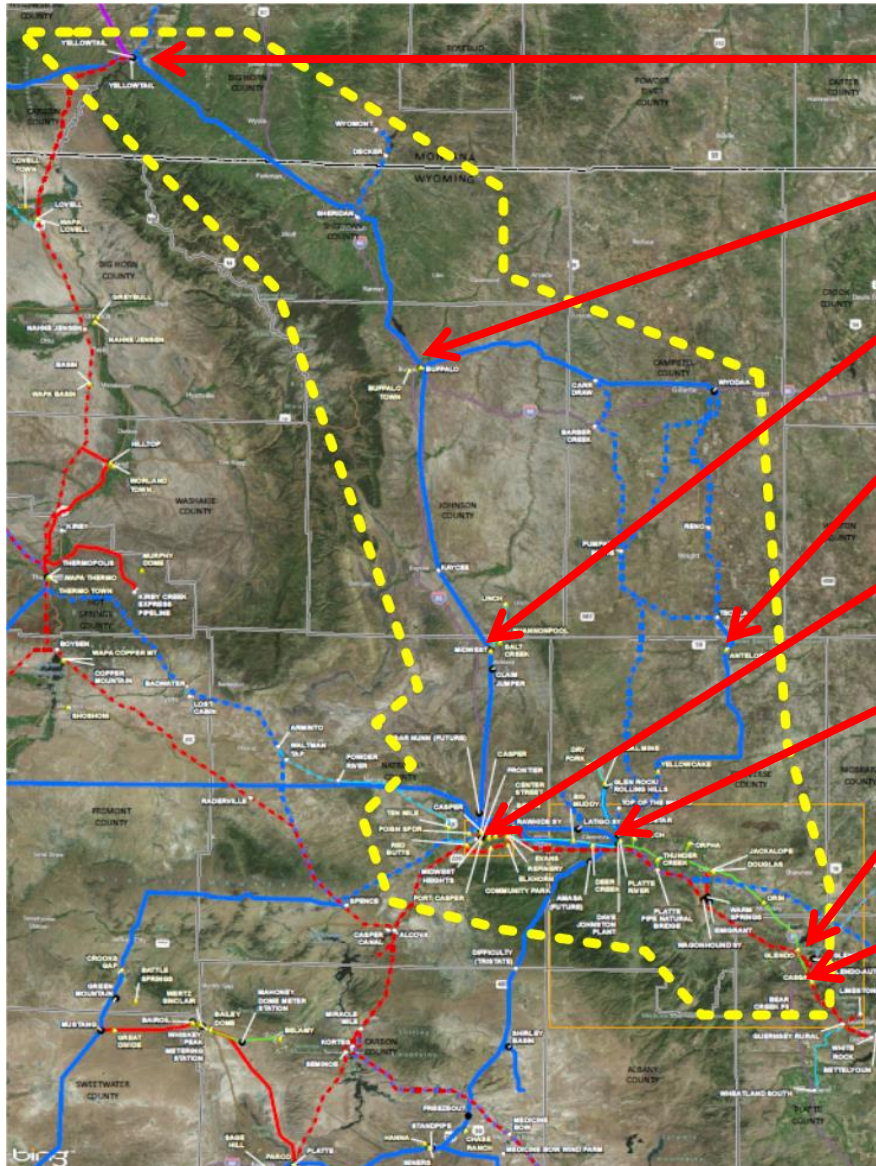


Seongtae Kim

POWDER RIVER AREA STUDY

Geographical Location – Powder River



Yellowtail

Buffalo

Midwest

Antelope Mine

City of Casper

Dave Johnston Plant

Glendo

Cassa

General Information – Powder River

- **Area:** Approximately 20,000 square miles (Campbell, Converse, Johnson, Natrona, Platte, Sheridan Counties in Wyoming & Big Horn County in Montana)
- **Substation**
 - 46 PacifiCorp-owned
 - 10 third party-owned
- **Transmission Voltage**
 - 230 kV
 - 115 kV
 - 69 kV
 - 57 kV

Generation – Powder River

- **Generator (PacifiCorp: 1298 MW & Third Parties: 385.7 MW)**
 - Dave Johnston generators – PacifiCorp (774 MW)
 - Unit #1: 104 MW
 - Unit #2: 104 MW
 - Unit #3: 228 MW
 - Unit #4: 338 MW
 - Wyodak generators (335 MW)
 - 80% owned by PacifiCorp (268 MW)
 - 20% owned by third party (67 MW)
 - Glen Rock wind generators – PacifiCorp (138 MW)
 - Rolling Hills wind generators – PacifiCorp (118 MW)
 - Top of World wind generators – third party (200.2 MW)
 - Three Buttes wind generators – third party (99 MW)
 - Casper (Rawhide) wind generators – third party (19.5 MW)

Load Distribution – Powder River

➤ Load Profile

❖ City of Casper

- 80 % of residential & commercial
- 20 % of industrial
- Double peaks (summer & winter)

❖ Rest of the study area (except the City of Casper)

- 10% of residential & commercial
- 90% of industrial
- Steady load

Load – Powder River

➤ **Base System Load**

- Summer 2015: 653 MW (201 MW for the City of Casper)
- Winter 2015-26: 688 MW (191 MW for the City of Casper)

➤ **Growth**

- Summer: 1.1%
- Winter: 1.0%

➤ **Projected System Load**

- Summer 2019: 699 MW (213 MW for the City of Casper)
- Winter 2019-20: 727 MW (206 MW for the City of Casper)

Contingency Analysis – Powder River

➤ **N-0 Analysis**

No issues identified

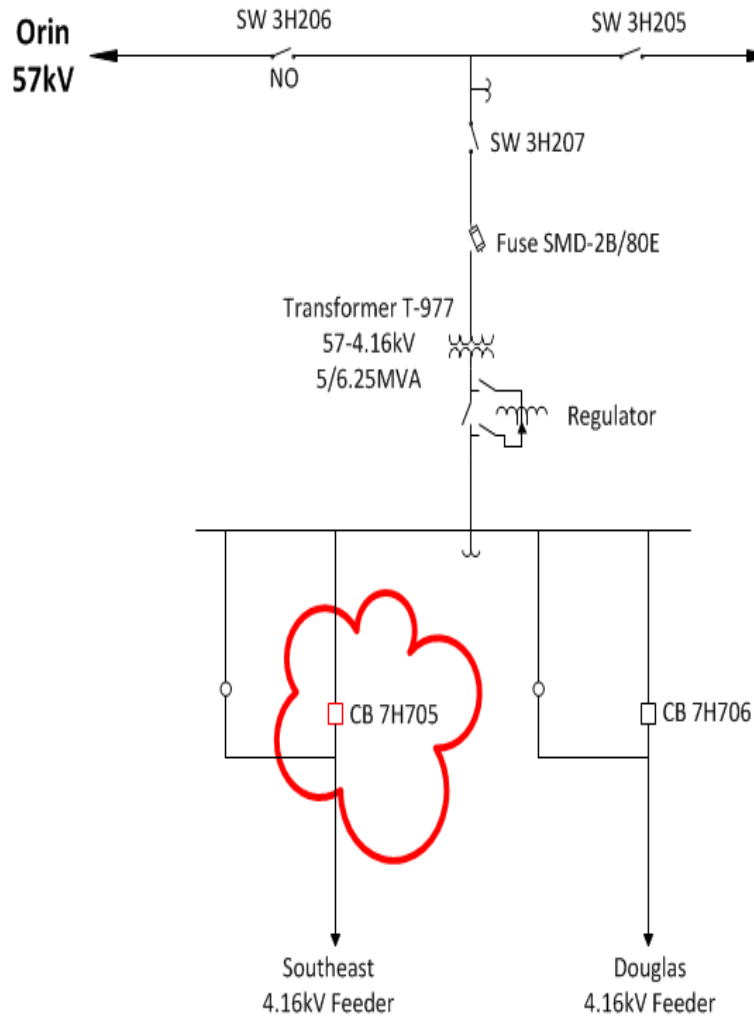
➤ **N-1 Analysis**

No issues identified

➤ **N-2 Analysis (BES only)**

No issues identified

Short Circuit Analysis – Powder River



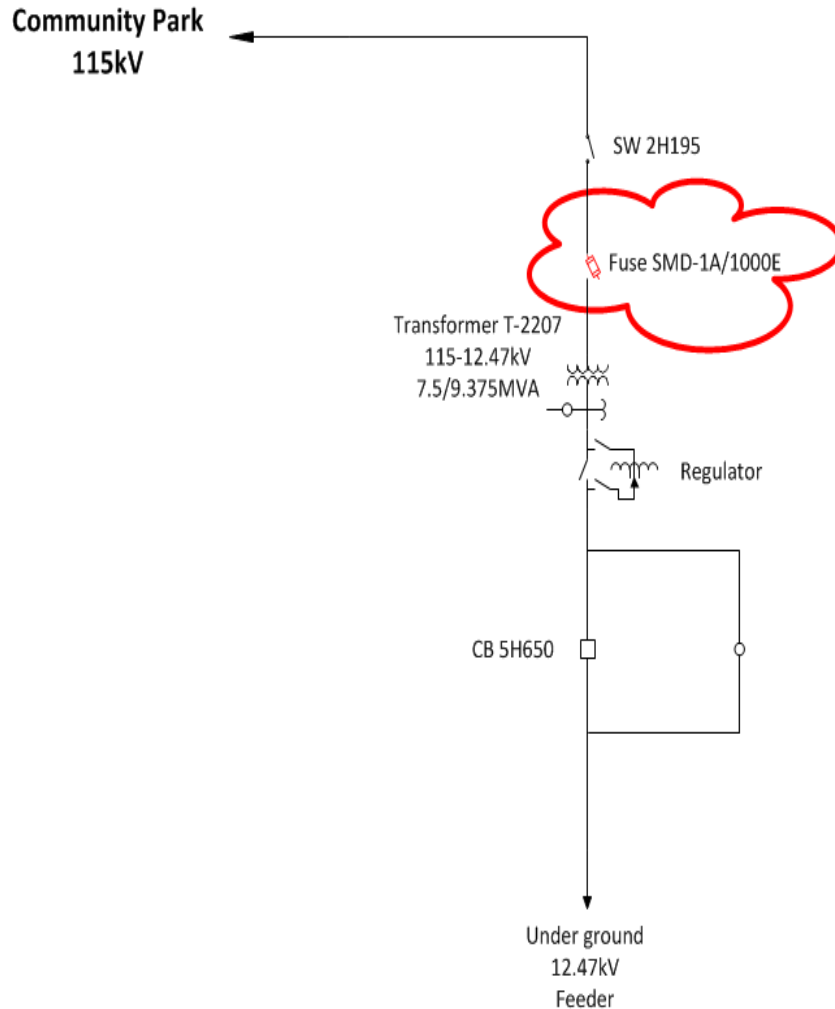
➤ **Issues:** Circuit breaker CB 7H705 is overdutied at Douglas 4.16 kV switch yard during 3-phase & 1-phase faults.

- CB 7H705 rating: 4 kA
- 3-phase fault: 5.78 kA
- 1-phase fault: 6.63 kA

➤ **Recommended solution:** Replace the circuit breaker with a higher rating

➤ **Estimated cost:** \$100,000

Short Circuit Analysis – Powder River



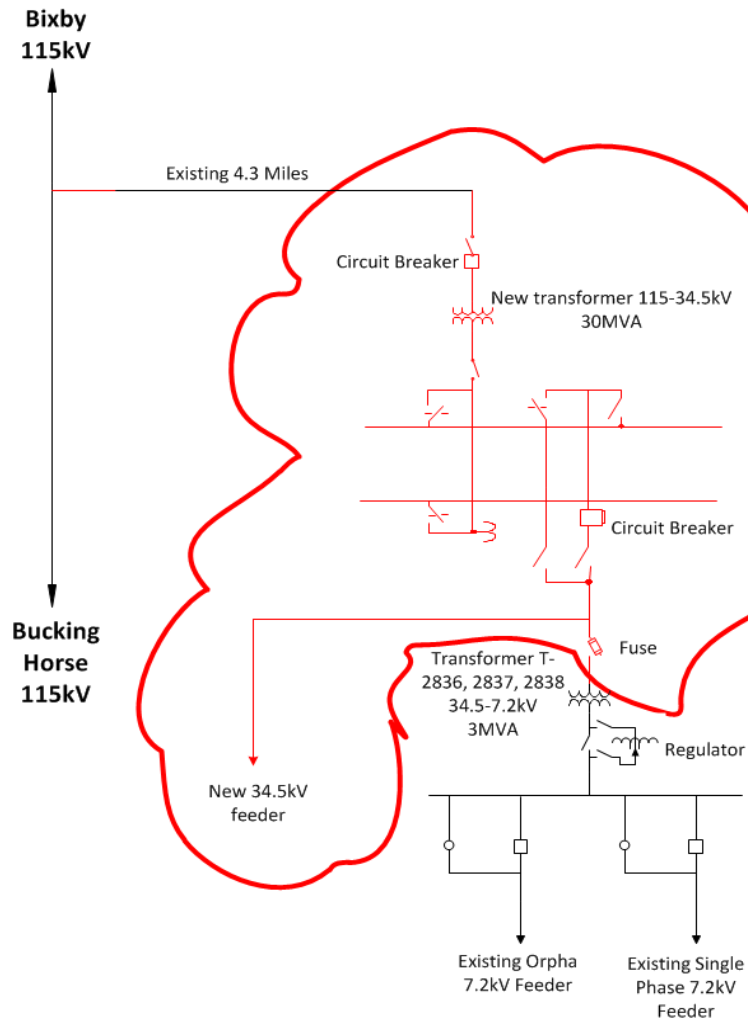
➤ **Issues:** Fuse SMD-1A/1000E is overdutied at Evans 115 kV switch yard during 3-phase & 1-phase faults.

- fuse rating: 5 kA
- 3-phase fault: 8.63 kA
- 1-phase fault: 6.58 kA

➤ **Recommended solution:**
Replace the fuse with a higher rating

➤ **Estimated cost:** \$10,000

Equipment Rating Analysis – Powder River



➤ **Issues:** 57/7.2 kV 3MVA transformers (1MVA/each) is overloaded at Orpha substation during 2019 summer peak.

- Transformer rating: 3 MVA
- 2019 summer peak: 3.18 MVA

➤ **Recommended solution:** Tap the existing Orpha Tap – Orpha 57 kV line at the Bixby – Bucking Horse 115 kV line and operate at 115 kV with a 115/34 kV transformer. Reconfiguration of Orpha substation is required. (Replacing with a higher rated transformer is not feasible because the 57 kV system has no excess capacity due to voltage limitation) – proposed 10-year capital budget

➤ **Estimated cost:** \$7,664,000

Construction Schedule & Cost – Powder River

POWDER RIVER AREA
TRANSMISSION SYSTEM STUDY
2015-2019

Reliability Conditions

The following is a list of proposal sloutions for reliability issues in the study area with their approximate block estimate cost.

<u>Douglas Substation</u>	
Replace the circuit breaker 7H705 with new higher rating circuit breaker	\$ 100,000
<u>Evans Substation</u>	
Replace the fuse SMD-1A/100E with new higher rating fuse	\$ 10,000
Total	\$ 110,000

POWDER RIVER AREA
TRANSMISSION SYSTEM STUDY
2015-2019

Recommended Construction Schedule

2015 Construction

Construct Casper - Red Butte 115 kV line with 1272 ACSR conductor - budgeted	\$ 3,995,572
Construct Pathfinder Tap - Casper (WAPA) 69 kV line with 1272 ACSR conductor - budgeted	\$ 800,000
Install new 230/115 kV 250 MVA transformer #2 at Casper substation - budgeted	\$ 10,445,000

2015 Total \$ -

2016 Construction

Install new 230/34.5 kV 75 MVA transformer #2 at Yellowcake substation - budgeted	\$ 3,387,000
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2016 Total \$ -

2017 Construction

No construction proposed for this year	\$ -
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2017 Total \$ -

2018 Construction

No construction proposed for this year	\$ -
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2018 Total \$ -

2019 Construction

Operate Orpha Tap - Orpha 57 kV line at 115 kV and reconfigure Orpha substation - proposed	\$ 7,664,000
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2019 Total \$ 7,664,000

Grand Total \$ 7,664,000

➤ Total Estimated Cost: \$7,774,000 (excluding budgeted projects)

Powder River Area Study

Any Questions or Comments?