking matrix if the data were equal for all routes (no discernable difference), or if the criteria no longer applied. Criteria removed are summarized in Section 3.3.

### Route Length

Route length is a key criterion that is commonly used to compare transmission line routes. Longer transmission line routes are typically (but not always) more costly to construct and may have greater impacts when compared with shorter routes.

### Percent of Route Adjacent to Existing Linear Features

Routing transmission lines along existing linear features such as roads and transmission lines can reduce the potential impact when compared with constructing a "greenfield" transmission line. In many instances, existing roadways or other types of ROW can provide access to the new transmission line for both construction and maintenance purposes. For the purposes of the routing study, the following criteria were included in the linear features category:

- Transmission and distribution lines;
- U.S. and State highways;
- County roads; and
- Section lines.

The length within 200 feet of each of these features was added together and divided by the total length of the route to create a percentage adjacent to linear features.

### Length Crossing Indian Trust Land

Indian Trust lands often have multiple owners, which can greatly complicate the process for obtaining easements. Consequently, parcels of Indian Trust land were identified as avoidance areas for this routing study.

### Length Crossing Reservoirs and Strip Mines

Due to their typical size and breadth, or operational constraints, transmission lines are typically routed around these types of facilities. In some cases, reservoirs can be spanned if necessary.

### Communication Facilities within 150 Feet

Transmission line routing must meet the requirements of the Federal Communications Commission (FCC) to avoid potential interference with AM radio, FM radio and telecommunications facilities.

### Residences within 500 Feet

Land use compatibility issues must be considered when routing a transmission line in proximity to residences. A typical transmission line routing criterion looks at residences within the proposed ROW and within an additional reasonable buffer zone outside the ROW. The proposed ROW is 125 feet (62.5 feet on either side of the transmission line centerline) and no residences were found within the proposed ROW. The number of residences within 500 feet of each route was included in the matrix.

### Number of Crossings of Perennial Streams

All of the streams within the Project study area can be spanned, but limiting the number of stream crossings can reduce direct and indirect effects to water quality and associated stream habitat, and, depending on the length of the stream crossing, can reduce construction costs.

### Length within 100 feet of Perennial/Intermittent Streams

Construction and long-term maintenance of utility lines and structures can result in direct and indirect effects to surface waters as a result of soil disturbance, erosion and habitat disturbance. Maintaining an adequate buffer between transmission line construction activities and adjacent surface waters is prudent.

### Length Crossing Waterbodies

Large waterbodies can pose obstacles to transmission line routing, and sometimes require routing around the water feature. The Project would be constructed using 230-kV transmission structures that allow for an average span length of 650 to 950 feet. Waterbodies that are less than 950 feet wide could be spanned by the proposed transmission line.

### Length Crossing National Wetland Inventory (NWI) Wetlands

Due to the sensitive nature of wetland habitat and the species occupying the habitat, direct impacts as a result of short-term construction or long-term operations should be avoided. Wetlands can typically be spanned by transmission lines; however, wetlands within the ROW would need to be delineated in localized areas prior to construction and measures to avoid impacts to wetlands would be implemented.

### Class I Cultural Resources Sites within 500 Feet

Important historical and cultural resources should be avoided when routing a transmission line. Depending on the resource and its status with the State Historic Preservation Office, some sites can be spanned as long as the ground surface in the vicinity of the site is not disturbed.

### Length within Known Prairie Dog Colonies

Prairie dog colonies can be a potential concern for routing transmission lines since these colonies typically provide habitat for the black-footed ferret, which is a federally-listed endangered species. Project biologists have determined that it is highly unlikely the black-footed ferret would occur in the Project study area, and RUS has concurred with this determination. Another potential concern is that burrowing owls often use prairie dog burrows for nest sites. The burrowing owl is protected under the Migratory Bird Treaty Act. Burrowing owl surveys within potential habitat areas would be conducted prior to construction.

### Raptor Nests within 0.25 mile of Centerline

Transmission line routing must consider potential effects to raptors and other avian species protected by the Migratory Bird Treaty Act. Areas of high flight activity are generally found around nests and foraging areas. Proximity of nests to transmission lines increases the risk of collision and potential mortality.

### Length within Sharp-Tailed Grouse Leks

Sharp-tailed grouse leks were included in the constraints criteria since the grouse population has been in decline through loss of habitat across the nation. The grouse prefers grasslands and prairies and primarily forages on the ground in summer months. Nesting typically occurs in May and June. The presence of active leks (i.e. communal display and breeding areas) along a transmission line route may influence construction scheduling, but these leks can typically be spanned by the transmission line with no long-term effects.

## 3.3 Criteria Considered but Removed from Comparative Analysis

Several routing criteria were evaluated against the data compiled during the AE/MCS data search but were ultimately removed from further evaluation in the comparative analysis matrix because they either did not apply to the alternative routes or the criteria applied evenly to all routes and therefore, would not make a discernable difference for purposes of comparing and ranking alternatives. These criteria were removed from the comparative analysis.

### Length within 0.25 mile of a Scenic Byway

Transmission lines and associated structures could result in an adverse visual effect to motorists traveling on scenic byways. Altering a scenic viewshed by erecting man-made utility infrastructure could detract from the overall viewing experience. All of the routes evaluated parallel a scenic byway (Native American Scenic Byway) for approximately 3 miles between Big Bend Dam and the proposed Lower Brule Substation, so this criterion was not particularly useful in distinguishing among the various alternative routes; however, the Applicant-Preferred Route parallels scenic byways for a slightly shorter length than any of the alternative routes. As a result, this criterion was removed from the comparative matrix.

### Length within 500 Feet of Census Landmarks

Census landmarks consist of structures accounted for in census data and typically include schools, hospitals, airports and landing strips, churches, cemeteries and jails. These types of land uses may present routing constraints depending upon the distance between the transmission line and the census landmark structure and the sensitivity of the land use. Other factors include the size of the transmission line (kV) and associated structure specifications. No census landmarks were identified within 500 feet of the centerline of alternative routes, with the exception of an old, inactive landing strip. As a result, this criterion was removed from the matrix.

### Length within Areas Classified as Important Farmland

Based on U.S. Department of Agriculture classifications, important farmland within the macro-corridor is classified as “prime farmland”, “farmland of statewide importance”, or “prime farmland, if irrigated.” Because of the extensive distribution of important farmland throughout the macro-corridor, all of the routes would cross varying amounts of important farmland. Since important farmland is widely distributed throughout the macro-corridor, this category was not a significant discriminator among the routes and was therefore removed from the matrix.

Construction of transmission lines through agricultural areas rarely results in a disruption of agricultural practices for more than a single growing season, and if constructed after harvest or during winter months, may result in minimal disruption. In addition, most agricultural operations may continue within the ROW once construction has been completed so the amount of land removed from agricultural production is minimal and is generally limited to the actual footprint of the transmission structures and the area immediately around the structures.

### Historic Structures

Only one historic structure was identified during the early stages of the AE/MCS, within 500 feet of an early version of the Applicant-Preferred Route. The Applicant-Preferred Route was subsequently shifted away from the structure. For this reason, this criterion was removed from the matrix.

## 3.4 Selection of Alternate Routes

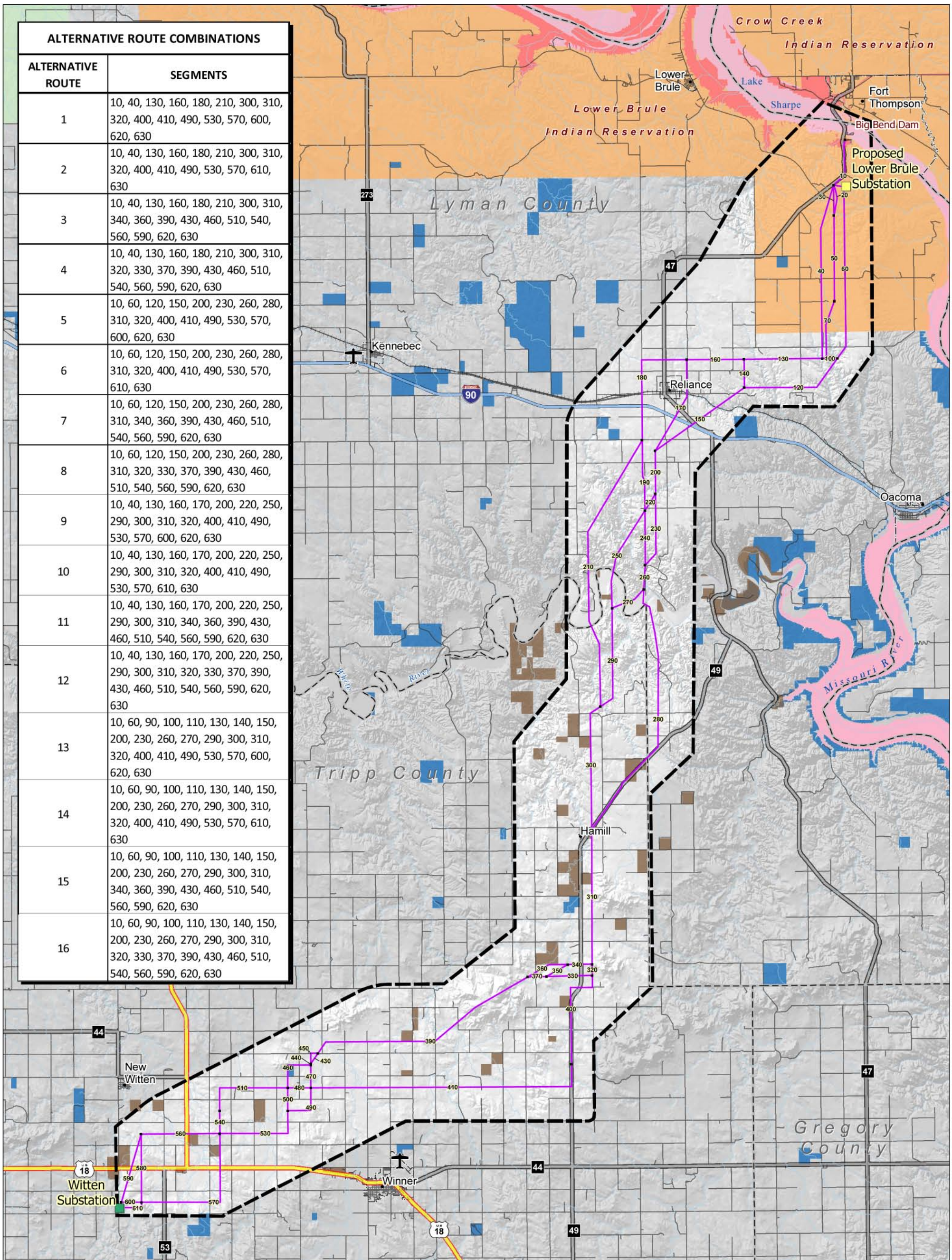
### *3.4.1 Big Bend – Lower Brule Substation 230-kV Transmission Line*

As shown in Figures 3-1 and 3-2, the northern portion of the Project, the proposed 230-kV transmission line between the Big Bend Dam (new 230-kV double-circuit structure) and the proposed Lower Brule Substation consists of a single route, with no alternatives. This part of the Project is located entirely on the Lower Brule Indian Reservation. Basin Electric and Western will work with the Lower Brule and Rosebud Tribal Representatives to determine an appropriate alignment for the new transmission line and location for the proposed substation.

### *3.4.2 Lower Brule – Witten 230-kV Transmission Line*

A total of 17 routes including the Applicant-Preferred Route (identified as Route 17) were evaluated in the comparative matrix. The 16 preliminary alternative routes consist of a combination of various segments. Figure 3-1 depicts the segments that were evaluated in this routing report and includes a table that defines the segment combinations that comprised each of the 16 alternative routes. Figure 3-2 is a map that shows the Applicant-Preferred Route. As noted previously, a number of adjustments were made to the Applicant-Preferred Route between public scoping and the comparative analysis/routing report phase in order to avoid conflicts, minimize environmental effects, and/or address the concerns of the greatest number of landowners.

| ALTERNATIVE ROUTE COMBINATIONS | |
|---|---|
| **ALTERNATIVE ROUTE** | **SEGMENTS** |
| 1 | 10, 40, 130, 160, 180, 210, 300, 310, 320, 400, 410, 490, 530, 570, 600, 620, 630 |
| 2 | 10, 40, 130, 160, 180, 210, 300, 310, 320, 400, 410, 490, 530, 570, 610, 630 |
| 3 | 10, 40, 130, 160, 180, 210, 300, 310, 340, 360, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 4 | 10, 40, 130, 160, 180, 210, 300, 310, 320, 330, 370, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 5 | 10, 60, 120, 150, 200, 230, 260, 280, 310, 320, 400, 410, 490, 530, 570, 600, 620, 630 |
| 6 | 10, 60, 120, 150, 200, 230, 260, 280, 310, 320, 400, 410, 490, 530, 570, 610, 630 |
| 7 | 10, 60, 120, 150, 200, 230, 260, 280, 310, 340, 360, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 8 | 10, 60, 120, 150, 200, 230, 260, 280, 310, 320, 330, 370, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 9 | 10, 40, 130, 160, 170, 200, 220, 250, 290, 300, 310, 320, 400, 410, 490, 530, 570, 600, 620, 630 |
| 10 | 10, 40, 130, 160, 170, 200, 220, 250, 290, 300, 310, 320, 400, 410, 490, 530, 570, 610, 630 |
| 11 | 10, 40, 130, 160, 170, 200, 220, 250, 290, 300, 310, 340, 360, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 12 | 10, 40, 130, 160, 170, 200, 220, 250, 290, 300, 310, 320, 330, 370, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 13 | 10, 60, 90, 100, 110, 130, 140, 150, 200, 230, 260, 270, 290, 300, 310, 320, 400, 410, 490, 530, 570, 600, 620, 630 |
| 14 | 10, 60, 90, 100, 110, 130, 140, 150, 200, 230, 260, 270, 290, 300, 310, 320, 400, 410, 490, 530, 570, 610, 630 |
| 15 | 10, 60, 90, 100, 110, 130, 140, 150, 200, 230, 260, 270, 290, 300, 310, 340, 360, 390, 430, 460, 510, 540, 560, 590, 620, 630 |
| 16 | 10, 60, 90, 100, 110, 130, 140, 150, 200, 230, 260, 270, 290, 300, 310, 320, 330, 370, 390, 430, 460, 510, 540, 560, 590, 620, 630 |




# BIG BEND TO WITTEN TRANSMISSION PROJECT

## ALTERNATIVE ROUTES

**Project Features**
- Project Study Area
- Alternative Route Segment

**Jurisdiction**
- DOD - Army Corps of Engineers
- Recreation Areas
- BIA - Indian Reservation
- USFS - National Grassland
- State of South Dakota
- Indian Trust Land

**Transportation**
- Interstate
- U.S. Highway
- State Highway
- Other Road
- Railroad
- Airport

**Boundaries**
- County
- Municipal

**Utility System**
- Existing Substation
- Proposed Substation

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

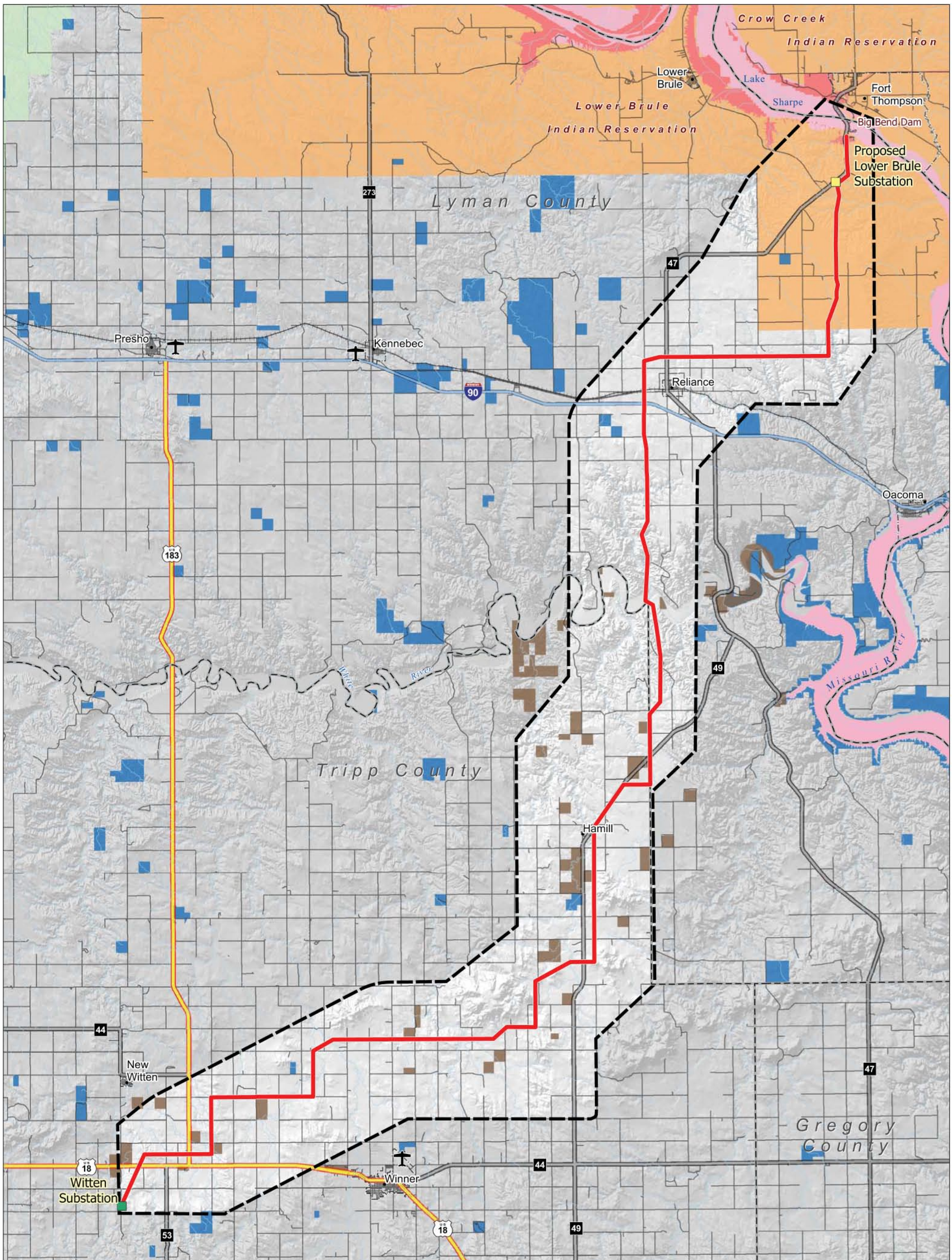
0 3 6 Miles

AECOM
717 17th Street Suite 2600
Denver, CO 80202

File: P:\2011\11180015.01Basin_LB2W\06GIS\6.3Layout\Resource_Maps\111121_Alternative_Routes.mxd
Date Modified: November 21, 2011

Projection: NAD 1983 State Plane, South Dakota South, Feet
Data Sources: ESRI, BTS, US Census, Basin, USGS, SDGIS, USACE

FIGURE 3-1




# BIG BEND TO WITTEN TRANSMISSION PROJECT

**Project Features**
- Project Study Area
- Applicant-Preferred Route

**Jurisdiction**
- DOD - Army Corps of Engineers
- Recreation Areas
- BIA - Indian Reservation
- USFS - National Grassland
- State of South Dakota
- Indian Trust Land

**Transportation**
- Interstate
- U.S. Highway
- State Highway
- Other Road
- Railroad
- Airport

**Boundaries**
- County
- Municipal

**Utility System**
- Existing Substation
- Proposed Substation

## APPLICANT-PREFERRED ROUTE

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

0 3 6
Miles

AECOM
717 17th Street Suite 2600
Denver, CO 80202

File: P:\2011\11180015.01Basin_LB2W\06GIS\6.3Layout\Resource_Maps\111121_Applicant_Preferred_Route.mxd
Date Modified: November 21, 2011

Projection: NAD 1983 State Plane, South Dakota South, Feet
Data Sources: ESRI, BTS, US Census, Basin, USGS, SDGIS, USACE

FIGURE 3-2

### *3.4.3 Comparative Analysis of 17 Routes (Applicant-Preferred Route and 16 Alternative Routes)*

Table 3-1 quantifies the resource data by alternative route and ranks the various routes based on the quantified data. With the exception of Engineering, lower values for each criterion (e.g., route length) result in a better ranking. For Engineering, the higher the quantitative data (e.g., length adjacent to linear features), the better the ranking since it is optimal to follow existing linear features when routing a transmission line.

As expected, many routes resulted in duplicate ranks for individual categories, as well as total scores and the spread between the various alternatives in the "Overall Total Score" row is considered minimal (totals ranging from 27 to 34), which emphasizes the fact that the Applicant-Preferred Route and the 16 alternative routes would result in similar impacts on the resources present within the corridor.

The following text provides a summary description of the results in Table 3-1. The values for each of these criteria allow the alternatives to be compared against each other and to see the relative differences among the alternatives.

#### 3.4.3.1 Route Length

The 16 routes that were evaluated in the GIS model ranged in length from approximately 72 to 77 miles. Routes 7, 8, 11, 12 and 15 were all the shortest at approximately 72 miles. Routes 1 and 2 ranked 5th and were the longest at 77 miles. The Applicant-Preferred Route ranked 4th at 76 miles.

#### 3.4.3.2 Percent of Route Adjacent to Existing Linear Features

The length of an alternative route within 200 feet of each category (transmission and distribution lines, U.S. and State Highways, county roads, and section lines) was added together and divided by the total length of the route to create a percentage adjacent to linear features. For the routes that were evaluated, the percent adjacent to existing linear features ranged from approximately 22 percent (Route 12) to 56 percent (Applicant-Preferred Route, 17). Due to the substantive difference between the routes, the percent adjacent to linear features were assigned ranks based on the range of percentages listed below:

| Adjacent to Existing Linear Features (Percent Ranges) | Assigned Rank |
|---|---|
| 55% to 59% | 1 |
| 50% to 54% | 2 |
| 45% to 49% | 3 |
| 40% to 44% | 4 |
| 35% to 39% | 5 |
| 30% to 34% | 6 |
| 25% to 29% | 7 |
| 20% to 24% | 8 |
| 19% or less | 9 |

#### 3.4.3.3 Length of Route Crossing Indian Trust Land

Routes 5, 6, 7 and 8 cross approximately 7,235 feet of Indian Trust land. In addition, the Applicant-Preferred Route crosses approximately 2,614 feet of Indian Trust land. The current alignment of the Applicant-Preferred Route barely encroaches onto a parcel of Indian Trust land (the reference line is located approximately 1 foot inside the parcel); however, Basin Electric intends to avoid this parcel of land completely during the ROW acquisition process.

#### 3.4.3.4 Length Crossing Reservoirs and Strip Mines

Based on the GIS data from the U.S. Census Bureau, eight of the 16 alternative routes would cross a feature identified in the Census dataset as a reservoir. The Applicant-Preferred Route does not cross any reservoirs. Based on the size of and the length across the reservoir (379 feet), this feature could be easily spanned or avoided entirely through minor route adjustments.

#### 3.4.3.5 Communication Facilities within 150 Feet

All 16 alternative routes are located within 150 feet of an existing telecommunications facility. The Applicant-Preferred Route does not have any telecommunications facilities within 150 feet of the current alignment.

#### 3.4.3.6 Residences within 500 Feet

As described in the AE/MCS, there are numerous residences scattered throughout the Project corridor. Of the 16 routes that were evaluated, all of the routes have at least one and a maximum of two homes within 500 feet of the transmission line, and 12 of the alternative routes have one residence within 250 feet of centerline. Based on the centerline used in this analysis, the Applicant-Preferred Route had 2 residences within 500 feet and no residences within 250 feet.

#### 3.4.3.7 Number of Perennial Stream Crossings

All 17 routes cross three or more perennial streams. The Applicant-Preferred Route and Alternative Routes 5, 6, 7, and 8 cross a total of 3 streams, Alternative Routes 1, 2, 3, and 4 cross 6 streams each, and Alternative Routes 9 through 16 cross 7 streams each. Stream crossings within the study area are relatively narrow and can be easily spanned by the proposed transmission line, which has a span length between 650 and 950 feet. Construction and long-term operational measures would need to be implemented to minimize impacts to water quality and stream habitat. The Applicant-Preferred Route and Alternative Routes 5, 6, 7, and 8 would have the least potential impact on water resources and therefore, ranked best for this category.

#### 3.4.3.8 Length within 100 feet of Perennial or Intermittent Streams

All 17 routes are located within 100 feet of perennial and intermittent streams, with cumulative paralleling distances ranging between 25,000 and 32,000 feet. Alternative Routes 3, 4, 7, and 8 had the shortest distance of transmission line within 100 feet of a perennial or intermittent stream and therefore ranked the

best. The Applicant-Preferred Route, along with Alternative Routes 1, 2, 5, and 6 were ranked in second place with cumulative distances of 28,000 feet.

#### 3.4.3.9 Length Crossing Waterbodies

All of the alternative routes, as well as the Applicant-Preferred Route, cross areas defined as waterbodies or open water. The cumulative total length of crossings over waterbodies ranged from 1,200 to 1,600 feet. The Applicant-Preferred Route crosses approximately 1,600 feet in total. However, it should be noted the waterbodies crossed by any of the alternative routes can be easily spanned by the transmission line since the maximum water body width (White River crossing) is 570 feet and the typical span distance of the transmission line is 650 to 950 feet.

#### 3.4.3.10 Length Crossing National Wetlands Inventory (NWI) Wetlands

There are numerous wetlands located within the Project study area and the total length of wetland crossings for the routes ranged from approximately 3,000 to 6,000 feet. Most of these wetland areas crossed by routes are small and can be easily spanned. One of the larger wetland areas (approximately 1,100 feet at its widest point) is crossed by the Applicant-Preferred Route, but the centerline is near the southern edge of the wetland and the ROW is expected to be shifted south to avoid or span the wetland area. All wetlands within the transmission line ROW would need to be delineated to avoid impacts during construction and maintenance activities.

#### 3.4.3.11 Class I Cultural Resources Sites within 500 Feet

Each of the alternative routes, including the Applicant-Preferred Route, are within 500 feet of 5 to 7 previously identified cultural resources sites. The specific nature of these sites, the potential impacts of the Project, and potential avoidance/mitigation measures for these cultural resources sites will be addressed in the EA. In addition, all of the alternative routes (excluding the Applicant-Preferred Route) cross one recorded site, which has been determined to be potentially eligible for listing in the National Register of Historic Places (NHRP). Alternative Routes 1, 2, 3, and 4 and the Applicant-Preferred Route cross a second site that is listed as NRHP-eligible. Further analysis of all sites within 500 feet of the Project centerline will be required during the EA process and consultation with the South Dakota SHPO will determine potential effects and mitigation requirements. In most cases, cultural resources can be avoided by spanning the site or through protective measures implemented during construction. In some cases, the transmission line may need to be relocated or the artifacts could be recovered and preserved.

#### 3.4.3.12 Length within Known Prairie Dog Colonies

All of the alternative routes traverse portions of previously documented prairie dog colonies, which may or may not currently be active. Prairie dog colonies are a potential concern since these colonies can provide nesting habitat for the burrowing owl, which is protected under the Migratory Bird Treaty Act. The length of the routes through prairie dog colonies ranged from 260 to 1,628 feet. The Applicant-Preferred Route would cross 1,097 feet of prairie dog colonies.

#### 3.4.3.13 Raptor Nests within 0.25 mile of Centerline

While detailed nest surveys have not yet been completed, existing resource data compiled for this study indicate recorded raptor nests within 0.25 mile from some of the alternative routes. Alternative Routes 1, 2, 5, 6, 9, 10, 13, and 14 are all within 0.25 mile of one recorded raptor nest. All remaining routes, including the Applicant-Preferred Route, were not located in proximity to a recorded nest site and therefore, received a better ranking for this criterion.

#### 3.4.3.14 Length within Sharp-Tailed Grouse Leks

There is one historic sharp-tailed grouse lek that has been identified within the Project study area. This historic grouse lek, which is located northwest of Reliance, would be crossed by alternative routes 1, 2, 3 and 4 and the Applicant-Preferred Route; however, the current status of this grouse lek is unknown. If this sharp-tailed grouse lek is determined to be active, construction of the transmission line may need to occur outside of the breeding season or the transmission line may need to be re-routed to avoid impacts to this sensitive species habitat.

### *3.4.4 Alternative Routes Removed From Further Consideration*

As a result of the comparative analysis described in Section 3.3, including the quantitative data in Table 3-1, and consideration of the qualitative metrics described in Section 3.1, a number of the potential alternative routes were eliminated from further consideration. As listed in Table 3-1, the Applicant-Preferred Route ranked number 1 in comparison to all the other alternatives with a total score of 27. Several alternatives ranked in second and third place (Alternative Routes 5, 6, 7, 8, 15 and 16), with total scores of 28 and 29. The minimal spread in scores between the alternative routes is due to the fact that the difference between these routes is fairly minimal. As discussed previously, both quantitative and qualitative metrics were used to determine which routes should be eliminated. A summary of the rationale used to eliminate 14 of the alternative routes from further analysis is provided below:

- Routes 1 and 2 were eliminated since they had the greatest length of any alternative and both of these alternative routes scored poorly in the matrix.
- Routes 3 and 4 were very similar to each other. These alternative routes were eliminated based on length within known prairie dog towns and length crossing NWI wetlands.
- Routes 5, 6, 7 and 8 were eliminated since they used segments that crossed Indian Trust land.
- Route 9 was eliminated due to length within known prairie dog towns and because it had the highest length within 100 feet of perennial streams. This alternative route had the worst overall score in the matrix.
- Routes 11 and 12 were very similar to each other. Those alternatives were eliminated based on length within known prairie dog towns and length crossing NWI wetlands.
- Routes 13 and 14 were also similar to each other. These routes were the second longest routes at 76 miles each and had the greatest length within 100 feet of perennial streams.

- Route 15 is similar to Route 16, but Route 15 had a longer length within 100 feet of perennial streams.

Alternative Route 16 had minimal constraints, scored well in the matrix (total rank of 3), and shared few segments with the Applicant-Preferred Route. Therefore, Alternative Route 16 was determined to provide a reasonable alternative to the Applicant-Preferred Route. Other routes that ranked in second or third place were nearly identical to the Applicant-Preferred Route or to Alternative Route 16 and therefore, did not represent reasonable additional alternatives. Although Alternative Route 10 does not perform well in the matrix when compared with the other alternative routes (Route 10 received a total score of 34 with a rank of 7 in Table 3-1), this route was retained for evaluation in the EA since the route provides a distinctly different alternative route than either the Applicant-Preferred Route or Alternative Route 16. Additional features of the Alternative Routes and the Applicant-Preferred Route are described in Section 4.0 below.

# 4.0 IDENTIFICATION OF ROUTES FOR ANALYSIS IN THE EA

As described in Section 3.1, both quantitative and qualitative criteria were used to evaluate the 16 alternative routes and the Applicant-Preferred Route and to identify two alternative routes for analysis in the EA. Basin Electric and Western worked closely with RUS, Native American tribal representatives, the U.S. Army Corps of Engineers, and local landowners to identify potential routes that would best meet the Project objectives and purpose and need, while minimizing adverse environmental effects and conflicts with existing land uses. This process resulted in the identification of the Applicant-Preferred Route, which will be evaluated in detail in the EA. Basin Electric will continue to refine this route such that some potential impacts can be minimized or avoided long before construction occurs. In comparison, no comparable route refinement process has been conducted for the alternative routes.

In addition to the Applicant-Preferred Route, two alternative routes were identified based on the route screening analysis described in Section 3. This quantitative and qualitative process resulted in the identification of Alternative Routes 10 and 16. The selected routes represent a reasonable range of alternative routes within the Project study area and these routes will be evaluated in the EA. Figure 4-1 illustrates the three selected alternative routes.

## 4.1 Alternative Route 10

As illustrated in Table 3-1, the following features of Alternative Route 10 are favorable:

- Route 10 is slightly shorter than the Applicant-Preferred Route.
- Route 10 has a shorter length across waterbodies when compared with Applicant-Preferred Route.

Potentially unfavorable aspects of Alternative Route 10 include:

- Only 35 percent of the total length of Route 10 is adjacent to existing linear features.
- Route 10 crosses an existing reservoir.
- Route 10 crosses 7 perennial streams and has the longest length within 100 feet of perennial and intermittent streams.
- Route 10 has the second longest length within known prairie dog towns.

## 4.2 Alternative Route 16

As illustrated in Table 3-1, the following features of Alternative Route 16 are favorable:

- Route 16 is approximately 2 miles shorter than Route 10 and approximately 3 miles shorter than the Applicant-Preferred Route.
- Route 16 has the shortest length crossing waterbodies and NWI wetlands.

- Route 16 has the shortest length within previously documented prairie dog colonies.

Potentially unfavorable aspects of Alternative Route 16 include:

- Only 37 percent of the total length of Route 16 is adjacent to existing linear features.
- Route 16 crosses 7 perennial streams.
- Route 16 has a longer length within 100 feet of perennial and intermittent streams when compared with the Applicant-Preferred Route.

## 4.3 Applicant-Preferred Route

Favorable aspects of the Applicant-Preferred Route compared with the two alternative routes include:

- The route has the greatest percentage of alignment paralleling linear features.
- The route is not within 150 feet of any known communications facilities.
- The route has the fewest crossings of perennial streams and the shortest length within 100 feet of perennial and intermittent streams.

Potentially unfavorable aspects of the Applicant-Preferred Route compared with the two alternative routes include:

- The Applicant-Preferred Route is longer than Routes 10 and 16.
- The centerline of the Applicant-Preferred Route encroaches on and crosses Indian Trust land for approximately 2,614 feet; although as previously described, Basin Electric will completely avoid this parcel during the easement acquisition process.
- Based on the centerline used in this analysis, the Applicant-Preferred Route had two residences within 500 feet of centerline compared to one residence along Routes 10 and 16. However, as a result of recent adjustments to the Applicant-Preferred Route, Basin Electric has confirmed there are presently no occupied residences within 500 feet of the centerline.
- The Applicant-Preferred Route has the greatest length crossing waterbodies and NWI wetlands.
- The Applicant-Preferred Route is the only one of the three retained routes that traverses a historic sharp-tailed grouse lek.

All of these resource issues will be thoroughly evaluated in the EA, and none of the issues identified in this preliminary screening of the alternatives appear to be insurmountable from a routing and permitting perspective. It is likely that all of the potential impacts associated with the Applicant-Preferred Route (or either of the alternative routes) can be minimized or avoided through minor adjustments as needed and through standard construction mitigation practices.

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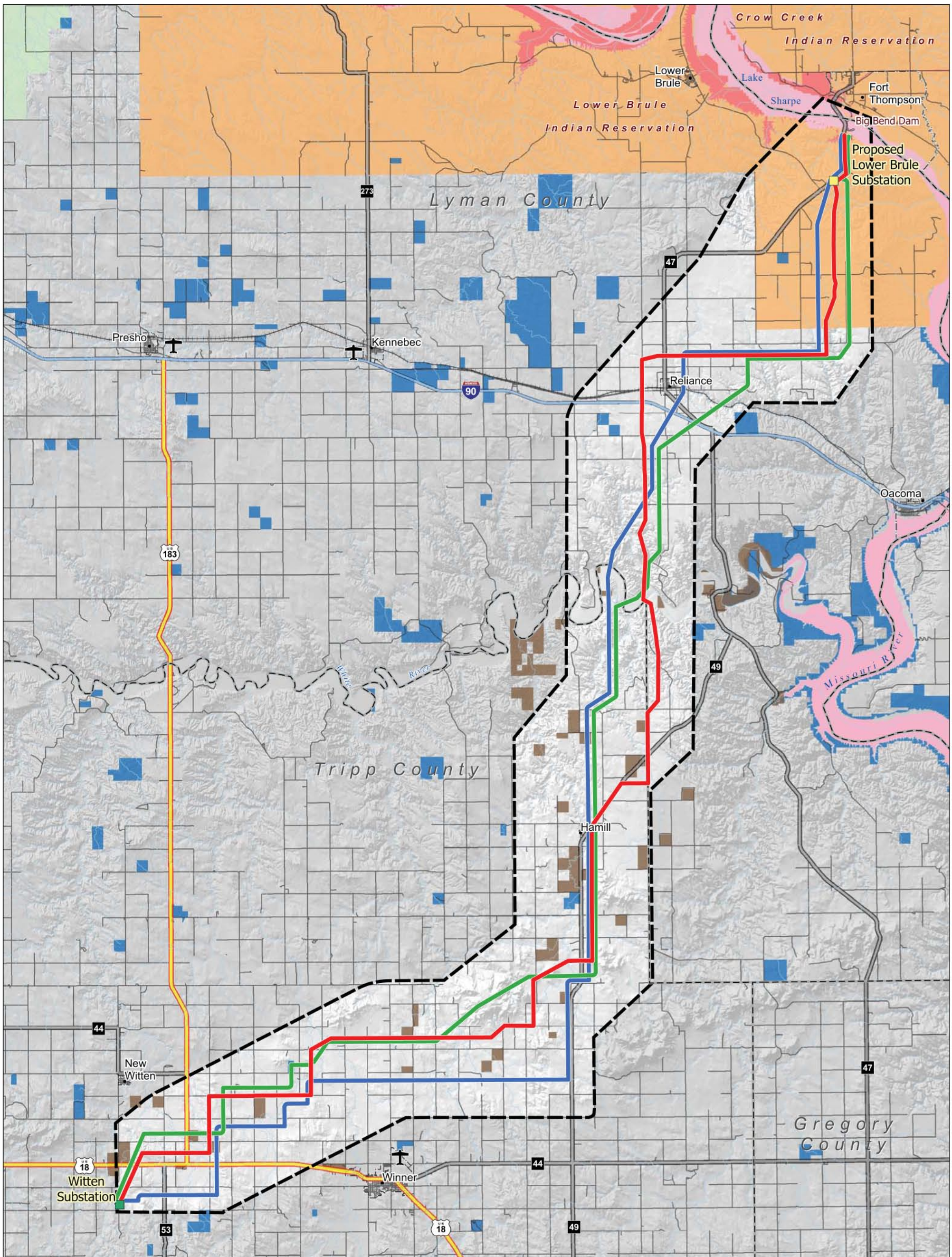


# BIG BEND TO WITTEN TRANSMISSION PROJECT

**Project Features**

- Project Study Area
- Applicant-Preferred Route
- Route 10
- Route 16

*Note:Routes 10 and 16 offset for display purposes.*

**Jurisdiction**

- DOD - Army Corps of Engineers
- Recreation Areas
- BIA - Indian Reservation
- USFS - National Grassland
- State of South Dakota
- Indian Trust Land

**Transportation**

- Interstate
- U.S. Highway
- State Highway
- Other Road
- Railroad
- Airport

**Boundaries**

- County
- Municipal

**Utility System**

- Existing Substation
- Proposed Substation

## APPLICANT-PREFERRED ROUTE AND SELECTED ALTERNATIVES

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

AECOM
717 17th Street Suite 2600
Denver, CO 80202

0 2.5 5
Miles

File: P:\2011\11180015.01Basin_LB2W\06GIS\6.3Layout\Resource_Maps\111121_Selected_Routes_Jurisdiction.mxd
Date Modified: November 21, 2011
Projection: NAD 1983 State Plane, South Dakota South, Feet
Data Sources: ESRI, BTS, US Census, Basin, USGS, SDGIS, USACE

FIGURE 4-1

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