2011 LOCAL TRANSMISSION PLAN:

TRANSMISSION COORDINATION AND PLANNING COMMITTEE ANNUAL TRANSMISSION ASSESSMENT

FOR

BLACK HILLS/COLORADO ELECTRIC UTILITY COMPANY, L.P., D/B/A BLACK HILLS ENERGY

PREPARED
BY
BLACK HILLS CORPORATION
TRANSMISSION PLANNING

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1. Introduction

In June of 2009, the Black Hills/Colorado Electric (BHCE) filed with FERC Attachment K to the Open Access Transmission Tariff (OATT) to meet the requirements outlined in FERC Order 890. Through their Attachment K filing, BHCE created the Transmission Coordination and Planning Committee (TCPC) as the forum to conduct long-range planning studies while promoting stakeholder input and involvement. This report, intended to serve as the 2011 Local Transmission Plan (LTP), will outline the 2011 study cycle and present the findings of the planning study.

1.1. Black Hills Colorado Electric Transmission System Background

Black Hills Colorado Electric (referred to hereinafter as the Transmission Provider) owns certain transmission facilities with transmission service pursuant to a FERC-approved Open Access Transmission Tariff ("OATT"). A diagram of the expected 2015 BHCE transmission system is shown in Figure 1. This diagram includes the current transmission system as well as planned system upgrades through calendar year 2014 as modeled in the baseline 2015 scenarios.

1.2. Stakeholder Participation

All interested parties were encouraged to participate in the 2011 TCPC study process. An open stakeholder kick-off meeting was held via webinar on December 13, 2010 to inform stakeholders of the proposed study plan and to provide an opportunity for suggestions and feedback on the study process. Requests for data pertaining to the modeling and evaluation of the transmission system were made by the Transmission Provider. Additional stakeholder meetings were held on March 16, October 4, and December 21. All meeting notices were distributed via email and posted along with presentation materials on the Black Hills Colorado Electric OASIS page at http://www.oatioasis.com/bhct/index.html.

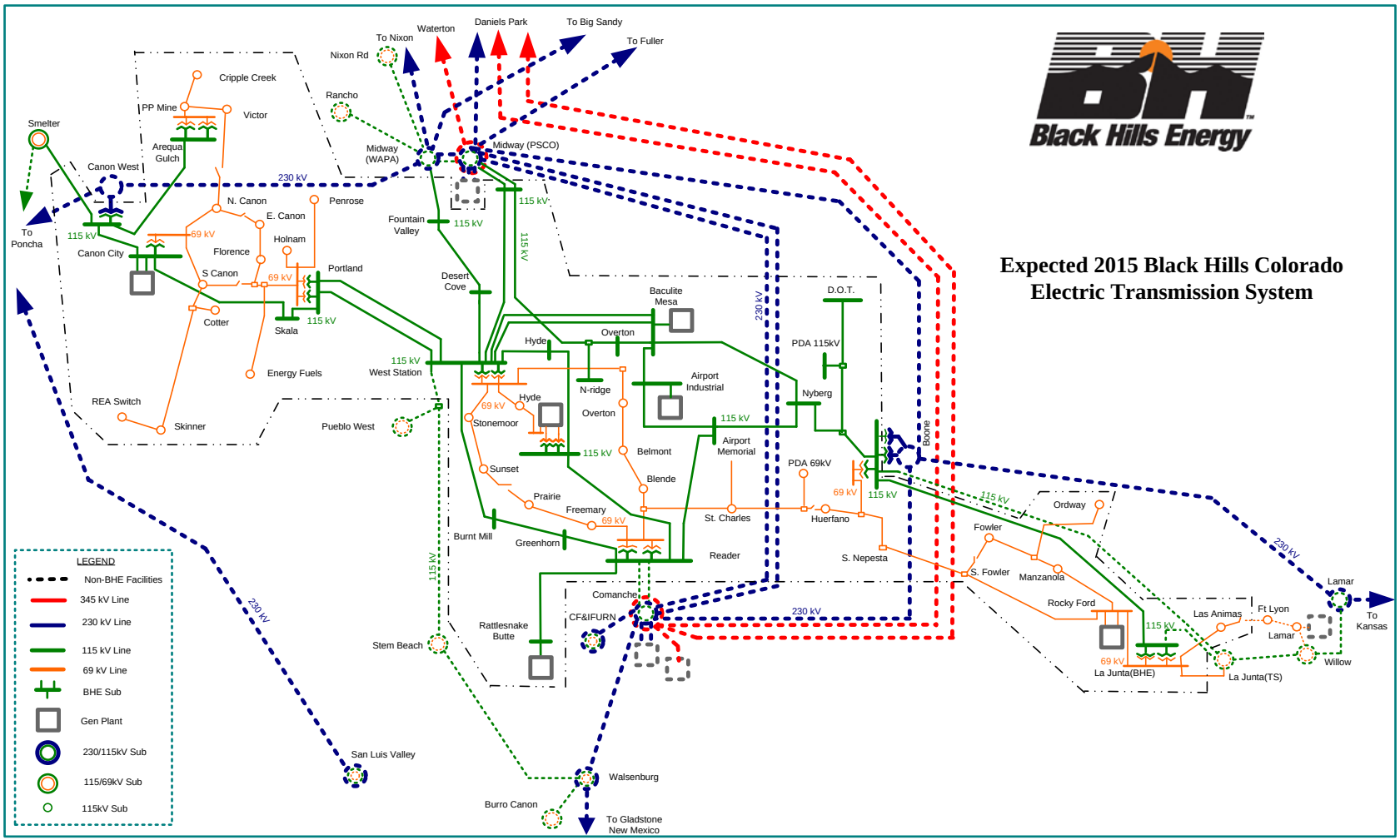

Figure 1: Expected 2015 Black Hills Colorado Electric Transmission System

2. Study Methodology

The BHCE transmission system was evaluated with planned system additions for 2015 under both peak summer and off-peak autumn load levels to identify any deficiencies in system performance. Steady state voltage and thermal analyses, as well as transient stability analysis was performed. Additional upgrades were identified and modeled as necessary to mitigate any reliability criteria violations. The analysis was repeated for the 2021 peak summer load scenario to validate the upgrades identified in the near-term study as well as assess the long-term integrity of the transmission system. A list of prior and forced outages used in the 2011 LTP study process was included in Appendix A.

2.1. Study Criteria

The criteria used in this analysis is consistent with the NERC TPL Reliability Standards, WECC TPL – (001 thru 004) – WECC – 1 – CR ─ System Performance Criteria and Colorado Coordinated Planning Group's Voltage Coordination Guide. Pre-existing voltage and thermal loading violations outside the localized study area were ignored during the evaluation. Worst-case Category D outages were evaluated for risk and consequence.

2.1.1. Steady State Voltage Criteria

Under system intact conditions, steady state bus voltages must remain between 0.95 and 1.05 per unit. Following a Category B or C contingency, bus voltages must remain between 0.90 and 1.10 per unit.

2.1.2. Steady State Thermal Criteria

All line and transformer loading must be less than 100% of their established continuous rating for system normal conditions (NERC/WECC Category A). All line and transformer loadings must be less than 100% of their established continuous or emergency rating under outage conditions (NERC/WECC Category B and C). BHCE utilizes an allowable overload on transformers of up to 125% of the continuous thermal rating for emergency situations.

2.1.3. Transient Voltage and Frequency Criteria

NERC Standards require that the system remain stable and within applicable thermal ratings and voltage limits for Category A, B, and C disturbances. The *WECC Disturbance – Performance Table of Allowable Effects on Other Systems* states the following requirements:

- **Category B:** Any transient voltage dip must not exceed 25% at load buses or 30% at non-load buses. The dip also must not exceed 20% for more than 20 cycles at load buses. Frequency must not drop below 59.6 Hz for 6 or more cycles at a load bus.
- **Category C:** Any transient voltage dip must not exceed 30% at load buses or 30% at non-load buses. The dip also must not exceed 20% for more than 40 cycles at load buses. Frequency must not drop below 59.0 Hz for 6 or more cycles at a load bus.

2.1.4. Voltage Stability

The established WECC voltage stability criteria for acceptable real power (MW) margins are as follows: 5% for Category A and B outages, 2.5% for Category C, and 0% for Category D outages.

2.1.5. Cascading

NERC Standards require that the system remain stable and no Cascading occurs for Category A, B, and C disturbances. Cascading is defined in the NERC Glossary as "The uncontrolled successive loss of system elements triggered by an incident at any location. Cascading…… cannot be restrained from sequentially spreading beyond an area predetermined by studies." A potential triggering event for Cascading will be investigated upon one of the following results:

a) A generator pulls out of synchronism in transient stability simulations. Loss of synchronism occurs when a rotor angle swing is greater than 180 degrees. Rotor angle swings greater than 180 degrees may also be the result of a generator becoming disconnected from the BES; or
b) A transmission element experiences thermal overload and the minimum transmission relay loadability threshold is exceeded. Thermal overloads of greater than 150% will be further investigated to determine the risk of Cascading by manually removing those facilities in sequence until the outage is contained or Cascading is confirmed.
c) Negative margin occurs in voltage stability simulations.

2.2. Study Area

The 2011 LTP study area will include all BHCE transmission equipment as well as neighboring transmission system elements roughly bound by Poncha to the west, Walsenburg to the south, Lamar to the east, and Midway to the north. Points of interconnection between BHCE and neighboring utilities are shown in Table 1.

Table 1: BHCE Transmission System Interconnection Points

Interconnection Name	Interconnecting Utility[1]
Midway (PSCo)	PSCo
Midway (WAPA)	WAPA, CSU, TSG&T
Boone	PSCo, TSG&T
Reader	PSCo
Cañon West	WAPA, PSCo
West Station	TSG&T

2.3. Study Case Development

The baseline cases for the 2011 LTP Study were chosen based upon availability of updated regional study cases, planned transmission system and resource upgrades, and previously completed planning studies. A complete list of individual case changes for each scenario is available upon request.

[1] CSU means Colorado Springs Utilities; WAPA means Western Area Power Administration and TSG&T means Tri-State Generation and Transmission Association, Inc.

2.3.1. 2015 Heavy Summer and Light Autumn Study Cases

The 2015 heavy summer time frame was chosen for the near-term analysis for several reasons. The summer demand levels have historically been the most critical of the seasonal load patterns in the study area. Additionally, Tri-State Generation & Transmission, Inc. ("Tri-State" or "TSG&T") had recently compiled a 2015 heavy summer case as part of their Generator Interconnection Procedures. The case originated as a WECC-approved base case. The TSG&T case was used as the starting point for the 2015HS analysis. Updates to the case loads, resources, and topography were solicited from neighboring systems and applied to the model by TSG&T. Black Hills' loads were served by planned or existing Black Hills' generation.

Significant changes to the existing 2011 Black Hills transmission system to create the 2015 model included all projects listed the most recent Colorado Rule 3206 filing, as well as the addition of a third LMS-100 generator at Baculite Mesa to offset planned generation retirements under Colorado HB 10-1365 (the "Clean Air - Clean Jobs Act"). (See Decision No. C10-1330 in Docket No. 10M-254E) Terminal equipment that was identified as the limiting element on several transmission lines was also assumed to be replaced in all study scenarios. These equipment replacements include:

- West Station-Stonemoor Hills 69kV line at 123% of 48 MVA rating in 2015HS, assumed replacement of CTs in all scenarios to increase rating to conductor limit
- Boone-Boone Tap 69kV line at 125% of 24 MVA rating in 2015HS, assumed replacement of CTs in all scenarios to increase rating to conductor limit
- Boone-La Junta (BH) 115 CTs assumed replaced as part of the Tri-State Interconnect project (2014).
- Rocky Ford-S. Fowler Tap 69 CT replacement per BHCE Strategic Plan (2012)
- La Junta (BH)-Rocky Ford 69 kV CT replacement as part of the Tri-State Interconnect project (2014).
- Boone-DOT Tap 115 CT replacement per BHCT-G6 SIS (2012).
- Baculite Mesa-Airport Industrial 115 kV CT replacement assumed to increase rating to conductor limit.
- Airport Memorial-Airport Industrial 115 kV CT replacement assumed to increase rating to conductor limit.
- Replacement of conductor and substation equipment at Northridge to increase rating on Baculite Mesa-Northridge to 222 MVA.

TSG&T also compiled a 2015 light autumn load case for their generator interconnection studies. This case contained a similar transmission system topology and reduced area loads. The light autumn case was evaluated as part of this 2011 LTP study.

It should be noted that the San Luis Valley-Calumet-Comanche transmission project and the Lamar Front Range transmission project were not included in the 2015 study cases, but were included in the 2021 case.

2.3.2. 2021 Heavy Summer Study Case

The 2021 case was created by the Colorado Coordinated Planning Group ("CCPG") members for the Douglas, Elbert, El Paso, And Pueblo ("DEEP") sub-committee study. As with the 2015 cases, current load and resource forecasts were modeled, as well as expected system topology for that time frame. As mentioned above, the San Luis Valley-Calumet-Comanche transmission project and the Lamar Front Range transmission project were included in the 2021 case. Also included in the 2021HS baseline case were upgrades identified in the 2015. Several terminal equipment limitations were removed. These changes are mentioned in Section 3.

2.4. Transmission Planning Assumptions

The 2011 LTP study was performed for both the 2015 and 2021 time frames with the following assumptions:

- All existing and planned facilities and the effects of control devices and protection systems were accurately represented in the system model.
- Projected firm transfers were represented per load and resource updates from each stakeholder.
- Existing and planned reactive power resources were modeled to ensure adequate system performance.
- There were no specific planned outages identified for the 2015 and 2021 study periods. A series of prior and forced outages on facilities deemed to be most critical by the transmission planner was simulated to identify potential risks associated with such outages in the study time frame. A list of the evaluated prior and forced outages is included in Appendix A.
- For system intact solutions, transformer taps and switched shunts were allowed to adjust. Following a contingency, adjustment of these devices was disabled unless designed to allow such operation. For all solutions, area interchange control and phase shifter adjustments were disabled, while DC tap adjustment was enabled. A fixed slope decoupled Newton solution method was utilized through the analysis. Dispatch of generation was utilized for certain prior outages as shown in Appendix A.
- System load and generation dispatch assumptions are included in Appendix B.

3. Steady-State Assessment

The BHCE transmission system evaluation was performed for three distinct regions within the BHCE service territory. The Cañon City area is located at the western end of the system, and is served via 230/115 kV transformer at West Cañon, the West Cañon-Smelter 115 kV line, and the Portland-West Station 115 kV lines. The Pueblo area lies in the center of the service territory and consists of the region surrounding the city of Pueblo, extending eastward to Boone. The Rocky Ford area is on the east end of the service territory and extends from Boone to La Junta. Study results for each region are described below.

The thermal overload or low voltage violations listed below were not included in the summary of study results due to irrelevant nature of the violation with respect to the BHCE system.

- Stem Beach-area voltage/overload violations following the loss of the West Station-Stem Beach 115 kV line or Comanche-Walsenburg 230 kV line (all scenarios)
- Lamar area low voltages following the Lamar 230/115 kV transformer outage
- Comanche-Walsenburg 230 kV line overloads following N-1-1 Daniel Park-Comanche 345 kV + Stem Beach-Walsenburg 115 kV line outage
- MidwayBR 230/115 kV transformer overload following the N-1-1 loss of MidwayBR-Nixon and MidwayPS-Fuller 230 kV lines or Desert Cove-West Station 115 kV line and the Nixon 230/115 kV transformer
- Walsenburg 230/115 kV transformer overload following the loss of the parallel 230/115 kV transformer

3.1. Cañon City Area

3.1.1. 2015 Heavy Summer Results

Simulation of the N-1 contingencies revealed a single thermal overload violation. The overload of the #2 Portland 115/69 kV transformer, which experienced loads of 144% of the 25 MVA continuous rating, was the result of the loss of the #1 Portland 115/69 kV transformer. It is recommended that the 25 MVA transformer be replaced with a larger unit to mitigate N-1 overloads.

The Skinner 69 kV bus experienced voltage levels at 0.906 per unit following the loss of the Cañon City-West Cañon 115 kV line. Pre-contingent adjustment of the LTC at Cañon City mitigated the issue, as well as the addition of a 20 MVAR capacitor at the Cañon City 115 kV bus. The capacitor addition is the preferred option and is planned for completion in 2012.

Low voltages exist at Arequa Gulch and the surrounding 69 kV system for a prior outage of the West Cañon-Arequa Gulch 115 kV line. The back-up 69 kV line serving the area cannot maintain voltage for this outage under expected load levels. Voltage support requirements to address this issue are currently under evaluation as part of a load growth analysis for the Arequa Gulch area.

The Portland-West Station #1 115 kV line became loaded to 104% of the 122 MVA conductor thermal limit following the N-1-1 loss of the Cañon City-West Cañon and Portland-West Station #2 115 kV lines. A review of the options to increase this rating will be conducted.

The West Cañon-Cañon City 115 kV line became loaded to 100% of the 120 MVA rating following the N-1-1 loss of both Portland-West Station 115 kV lines. The line rating is based on a CT limitation which, when removed, would increase the rating to 151 MVA.

The loss of both Portland-West Station 115 kV lines also loaded the West Cañon 230/115 transformer to 110% of the 100 MVA continuous rating. This is within the allowable emergency overload of 125%.

The Cañon City 115/69 transformer loading reached 107% of the 56 MVA continuous rating following the loss of both Portland 115/69 kV transformers. This is within the allowable emergency overload of 125%.

Loading on the Portland #1 115/69 kV transformer reached 145% of the 42 MVA continuous rating following the N-1-1 loss of the Cañon City and Portland #2 115/69 kV transformers. This overload exceeds the allowable emergency rating of 125%.

The Cañon City-West Cañon 115 kV prior outage followed by the Portland-Skala 115 kV forced outage dropped approximately 55 MW of load, assuming the 69 kV normal open points in the area remained unchanged. The forced outage of the Skala-Cañon City line produced results similar to those of the Portland-Skala outage, but to a lesser degree. By switching the 69 kV load to be fed from Portland for this prior outage, the Portland-Highland and Highland-Florence 69 kV lines became overloaded to 180% and 113%, respectively. The Portland transformers also overloaded to approximately 150%. Consequential load loss is allowable for this outage, and is an option to consider until a comprehensive long-term solution is developed for the area.

The loss of the West Cañon 230/115 kV transformer plus the loss of a segment of the Portland-Skala-Cañon City 115 kV line resulted in the Poncha-Smelter 115 kV line loading to 200% of the 48 MVA rating. Low system voltages also resulted from this outage. The addition of a 20 MVAR capacitor at Cañon City reduced the overload to 170%. The PSCo-owned line is limited by a line trap which is scheduled for replacement in 2012. This upgrade, along with the Cañon City capacitor addition would mitigate the overload in the study timeframe.

3.1.2. 2015 Light Autumn Results

The results of the 2015 Light Autumn analysis did not identify any criteria violations in addition to those in the Heavy Summer analysis. Due to the reduced load levels, many of the Heavy Summer scenario violations did not occur, and those that did were not as critical.

3.1.3. 2021 Heavy Summer Results

The 2021 Heavy Summer scenario assumed the Portland 25 MVA 115/69 kV transformer was replaced with an 80 MVA unit, similar to the planned replacement transformers at Reader. It was also assumed that terminal equipment limitations on the Cañon City-South Cañon, North Cañon-Victor, and Portland-Highland Tap 69 kV lines were removed, as well as the West Cañon-Cañon City 115 kV line. A 20 MVAR capacitor (2x10) was assumed at Cañon City and Arequa Gulch.

The Portland #1 115/69 kV transformer reached 92% of its 42 MVA continuous thermal rating following the N-1 loss of the Portland #2 transformer. This outage, when combined with the loss of the Cañon City 115/69 transformer, increased the loading to 161%.

The West Cañon 230/115 kV transformer reached 121% of its 100 MVA continuous rating following the loss of both Portland-West Station 115 kV lines. This overload is within the allowable 125% emergency rating.

The Cañon City 115/69 kV transformer loading reached 120% following the N-1-1 loss of both Portland transformers. Loading on the transformer reached 104% following the N-1-1 loss of the Portland-Highland 69 kV line and the Cañon City-West Cañon 115 kV line.

The Portland-West Station #1 115 kV line loaded to 111% of the 122 MVA rating following the N-1-1 loss of the Cañon City-West Cañon and Portland-West Station #2 115 kV lines. The West Cañon 230/115 kV transformer outage combined with the Portland-West Station #2 115 kV line outage resulted in loading on the Portland-West Station #1 line to reach 101%.

Loading on the Poncha-Smelter 115 kV line reached 94% of the 159 MVA rating following the Portland-Skala 115 kV line outage followed by the West Cañon 230/115 kV transformer outage. The line loading assumes the replacement of the 80 MVA line trap limitation described in Section 3.1.1.

3.1.4. Cañon City Area Summary

Based on the results described in Sections 3.1.1-3.1.3, several conclusions can be made. There is limited import capability into the Cañon City 115 kV system under peak demand and more than one concurrent transmission outage. The Poncha-Smelter overload will be reduced to 94% in the near term through line trap upgrades currently planned by PSCo. A second 115 kV circuit into the area from West Station to Portland is scheduled for completion in 2012. Terminal equipment upgrades on the West Cañon-Cañon City 115 kV line would reduce post-contingent loading to 80% in the 2015 time frame. Mitigating the N-1-1 overloads on the West Cañon 230/115 kV transformer and Portland-West Station #1 115 kV line will require additional evaluation of solutions and additional investment.

Much like the 115 kV import limitation described above, transformation capacity into the Cañon City 69 kV load center is limited. Various outage combinations create overloads on the existing 115/69 kV transformers. Overloads in the Cañon City area could be reduced by changing the normal open points on the 69 kV transmission system or operating them closed, but that often results in new overloads on other 69 kV facilities.

In order to mitigate the violations identified for the Cañon City area, the following near-term projects are recommended:

- Add a Cañon City 20 MVAR capacitor (2 steps of 10 MVAR each, auto-switched).
- Replace Portland 25 MVA 115/69 kV transformer with 80 MVA unit.
- Replace 120 MVA terminal equipment limitation on Cañon City-West Cañon 115 kV line.
- Add sufficient voltage support at Arequa Gulch (currently under separate evaluation).

It is also recommended that terminal equipment limitations on 115 and 69 kV facilities be scheduled for replacement to mitigate potential overloads. In order to mitigate the remaining system issues, the following options were identified for further consideration:

Option A

- Replace Portland #1 115/69 kV transformer with 80 MVA unit
- Replace Cañon City 115/69 kV transformer with larger unit or add second transformer
- Replace West Cañon 230/115 kV transformer with larger unit or add second transformer
- Increase Portland-West Station #1 115 kV line rating

Note: Option A directly addresses the identified overloads that remained assuming the near-term projects identified previously were implemented.

Option B

- Add a new 230/69 kV substation and transformer tapping Western's West Cañon-Midway 230 kV line near the intersection with the North Cañon-Victor 69 kV line (requires formal interconnection request)
- Increase the rating of the 69 kV line from the new substation to Cañon City (reconductor or rebuild)
- Increase the rating of the 69 kV line from Florence to Highland Tap (reconductor or rebuild)

Note: Option B mitigates the overloads on the transformers at West Cañon (88%, down from 121%), Cañon City (45%, down from 120%), and Portland #1 (84%, down from 92% for N-1). The loading on the Poncha-Smelter 115 kV line was reduced to 36%, down from 94% and the Portland-West Station 115 kV line loading was reduced to 81%, down from 111%. This option would require the rebuild of two 69 kV lines due to increased flow. It would eliminate the injection bottleneck issues associated with the 115 and 69 kV system. Another potential benefit of this option is increased voltage support to the Victor/Arequa Gulch area for an outage on the West Cañon-Arequa Gulch 115 kV line. The potential value of a dual-wound 115/69 kV secondary on the transformer should be considered in the development of a long-term transmission expansion plan for the area. A preliminary diagram of Option B is shown in Figure 2.

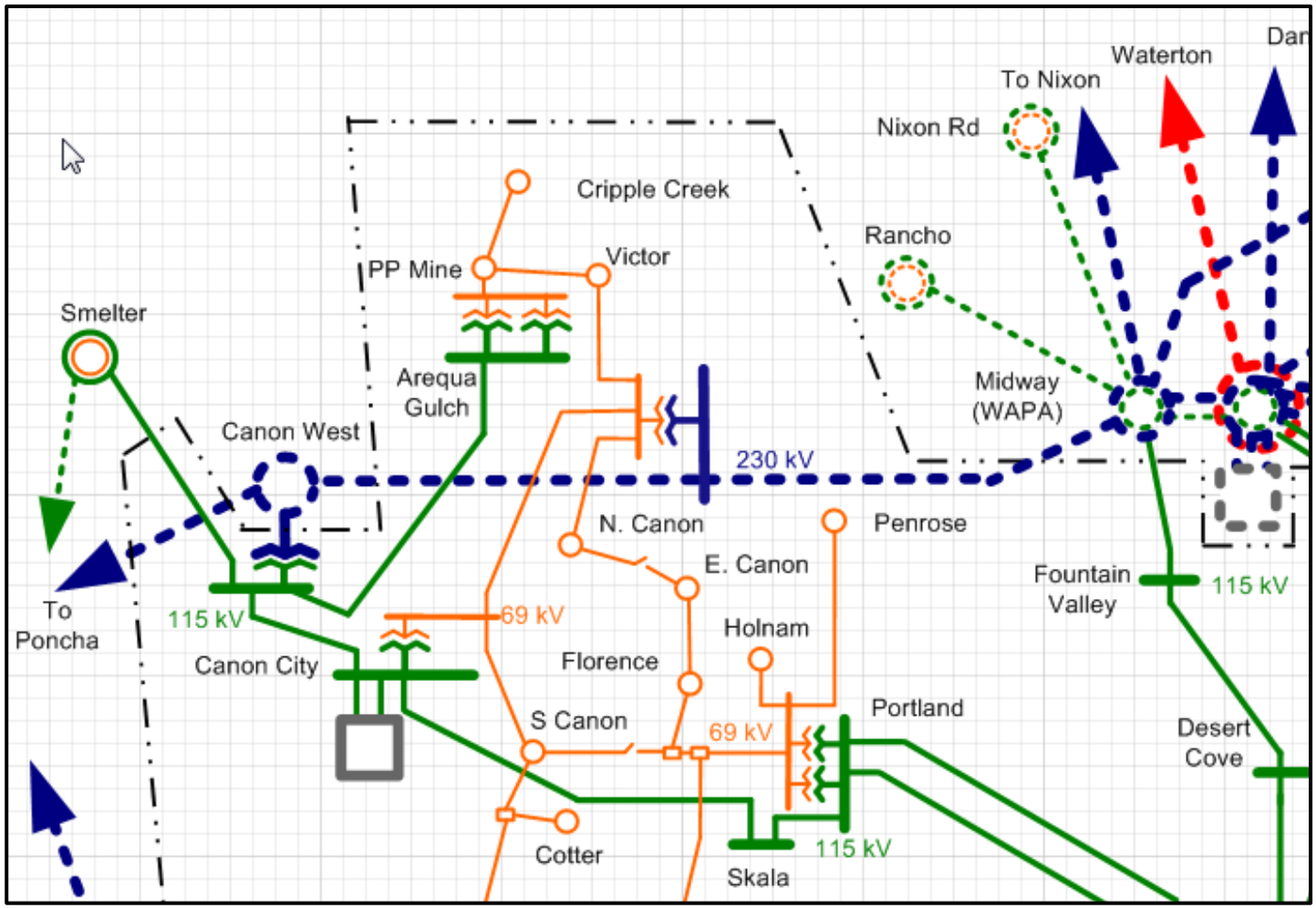

Figure 2: Conceptual Diagram of Cañon City Option B

Option C

- Implement automatic direct load tripping for critical N-1-1 contingencies.

Note: Option C would provide an immediate, least-cost solution to the issues identified for the Cañon City area. The cost advantage would need to be weighed against the cost of interruption of service. This option could also be implemented as a temporary solution until a more comprehensive plan is developed and approved.

BHCE utilizes an allowable emergency rating of 125% of the continuous thermal rating on transformers. Consideration should be given to the reduction of life expectancy of the transformers to determine the point at which replacement is warranted. A thorough review of expected and potential load growth in the Cañon City area is necessary to determine the time line for implementing the recommended system upgrades as well as selecting the best option for mitigating the remaining transmission issues.

3.2. Pueblo Area

The baseline case used for all three study scenarios included the planned 115 kV substation at Overton. This project would transfer load from the existing Overton 69 kV substation. Also included in the baseline case was the replacement of the 42 MVA Reader 115/69 kV transformers with 80 MVA units. As described below, sensitivities to the baseline case were evaluated to identify the best solution for the area.

3.2.1. 2015 Heavy Summer Results

The only issue identified due to a single event was the overload of one of the West Station 115/69 kV transformers following an internal breaker fault, clearing the other transformer and either the West Station-Stem Beach or West Station-Desert Cove 115 kV lines. Loading on the remaining transformer was at 100% of the 42 MVA continuous rating. The allowable emergency overload on transformers is 125%, allowing the Pueblo diesels to be dispatched, reducing the loading to 83%.

The evaluation of N-1-1 contingencies produced several thermal overloads in the Pueblo area. These issues are primarily confined to the 69 kV system and the 115/69 kV transformers at West Station.

The West Station 115/69 kV transformers became overloaded following several outage combinations. The most critical combination loaded both transformers to 149% following the loss of both Reader transformers. The loss of the Freemary-Reader 69 kV line followed by the loss of a West Station transformer loaded the remaining transformer to 139%. The West Station transformer prior outage followed by the Reader-Belmont 69 kV contingency loaded the remaining transformer at West Station to 128%. The remaining overloads on the West Station transformer were within the 125% emergency rating.

The Reader 115/69 kV transformer became loaded to 98% of the 80 MVA rating following the prior outage of the other Reader transformer followed by the West Station-Belmont 69 kV outage.

Switching the 69 kV system normal open points to reduce loading on the Reader transformer shifted the overload to West Station following other contingencies. Closing the 69 kV south loop between Reader and West Station mitigated this overload.

The Freemary-Reader 69 kV line loaded to 105% of the 57 MVA rating following the West Station-Stonemoor 69 kV prior outage. The rating is based on a relay limitation, and the conductor is rated for 74 MVA.

The St. Charles 69 kV bus experienced voltages of 0.895 per unit following the N-1-1 of the Blende-St. Charles 69 kV line and the Boone 115/69 kV transformer. This assumed the Rocky Ford diesel generation was online at 10 MW and the Rocky Ford capacitor was in service at 12 MVAR.

The Reader-Aspen Tap-Blende-Belmont 69 kV line became overloaded following the N-1-1 loss of both West Station 115/69 kV transformers. The Reader-Aspen Tap segment reached 126% of the 68 MVA rating which is based on a conductor limitation. It was assumed that the existing 57 MVA CT limitation was removed during the replacement of the Reader transformers. The Aspen Tap-Blende segment loaded to 150% of the 57 MVA rating based on a CT limitation. The conductor limit on this segment is 127 MVA. The Blende-Belmont segment loaded to 140% of the 41 MVA conductor rating.

The West Station-Blende 69 kV line segments became overloaded following the N-1-1 loss of both Reader transformers. West Station-Belmont Tap-Overton-Belmont loaded to 183% of the 48 MVA rating, which is based on terminal equipment limitations. The overload still exceeded the conductor limit of the segments. The Belmont-Blende line loaded to 170% of the 41 MVA conductor limit. Changing the operating configuration of the 69 kV system reduced the stated overloads, but resulted in new ones, so it was disregarded as a solution.

Based on the overloads identified on the 69 kV system, a sensitivity analysis was performed assuming several system upgrades. The 69 kV line ratings based on terminal equipment limitations were upgraded to reflect the conductor limit. This included the Reader-Freemary, Reader-Blende, Belmont-West Station, and Blende-St. Charles 69 kV lines. This resulted in the elimination of the overloads on Reader-Freemary and Aspen Tap-Blende lines. The remaining 69 kV line overloads were eliminated by allowing the south 69 kV loop to be operated in a closed configuration for certain prior outages. This ‘closed-in’ configuration would require changes to the existing protection scheme on this line. It should be noted that the West Station-Stonemoor 69 kV line loading exceeded 93% of the 72 MVA conductor limit for the loss of both Reader transformers.

3.2.2. 2015 Light Autumn Results

The results of the 2015 Light Autumn analysis did not identify any criteria violations in addition to those in the Heavy Summer analysis. Due to the reduced load levels, many of the Heavy Summer scenario violations did not occur, and those that did were not as critical.

3.2.3. 2021 Heavy Summer Results

Based on the results of the 2015HS scenario, the 2021HS scenario assumed system upgrades to eliminate common criteria violations. The terminal equipment limitations mentioned in Section 3.2.1 were assumed to be removed, and the south 69 kV loop was assumed to be closed.

The N-1 loss of one of the West Station transformers resulted in the remaining transformer loading to 104% of the 42 MVA continuous rating. Overloads increased to 156% following various N-1-1 events involving the loss of one West Station transformer. The loss of both Reader transformers loaded the West Station transformers to 158%.

The West Station-Stonemoor 69 kV prior outage followed by the loss of a Reader transformer loaded the remaining Reader transformer to 104% of the 80 MVA continuous rating. This was reduced to 93% if the St. Charles load was transferred to the Boone transformer for this prior outage, but Rocky Ford generation would be required, as well as voltage support in the St. Charles area. This option is effective but may be cost-prohibitive as a long-term solution.

The West Station-Stonemoor 69 kV line reached 104% of the 72 MVA conductor limit following the N-1-1 loss of both Reader transformers.

3.2.4. Pueblo Area Summary

The results of the power flow analysis for the Pueblo area indicate a deficiency in 115/69 kV transformation capacity as well as limitations on the 69 kV system, especially when providing back-up service following transformer outages. In order to mitigate the violations identified for the Pueblo area, the following near-term projects are recommended:

- Complete planned replacement of the Reader transformers with 80 MVA units.
- Increase rating on Aspen Tap-Blende 69 kV line to 127 MVA conductor limit.
- Increase rating on West Station-Stonemoor 69 kV line to 72 MVA conductor limit. This line will need to be rebuilt as load on south loop approaches 72 MVA.
- Increase rating on Reader-Freemary 69 kV line to 74 MVA conductor limit.
- Add 69 kV voltage support in the St. Charles/PDA area (auto-switched).

It is also suggested that the remaining terminal equipment limitations on 115 and 69 kV facilities in the Pueblo area be scheduled for replacement. Refer to Table 2 for several options that were evaluated in the 2015HS scenario as part of a comprehensive long-term transmission build-out plan. It should be noted that the options in Table 2 have been identified for further analysis and coordination with other stakeholders to determine the best final solution.

The West Station-Desert Cove 115 kV line exhibited loading of 93% of the 120 MVA rating following the loss of both Comanche-Daniel's Park 345 kV lines in all 2015HS scenarios. Overloads of up to 109% were identified in the Colorado Coordinated Planning Group's (CCPG) 2011 Compliance Assessment following the N-1-1 loss of the Midway 230 kV bus tie and the Midway-Fuller 230 kV line. Post-contingent loading on this line is significantly reduced following the planned Lamar-Front Range transmission additions. This project will create a high voltage, low

impedance path between Comanche generation and the Denver metro load, reducing flows through the BHCE system. One temporary mitigation option would be to install thermal overload protection on the West Station-Desert Cove 115 kV line. The overload would be eliminated for the limited N-1-1 events that cause it without incurring the cost of rebuilding the line. Further investigation of this option both internally and among neighboring utilities will be pursued.

Table 2: 2015HS Preliminary Evaluation of Options for Pueblo Area

Option A)	**Un-Resolved Violations/Potential Issues**
Overton 115 kV substation	Reader XFMR @ 93% of 80 MVA for WST-STM 69 + RDR XFMR**
Overton 115/13.2 kV XFMR	WST-STM 69 @ 94% of 72 MVA for N-1-1 of both RDR XFMRS
Replace West Station 115/69 kV XFMRs	St. Charles voltage @ 0.895 for BLD-STC 69 + BNE XFMR (w/RF diesels and cap on)
Close South Loop 69 kV	BAC-AIP 115 @ 93% of 222 for N-2 loss of both BAC-WST 115 lines
Remove area terminal equipment limitations	
Note: This option mitigates all overloads on the West Station transformers, and transfers load from the OVT 69 to the 115 allowing for future growth in the Overton area.	
Option B)	**Un-Resolved Violations/Potential Issues**
Overton 115 kV substation	WST XFMR @ 90% of 42 MVA for OVT-BAC 115 + WST XFMR**
Overton 115/69 kV XFMR	St. Charles voltage @ 0.895 for BLD-STC 69 + BNE XFMR (w/RF diesels and cap on)
Existing West Station 115/69 kV XFMRs	BAC-AIP 115 @ 80% of 222 for N-2 loss of both BAC-WST 115 lines**
Close South Loop 69 kV	WST-STM 69 @ 78% of 72 MVA for N-1-1 of both RDR XFMRS**
Remove area terminal equipment limitations	
Option B provides reduced loading on the Reader transformer compared to Option A. The WST XFMRS were not replaced for this option, resulting in a single N-1-1 event loading the existing transformer to 90%. West Station-Stonemoor 69 loading is also reduced.	
Option C)	**Un-Resolved Violations/Potential Issues**
Overton 115 kV substation	WST XFMR @ 87% of 42 MVA for OVT-BAC 115 + WST XFMR**
Overton 115/69 kV XFMR	St. Charles voltage @ 0.895 for BLD-STC 69 + BNE XFMR (w/RF diesels and cap on)
Overton 115/13.2 kV XFMR	BAC-AIP 115 @ 80% of 222 for N-2 loss of both BAC-WST 115 lines**
Existing West Station 115/69 kV XFMRs	WST-STM 69 @ 78% of 72 MVA for N-1-1 of both RDR XFMRS**
Close South Loop 69 kV	
Remove area terminal equipment limitations	
Note: Option C is similar to Option B with a slight reduction in West Station transformer loading due to the load transfer from the 69 kV Overton sub to the 115 kV sub. Future load growth in the Overton area is also accommodated.	
Option D)	**Un-Resolved Violations/Potential Issues**
Santa Fe 115 kV substation	WST XFMR @ 128% of 42 MVA for RDR-FMY 69 + WST XFMR
Overton 115/69 kV XFMR	STF-BMT 69 @ 100% of 41 MVA for RDR-FMY 69 + WST XFMR
Existing West Station 115/69 kV XFMRs	Reader-Santa Fe 115 @ 95% of 194 MVA for N-2 loss of both BAC-WST 115 lines (compared to 77% in Scenario A)
69 kV system radial, tie through capable	St. Charles voltage @ 0.895 for BLD-STC 69 + BNE XFMR (w/RF diesels and cap on)
Remove area terminal equipment limitations	BAC-AIP 115 @ 93% of 222 for N-2 loss of both BAC-WST 115 lines
Note: Option D was evaluated as an extension of conceptual plans for a Santa Fe 115/13.2 kV substation. This option allowed the Pueblo 69 kV system to be operated radial from the 115/69 kV transformers. There appeared to be little benefit of Option D when compared to Options B or C.	
Option E)	**Un-Resolved Violations/Potential Issues**
Replace West Station 115/69 kV XFMRs	Reader XFMR @ 100% of 80 MVA for WST-STM 69 + RDR XFMR
Close South Loop 69 kV	WST-STM 69 @ 98% of 72 MVA for N-1-1 of both RDR XFMRS
Remove area terminal equipment limitations	St. Charles voltage @ 0.895 for BLD-STC 69 + BNE XFMR (w/RF diesels and cap on)
Consider West Station-Stonemoor 69 kV rebuild	BAC-AIP 115 @ 94% of 222 for N-2 loss of both BAC-WST 115 lines
Note: Option E omitted the addition of the Overton substation or any additional 115/69 kV transformation, which amounted to a West Station XFMR replacement versus Overton substation addition. Option E is inferior to Options B or C from a reliability perspective.	
Option F)	**Un-Resolved Violations/Potential Issues**
Airport Memorial 115/69 kV XFMR	BAC-AIP 115 @ 98% of 222 for N-2 loss of both BAC-WST 115 lines
Apt. Memorial-St. Charles 69 kV line	BMT-BLD 69 @ 101% of 41 MVA for RDR-FMY 69 + WST XFMR
Existing West Station 115/69 kV transformers	WST XFMRS @ 115% of 42 MVA for RDR-FMY 69 + RDR-BMT 69
Close South Loop 69 kV	WST XFMR @ 135% of 42 MVA for RDR-FMY 69 + WST XFMR
Remove area terminal equipment limitations	WST XFMR @ 107% of 42 MVA for WST XFMR + RDR-BMT 69
	WST XFMR @ 99% of 42 MVA for WST XFMR + RDR XFMR
Option F provided limited reliability benefits for the capital additions specified. This option will not be further evaluated.	

****Transformer loading under 95% and line loading under 90% were included for comparison and are not violations**

3.3. Rocky Ford Area

3.3.1. 2015 Heavy Summer Results

Tri-State's La Junta 115/69 kV transformer became loaded to 113% of the 42 MVA rating following the N-1-1 loss of the of the La Junta (BH)-La Junta (TS) 115 kV line and the Boone-La Junta (BH) 115 kV line. This prior outage assumed the 69 kV line between the two La Junta substations was closed. TSG&T indicated they plan to increase transformation capacity at La Junta (TS) so the overload was considered mitigated for this analysis.

Assuming the La Junta Interconnection Project is in-service, a bus section fault on the Boone 115 kV bus resulted in severely depressed voltages at the BHCE and TSG&T 69 kV load buses fed from Boone. Load normally tripped by this event would remain connected to Lamar via the planned La Junta (BH)-La Junta (TS) 115 kV line. Overloads were identified on the La Junta (TS)-Willow Creek 115 kV line (104%), La Junta (BH)-Rocky Ford 69 kV line (110%), La Junta (TS) 115/ 69 kV transformer (117%), and the Lamar 230/115 kV transformer (125%). Under the existing TPL Standard, this event is a Category C contingency. Replacing the motor-operated 115 kV switch at Boone with a breaker would not result in improved reliability-based performance because an internal breaker fault is also considered a Category C contingency. Under the new TPL Standard (pending regulatory approval), this event is considered a Category P.2 single contingency, and would carry more stringent performance requirements. One option to mitigate the criteria violation would be to shed load by automatically opening a line. Acceptable performance was achieved in the 2015HS scenario by opening the Rocky Ford-La Junta (BH) 69 kV line, resulting in the loss of 33 MW of load. A more conservative approach would be to open the La Junta (BH)-La Junta (TS) 115 kV line or the La Junta (TS)-Willow Creek 115 kV line, achieving better area voltage recovery at the expense of additional load loss.

There were no other issues identified in the Rocky Ford area for the 2015HS scenario.

3.3.2. 2015 Light Autumn Results

There were no issues identified in the Rocky Ford area for the 2015LA scenario.

3.3.3. 2021 Heavy Summer Results

The Boone 115/69 kV transformer became loaded to 100% of the 33 MVA continuous rating following the N-1 loss of the Rocky Ford-La Junta (BH) 69 kV line. This is within the allowable 125% emergency rating of the transformer. The prior outage of this line resulted in low voltages at Ordway (0.936), Fowler (0.940), and Manzanola (0.948). Dispatching the Rocky Ford diesel generation reduced the transformer loading to 65% and mitigated all voltage violations associated with the prior outage.

There were five N-1-1 outage combinations that resulted in overloads on the Boone 115/69 kV transformer. The largest overload was 109% following the loss of both La Junta (BH) 115/69 kV transformers, assuming the Rocky Ford diesel generation was online at 10 MW. Switching the Huerfano 69 kV load to the St. Charles line reduced the overload to 102%.

The Boone/PDA/St. Charles 69 kV buses experienced low voltages (St. Charles = 0.845) following the N-1-1 outage of the Blende-St. Charles 69 kV line and the Boone 115/69 kV transformer.

Similar to the performance described in Section 3.3.1, the stripping of the Boone 115 kV bus resulted in voltage collapse on the area buses connected to the tripped bus. Acceptable performance was achieved by opening the La Junta (BH)-La Junta (TS) 115 kV line, dropping approximately 44 MW of load, compared to the 33 MW required in the 2015HS scenario.

3.3.4. Rocky Ford Area Summary

The following suggestions were identified as options to mitigate the Rocky Ford area criteria violations listed in Sections 3.3.1-3.3.3.

- Replace the Boone 115/69 kV transformer (size TBD).
- Add an auto-switched 69 kV capacitor in the Huerfano/PDA area (size/location TBD).
- Implement a Remedial Action Scheme to open the La Junta (BH)-La Junta (TS) 115 kV line following the loss of the Boone 115 kV bus. Alternatively, the Boone 115 kV bus could be reconfigured to avoid the critical contingency.

A detailed review of expected load growth in the Rocky Ford area will be required to determine the proper timing and size of the Boone transformer replacement, as well as the capacitor in the Huerfano/PDA area. These issues were not present in the near-term case, and are not considered to be projects with a long lead time. They will be closely monitored in future planning studies. Another long-term solution would be to consider another 115 or 69 kV connection to the Rocky Ford area from an outside source. This option would also be driven by area load growth projections.

The loss of the Boone 115 kV bus resulted in low voltages on the BHCE and TSG&T 69 kV system in the 2015HS scenario. A numerical solution was not reached following the tripping of the Boone 115 kV bus in the 2021HS steady-state scenario. Further investigation in the transient stability analysis indicated that instability was not encountered. It is expected that the planned addition of the second Boone 230/115 kV transformer will reconfigure the 115 kV substation, potentially removing the bus trip as a valid Category C contingency. This contingency does not result in reliability issues until the La Junta Tie project is complete. The identified issues were mitigated by implementing a RAS that opened the La Junta (BH)-La Junta (TS) 115 kV line for that particular contingency. Further investigation into the addition of the Boone #2 230/115 kV transformer will be required to determine the operating requirements of the system. Tri-State G&T and PSCo should be consulted with any plans regarding the Boone 115 kV bus.

3.4. Category D Extreme Outage Analysis

Several significant Category D outages were selected to identify the impacts of each outage on the transmission system. The outages were selected from all valid Category D events based on past study results and working understanding of the criticality of the associated system elements. Bus outages were simulated by disconnecting the bus and all associated network elements at the each of

the following substations: Pueblo 115 kV, Nyberg 115 kV, Reader 115 kV, West Station 115 kV, Baculite Mesa 115 kV, Portland 115 kV, Cañon City 115 kV, and West Cañon 115 kV. The right-of-way ("ROW") loss of the Baculite Mesa-West Station 115 kV double circuit, the MidwayPS-Overton 115 kV line, and the West Station-Belmont 69 kV line was also simulated as a Category D event.

The simulation of Category D outages in each load scenario did not result in system instability or cascading outages.

The ROW outage described above caused several thermal overloads on the 115 kV system, with the largest being 125% on the Baculite Mesa-Airport Industrial Park 115 kV line. All issues related to this outage were mitigated by reducing the amount of online generation at Baculite Mesa. Cascading or instability did not occur.

The loss of the Reader 115 kV bus resulted in low voltages and line overloads on the 69 kV system between Reader and West Station. The largest overload was on the West Station-Belmont 69 kV line, reaching 187% of the 48 MVA terminal equipment rating. The issues were confined to the Pueblo area and were mitigated by opening the West Station transformers. Cascading or instability did not occur.

The loss of the West Station 115 kV bus resulted in low voltages and line overloads on the 69 kV system between Reader and West Station. The largest overload was on the Reader-Blende 69 kV line, reaching 153% of the 57 MVA terminal equipment rating. The issues were confined to the Pueblo area and were mitigated by opening the Reader-Blende 69 kV line. Cascading or instability did not occur.

3.5. Voltage Stability Analysis

Voltage stability analysis was not performed as part of this TCPC study cycle. The 2011 NERC/WECC Compliance Study performed by the CCPG included a PV analysis for the Colorado area. The results indicated adequate voltage stability margins exist on the bulk transmission system within the CCPG footprint. Details on the 2011 study can be found at http://www.westconnect.com/planning_ccpg.php.

4. Transient Stability Assessment

Transient analysis was performed to evaluate the dynamic characteristics of the transmission system in proximity to the BHCE footprint following various disturbances. System loads were modeled using the WECC generic motor load penetration of 20 percent, with the under voltage load shedding function disabled to provide a worst-case representation of system performance. The critical outage combinations evaluated in the transient analysis were selected based on significance with respect to proximity to local generation, as well as performance in the steady-state assessment. The faults listed in Table 2 were simulated for both 2015 load scenarios.

Transient analysis was not performed for the 2021HS scenario. There were no marginal conditions identified in the 2015 heavy summer or light autumn steady-state analysis as well as the 2015 transient stability analysis that would require longer lead-time solutions. It was determined that the 2015 cases provided an adequate representation of long-term dynamic system performance. In the event of additional generation installations in the planning horizon, transient stability issues would be addressed in the generation interconnection studies.

For each ten second simulation, plots including bus voltages and frequencies at various points on the transmission system were created. Due to the large quantity of plots created, they are not included in this report but are available upon request.

A stability problem was encountered with the two large synchronous motors at TSG&T's Rosebud 115 kV bus in the New Mexico system model for various faults in the study area. This known stability problem has been encountered and acknowledged in several other studies performed by BHCE as well as other entities. Since these machines are relatively small and electrically distant from the study area, they were taken out of service in the dynamics simulations.

4.1. 2015 Transient Stability Results

As shown in Table 3, there were no reliability criteria violations associated with any of the events simulated in the 2015 scenarios. The only issue encountered was for the loss of the Boone 115 kV bus, which resulted in voltages on the BHCE and TSG&T 115 and 69 kV systems stabilizing between 0.80 and 0.90. The tripping of the La Junta (BH)-La Junta (TS) 115 kV line mitigated these low voltages. These results indicate that instability associated with this outage is not a concern. Refer to Section 3.4 for more details on this contingency.

With the exception of the single issue mentioned above, all dynamic simulations resulted in acceptable results for each evaluated study scenario. There were no additional post-contingent voltage or frequency criteria violations, and all system oscillations were adequately damped.

Table 3: 2015 Transient Stability Analysis Results

Prior Outage	Fault Type	Faulted Bus	Clearing Time (cy)	Tripped Facilities	Stable	Acceptable Voltage	Acceptable Frequency
System Intact	3Φ	Baculite Mesa 115 kV	5	Bac. Mesa-Airport Industrial Park 115 kV	Yes	Yes	Yes
System Intact	3Φ	Baculite Mesa 115 kV	5	Baculite Mesa-Nyberg 115 kV	Yes	Yes	Yes
System Intact	3Φ	Baculite Mesa 115 kV	5	Baculite Mesa-Overton 115 kV	Yes	Yes	Yes
System Intact	3Φ	Baculite Mesa 115 kV	5	Baculite Mesa-West Station 115 kV	Yes	Yes	Yes
System Intact	3Φ	Baculite Mesa 115 kV	5	Baculite Mesa-W. Station 115 kV #1 & #2	Yes	Yes	Yes
System Intact	3Φ	Reader 115 kV	5	Reader-Airport Memorial 115 kV	Yes	Yes	Yes
System Intact	3Φ	Reader 115 kV	5	Reader-Comanche 115 kV	Yes	Yes	Yes
System Intact	3Φ	Reader 115 kV	5	Reader-Greenhorn 115 kV	Yes	Yes	Yes
System Intact	3Φ	Reader 115 kV	5	Reader-Pueblo 115 kV	Yes	Yes	Yes
System Intact	3Φ	La Junta (BH) 115 kV	5	La Junta (BH)-Boone 115 kV	Yes	Yes	Yes
System Intact	3Φ	La Junta (BH) 115 kV	5	La Junta (BH)-La Junta (TS) 115 kV	Yes	Yes	Yes
System Intact	3Φ	Cañon City 115 kV	5	Cañon City-West Cañon 115 kV	Yes	Yes	Yes
System Intact	3Φ	West Station 115 kV	5	West Station-Portland 115 kV #1 & #2	Yes	Yes	Yes
System Intact	3Φ	West Station 115 kV	5	W. Station-MidwayPS + Overton-MidwayPS 115 kV	Yes	Yes	Yes
System Intact	3Φ	Comanche 230 kV	5	Comanche-Midway 230 kV	Yes	Yes	Yes
System Intact	3Φ	Comanche 230 kV	5	Comanche-Boone 230 kV	Yes	Yes	Yes
System Intact	3Φ	Comanche 345 kV	5	Comanche-Daniels Park 345 kV	Yes	Yes	Yes
System Intact	3Φ	Boone 115 kV	5	Boone 115 kV bus	Yes	No	Yes
System Intact	3Φ	Boone 115 kV	5	Boone 115 kV bus + La Junta 115 kV Tie (RAS)	Yes	Yes	Yes
System Intact	3Φ	Reader 115 kV	5	Reader 115 kV bus	Yes	Yes	Yes
System Intact	3Φ	West Station 115 kV	5	West Station 115 kV bus	Yes	Yes	Yes
System Intact	3Φ	Baculite Mesa 115 kV	5	Baculite Mesa-W. Station 115 kV #1 & #2 MidwayPS-Overton 115 kV West Station-Belmont 69 kV	Yes	Yes	Yes
West Cañon 230/115 kV XFMR**	3Φ	Portland 115 kV	5	Portland-Skala 115 kV	Yes	Yes	Yes

** This prior outage/contingency combination was only simulated for the 2015HS scenario based on steady state results

5. Transmission System Expansion

5.1. Previously Identified/Existing Projects

The following transmission projects have been previously identified and are currently planned projects for the BHCE transmission system.

5.1.1. Reader 115/69 kV Transformer Replacement

The 42 MVA Reader 115/69 kV transformers are currently scheduled for replacement in 2013. This will upgrade both units to 80 MVA. Also included in this project is the replacement of the CTs on the Reader end of the Reader-Aspen Tap 69 kV line, increasing the current 57 MVA rating to 68 MVA based on the conductor limit. The estimated cost of this project is $6,500,000.

5.1.2. Rocky Ford-South Fowler Tap 69 kV Line CT Replacement

The South Fowler Tap-Rocky Ford 69 kV line is currently rated for 24 MVA, which is based on a CT limitation at Rocky Ford. By re-tapping the CT's and re-coordinating the relaying and metering, the line rating would increase to the summer conductor limit of 72 MVA. The total estimated cost of this project was $50,000. The equipment upgrades are scheduled for construction and completion in 2012.

5.1.3. Baculite Mesa-Overton-Northridge 115 kV Line Upgrade

The 115 kV line from Baculite Mesa to the planned Overton substation was scheduled for a rebuild in the 2010 TCPC study to increase the rating from 122 MVA to 222 MVA. The 115 kV line from Overton to Northridge is limited by a short span of conductor in and out of the Northridge substation, as well as the substation equipment itself. The rating can be increased by replacing the short sections of 336 ACSR conductor with 795 ACSR conductor. Also, portions of the Northridge substation bus should be replaced. This will increase the Overton-Northridge 115 kV line thermal rating to 222 MVA. The total estimated cost of these projects is $2,000,000. They are scheduled for completion in 2012 as part of the required upgrades for the BHCT-G6 generator interconnection at Baculite Mesa.

5.1.4. Boone-DOT Tap 115 kV Line CT Ratio Change

The Boone-DOT Tap 115 kV line is currently CT limited to 100 MVA. If the limiting MRCT ratio was changed to 800:5, the new line rating would be 120 MVA based on the conductor thermal limit. This upgrade would require relay re-coordination and replacement of metering devices. The estimated cost of this project is $10,000 and was scheduled for completion in 2012 as part of the required upgrades for the BHCT-G6 generator interconnection at Baculite Mesa.

5.1.5. Cañon City 115 kV Capacitor

The addition of a 20 MVAR auto-switched capacitor (2x10 MVAR) has been identified to mitigate low voltages in the Cañon City area following the planned retirement of the Cañon City generation. The capacitor was approved in the 2011 Rule 3206 filing with a completion date in 2012 at an estimated cost of $500,000. Additional study work should be completed to confirm the size and number of steps required to achieve optimum performance.

5.1.6. Arequa Gulch Area Voltage Support

The need for voltage support in the Arequa Gulch area was identified in the 2010 BHCE TCPC study and confirmed in the 2011 study. A detailed analysis of the specific project requirements is being performed as part of a separate load growth analysis for the area. The results of that analysis will be incorporated into the BHCE LTP when they become available.

5.1.7. Pueblo-Hyde Park-West Station 115 kV Line Rebuild

The Pueblo-Hyde Park-West Station 115 kV line rebuild will increase the line rating for improved reliability in the Pueblo area and was identified in Black Hills' 2009 SB-100 report. This project has an estimated total cost of $2.7 million. The project is currently scheduled for construction in 2013 with an in-service date of 2013.

5.1.8. Reader-Freemary 69 kV Line Terminal Equipment Replacement

The Reader-Freemary 69 kV line is rated at 57 MVA based on a 51P relay limit. The rating of this line should be increased to the summer continuous conductor rating of 74 MVA. The estimated date of completion for all Reader 69 kV relay upgrades is 2014 at a cost of 200,000.

5.1.9. Reader-Rattlesnake Butte 115 kV Project

The Reader-Rattlesnake Butte project includes a new 36 mile 115 kV transmission line consisting of 795 ACSR conductor and terminating at the new 115 kV Rattlesnake Butte substation. The line will be rated for 222 MVA (summer). The Reader-Greenhorn 115 kV line will be rebuilt as part of this project. Terminal equipment additions at the Reader 115 kV substation are also required to accommodate the new line. This project has an estimated total cost of $15.6 million which includes the transmission line cost and associated 115 kV substation construction/upgrades at Reader and Rattlesnake Butte. This project is planned to be in service by October 2012.

5.1.10. Portland-West Station #2 115 kV Line

The Portland-West Station #2 115 kV project consists of a second 115 kV line utilizing an existing right-of-way. Also included in the project is the replacement of limiting CTs on the existing Portland-West Station 115 kV line, increasing the rating to 122 MVA. This project is estimated to be in service in 2012 at an estimated cost of $12,500,000.

5.1.11. La Junta Interconnection Project

The La Junta Interconnection Project consists of a new 115 kV line between the La Junta (BH) and La Junta (TS) substations, as well as a new parallel 69 kV line. Additional upgrades identified for inclusion with this project are the replacement of the CTs on the Boone-La Junta (BH) 115 kV line and the La Junta (BH)-Rocky Ford 69 kV line.

The La Junta (BH)-Rocky Ford 69 kV line is currently rated for 24 MVA, which is based on a CT limitation at both La Junta and Rocky Ford. The La Junta CT's should be re-tapped with all relaying and indicating instrumentation re-coordinated. Additionally, the replacement of the

limiting bushing CT's at Rocky Ford would increase the line rating to the summer conductor limit of 41 MVA.

The Boone-La Junta (BH) 115 kV line is currently rated for 40 MVA, which is based on a CT limitation at La Junta (BH). Line relaying should be re-coordinated and differential relaying reset for 600:5 ratios. The next limiting element would be the CT's at Boone, which are set at 500:5. The ratios should be changed on the line relaying and watt/var transducer. The watt/var transducer owned by PSCo will also need to be reviewed and its replacement coordinated with them. The final line rating would be 120 MVA.

The La Junta Interconnection project is expected to be in service in 2014 at an estimated cost of $6,000,000.

5.1.12. Boone 230/115 kV #2 Transformer

The second Boone 230/115 kV transformer would add reliability to the Boone and La Junta area. This project was included in the 2011 Rule 3206 filing. The project is planned for operation in 2013 at an estimated cost of $5,300,000.

5.2. Recommended Projects

The following transmission projects are recommended for inclusion in the BHCE LTP. Further analysis of the expected load growth and completion of other system upgrades is necessary to identify an expected in-service date of these projects.

5.2.1. Cañon City-West Cañon 115 kV line CT replacement

This project was identified in the 2010 TCPC Study and the need was confirmed in the 2011 analysis. The Cañon City-West Cañon 115 kV line is currently CT limited to 120 MVA. If the limiting metering and relaying CTs at Cañon City were replaced, the new line rating would be 151 MVA based on the conductor thermal limit. The estimated time for completion of this upgrade is 8 months at a cost of $350,000.

5.2.2. West Station-Stonemoor Hills 69 kV Line CT Replacement

The West Station-Stonemoor Hills 69 kV line is CT limited to 48 MVA. The rating of this line should be increased to the summer continuous conductor rating of 72 MVA. An increase in the conductor rating of this line will be required as the total load on the line approaches 72 MVA. The estimated time for completion of the CT replacement is 3 months at a cost of $25,000.

5.2.3. Boone-Boone Tap 69 kV Line CT Replacement

The Boone-Boone Tap 69 kV line is currently rated for 24 MVA, which is based on a CT limitation at the Boone 69 kV substation. By replacing the limiting bushing CT's, the line rating would increase to 40 MVA based on the CT's at the Boone 115 kV breaker 8132. The emergency rating on the Boone 115/69 kV transformer is 41 MVA; therefore a transformer replacement would be required in addition to the replacement of metering and protection equipment associated with

breaker 8132 to obtain a rating above 41 MVA. The total estimated cost of the Boone CT replacement is $25,000.

5.2.4. Aspen Tap-Blende 69 kV Line CT Replacement

The Aspen Tap-Blende 69 kV line is CT limited to 60 MVA. The rating of this line should be increased to the summer continuous conductor rating of 127 MVA. The estimated time for completion of this upgrade is 6 months at a cost of 75,000. The CTs at Reader are set at 600:5. Modification will require resetting all CTs on all breakers in the 69 kV ring bus at Reader, with re-coordination of all relaying.

5.2.5. Baculite Mesa-Airport Industrial Park 115 kV Line CT Replacement

The Baculite Mesa-Airport Industrial Park 115 kV line is rated for 199 MVA based on a CT limit at Airport Industrial Park. The rating of this line should be increased to the summer continuous conductor rating of 222 MVA by increasing the tap ratios on the limiting relaying and metering CTs. The estimated time for completion of this upgrade is 6 months at a cost of 30,000.

5.2.6. Airport Industrial Park-Airport Memorial 115 kV Line CT Replacement

The Airport Industrial Park-Airport Memorial 115 kV line is rated for 199 MVA based on CT limits at both ends of the line. The rating of this line should be increased to the summer continuous conductor rating of 222 MVA by increasing the tap ratios on the limiting relaying and metering CTs. The estimated time for completion of this upgrade is 6 months at a cost of $30,000.

5.2.7. Portland-Highland Tap 69 kV Line CT Replacement

The Portland-Highland Tap 69 kV line is CT limited to 48 MVA. The rating of this line should be increased to the summer continuous conductor rating of 74 MVA. All of the CTs in the 69 kV ring bus at Portland are set to 400:5. The proposed upgrade would require resetting all CTs on all breakers in the ring as well as re-coordinating all line and transformer differential relaying. The estimated time for completion of this upgrade is 9 months at a cost of $100,000.

5.3. Projects Requiring Further Analysis

The following projects were identified as potential solutions to issues encountered in this analysis and will require additional evaluation and coordination with applicable stakeholders before proceeding with planning and construction.

5.3.1. St. Charles/Huerfano Area 69 kV Voltage Support

This project was identified in the 2011 TCPC analysis to mitigate low voltages associated with the Blende-St. Charles 69 kV prior outage in the 2015 time frame. The required in-service date, size, and location of the capacitor will require further analysis and will be primarily driven by expected load growth and space constraints at the potential substations.

5.3.2. Reader-Pueblo 115 kV Line Trap Replacement

The Reader-Pueblo 115 kV line is currently rated for 159 MVA, which is based on an 800 amp wave trap limitation at the Reader and Pueblo substations. By removing the wave trap, the line

rating would increase to the summer conductor limit of 194 MVA. Although overloads were not encountered on this line during the 2011 study, the line is one of three critical paths between Reader and West Station. A reduced rating due to terminal equipment could be eliminated at a relatively low cost, allowing for maximum utilization of existing facilities. The total estimated cost of this project is $25,000 and would take approximately 8 months to implement.

5.3.3. Reader-Aspen Tap 69 kV Line Rebuild

Assuming the terminal equipment upgrades identified as part of the planned Reader transformer replacement, the Reader-Aspen Tap 69 kV line would be limited to 68 MVA by the Merlin conductor between Reader and Switch 5656. This 0.4 mile line segment should be rebuilt to increase the line rating. The need for this upgrade is not critical, but is suggested to prevent unnecessary overloads on the 69 kV system. Additional analysis is required to determine the timing of this project as part of a long term solution. Estimated cost is $200,000 and would take approximately 6 months to implement.

5.3.4. North Cañon-Victor 69 kV line CT replacement

The North Cañon-Victor 69 kV line is currently CT limited to 24 MVA. If the limiting MRCT ratio was changed to a minimum of 500:5 at North Cañon, the new line rating would be 41 MVA based on the conductor thermal limit. This upgrade should be evaluated further as part of the separate load growth analysis for the Arequa Gulch area.

5.3.5. MidwayPS-Northridge 115 kV Line CT Replacement

The MidwayPS-Northridge 115 kV line is rated for 100 MVA based on a CT limit. The CTs on breaker 9637 at Midway are set to 500:5. The rating of this line should be increased to the summer continuous conductor rating of 122 MVA by replacing the limiting equipment. Although overloads were not encountered on this line during the 2011 study, the line is one of three transmission paths between Midway and West Station. A reduced rating due to terminal equipment could be eliminated at a relatively low cost, allowing for maximum utilization of existing facilities. Changes to the limiting equipment would require coordination with all adjacent utilities. The estimated cost of this upgrade is $50,000 and would take approximately 6 months to implement.

5.3.6. Thermal Loading Protection on West Station-Desert Cove 115 kV Line

This project was identified as a solution to overloads on the line following certain contingency events. The line is rated for 120 MVA, with a conductor rating of 122 MVA. Studies have indicated that the planned addition of major transmission projects by neighboring utilities will reduce loading on the line and eliminate the overloads. The tripping of the line in the interim was identified as a cost-effective solution until the planned transmission projects are completed. The project would take approximately 3 months to complete, at an estimated cost of $20,000.

5.3.7. Post-Contingency Tripping of La Junta Tie 115 kV Line

This project was identified to mitigate voltage and thermal loading violations associated with the loss of the Boone 115 kV transformer, assuming the La Junta Tie project is complete. It is assumed

that this contingency would be classified as an Extreme event. The need for this project should be evaluated further when details of the second Boone 230/115 kV transformer project are available.

5.3.8. Cañon City Area Load Serving Requirements

Several options were identified in Section 3.1.4 to mitigate reliability issues in the Cañon City area. These options should be further evaluated to develop a comprehensive, long-term solution for the area.

5.3.9. Pueblo Area Load Serving Requirements

Several options were identified in Section 3.2.4 to mitigate reliability issues in the Pueblo area. These options should be further evaluated to develop a comprehensive, long-term solution for the area.

5.3.10. Rocky Ford Area Load Serving Requirements

Several options were identified in Section 3.3.4 to mitigate reliability issues in the Rocky Ford area. These options should be further evaluated among affected parties to develop a comprehensive, long-term solution for the area.

6. Conclusions

An open and transparent process was utilized in conducting the 2011 Local Transmission Plan study. Stakeholders were provided several opportunities for involvement and input into the study process and scope. Through this process, the TCPC participants believe they have fulfilled the requirements of Attachment K to the Open Access Transmission Tariff (OATT).

The need for several previously planned projects was confirmed in the 2011 study process, and several new projects were identified to address reliability concerns. Additionally, there were several options identified for further analysis and stakeholder consideration before developing a final long-term build out plan. A review of expected load growth and planned resource development should be performed in the development of the next ten-year LTP. A longer-term transmission strategy should also be developed to meet the expected needs of BHCE customers beyond the ten year planning horizon while shaping the LTP over time to ultimately reach that goal.

Also, the critical nature of the loss of a 115/69 kV transformer on the BHCE system, in conjunction with the considerable lead time necessary to replace one, should instigate a discussion on the philosophy of maintaining a spare transformer.

Assessment of the identified system enhancements will continue through additional transmission planning studies and the next TCPC study cycle. Active stakeholder involvement will be a key component as the process continues. This will ensure the BHCE transmission system will effectively meet the long-term requirements for all transmission customers.

Cascading and instability were not identified as valid issues in the 2011 TCPC analysis. All identified violations of NERC and WECC TPL criteria were accompanied by a suggested mitigation plan, including estimated cost and implementation schedule. It was determined that this analysis satisfied the requirement of the TPL-001 through 004 Standards for BHCE.

Appendix A

Steady State
Prior and Forced Outage Lists

2015 Reliability Analysis Prior Outages

PO 345 SERIES		PO 230 SERIES		PO 115 SERIES		PO 69 SERIES		PO X SERIES		PO GEN SERIES	
LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION
POSYSINT	SYTEM INTACT	PO230-1	BOONE-MIDWAYPS	PO115-1	MIDWAYBR-RANCHO	PO69-1	ROCKY FORD-LAJUNTAW	POX-1	MIDWAYPS 345:230	POGEN-1	COMANCHE 3
PO345-1	DAN PARK-COMANCHE-1	PO230-2	BOONE-COMANCHE	PO115-2	MIDWAYBR-NIXON	PO69-2	BLENDE-ST. CHARLES***	POX-2	COMANCHE 345:230-T3	POGEN-2	BAC MESA GEN 1
PO345-2		PO230-3	BOONE-LAMAR	PO115-3	FTN VALLEY-MIDWAYBR	PO69-3	WEST STATION-STONEMOOR	POX-3	LAMAR 230:115	POGEN-3	
PO345-3		PO230-4	COMANCHE-MIDWAYPS-1	PO115-4	FTN VALLEY-DESERT COVE	PO69-4	READER-FREEMARY	POX-4	BOONE 230:115-1	POGEN-4	
PO345-4		PO230-5	MIDWAYPS-FULLER	PO115-5	DESERT COVE-WEST STATION	PO69-5	PORTLAND-HIGHLAND	POX-5	WEST CANON 230:115	POGEN-5	
PO345-5		PO230-6	MIDWAYBR-NIXON	PO115-6	MIDWAYPS-WEST STATION	PO69-6		POX-6	COMANCHE 230:115-T1	POGEN-6	
PO345-6		PO230-7	MIDWAYBR-LINCOLN	PO115-7	MIDWAYPS-NORTHRIDGE	PO69-7		POX-7	WALSENBURG 230:115-1	POGEN-7	
PO345-7		PO230-8	MIDWAYBR-WEST CANON	PO115-8	OVERTON-NORTHRIDGE	PO69-8		POX-8	MIDWAYPS 230:115	POGEN-8	
PO345-8		PO230-9	WEST CANON-PONCHA	PO115-9	OVERTON-BACULITE MESA	PO69-9		POX-9	MIDWAYBR 230:115	POGEN-9	
PO345-9		PO230-10	COMANCHE-WALSENBURG	PO115-10	BACULITE MESA-WEST STATION-1	PO69-10		POX-10	LAJUNTAW 115:69-1***	POGEN-10	
PO345-10		PO230-11		PO115-11		PO69-11		POX-11	BOONE 115:69***	POGEN-11	
PO345-11		PO230-12		PO115-12	HYDE PARK-WEST STATION	PO69-12		POX-12	READER 115:69-T1	POGEN-12	
PO345-12		PO230-13		PO115-13	HYDE PARK-PUEBLO	PO69-13		POX-13	WEST STATION 115:69-1	POGEN-13	
PO345-13		PO230-14		PO115-14	PUEBLO-READER	PO69-14		POX-14	PORTLAND 115:69-T1	POGEN-14	
PO345-14		PO230-15		PO115-15	PORTLAND-WEST STATION	PO69-15		POX-15	PORTLAND 115:69-T1tied	POGEN-15	
PO345-15		PO230-16		PO115-16	PUEBLO TAP-STEM BEACH	PO69-16		POX-16	CANON CITY 115:69	POGEN-16	
PO345-16		PO230-17		PO115-17	PUEBLO TAP-WEST STATION	PO69-17		POX-17	CANON CITY 115:69tied	POGEN-17	
PO345-17		PO230-18		PO115-18	BURNT MILL-WEST STATION	PO69-18		POX-18	AREQUA GULCH 115:69	POGEN-18	
PO345-18		PO230-19		PO115-19	BURNT MILL-GREENHORN	PO69-19		POX-19		POGEN-19	
PO345-19		PO230-20		PO115-20	GREENHORN-READER	PO69-20		POX-20		POGEN-20	
PO345-20		PO230-21		PO115-21	READER-AIRPORT MEMORIAL	PO69-21		POX-21		POGEN-21	
PO345-21		PO230-22		PO115-22	AIRPORT PARK-AIRPORT MEMORIAL	PO69-22		POX-22		POGEN-22	
PO345-22		PO230-23		PO115-23	AIRPORT PARK-BACULITE MESA	PO69-23		POX-23		POGEN-23	
PO345-23		PO230-24		PO115-24	NYBERG-BACULITE MESA	PO69-24		POX-24		POGEN-24	
PO345-24		PO230-25		PO115-25	NYBERG-AIRPORT MEMORIAL	PO69-25		POX-25		POGEN-25	
PO345-25		PO230-26		PO115-26	NYBERG-DOT TAP	PO69-26		POX-26		POGEN-26	
PO345-26		PO230-27		PO115-27	BOONE-DOT TAP	PO69-27		POX-27		POGEN-27	
PO345-27		PO230-28		PO115-28	BOONE-LAJUNTAW***	PO69-28		POX-28		POGEN-28	
PO345-28		PO230-29		PO115-29	BOONE-LAJUNTAT	PO69-29		POX-29		POGEN-29	
PO345-29		PO230-30		PO115-30	LAJUNTAT-LAJUNTAW	PO69-30		POX-30		POGEN-30	
PO345-30		PO230-31		PO115-31	COMANCHE-READER-1	PO69-31		POX-31		POGEN-31	
PO345-31		PO230-32		PO115-32		PO69-32		POX-32		POGEN-32	
PO345-32		PO230-33		PO115-33	PORTLAND-SKALA	PO69-33		POX-33		POGEN-33	
PO345-33		PO230-34		PO115-34	CANON CITY-SKALA	PO69-34		POX-34		POGEN-34	
PO345-34		PO230-35		PO115-35	CANON CITY-WEST CANON	PO69-35		POX-35		POGEN-35	
PO345-35		PO230-36		PO115-36	AREQUA GULCH-WEST CANON	PO69-36		POX-36		POGEN-36	
PO345-36		PO230-37		PO115-37	SMELTER-WEST CANON	PO69-37		POX-37		POGEN-37	

*** INDICATES MUST RUN GENERATION AT ROCKY FORD WAS UTILIZED FOR THIS PRIOR OUTAGE

2015 STEADY STATE FORCED OUTAGES (SYSTEM INTACT ONLY)

1	BACULITE MESA GEN #1	35	LAJUNTAT-LAJUNTAW 115	69	WSTATN-PORTLAND115+WSTATN115 XFMR+2.7CAP	103	WEST STATION-MIDWAYBR 115	137	LAMAR 230:115 XFMR #1
2	BACULITE MESA GEN #2	36	AREQUA GULCH-NORTH CANONW 69	70	WSTATN-STEMBCH115+WSTATN115 XFMR+2.7CAP	104	SKALA 115 SUB	138	MIDWAYPS 230:115 XFMR
3	ROCKY FORD DIESELS	37	CANON CITY-EAST CANON 69	71	WSTATN-HYDE115+WSTATN115 XFMR+3.6CAP	105	WEST CANON-PONCHA+WCANON 115 CAP	139	MIDWAYPS 345:230 XFMR
4	BOONE-DOT TAP-NYBERG 115	38	PORTLAND-EAST CANON 69	72	WSTATN-MWPS115+WSTATN115 XFMR+3.6CAP	106	WSTATN-MWPS 115 + OVERTON-MWPS 115	140	MIDWAYPS-FTNVLY GSU XFMR + FTNVLY GEN #3&4
5	BOONE-LAJUNTAW 115	39	CANON CITY-HIGHLAND 69	73	WSTATN-DCOVE115+WSTATN115 XFMR+3.6CAP	107	MWPS-OVERTON 115 + WSTATN-BELMONT 69	141	WALSENBURG 230:115 XFMR #3
6	NYBERG-BACULITE MESA 115	40	WEST STATION-SUNSET 69	74	WSTATN-BACULITEMSA115 #2+WSTATN115 XFMR+3.6CAP	108	BACULITE MESA-WSTATN 115 #1 & #2	142	MIDWAYBR 230:115 XFMR
7	NYBERG-APTMEMORIAL 115	41	PUEBLO-WEST STATION 69	75	WSTATN-BACULITEMSA115 #2+WSTATN115 XFMR+2.7CAP	109	READER-WEST STATION 69	143	RD_NIXON 230:115 XFMR
8	APTINDUSTRIAL PARK-BACULITE MESA 115	42	WEST STATION-BELMONT 69	76	READER-APTMEMORIAL 115+READER 115 XFMR #1	110	WALSENBURG-GLADSTONE 230	144	FULLER 230:115 XFMR
9	APTINDUSTRIAL PARK-APTMEMORIAL 115	43	READER-BELMONT 69	77	READER-COMANCHE 115 #1 + READER 115 XFMR #2	111	BOONE-LAJUNTAT 115	145	COMANCHE #1 GEN
10	READER-APTMEMORIAL 115	44	BOONE-ROCKY FORD 69	78	READER-COMANCHE 115 #2 + READER 115 XFMR #1	112	BOONE-COMANCHE 230 #1	146	COMANCHE #2 GEN
11	PUEBLO-READER 115	45	ROCKY FORD-FOWLER 69	79	READER-GREENHORN 115 + READER 115 XFMR #1	113	BOONE-LAMAR 230 + RAS	147	COMANCHE #3 GEN
12	HYDE PARK-PUEBLO 115	46	LAJUNTAW-ROCKY FORD 69	80	READER-PUEBLO 115 + READER 115 XFMR #2	114	BOONE-MIDWAYPS 230	148	RD_NIXON #1 GEN
13	HYDE PARK-WEST STATION 115	47	LAJUNTAT-LAJUNTAW 69	81	READER-RATTLESNAKE 115 + READER 115 XFMR #1	115	CF&IFURN-COMANCHE 230	149	EX_PUEBLO 115 SUB
14	BACULITE MESA-WEST STATION 115 #1	48	LAJUNTAW-LAMAR 69	82	CCY 115 XFMR+CCY-E.CANON69+CCY-SCANON69	116	COMANCHE-MIDWAYPS 230 #2	150	EX_BOONE 115 SUB
15	BACULITE MESA-WEST STATION 115 #2	49	BOONE 230 XFMR #1	83	NYBERG-BACULITE MESA 115+ NYBERG-APTMEMORIAL 115	117	COMANCHE-WALSENBURG+WALS-GLADSTONE 230 RAS	151	EX_BACMSA-WST115 #1&#2 + MWPS-OVT115 + WSTA
16	BACULITE MESA-OVERTON 115	50	BOONE 230 XFMR #2	84	READER-APTMEMORIAL 115+READER-GREENHORN 115	118	LAJUNTAT-WILLOWCREEK 115	152	EX_PORTLAND-WSTATN 115 #1 & #2
17	MIDWAYPS-NORTHRIDGE-OVERTON 115	51	WEST CANON 230 XFMR	85	READER-COMANCHE 115 #1 & #2	119	LAMAR-VILAS 115	153	EX_PORTLAND 115 SUB
18	MIDWAYPS-WEST STATION 115	52	CANON CITY 115 XFMR	86	READER-RATTLESNAKE 115+READER-PUEBLO 115	120	LAMAR-WILLOWCREEK 115	154	EX_BACULITE MESA 115 SUB
19	DESERT COVE-WEST STATON 115	53	PORTLAND 115 XFMR #1	87	BURNT MILL 115 SUB	121	MIDWAYPS-FULLER 230	155	EX_NYBERG 115 SUB
20	MIDWAYBR-FTNVLY-DESERT COVE 115	54	PORTLAND 115 XFMR #2	88	GREENHORN 115 SUB	122	PONCHA-SARGENT 115	156	EX_READER 115 SUB
21	PORTLAND-WEST STATION 115 #1	55	AREQUA GULCH 115 XFMR #1	89	APTINDUSTRIAL PARK 115 SUB	123	PONCHA-CURRECANTI 230	157	EX_CANON CITY 115 SUB
22	PORTLAND-WEST STATION 115 #2	56	AREQUA GULCH 115 XFMR #2	90	APTMEMORIAL 115 SUB	124	STEMBEACH-WALSENBURG 115	158	EX_WEST CANON 115 SUB
23	WEST STATION-STEM BEACH 115	57	WEST STATION 115 XFMR #1	91	HYDE PARK 115 SUB	125	MIDWAYPS-WATERTON 345	159	EX_WEST STATION 115 SUB
24	BURNT MILL-WEST STATION 115	58	WEST STATION 115 XFMR #2	92	OVERTON 115 SUB	126	DANIELPK-COMANCHE 345 #2	160	
25	BURNT MILL-GREENHORN 115	59	READER 115 XFMR #1	93	BACULITE MESA-NYBERG 115+BACULITE MESA GEN #1	127	MIDWAYBR-RANCHO 115	161	
26	GREENHORN-READER 115	60	READER 115 XFMR #2	94	BACULITE MESA-APTINDUSTRIAL115+BACULITE MESA GEN #2	128	MIDWAYBR-RD_NIXON 115	162	
27	COMANCHE-READER 115 #1	61	BOONE 115 XFMR	95	BACULITE MESA-W.STATION 115 #2 + BACULITE MESA GEN #3	129	MIDWAYBR-RD_NIXON 230	163	
28	COMANCHE-READER 115 #2	62	LAJUNTAW 115 XFMR #1	96	BACULITE MESA-W.STATION 115 #1 + BACULITE MESA GEN #4	130	MIDWAYBR-MIDWAYPS 230	164	
29	READER-RATTLESNAKE 115	63	LAJUNTAW 115 XFMR #2	97	WSTATN-BURNT MILL 115+WSTATN-HYDEPARK 115	131	MIDWAYBR-LINCOLN 230	165	
30	PORTLAND-SKALA 115	64	WEST CANON 115 CAPACITOR	98	WSTATN-PORTLAND 115 #1 + WSTATN-MIDWAYPS 115	132	MIDWAYBR-WEST CANON 230	166	
31	CANON CITY-SKALA 115	65	PORTLAND 115 CAPACITOR	99	WSTATN-STEMBEACH 115 + WSTATN-DESERT COVE 115	133	WEST CANON-PONCHA 230	167	
32	CANON CITY-WEST SCANON 115	66	BOONE 115 REACTOR	100	PORTLAND-WSTATN 115 #1 + PORTLAND-SKALA 115	134	COMANCHE 230:115 XFMR #2	168	
33	WEST CANON-PONCHA 115	67	BOONE-LAJUNTAW 115 + LAJUNTAW 115 XFMR #2	101	PORTLAND 115 XFMRS #1 & #2	135	COMANCHE 345:230 XFMR #4	169	
34	AREQUA GULCH-WEST CANON 115	68	WSTATN-BURNTMILL115+WSTATN115 XFMR #1+2.7CAP	102	BACULITE MESA-MIDWAYPS 115 + BACULITE MESA GEN #5	136	LAJUNTAT 115:69 XFMR #2	170	

2015 STEADY STATE FORCED OUTAGES (WITH PRIOR OUTAGES ONLY)							
1	BACULITE MESA GEN #1	**35**	LAJUNTAT-LAJUNTAW 115	**69**	BOONE-COMANCHE 230 #1	**103**	COMANCHE #2 GEN
2	BACULITE MESA GEN #2	**36**	AREQUA GULCH-NORTH CANONW 69	**70**	BOONE-LAMAR 230 + RAS	**104**	COMANCHE #3 GEN
3	ROCKY FORD DIESELS	**37**	CANON CITY-EAST CANON 69	**71**	BOONE-MIDWAYPS 230	**105**	RD_NIXON #1 GEN
4	BOONE-DOT TAP-NYBERG 115	**38**	PORTLAND-EAST CANON 69	**72**	CF&IFURN-COMANCHE 230	**106**	
5	BOONE-LAJUNTAW 115	**39**	CANON CITY-HIGHLAND 69	**73**	COMANCHE-MIDWAYPS 230 #2	**107**	
6	NYBERG-BACULITE MESA 115	**40**	WEST STATION-SUNSET 69	**74**	COMANCHE-WALSENBURG+WALS-GLADSTONE 230 RAS	**108**	
7	NYBERG-APTMEMORIAL 115	**41**	PUEBLO-WEST STATION 69	**75**	LAJUNTAT-WILLOWCREEK 115	**109**	
8	APTINDUSTRIAL PARK-BACULITE MESA 115	**42**	WEST STATION-BELMONT 69	**76**	LAMAR-VILAS 115	**110**	
9	APTINDUSTRIAL PARK-APTMEMORIAL 115	**43**	READER-BELMONT 69	**77**	LAMAR-WILLOWCREEK 115	**111**	
10	READER-APTMEMORIAL 115	**44**	BOONE-ROCKY FORD 69	**78**	MIDWAYPS-FULLER 230	**112**	
11	PUEBLO-READER 115	**45**	ROCKY FORD-FOWLER 69	**79**	PONCHA-SARGENT 115	**113**	
12	HYDE PARK-PUEBLO 115	**46**	LAJUNTAW-ROCKY FORD 69	**80**	PONCHA-CURRECANTI 230	**114**	
13	HYDE PARK-WEST STATION 115	**47**	LAJUNTAT-LAJUNTAW 69	**81**	STEMBEACH-WALSENBURG 115	**115**	
14	BACULITE MESA-WEST STATION 115 #1	**48**	LAJUNTAW-LAMAR 69	**82**	MIDWAYPS-WATERTON 345	**116**	
15	BACULITE MESA-WEST STATION 115 #2	**49**	BOONE 230 XFMR #1	**83**	DANIELPK-COMANCHE 345 #2	**117**	
16	BACULITE MESA-OVERTON 115	**50**	BOONE 230 XFMR #2	**84**	MIDWAYBR-RANCHO 115	**118**	
17	MIDWAYPS-NORTHRIDGE-OVERTON 115	**51**	WEST CANON 230 XFMR	**85**	MIDWAYBR-RD_NIXON 115	**119**	
18	MIDWAYPS-WEST STATION 115	**52**	CANON CITY 115 XFMR	**86**	MIDWAYBR-RD_NIXON 230	**120**	
19	DESERT COVE-WEST STATON 115	**53**	PORTLAND 115 XFMR #1	**87**	MIDWAYBR-MIDWAYPS 230	**121**	
20	MIDWAYBR-FTNVLY-DESERT COVE 115	**54**	PORTLAND 115 XFMR #2	**88**	MIDWAYBR-LINCOLN 230	**122**	
21	PORTLAND-WEST STATION 115 #1	**55**	AREQUA GULCH 115 XFMR #1	**89**	MIDWAYBR-WEST CANON 230	**123**	
22	PORTLAND-WEST STATION 115 #2	**56**	AREQUA GULCH 115 XFMR #2	**90**	WEST CANON-PONCHA 230	**124**	
23	WEST STATION-STEM BEACH 115	**57**	WEST STATION 115 XFMR #1	**91**	COMANCHE 230:115 XFMR #2	**125**	
24	BURNT MILL-WEST STATION 115	**58**	WEST STATION 115 XFMR #2	**92**	COMANCHE 345:230 XFMR #4	**126**	
25	BURNT MILL-GREENHORN 115	**59**	READER 115 XFMR #1	**93**	LAJUNTAT 115:69 XFMR #2	**127**	
26	GREENHORN-READER 115	**60**	READER 115 XFMR #2	**94**	LAMAR 230:115 XFMR #1	**128**	
27	COMANCHE-READER 115 #1	**61**	BOONE 115 XFMR	**95**	MIDWAYPS 230:115 XFMR	**129**	
28	COMANCHE-READER 115 #2	**62**	LAJUNTAW 115 XFMR #1	**96**	MIDWAYPS 345:230 XFMR	**130**	
29	READER-RATTLESNAKE 115	**63**	LAJUNTAW 115 XFMR #2	**97**	MIDWAYPS-FTNVLY GSU XFMR + FTNVLY GEN #3&4	**131**	
30	PORTLAND-SKALA 115	**64**	WEST CANON 115 CAPACITOR	**98**	WALSENBURG 230:115 XFMR #3	**132**	
31	CANON CITY-SKALA 115	**65**	PORTLAND 115 CAPACITOR	**99**	MIDWAYBR 230:115 XFMR	**133**	
32	CANON CITY-WEST SCANON 115	**66**	BOONE 115 REACTOR	**100**	RD_NIXON 230:115 XFMR	**134**	
33	WEST CANON-PONCHA 115	**67**	WALSENBURG-GLADSTONE 230	**101**	FULLER 230:115 XFMR	**135**	
34	AREQUA GULCH-WEST CANON 115	**68**	BOONE-LAJUNTAT 115	**102**	COMANCHE #1 GEN	**136**	

2021 Reliability Analysis Prior Outages

PO 345 SERIES		PO 230 SERIES		PO 115 SERIES		PO 69 SERIES		PO X SERIES		PO GEN SERIES	
LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION	LABEL	DESCRIPTION
POSYSINT	SYTEM INTACT	PO230-1	BOONE-MIDWAYPS	PO115-1	MIDWAYBR-RANCHO	PO69-1	ROCKY FORD-LAJUNTAW	POX-1	MIDWAYPS 345:230	POGEN-1	COMANCHE 3
PO345-1	DAN PARK-COMANCHE-1	PO230-2	BOONE-COMANCHE	PO115-2	MIDWAYBR-NIXON	PO69-2	BLENDE-ST. CHARLES***	POX-2	COMANCHE 345:230-T3	POGEN-2	BAC MESA GEN 1
PO345-2	COMANCHE-CALUMET-1	PO230-3	BOONE-LAMAR	PO115-3	FTN VALLEY-MIDWAYBR	PO69-3	WEST STATION-STONEMOOR	POX-3	LAMAR 230:115	POGEN-3	
PO345-3	COMANCHE-LAMAR-1	PO230-4	COMANCHE-MIDWAYPS-1	PO115-4	FTN VALLEY-DESERT COVE	PO69-4	READER-FREEMARY	POX-4	BOONE 230:115-1	POGEN-4	
PO345-4	LAMAR-ENGYCNTR-1	PO230-5	MIDWAYPS-FULLER	PO115-5	DESERT COVE-WEST STATION	PO69-5	PORTLAND-HIGHLAND	POX-5	WEST CANON 230:115	POGEN-5	
PO345-5		PO230-6	MIDWAYBR-NIXON	PO115-6	MIDWAYPS-WEST STATION	PO69-6		POX-6	COMANCHE 230:115-T1	POGEN-6	
PO345-6		PO230-7	MIDWAYBR-LINCOLN	PO115-7	MIDWAYPS-NORTHRIDGE	PO69-7		POX-7	WALSENBURG 230:115-1	POGEN-7	
PO345-7		PO230-8	MIDWAYBR-WEST CANON	PO115-8	OVERTON-NORTHRIDGE	PO69-8		POX-8	MIDWAYPS 230:115	POGEN-8	
PO345-8		PO230-9	WEST CANON-PONCHA	PO115-9	OVERTON-BACULITE MESA	PO69-9		POX-9	MIDWAYBR 230:115	POGEN-9	
PO345-9		PO230-10	COMANCHE-CALUMET	PO115-10	BACULITE MESA-WEST STATION-1	PO69-10		POX-10	LAJUNTAW 115:69-1***	POGEN-10	
PO345-10		PO230-11		PO115-11		PO69-11		POX-11	BOONE 115:69***	POGEN-11	
PO345-11		PO230-12		PO115-12	HYDE PARK-WEST STATION	PO69-12		POX-12	READER 115:69-T1	POGEN-12	
PO345-12		PO230-13		PO115-13	HYDE PARK-PUEBLO	PO69-13		POX-13	WEST STATION 115:69-1	POGEN-13	
PO345-13		PO230-14		PO115-14	PUEBLO-READER	PO69-14		POX-14	PORTLAND 115:69-T1	POGEN-14	
PO345-14		PO230-15		PO115-15	PORTLAND-WEST STATION	PO69-15		POX-15	PORTLAND 115:69-T1tied	POGEN-15	
PO345-15		PO230-16		PO115-16	PUEBLO TAP-STEM BEACH	PO69-16		POX-16	CANON CITY 115:69	POGEN-16	
PO345-16		PO230-17		PO115-17	PUEBLO TAP-WEST STATION	PO69-17		POX-17	CANON CITY 115:69tied	POGEN-17	
PO345-17		PO230-18		PO115-18	BURNT MILL-WEST STATION	PO69-18		POX-18	AREQUA GULCH 115:69	POGEN-18	
PO345-18		PO230-19		PO115-19	BURNT MILL-GREENHORN	PO69-19		POX-19	CALUMET 345:230 T2	POGEN-19	
PO345-19		PO230-20		PO115-20	GREENHORN-READER	PO69-20		POX-20	LAMAR 345:230 T2	POGEN-20	
PO345-20		PO230-21		PO115-21	READER-AIRPORT MEMORIAL	PO69-21		POX-21		POGEN-21	
PO345-21		PO230-22		PO115-22	AIRPORT PARK-AIRPORT MEMORIAL	PO69-22		POX-22		POGEN-22	
PO345-22		PO230-23		PO115-23	AIRPORT PARK-BACULITE MESA	PO69-23		POX-23		POGEN-23	
PO345-23		PO230-24		PO115-24	NYBERG-BACULITE MESA	PO69-24		POX-24		POGEN-24	
PO345-24		PO230-25		PO115-25	NYBERG-AIRPORT MEMORIAL	PO69-25		POX-25		POGEN-25	
PO345-25		PO230-26		PO115-26	NYBERG-DOT TAP	PO69-26		POX-26		POGEN-26	
PO345-26		PO230-27		PO115-27	BOONE-DOT TAP	PO69-27		POX-27		POGEN-27	
PO345-27		PO230-28		PO115-28	BOONE-LAJUNTAW***	PO69-28		POX-28		POGEN-28	
PO345-28		PO230-29		PO115-29	BOONE-LAJUNTAT	PO69-29		POX-29		POGEN-29	
PO345-29		PO230-30		PO115-30	LAJUNTAT-LAJUNTAW	PO69-30		POX-30		POGEN-30	
PO345-30		PO230-31		PO115-31	COMANCHE-READER-1	PO69-31		POX-31		POGEN-31	
PO345-31		PO230-32		PO115-32		PO69-32		POX-32		POGEN-32	
PO345-32		PO230-33		PO115-33	PORTLAND-SKALA	PO69-33		POX-33		POGEN-33	
PO345-33		PO230-34		PO115-34	CANON CITY-SKALA	PO69-34		POX-34		POGEN-34	
PO345-34		PO230-35		PO115-35	CANON CITY-WEST CANON	PO69-35		POX-35		POGEN-35	
PO345-35		PO230-36		PO115-36	AREQUA GULCH-WEST CANON	PO69-36		POX-36		POGEN-36	
PO345-36		PO230-37		PO115-37	SMELTER-WEST CANON	PO69-37		POX-37		POGEN-37	

*** INDICATES MUST RUN GENERATION WAS UTILIZED FOR THIS PRIOR OUTAGE

2021 STEADY STATE FORCED OUTAGES (SYSTEM INTACT ONLY)

1	BACULITE MESA GEN #1	35	LAJUNTAT-LAJUNTAW 115	69	WSTATN-PORTLAND115+WSTATN115 XFMR+2.7CAP	103	WEST STATION-MIDWAYBR 115	137	LAMAR-ENGYCNTR 345-2
2	BACULITE MESA GEN #2	36	AREQUA GULCH-NORTH CANONW 69	70	WSTATN-STEMBCH115+WSTATN115 XFMR+2.7CAP	104	SKALA 115 SUB	138	COMANCHE 230:115 XFMR #2
3	ROCKY FORD DIESELS	37	CANON CITY-EAST CANON 69	71	WSTATN-HYDE115+WSTATN115 XFMR+3.6CAP	105	WEST CANON-PONCHA+WCANON 115 CAP	139	COMANCHE 345:230 XFMR #4
4	BOONE-DOT TAP-NYBERG 115	38	PORTLAND-EAST CANON 69	72	WSTATN-MWPS115+WSTATN115 XFMR+3.6CAP	106	WSTATN-MWPS 115 + OVERTON-MWPS 115	140	LAJUNTAT 115:69 XFMR #2
5	BOONE-LAJUNTAW 115	39	CANON CITY-HIGHLAND 69	73	WSTATN-DCOVE115+WSTATN115 XFMR+3.6CAP	107	MWPS-OVERTON 115 + WSTATN-BELMONT 69	141	LAMAR 230:115 XFMR #1
6	NYBERG-BACULITE MESA 115	40	WEST STATION-SUNSET 69	74	WSTATN-BACULITEMSA115 #2+WSTATN115 XFMR+3.6CAP	108	BACULITE MESA-WSTATN 115 #1 & #2	142	MIDWAYPS 230:115 XFMR
7	NYBERG-APTMEMORIAL 115	41	PUEBLO-WEST STATION 69	75	WSTATN-BACULITEMSA115 #2+WSTATN115 XFMR+2.7CAP	109	READER-WEST STATION 69	143	MIDWAYPS 345:230 XFMR
8	APTINDUSTRIAL PARK-BACULITE MESA 115	42	WEST STATION-BELMONT 69	76	READER-APTMEMORIAL 115+READER 115 XFMR #1	110	WALSENBURG-GLADSTONE 230	144	MIDWAYPS-FTNVLY GSU XFMR + FTNVLY GEN #3&4
9	APTINDUSTRIAL PARK-APTMEMORIAL 115	43	READER-BELMONT 69	77	READER-COMANCHE 115 #1 + READER 115 XFMR #2	111	BOONE-LAJUNTAT 115	145	WALSENBURG 230:115 XFMR #3
10	READER-APTMEMORIAL 115	44	BOONE-ROCKY FORD 69	78	READER-COMANCHE 115 #2 + READER 115 XFMR #1	112	BOONE-COMANCHE 230 #1	146	MIDWAYBR 230:115 XFMR
11	PUEBLO-READER 115	45	ROCKY FORD-FOWLER 69	79	READER-GREENHORN 115 + READER 115 XFMR #1	113	BOONE-LAMAR 230 + RAS	147	RD_NIXON 230:115 XFMR
12	HYDE PARK-PUEBLO 115	46	LAJUNTAW-ROCKY FORD 69	80	READER-PUEBLO 115 + READER 115 XFMR #2	114	BOONE-MIDWAYPS 230	148	FULLER 230:115 XFMR
13	HYDE PARK-WEST STATION 115	47	LAJUNTAT-LAJUNTAW 69	81	READER-RATTLESNAKE 115 + READER 115 XFMR #1	115	CF&IFURN-COMANCHE 230	149	CALUMET 345:230 T2 XFMR
14	BACULITE MESA-WEST STATION 115 #1	48	LAJUNTAW-LAMAR 69	82	CCY 115 XFMR+CCY-E.CANON69+CCY-SCANON69	116	COMANCHE-MIDWAYPS 230 #2	150	LAMAR 345:230 T2 XFMR
15	BACULITE MESA-WEST STATION 115 #2	49	BOONE 230 XFMR #1	83	NYBERG-BACULITE MESA 115+ NYBERG-APTMEMORIAL 115	117	COMANCHE-CALUMET 230 #1	151	COMANCHE #1 GEN
16	BACULITE MESA-OVERTON 115	50	BOONE 230 XFMR #2	84	READER-APTMEMORIAL 115+READER-GREENHORN 115	118	LAJUNTAT-WILLOWCREEK 115	152	COMANCHE #2 GEN
17	MIDWAYPS-NORTHRIDGE-OVERTON 115	51	WEST CANON 230 XFMR	85	READER-COMANCHE 115 #1 & #2	119	LAMAR-VILAS 115	153	COMANCHE #3 GEN
18	MIDWAYPS-WEST STATION 115	52	CANON CITY 115 XFMR	86	READER-RATTLESNAKE 115+READER-PUEBLO 115	120	LAMAR-WILLOWCREEK 115	154	RD_NIXON #1 GEN
19	DESERT COVE-WEST STATON 115	53	PORTLAND 115 XFMR #1	87	BURNT MILL 115 SUB	121	MIDWAYPS-FULLER 230	155	PUEBLO 115 SUB
20	MIDWAYBR-FTNVLY-DESERT COVE 115	54	PORTLAND 115 XFMR #2	88	GREENHORN 115 SUB	122	PONCHA-SARGENT 115	156	BOONE 115 SUB
21	PORTLAND-WEST STATION 115 #1	55	AREQUA GULCH 115 XFMR #1	89	APTINDUSTRIAL PARK 115 SUB	123	SANLUISVALLEY-PONCHA 230	157	BACMSA-WST115 #1&#2 + MWPS-OVT115 + WSTATN-BMT69
22	PORTLAND-WEST STATION 115 #2	56	AREQUA GULCH 115 XFMR #2	90	APTMEMORIAL 115 SUB	124	PONCHA-CURRECANTI 230	158	PORTLAND-WSTATN 115 #1 & #2
23	WEST STATION-STEM BEACH 115	57	WEST STATION 115 XFMR #1	91	HYDE PARK 115 SUB	125	STEMBEACH-WALSENBURG 115	159	PORTLAND 115 SUB
24	BURNT MILL-WEST STATION 115	58	WEST STATION 115 XFMR #2	92	OVERTON 115 SUB	126	MIDWAYPS-WATERTON 345	160	BACULITE MESA 115 SUB
25	BURNT MILL-GREENHORN 115	59	READER 115 XFMR #1	93	BACULITE MESA-NYBERG 115+BACULITE MESA GEN #1	127	DANIELPK-COMANCHE 345 #2	161	NYBERG 115 SUB
26	GREENHORN-READER 115	60	READER 115 XFMR #2	94	BACULITE MESA-APTINDUSTRIAL115+BACULITE MESA GEN #2	128	MIDWAYBR-RANCHO 115	162	READER 115 SUB
27	COMANCHE-READER 115 #1	61	BOONE 115 XFMR	95	BACULITE MESA-W.STATION 115 #2 + BACULITE MESA GEN #3	129	MIDWAYBR-RD_NIXON 115	163	CANON CITY 115 SUB
28	COMANCHE-READER 115 #2	62	LAJUNTAW 115 XFMR #1	96	BACULITE MESA-W.STATION 115 #1 + BACULITE MESA GEN #4	130	MIDWAYBR-RD_NIXON 230	164	WEST CANON 115 SUB
29	READER-RATTLESNAKE 115	63	LAJUNTAW 115 XFMR #2	97	WSTATN-BURNT MILL 115+WSTATN-HYDEPARK 115	131	MIDWAYBR-MIDWAYPS 230	165	WEST STATION 115 SUB
30	PORTLAND-SKALA 115	64	WEST CANON 115 CAPACITOR	98	WSTATN-PORTLAND 115 #1 + WSTATN-MIDWAYPS 115	132	MIDWAYBR-LINCOLN 230	166	
31	CANON CITY-SKALA 115	65	PORTLAND 115 CAPACITOR	99	WSTATN-STEMBEACH 115 + WSTATN-DESERT COVE 115	133	MIDWAYBR-WEST CANON 230	167	
32	CANON CITY-WEST SCANON 115	66	BOONE 115 REACTOR	100	PORTLAND-WSTATN 115 #1 + PORTLAND-SKALA 115	134	WEST CANON-PONCHA 230	168	
33	WEST CANON-PONCHA 115	67	BOONE-LAJUNTAW 115 + LAJUNTAW 115 XFMR #2	101	PORTLAND 115 XFMRS #1 & #2	135	COMANCHE-CALUMET 345-2	169	
34	AREQUA GULCH-WEST CANON 115	68	WSTATN-BURNTMILL115+WSTATN115 XFMR #1+2.7CAP	102	BACULITE MESA-MIDWAYPS 115 + BACULITE MESA GEN #5	136	COMANCHE-LAMAR 345-2	170	

2021 STEADY STATE FORCED OUTAGES (WITH PRIOR OUTAGES ONLY)

1	BACULITE MESA GEN #1	35	LAJUNTAT-LAJUNTAW 115	69	BOONE-COMANCHE 230 #1	103	MIDWAYBR 230:115 XFMR
2	BACULITE MESA GEN #2	36	AREQUA GULCH-NORTH CANONW 69	70	BOONE-LAMAR 230 + RAS	104	RD_NIXON 230:115 XFMR
3	ROCKY FORD DIESELS	37	CANON CITY-EAST CANON 69	71	BOONE-MIDWAYPS 230	105	FULLER 230:115 XFMR
4	BOONE-DOT TAP-NYBERG 115	38	PORTLAND-EAST CANON 69	72	CF&IFURN-COMANCHE 230	106	CALUMET 345:230 T2 XFMR
5	BOONE-LAJUNTAW 115	39	CANON CITY-HIGHLAND 69	73	COMANCHE-MIDWAYPS 230 #2	107	LAMAR 345:230 T2 XFMR
6	NYBERG-BACULITE MESA 115	40	WEST STATION-SUNSET 69	74	COMANCHE-CALUMET 230 #1	108	COMANCHE #1 GEN
7	NYBERG-APTMEMORIAL 115	41	PUEBLO-WEST STATION 69	75	LAJUNTAT-WILLOWCREEK 115	109	COMANCHE #2 GEN
8	APTINDUSTRIAL PARK-BACULITE MESA 115	42	WEST STATION-BELMONT 69	76	LAMAR-VILAS 115	110	COMANCHE #3 GEN
9	APTINDUSTRIAL PARK-APTMEMORIAL 115	43	READER-BELMONT 69	77	LAMAR-WILLOWCREEK 115	111	RD_NIXON #1 GEN
10	READER-APTMEMORIAL 115	44	BOONE-ROCKY FORD 69	78	MIDWAYPS-FULLER 230	112	
11	PUEBLO-READER 115	45	ROCKY FORD-FOWLER 69	79	PONCHA-SARGENT 115	113	
12	HYDE PARK-PUEBLO 115	46	LAJUNTAW-ROCKY FORD 69	80	SANLUISVALLEY-PONCHA 230	114	
13	HYDE PARK-WEST STATION 115	47	LAJUNTAT-LAJUNTAW 69	81	PONCHA-CURRECANTI 230	115	
14	BACULITE MESA-WEST STATION 115 #1	48	LAJUNTAW-LAMAR 69	82	STEMBEACH-WALSENBURG 115	116	
15	BACULITE MESA-WEST STATION 115 #2	49	BOONE 230 XFMR #1	83	MIDWAYPS-WATERTON 345	117	
16	BACULITE MESA-OVERTON 115	50	BOONE 230 XFMR #2	84	DANIELPK-COMANCHE 345 #2	118	
17	MIDWAYPS-NORTHRIDGE-OVERTON 115	51	WEST CANON 230 XFMR	85	MIDWAYBR-RANCHO 115	119	
18	MIDWAYPS-WEST STATION 115	52	CANON CITY 115 XFMR	86	MIDWAYBR-RD_NIXON 115	120	
19	DESERT COVE-WEST STATON 115	53	PORTLAND 115 XFMR #1	87	MIDWAYBR-RD_NIXON 230	121	
20	MIDWAYBR-FTNVLY-DESERT COVE 115	54	PORTLAND 115 XFMR #2	88	MIDWAYBR-MIDWAYPS 230	122	
21	PORTLAND-WEST STATION 115 #1	55	AREQUA GULCH 115 XFMR #1	89	MIDWAYBR-LINCOLN 230	123	
22	PORTLAND-WEST STATION 115 #2	56	AREQUA GULCH 115 XFMR #2	90	MIDWAYBR-WEST CANON 230	124	
23	WEST STATION-STEM BEACH 115	57	WEST STATION 115 XFMR #1	91	WEST CANON-PONCHA 230	125	
24	BURNT MILL-WEST STATION 115	58	WEST STATION 115 XFMR #2	92	COMANCHE-CALUMET 345-2	126	
25	BURNT MILL-GREENHORN 115	59	READER 115 XFMR #1	93	COMANCHE-LAMAR 345-2	127	
26	GREENHORN-READER 115	60	READER 115 XFMR #2	94	LAMAR-ENGYCNTR 345-2	128	
27	COMANCHE-READER 115 #1	61	BOONE 115 XFMR	95	COMANCHE 230:115 XFMR #2	129	
28	COMANCHE-READER 115 #2	62	LAJUNTAW 115 XFMR #1	96	COMANCHE 345:230 XFMR #4	130	
29	READER-RATTLESNAKE 115	63	LAJUNTAW 115 XFMR #2	97	LAJUNTAT 115:69 XFMR #2	131	
30	PORTLAND-SKALA 115	64	WEST CANON 115 CAPACITOR	98	LAMAR 230:115 XFMR #1	132	
31	CANON CITY-SKALA 115	65	PORTLAND 115 CAPACITOR	99	MIDWAYPS 230:115 XFMR	133	
32	CANON CITY-WEST SCANON 115	66	BOONE 115 REACTOR	100	MIDWAYPS 345:230 XFMR	134	
33	WEST CANON-PONCHA 115	67	WALSENBURG-GLADSTONE 230	101	MIDWAYPS-FTNVLY GSU XFMR + FTNVLY GEN #3&4	135	
34	AREQUA GULCH-WEST CANON 115	68	BOONE-LAJUNTAT 115	102	WALSENBURG 230:115 XFMR #3	136	

Appendix B

Load and Resource Assumptions

Table B1: Load and Resource Assumptions

SCENARIO	CANON_55 70083	CANON_59 70084	E_CANON 70160	PP_MINE 70306	PUB_DSLS 70334	PUEBPLNT G1 70337	PUEBPLNT G2 70337	R.F.DSLS 70344	APT_DSLS 71001	BAC_MSA GEN1 71001	BAC_MSA GEN2 71002	BAC_MSA GEN3 71003	BAC_MSA GEN3 71003	BAC_MSA GEN3 71003	BAC_MSA GEN4 71004	BAC_MSA GEN4 71004	BAC_MSA GEN4 71004	BAC_MSA GEN5 71005	Total Generation (MW)	Total BHCE Load + Losses (MW)
2015 Heavy Summer Load	0	0	0	0	0	0	0	0	0	95	95	40	40	19	40	40	19	95	483	483
2015 Light Autumn Load	0	0	0	0	0	0	0	0	0	90	90	40	40	0	33	30	0	0	323	323
2021 Heavy Summer load**	0	0	0	0	0	20	9	0	8	90	90	40	40	24	40	40	24	90	515	515
Note: Certain prior outages were evaluated with the Rocky Ford Diesels online to address reliability concerns																				
** The Pueblo G1 and G2 units were modeled online in the 2021HS scenario to meet anticipated demand requirements until the 2011 Electric Resource Plan becomes available.																				