Black Hills Corporation
Trevor J. Rombough
Senior Engineer, Transmission

7001 Mt. Rushmore Rd. (57702)
PO Box 1400
Rapid City, SD 57709-1400
P: 605.800.1799

April 30, 2024

Rebecca White
Director
Public Utilities Commission of the State of Colorado
1560 Broadway, Suite 250
Denver, Colorado 80202

Re: Proceeding No. 24M-0005E, 2023 Filing pursuant to Rule 3206 (d), 4 *Code of Colorado Regulations*, 723-3

Your Honor:

Pursuant to subpart (d) of Rule 3206, 4 *Code of Colorado Regulations*, 723-3, Black Hills Colorado Electric, LLC d/b/a Black Hills Energy, herewith files the required information for planned transmission facilities. The information covers the current calendar year (2024) as well as the next three calendar years (2025-2027).

One new transmission project is included in this report. The Company requests that the Commission find this project in the ordinary course of business and no CPCN is required. All other projects identified in the report have already been approved by the Commission in prior Rule 3206 Decisions. The Company has provided a status update on these projects.

Appendix C is included in this report as informational. Appendix C provides a project description of transmission investments which will be submitted for cost recovery in the Company's next annual Transmission Cost Adjustment ("TCA") filing.

If there are any questions, please contact me.

Sincerely,

Trevor Rombough

Trevor J. Rombough
Senior Engineer, Transmission Planning
trevor.j.rombough@blackhillscorp.com

Colorado PUC E-Filings System

Rule 3206 Transmission Projects Report

Black Hills Colorado Electric, LLC d/b/a Black Hills Energy

Proceeding No. 24M-0005E

April 30, 2024

Black Hills Energy Ready

Proceeding No. 24M-0005E
Black Hills Colorado Electric, LLC d/b/a Black Hills Energy (BHCE)
2024 Rule 3206 Report

Table of Contents

[1] Filed pursuant to Decision C21-0814 in Proceeding No. 21AL-0516E.

Proceeding No. 24M-0005E
Black Hills Colorado Electric, LLC d/b/a Black Hills Energy (BHCE)
2024 Rule 3206 Report

Background. No later than April 30 of each year, each electric utility shall file with the Colorado Public Utilities Commission (the "Commission") its proposed new construction or extension of transmission facilities for the next three calendar years, commencing with the year following the filing. The purpose of this filing is to advise the Commission of planned transmission system development and inform their decision as to whether those projects require a Certificate of Public Convenience and Necessity ("CPCN") or are considered in the ordinary course of business. This report covers 2024 and the three-year planning period 2025 through 2027.

Transmission projects. The transmission and/or substation projects 1 through 8 below have been included in previous Rule 3206 filings. An update to the status of these facilities is being provided pursuant to Rule 3206(d)(I)(G). Where applicable, references are included to past Commission decisions on the previous Rule 3206 filings, including determinations pursuant to Colo. Rev. Stat. § 40-5-101 that the projects were necessary in the ordinary course of Black Hills' business, and thus, no CPCNs for the projects were required.
Commission Decision C21-0814 in Proceeding No. 21AL-0516E (the "TCA 2021 filing"), at Paragraph 12, states "In order to clarify future reporting obligations for TCA projects, a utility should report for each included project in either: (a) the specific Commission decision granting the CPCN; (b) the specific Commission decision that no CPCN is required; or (c) the specific source of authority, such as a Commission rule that the project's scope does not require a CPCN or its inclusion in a Rule 3206, 4 CCR 723-3 Annual Filing with an approval order by the Commission." [emphasis added]

Consistent with Decision C21-0814, the Company therefore requests that the Commission find the TCA projects in this Rule 3206 filing (Appendix C) are in the ordinary course of business and no CPCN is required.

Energy storage systems. Consideration of energy storage systems among project alternatives is a requirement within Rule 3206. This rule requirement was established by the Commission on November 28, 2018 in Decision C18-1124; the rule requirement became effective on March 2, 2019. The rule requirement is codified at Rule 3206(d)(I)(D). This Rule 3206 filing addresses the consideration of any new alternatives that were not previously examined and addressed.

Proceeding No. 24M-0005E
Black Hills Colorado Electric, LLC d/b/a Black Hills Energy (BHCE)
2024 Rule 3206 Report

Projects Placed into Service:

These projects have been completed and placed into service. Therefore, these will be removed from future Rule 3206 filings.

1. Hogback 115/69 kV Substation
   (Decision No. C17-0539-E; *see* Project Sheets, Page A-8)
   Previously named "Cañon City Area 115/69 kV Substation."
   The project had a cost of $3.4 million and was placed in-service date on November 18, 2022.
   Error! Bookmark not defined.
2. North Penrose 115 kV Distribution Substation
   (Decision No. C20-0477; *see* Project Sheets, Page A-16)
   The project had a cost of $3.6 million and was placed in-service date on February 22, 2023.

3. West Station–Hogback 115 kV Transmission Project
   (Decision No. C17-0539-E; *see* Project Sheets, Page A-7)
   Previously named "West Station-West Cañon 115 kV Transmission Project." M
   The project cost $52.8 million, and was placed in-service date of August 22, 2023.

4. Pueblo West 115 kV Distribution Substation
   (Decision No. C20-0477; *see* Project Sheets, Page A-13)
   The project cost $4.5 million, and was placed in-service date of February 29, 2024.

Projects with Updated Scope or Status, Filed Pursuant to Rule 3206(d)(I)(G):

These projects have had a change in the project scope or status since the previous Rule 3206 filing.

5. Rodrigues 115 kV Distribution Substation
   This planned project is being rescoped. A-13
6. Manzanola – Ordway 69/115 kV Upgrades
   This project has been cancelled because the projected load growth has decreased.

7. Fowler – South Fowler 69/115 kV Conversion
   This project has been cancelled because the projected load growth has decreased.

8. West Station –Canon West 115 kV line Rebuild
   (Decision No. C23-0810; S*ee* Project Sheets, Page A-38)
   This planned project has an estimated cost of $49.2 million and a proposed in-service date of Q2 2026

New Projects for Commission Ruling:

These are new projects that the company is requesting the commission find in the ordinary course of business.

9. Pueblo Plant 115kV Substation Rebuild
(See Projects Sheets, Page A-21)

Appendix A

Project Sheets

West Station-Hogback 115 kV Transmission Project

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	New 115 kV line from West Station to a new load service substation in Cañon City (Hogback).
Voltage Class:	115 kV
Facility Rating:	221 MVA
Point of Origin/Location:	West Station 115 kV
Point of Termination:	New Hogback 115/69 kV Substation
Intermediate Points:	Pueblo West Sub (new), N. Penrose Sub (new)
Length of Line (in Miles):	42
Type of Project:	Transmission Line and Substation
Development Status:	In-Service
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Increased reliability
Estimated Cost (in 2023 Dollars):	$52.8 Million
Schedule:	
Construction Date:	2020
In-Service Date:	August 22, 2023
Regulatory Info:	Approved – Colorado PUC: Decision No. C17-0539-E.
Regulatory Date:	July 10, 2017
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

Hogback 115/69 kV Substation

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	New 115/69 kV substation west of Cañon City on the West Station – Hogback 115 kV line. Formerly known as "Cañon City Area 115 kV/69 kV Substation" in 2018 Rule 3206 Report.
Voltage Class:	115 kV
Facility Rating:	80 MVA
Point of Origin/Location:	Hogback 115/69 kV substation
Point of Termination:	
Intermediate Points:	
Length of Line (in Miles):	N/A
Type of Project:	Substation
Development Status:	In-Service
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Increased reliability and load growth capacity.
Estimated Cost (in 2023 Dollars):	$3.4 Million
Schedule:	
Construction Date:	2021
In-Service Date:	November 18, 2022
Regulatory Info:	Approved – Colorado PUC: Decision No. C17-0539-E.
Regulatory Date:	July 10, 2017
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

West Station-Hogback 115 kV Line and New Hogback Substation

Description. Given their interrelatedness, we describe these two previously reviewed projects together. The proposed West Station – Hogback 115 kV line (formerly referred to as the West Station-West Cañon 115 kV line) would provide additional import capacity along with increased reliability into the Cañon City 115 kV system. The new line will also provide a second connection into the Penrose distribution system, eliminating the impacts of a single outage loss of load. Additionally, the new line will accommodate a new Pueblo West distribution substation to relieve existing distribution system constraints and facilitate developing load growth in that community. Past TPL-001-4 reliability[2] and interconnection studies along with current summer peak operational studies have shown overloads on the Portland-Skala, Skala-Cañon City, and Portland-West Station #1 and #2 115 kV lines. The West Cañon 230/69 kV transformer, which supports the Cañon City network from the west end, is a long lead time piece of equipment that adds additional overload scenarios to the above mentioned 115 kV lines if the transformer were to fail. A corrective action plan has been developed per the TPL-001-4 standard to provide a solution. A limited number of options to alleviate the 115 kV line overloads were available for consideration due to the geographic challenges and transmission system configuration. Due to the nature of the system, rebuilding the existing 115 kV lines feeding into the Cañon City network would be challenging due to operational constraints as they are the only source into Cañon City. The best overall option was identified as a new 115 kV line that would feed into the Cañon City network from the 115 kV West Station substation. The new line will provide additional capacity into the load center and eliminate the need to sectionalize the existing 115 kV system to prevent post-contingency overloads. The new line will also provide the ability to reliably rebuild the constrained 115 kV line segments between Portland and Cañon City at a future time. A new 115/69 kV substation west of Cañon City was added to the project since it would decrease the loading issues on the existing Portland & Cañon City 115/69 kV transformers as identified in past reliability studies and provide increased operational flexibility. This substation is labeled as Hogback in the project map below. A summary of project components is as follows:

- The West Station - Desert Cove 115 kV rebuild project was previously completed using double circuit structures to accommodate the new West Station to West Cañon 115 kV circuit up to Desert Cove. The new transmission line will continue on from Desert Cove to a new 115/69 kV substation west of Cañon City (Hogback). This project will be constructed within existing right-of-way where possible, and new right-of-way will be obtained in a manner to minimize disruption.
- Construct a new 115/69 kV Hogback substation located to the west of the Cañon City area to support the Cañon City 69 kV network. Upgrades to the existing 69 kV facilities may be required to integrate the new substation into the 69 kV network.

[2] Including both BHCT TCPC & CCPG studies

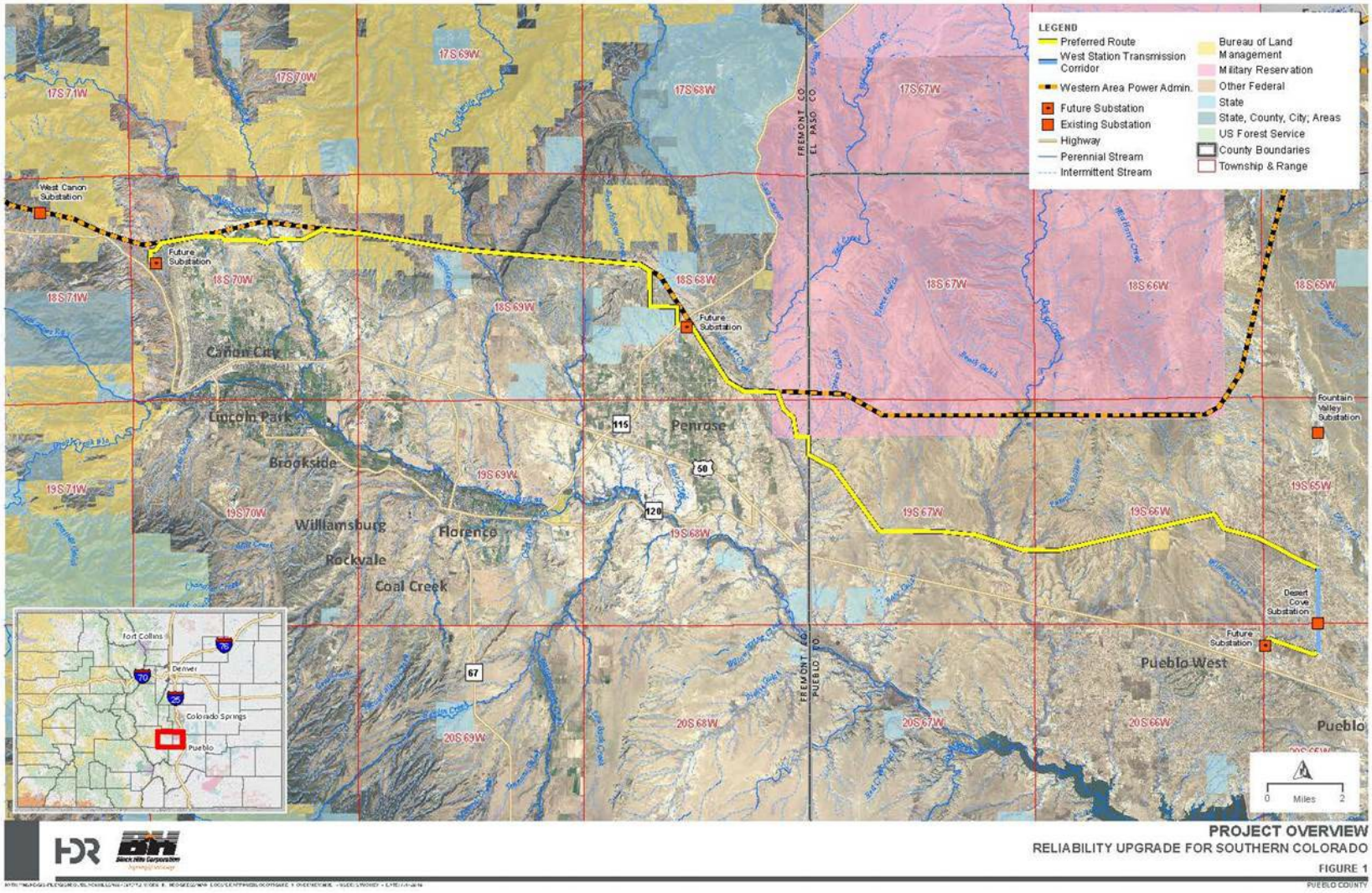
- Obtain new right-of-way westward from the Desert Cove transmission corridor to the new Hogback substation for 115 kV single circuit H-Frame structures. The Hogback substation will intersect the Cañon City Plant-West Cañon 115 kV line in the northwest corner of Cañon City which will complete the circuit to West Cañon.
- Since the West Cañon-Arequa Gulch 115 kV line is geographically nearby the proposed site of the new Hogback substation, bisecting it with the new substation would add additional reliability. This option will not be implemented initially, but the new substation will be designed to accommodate the additional terminals later to balance initial cost with future flexibility.
- The routing of the new transmission line will readily accommodate a proposed distribution substation in the Pueblo West community. The accommodation of the new Pueblo West substation will increase reliability and load serving capability in the Pueblo West area of the Black Hills system without materially impacting project costs or the planned benefits to the Cañon City area. Discussions with impacted customers during the permitting process resulted in changes to the line route to maintain project objectives while preserving customers' viewshed.
- The routing of the new transmission line will accommodate a proposed distribution substation in the Penrose community. Penrose is currently served via single radial 69 kV line. The new North Penrose substation will increase reliability and load serving capability in the Penrose area of the Black Hills system without materially impacting project costs or the planned benefits to the Cañon City area.
- The facility rating of the West Station – North Penrose-Hogback 115 kV circuit will be at least 221 MVA Summer and 274 MVA Winter (795 ACSR Drake @ 100°C).
- The engineering and design work associated with the substation portion of the project will be performed to ensure that the completed project will meet the established noise and magnetic field requirements as stated in Rule 3206 (f) and Rule 3206 (e), respectively. Namely, the noise level of the substation will not exceed 50 db(A) at a distance of 25 feet beyond the property line, and the magnetic field level at the property line, one meter above the ground will not exceed 150 MilliGauss.
- The engineering and design work associated with the transmission line portion of the project was performed and also meets the established noise and magnetic field requirements.
- The 1041 permit approval in Pueblo County and the Walker Easement both required monopole structures. The design will have to be steel poles to be monopole; earlier, less expensive wood H-frames were estimated.

Black Hills initially included these two projects in the 2015 Rule 3206 filing for informational purposes only. Transmission planning analysis has subsequently refined the project scope. Potential joint participation was under consideration in the San Luis Valley Subcommittee within the Colorado Coordinated Planning Group (CCPG). There was absence of interest in joint participation by other entities as well as any foreseeable long-term drivers to justify construction at a higher voltage. The best-cost solution was determined to have the project designed, constructed, and operated as a single 115 kV circuit. The additional right-of-way that will be acquired will be 125 feet wide to accommodate an

additional circuit or an increase in operating voltage if needed. The total overall cost is estimated at $33.3 million, including the transmission line and the new Hogback substation.

Consideration of project alternatives including energy storage systems (Rule 3206(d)(I)(D)). Not applicable. The two projects were designed and planned prior to the rule requirement effective date of March 2, 2019.

Decision. In Decision No. C17-0539-E, the Commission determined that the two projects were in the ordinary course of business and that a CPCN was not necessary.


LEGEND
Preferred Route
West Station Transmission Corridor
Western Area Power Admin.
Future Substation
Existing Substation
Highway
Perennial Stream
Intermittent Stream
Bureau of Land Management
Military Reservation
Other Federal
State
State, County, City; Areas
US Forest Service
County Boundaries
Township & Range
West Canon Substation
Future Substation
Canon City
Lincoln Park
Brookside
Williamsburg
Florence
Rockvale
Coal Creek
Penrose
Fountain Valley Substation
Desert Cove Substation
Pueblo West
Pueblo
Fort Collins
Denver
Colorado Springs
Pueblo
0 Miles 2
PROJECT OVERVIEW
RELIABILITY UPGRADE FOR SOUTHERN COLORADO
FIGURE 1
PUEBLO COUNTY

Pueblo West 115 kV Distribution Substation

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	New 115 kV distribution substation in Pueblo West; will intersect the West Station-Hogback 115 kV line.
Voltage Class:	115 kV
Facility Rating:	50 MVA
Point of Origin/Location:	Pueblo West, CO
Point of Termination:	
Intermediate Points:	
Length of Line (in Miles):	0
Type of Project:	Distribution
Development Status:	In Service
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Load service
Estimated Cost (in 2023 Dollars):	$4.5 Million
Schedule:	
Construction Date:	2022
In-Service Date:	February 29, 2024
Regulatory Info:	Approved - Colorado PUC: Decision No. C20-0477
Regulatory Date:	
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

Pueblo West 115 kV Distribution Substation

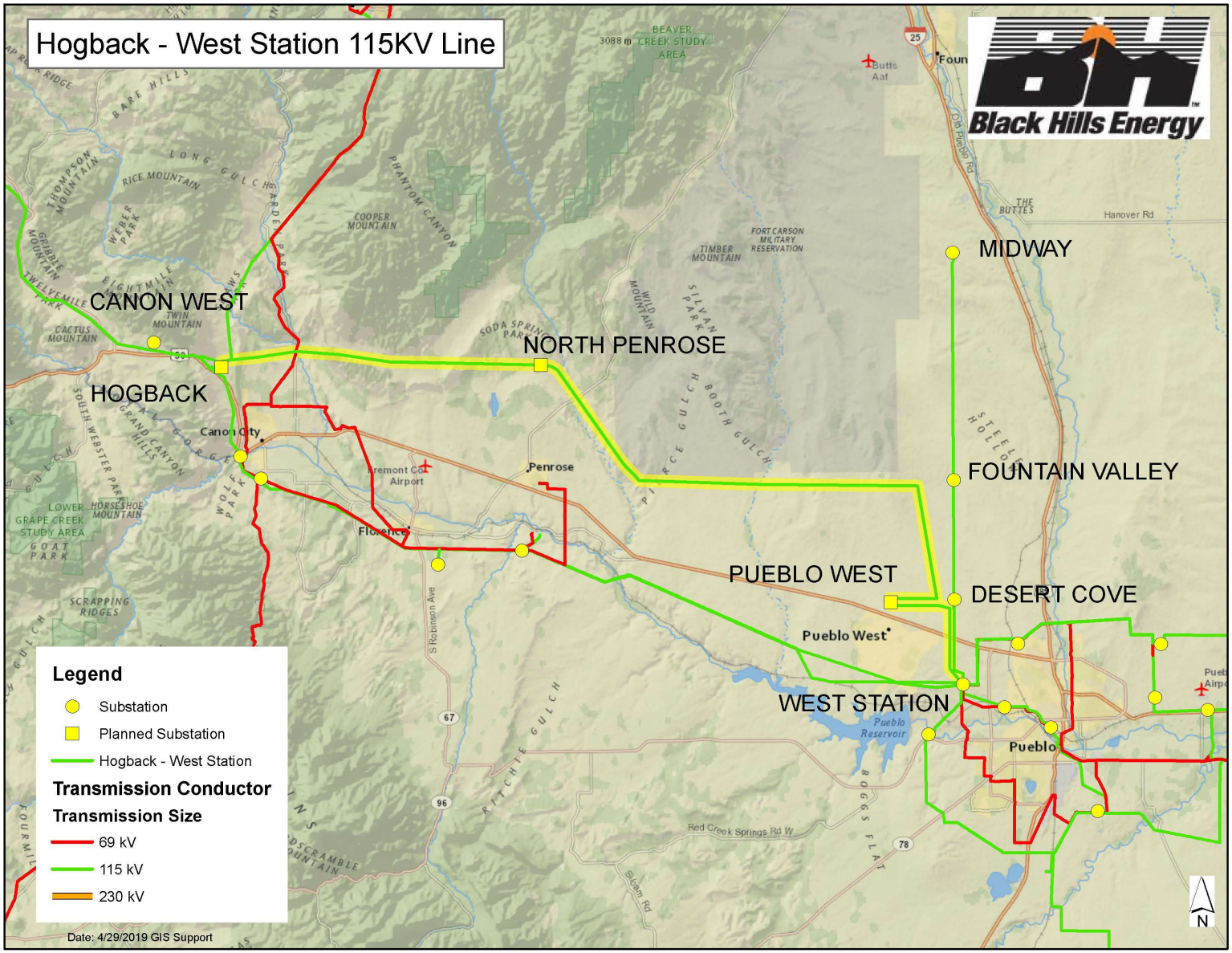
Description. This project consists of constructing a new distribution substation by intersecting BHCE's planned West Station-Hogback 115 kV transmission line. The substation will be built to ultimately accommodate two 115/13.2kV, 50 MVA transformers, but only one bank will be installed initially. This project is required to serve new industrial agriculture load as well as contingency back-up for existing distribution infrastructure. The substation location is north of Highway 50 on the western edge of Pueblo West, CO.

The engineering and design work associated with the substation portion of the project will be performed to ensure that the completed project will meet the established noise and magnetic field requirements as stated in Rule 3206 (f) and Rule 3206 (e), respectively. Namely, the noise level of the substation will not exceed 50 db(A) at a distance of 25 feet beyond the property line, and the magnetic field level at the property line, one meter above the ground, will not exceed 150 MilliGauss.

Consideration of project alternatives including energy storage systems (Rule 3206(d)(I)(D)). Not applicable. The project was designed and planned prior to the rule requirement effective date of March 2, 2019.

Decision requested.

In Decision No. C20-0477, the Commission determined that the project was in the ordinary course of business and that a CPCN was not necessary.


Hogback - West Station 115KV Line
CANON WEST
HOGBACK
NORTH PENROSE
MIDWAY
FOUNTAIN VALLEY
PUEBLO WEST
DESERT COVE
WEST STATION
Canon City
Penrose
Florence
Pueblo West
Pueblo
Legend
Substation
Planned Substation
Hogback - West Station
Transmission Conductor
Transmission Size
69 kV
115 kV
230 kV
Date: 4/29/2019 GIS Support
Black Hills Energy
N

North Penrose 115 kV Distribution Substation

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	New 115 kV distribution substation near Penrose, CO; will intersect the West Station-Hogback 115 kV line.
Voltage Class:	115 kV
Facility Rating:	50 MVA
Point of Origin/Location:	Penrose, CO
Point of Termination:	
Intermediate Points:	
Length of Line (in Miles):	
Type of Project:	Distribution
Development Status:	In-Service
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Load service
Estimated Cost (in 2023 Dollars):	$3.6 Million
Schedule:	
Construction Date:	2021
In-Service Date:	February 22, 2023
Regulatory Info:	Approved - Colorado PUC: Decision No. C20-0477
Regulatory Date:	2020
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

North Penrose Area 115 kV Distribution Substation

Description. This project consists of constructing a new distribution substation by intersecting BHCE's planned West Station-Hogback 115 kV transmission line on the north side of Penrose, CO. The substation will be built to ultimately accommodate two 115/13.2kV, 50 MVA transformers, but only one bank will be installed initially. The community of Penrose is currently served via radial 69 kV line with limited contingency backup alternatives. This proposed distribution substation would provide an additional source to the community of Penrose as well as offload the 115/69 kV transformers at Portland, deferring the previously identified capacity constraint on the existing 42 MVA Portland #1 transformer.

The engineering and design work associated with the substation portion of the project will be performed to ensure that the completed project will meet the established noise and magnetic field requirements as stated in Rule 3206 (f) and Rule 3206 (e), respectively. Namely, the noise level of the substation will not exceed 50 db(A) at a distance of 25 feet beyond the property line, and the magnetic field level at the property line, one meter above the ground will not exceed 150 MilliGauss.

The completion date of the substation coincides with the completion of the West Station-Hogback 115 kV line in January 2022.

Consideration of project alternatives including energy storage systems (Rule 3206(d)(I)(D)). Not applicable. The project was designed and planned prior to the rule requirement effective date of March 2, 2019. Additional note: Providing back-up energy to radial loads under contingency conditions is a benefit provided by energy storage technology; however, the magnitude of the Penrose substation demand exceeds what could be cost-effectively served with an energy storage project.

Decision requested. In Decision No. C20-0477, the Commission determined that the project was in the ordinary course of business and that a CPCN was not necessary.

West Station – Canon West 115 kV Rebuild

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	Rebuild the 115 kV lines from West Station to Canon West to 221 MVA
Voltage Class:	115 kV
Facility Rating:	221MVA
Point of Origin/Location:	West Station, CO
Point of Termination:	Canon West, CO
Intermediate Points:	Portland Substation, Skala Substation, Canon Plant Substation
Length of Line (in Miles):	41
Type of Project:	Transmission & Distribution
Development Status:	Planned
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Load service & Reliability
Estimated Cost (in 2023 Dollars):	$25.8 Million
Schedule:	
Construction Date:	2023
Planned Completion/In-Service Date:	2024
Regulatory Info:	
Regulatory Date:	
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

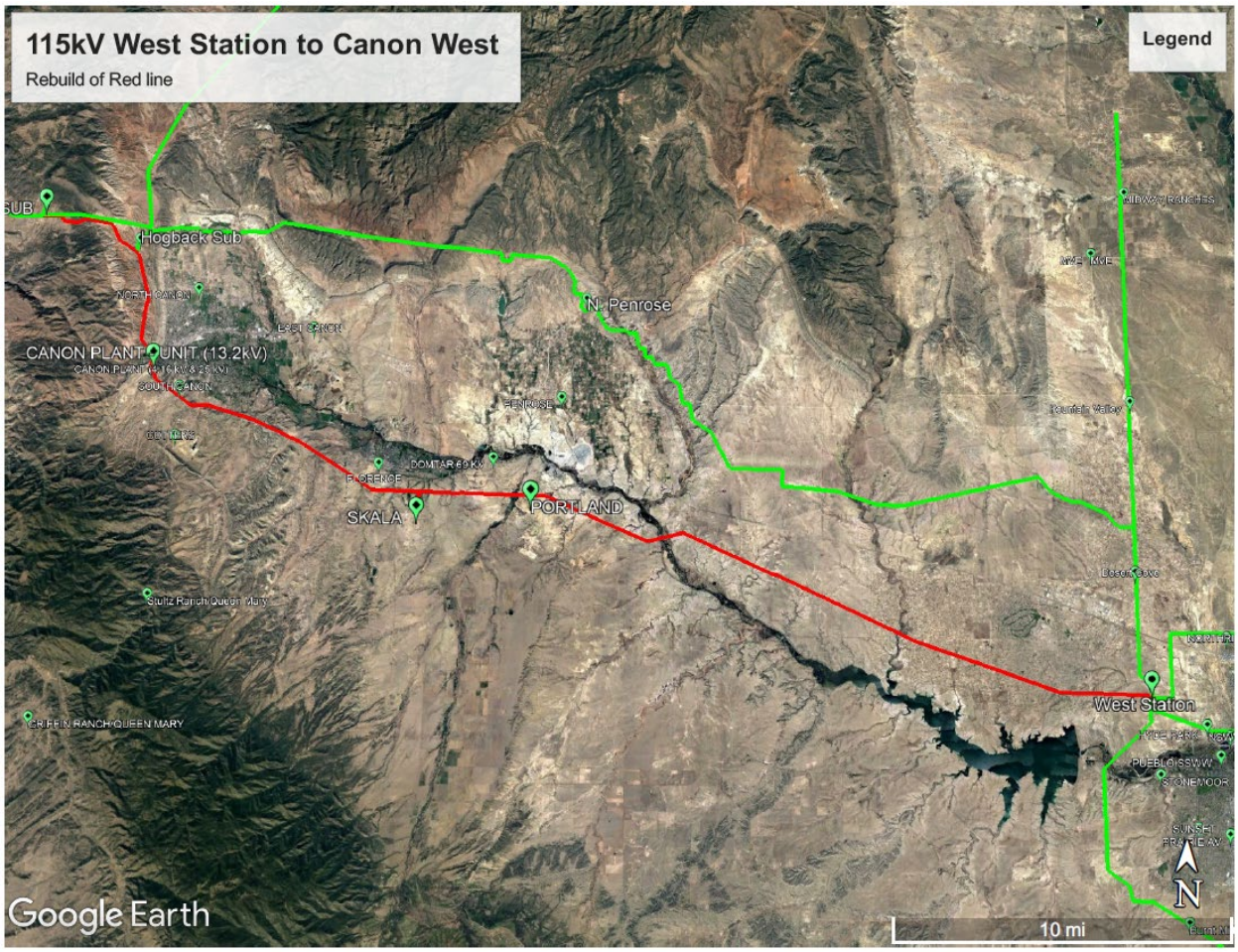
West Station – Canon West 115 kV Rebuild

Description. Past TPL-001-4 reliability[3] and interconnection studies along with current summer peak operational studies have shown overloads on the Portland-Skala, Skala-Cañon City, and Portland-West Station #1 and #2 115 kV lines. Also the West Cañon 230/69 kV transformer, which supports the Cañon City network from the west end, is a long lead time piece of equipment that adds additional overload scenarios to the above mentioned 115 kV lines if the transformer were to fail. This project is a rebuild of 41 miles of the existing transmission line from West Station to Canon West and replaces aging infrastructure, which resulted in overloads and N-1 contingencies. The need for this project was delayed with the completion of the West Station – Hogback project, however, the project timeline was moved up when this line was identified as a network upgrade to accommodate the Large Generation Interconnection Agreement ("LGIA"). At the time of the 2022 Rule 3206 filing, this LGIA was not intending to move forward. LGIA discussions were revived in late 2022 resulting in a signed LGIA in October 2022. Design work has been completed and construction in anticipated to begin in April 2023.

Consideration of project alternatives including energy storage systems (Rule 3206(d)(I)(D)). This line rebuild is caused by a Large Generator Interconnection. Non-wires alternatives such as large scale battery storage are not an option for this project

Decision. The Commission determined that CPCN is not necessary in Decision No. C23-0810.

[3] Including both BHCT TCPC & CCPG studies


115kV West Station to Canon West
Rebuild of Red line
Legend
Hogback Sub
N. Penrose
CANON PLANT UNIT (13.2kV)
PENROSE
DOMTAR 69 kV
FLORENCE
SKALA
PORTLAND
West Station
GRIFFIN RANCH/QUEEN MARY
Google Earth
10 mi
N

Pueblo Plant 115 kV Substation Rebuild

Project Sponsor:	Black Hills Colorado Electric
Additional Project Participants:	
Project Description:	Rebuild the Pueblo Plant 115/13.8 kV Substation
Voltage Class:	115 kV
Facility Rating:	221MVA
Point of Origin/Location:	Pueblo, CO
Additional Transmission Capacity:	Yes --Added capacity for Pueblo Plant Reader 115 kV and Pueblo Plant-Hyder Park 115 kV lines.
Point of Termination:	
Intermediate Points:	
Length of Line (in Miles):	
Type of Project:	Transmission & Distribution
Development Status:	Planned
Routing:	
Subregional Planning Group:	CCPG
Purpose of Project:	Load service & Reliability
Estimated Cost (in 2023 Dollars):	$4.0 Million
Schedule:	
Construction Date:	2026
Planned Completion/In-Service Date:	2027
Regulatory Info:	
Regulatory Date:	
Permitting Info:	
Permitting Date:	
Contact Information:	Trevor Rombough, Transmission Planning
Email	Trevor.J.Rombough@blackhillscorp.com

Pueblo Plant 115 kV Substation Rebuild

Description. Past TPL-001-4 reliability[4] and interconnection studies along with current summer peak operational studies have shown overloads on the Pueblo Plant – Reader and Pueblo Plant – Hyde Park 115 kV lines. These 115 kV lines are limited by terminal equipment at the Pueblo Plant substation. Additionally, the 2023 Distribution System Plan (DSP) Report identified N-1 risks and numerous equipment overloads inside the Pueblo Plant 13.8 kV distribution substation. Replacing the limiting substation equipment is a challenge due to the small geographic size and substation layout. To address the limiting 115 kV equipment, the entire 115 kV substation must me de-energized for safe working clearances.

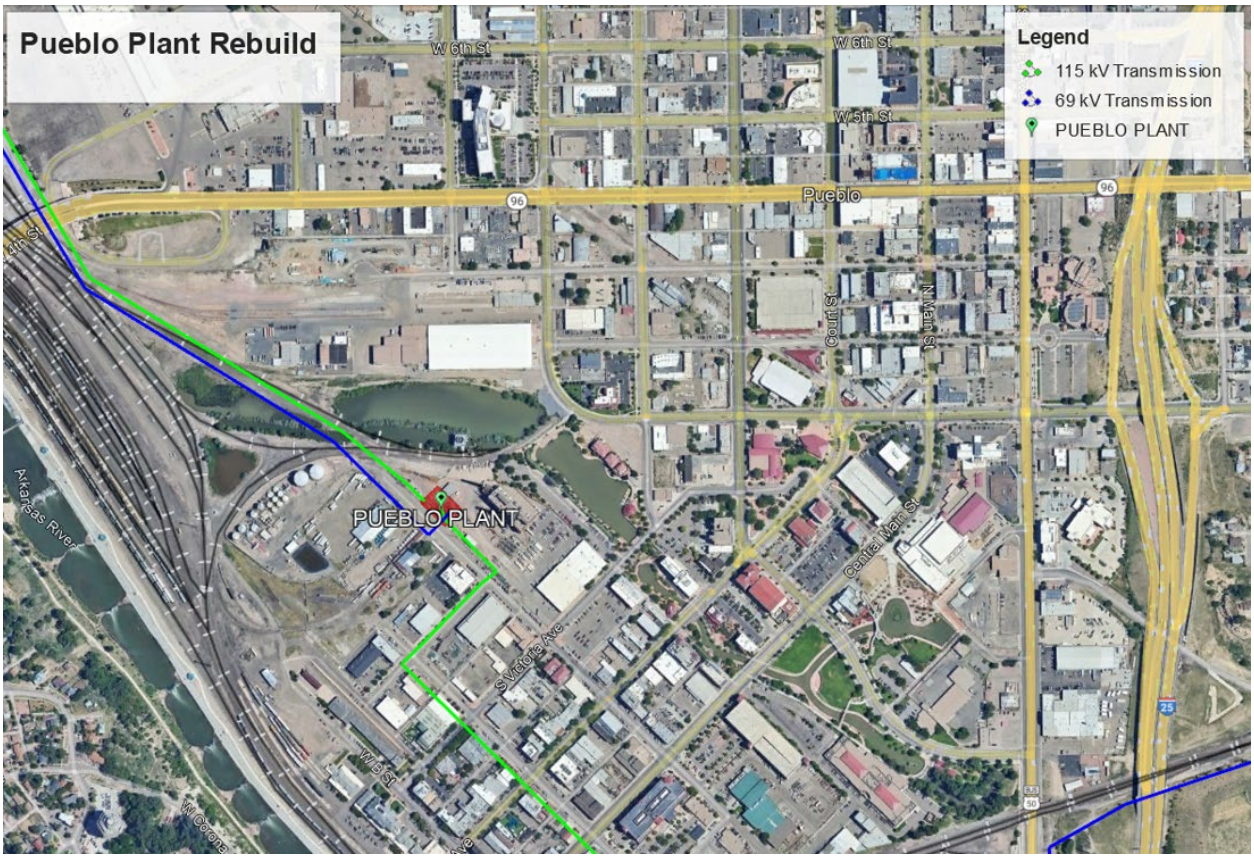
This project will rebuild the existing Pueblo Plant 115/13.8 kV substation to address the limiting substation equipment and improve the load serving redundancy.

The engineering and design work associated with the substation portion of the project will be performed to ensure that the completed project will meet the established noise and magnetic field requirements as stated in Rule 3206 (f) and Rule 3206 (e), respectively. Namely, the noise level of the substation will not exceed 50 db(A) at a distance of 25 feet beyond the property line, and the magnetic field level at the property line, one meter above the ground, will not exceed 150 MilliGauss.

Consideration of project alternatives including energy storage systems (Rule 3206(d)(I)(D)). Providing back-up energy to radial loads under contingency conditions is a benefit provided by energy storage technology and may address some of the needs associated with this project. However, energy storage cannot address the outage and clearance safety concerns related to the age and layout of the existing substation. A substation rebuild is the most effective solution to address all the project needs.

Decision. Black Hills Colorado Electric requests that the Commission determine that the project is in the ordinary course of business and that a CPCN is not necessary.

[4] Including both BHCT TCPC & CCPG studies


Pueblo Plant Rebuild
Legend
115 kV Transmission
69 kV Transmission
PUEBLO PLANT
W 6th St
W 5th St
Pueblo
96
Court St
N Main St
Central Main St
PUEBLO PLANT
Arkansas River
S Victoria Ave
W B St
W Orone
25

Appendix B

Black Hills Colorado Electric

EMF and Noise Report

115kV Transmission Lines

Magnetic Fields and Audible Noise

Black Hills Colorado Electric Utility, Inc.

Pueblo, Colorado
April 25, 2018

Contents

Tables

Figures

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1 115 kV Transmission Lines, Magnetic Fields and Audible Noise

1.1 Introduction

Black Hills Colorado Electric Utility, Inc. (BHCOE) is proposing to construct and rebuild several new 115 kV transmission lines around the Pueblo, CO area. Three (3) different structure configurations will be used depending on the particular location for these Projects. These include an H-frame, vertical configuration, and/or delta configuration, structures with either wood or steel poles. This report describes the modeling of magnetic fields and the audible noise produced from the line's voltage potential and current magnitude with varying right-of-way (ROW) widths.

1.2 Magnetic Fields

Electric transmission lines produce electric and magnetic fields (EMF) when they are in operation. These fields are affected by the different characteristics of the line and they can be evaluated separately. The voltage (potential) of the line produces electrical fields and the current (load) flowing on the line produces magnetic fields.

The voltage of a line is fairly constant, so the electric fields don't vary much over time while the line is operating. Magnetic fields however are dynamic and constantly changes with the loading on the line. For example, whenever an electric appliance on the electrical grid is turned on or off, the current flow changes to provide energy or remove it from the line.

1.3 Magnetic Field Modeling Methodology

The proposed transmission line was modeled to determine the resulting magnetic fields using the "CDEGS" (**C**urrent, **D**istribution, **E**lectromagnetic Fields, **G**rounding, and **S**oil Structure Analysis) program, which is distributed by Safe Engineering Services & Technologies Ltd. The specific module used was "SESEnviroPlus" which can be configured to match the outputs of several currently accepted method of measurement, such as Bonneville Power Administration (BPA) and Electric Power Research Institute (EPRI). This program accurately predicts the magnetic fields produced by linear transmission lines such as the proposed Projects. The commonly used magnetic field intensity unit of measure is the gauss (G). For most applications, the gauss is too large, so a much smaller unit, the milligauss (mG), is used for reporting magnetic field levels. The milligauss is one thousandth of a gauss. The magnetic field has both magnitude and direction.

To perform this modeling, detailed information was provided by BHCOE for their proposed 115 kV transmission lines. This included the maximum projected electrical power flow, operating voltage, structure configurations, conductor/shield wire size and type, the height and horizontal location of each conductor/shield wire, conductor sag and conductor phasing. The proposed BHCOE projects will operate at 115 kV, so the design

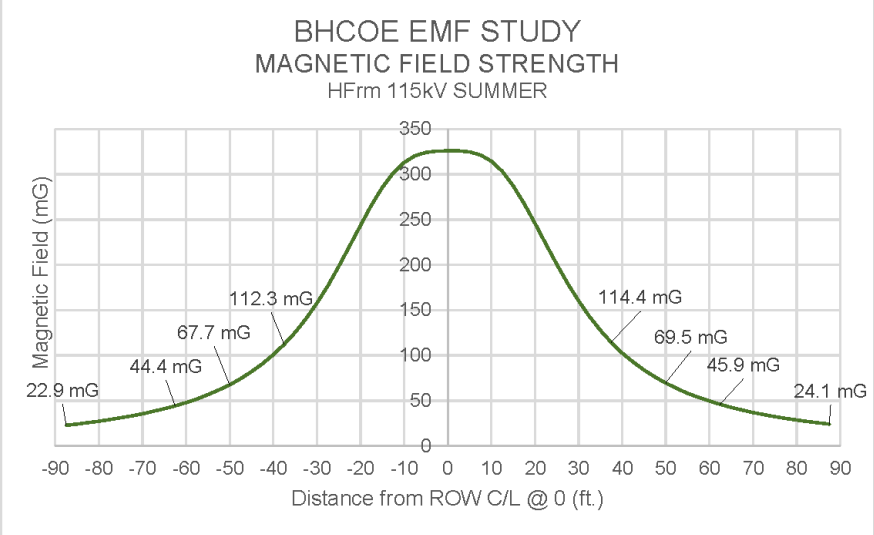
will need to meet the thresholds requirements in Colorado Public Utility Commission (CPUC) Rule 3106, (b (II)) for magnetic fields. Only the maximum load was considered at the lowest conductor sag at mid span to provide the highest (worst case) magnetic fields. Table 1 and Table 2 of Appendix A shows the electrical parameters (loading) and design information for each line.

The data provided in Tables A-1 and A-2 were input into the SESEnivroPlus program to calculate the lateral (at right angles to the ROW alignment) values of the magnetic field strength. These values were then plotted to produce the graphs that are presented on the following pages. The program calculated the magnetic field at minimum design clearance representing worse case. The accuracy of the modeling is dependent on the accuracy of the input data (i.e., if the maximum line loading (phase current) is higher than what was modeled, the resulting magnetic fields will be higher than what was modeled).

1.4 Magnetic Field Modeling Results

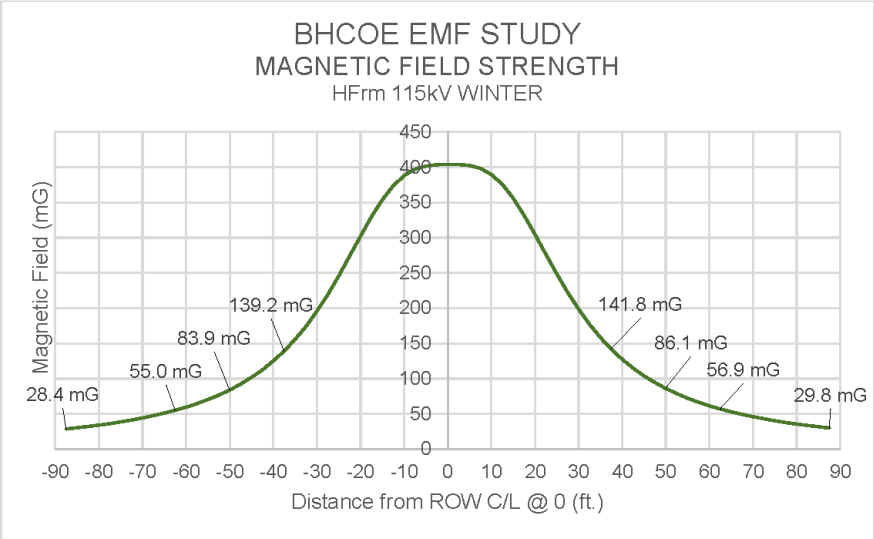
The magnetic field profile for the H-frame configured pole with 14''-6" phase spacing and a summer load current of 1110 amps is shown in Figure 1. The magnetic field values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline of ROW on both sides, respectively.

Figure 1 H-Frame Configuration with 115kV Phase Spacing SUMMER Magnetic Field Chart)



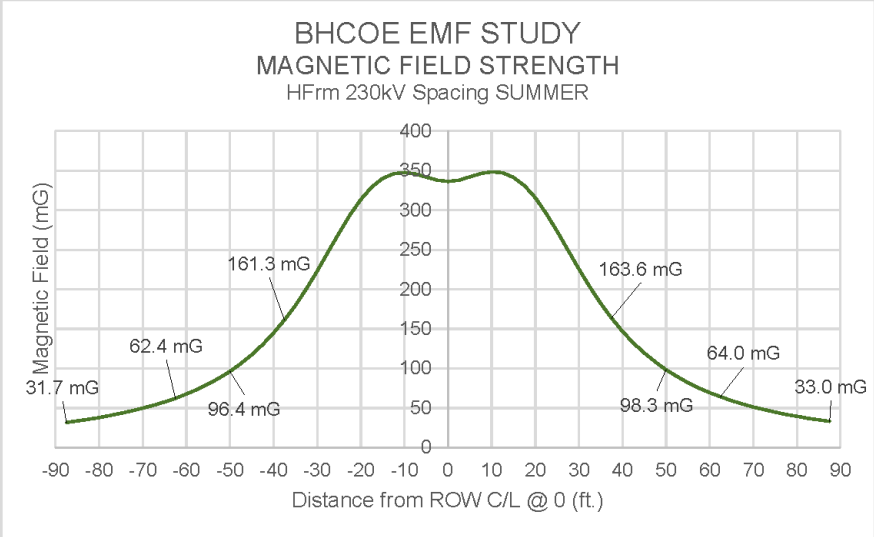
The magnetic field profile for the H-frame configured pole with 14''-6" phase spacing and a winter load current of 1376 amps is shown in Figure 2. The magnetic field values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline of ROW on both sides, respectively.

Figure 2 H-Frame Configuration with 115kV Phase Spacing WINTER Magnetic Field Chart



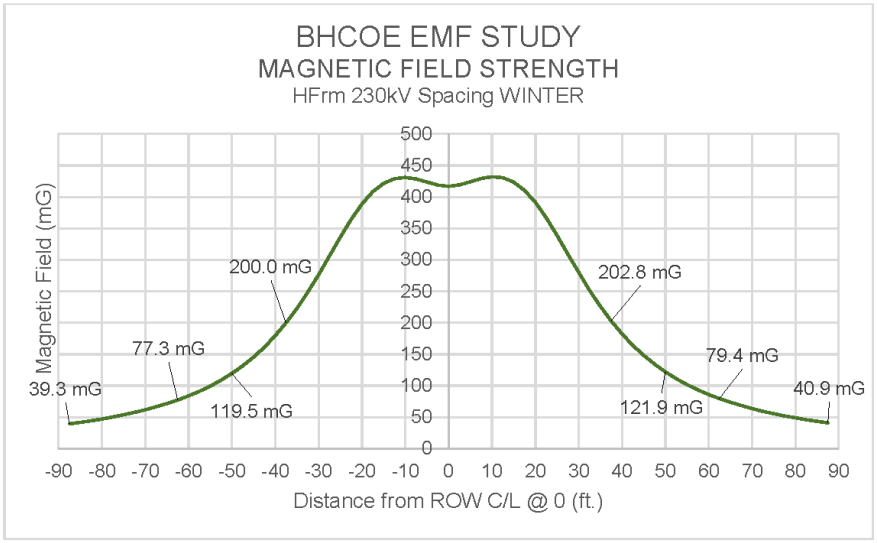
The magnetic field profile for the H-frame configured pole with 19'-6" phase spacing and a summer load current of 1110 amps is shown in Figure 3. The magnetic field values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline of ROW on both sides, respectively.

Figure 3 H-Frame Configuration with 230kV Phase Spacing SUMMER Magnetic Field Chart



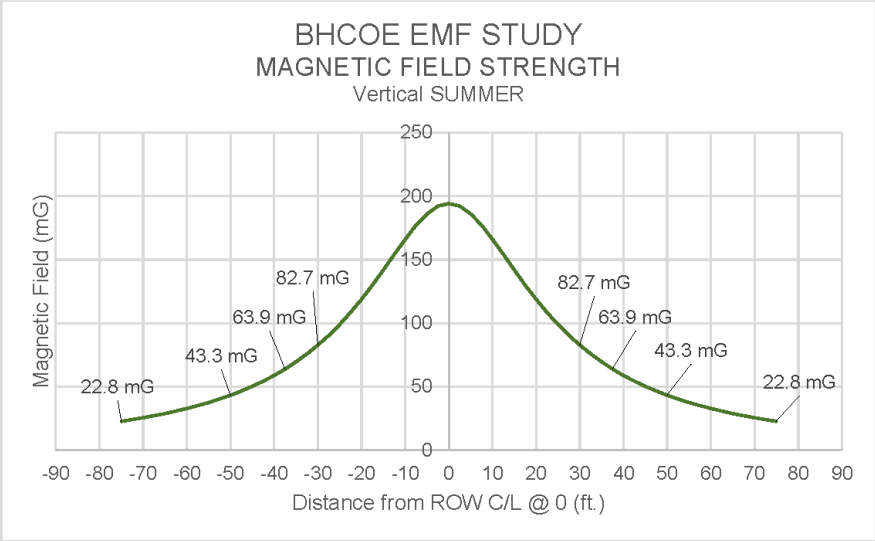
The magnetic field profile for the H-frame configured pole with 19'-6" phase spacing and a winter load current of 1376 amps is shown in Figure 4. The magnetic field values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline of ROW on both sides, respectively.

Figure 4 H-Frame Configuration with 230kV Phase Spacing WINTER Magnetic Field Chart



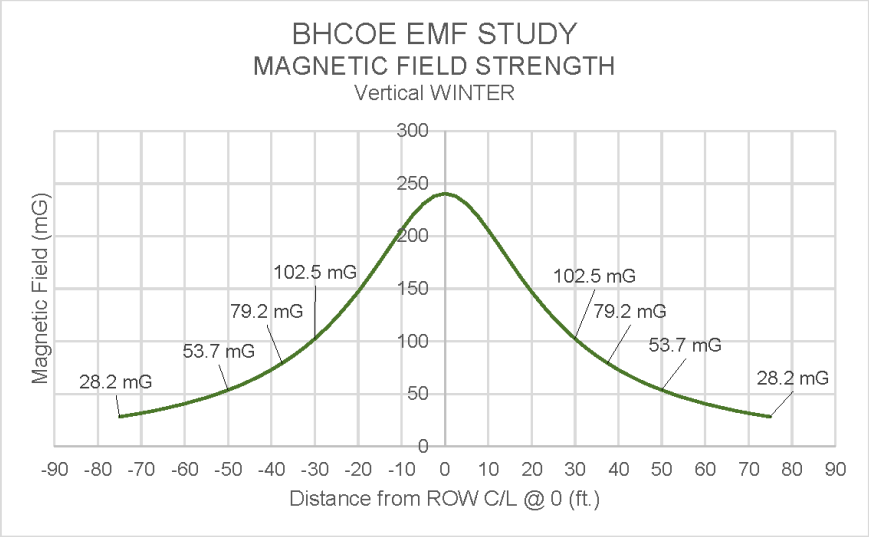
The magnetic field profile for the Vertical-frame configured pole and a summer load current of 1110 amps is shown in Figure 5. The magnetic field values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

Figure 5 Vertical Configuration SUMMER Magnetic Field Chart



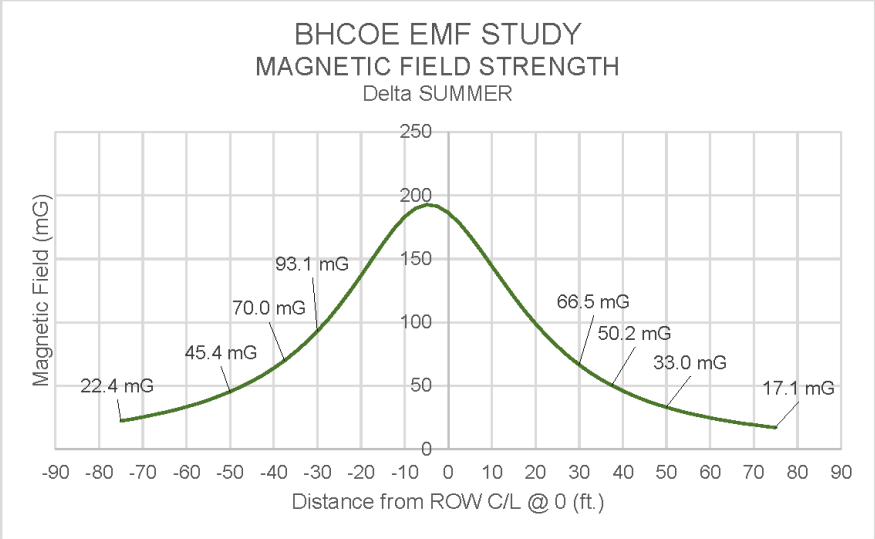
The magnetic field profile for the Vertical-frame configured pole and a winter load current of 1376 amps is shown in Figure 6. The magnetic field values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

Figure 6 Vertical Configuration WINTER Magnetic Field Chart



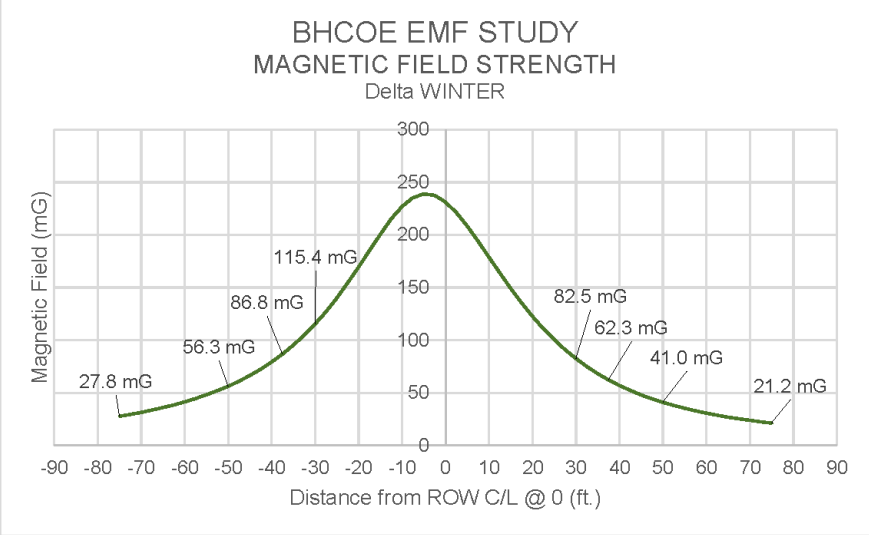
The magnetic field profile for the Delta-frame configured pole and a summer load current of 1110 amps is shown in Figure 7. The magnetic field values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

Figure 7 Delta Configuration SUMMER Magnetic Field Chart



The magnetic field profile for the Delta-frame configured pole and a winter load current of 1376 amps is shown in Figure 8. The magnetic field values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

Figure 8 Delta Configuration WINTER Magnetic Field Chart



1.5 Audible Noise (Corona)

Corona is the electrical ionization of the air that occurs near the surface of energized conductor, hardware, and insulators due to very high electric field strength. Corona may result in audible noise being produced by the transmission lines.

The amount of corona produced by a transmission line is a function of line voltage, the diameter of the conductors, the locations of the conductors in relation to each other, the elevation of the line above sea level, the condition of the conductors, hardware, and insulators, and the local weather conditions. Power flow does not affect the amount of corona produced by a transmission line because it is related to the voltage, which is fairly constant and does not change much over time. Lower voltage lines like the proposed 115 kV Projects typically don't have corona issues because the electrical field gradient is lower at this voltage level.

The electric field gradient is greatest at the surface of the conductor. Larger diameter conductors have lower electric field gradients on the conductor surface compared to smaller conductors because there is more area, thereby lowering the electrical stress; everything being equal. The conductor chosen for the proposed Projects voltage was selected to have a larger diameter and thus reducing any potential to create audible noise.

Irregularities (such as nicks and scrapes on the conductor surface or sharp edges on the hardware) concentrate the electric field at these locations and thus increase the electric field gradient and the resulting corona at these locations. Similarly, foreign objects on the conductor surface, such as dust, insects, and water drops, can cause irregularities on the surface that are a source for corona.

Corona also increases at higher elevations where the density of the atmosphere is less than at sea level. Audible noise will vary with elevation with the relationship of A/300, where A is the elevation of the line above sea level measured in meters (EPRI). Audible noise at 600 meters elevation will be twice the audible noise at 300 meters, all other things being equal.

Raindrops, snow, fog, hoarfrost, ice, and condensation accumulated on the conductor surface are also sources of surface irregularities that can increase corona. During fair weather, the number of these condensed water droplets or ice crystals is usually small and the corona effect is also small. However, during wet weather, the number of these sources increases (for instance due to rain drops standing on the conductor) and corona effects are therefore greater. During wet or foul weather conditions, the conductor will produce the greatest amount of corona noise. It also important to note, during heavy rain the noise generated by the falling rain drops hitting the ground and other objects will typically be greater than the noise generated by corona and thus will mask the audible noise from the transmission line.

Corona produced on a transmission line can be reduced by the design of the transmission line and the selection of hardware and conductors used for the construction

of the line. For instance the use of conductor attachment hardware that have rounded rather than sharp edges and not protruding bolts with sharp edges will reduce corona. The conductors themselves can be made with larger diameters and handled so that they have smooth surfaces without nicks or burrs or scrapes in the conductor strands. The transmission lines proposed here are designed to reduce corona generation.

1.6 Audible Noise Modeling Methodology

CPUC Rule 3102 requires that the applicant for a CPCN for a new transmission line model the potential audible noise levels that the line could produce.

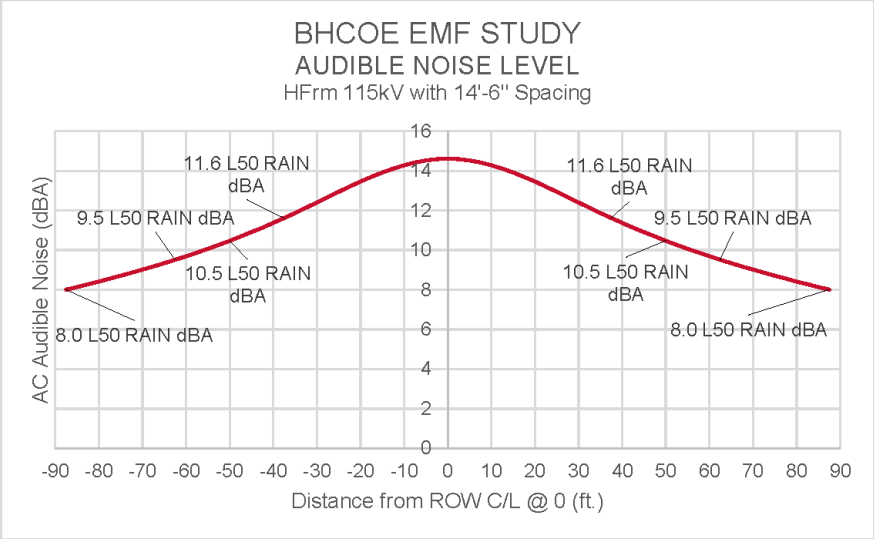
The audible noise from the proposed transmission lines was predicted using SES's SESEnviroPlus program. The same structure and ROW configurations used in the magnetic field calculations were used to predict the audible noise. The rated line voltage (115 kV) plus a 5% overvoltage was used at the lowest conductor sag at mid span to provide the worst case. Audible noise is calculated as an equivalent A-weighted sound-pressure level in decibels (dbA). The L_{50} audible noise for foul weather represents a predicted average (L_{50}) noise level present when the conductor is wet under foul (rain) weather conditions. The actual value is expected to be at or below this calculated L_{50} value 50% of the time, and above the value the other 50% of the time. The A-weighted decibels (dbA), most effectively approximates the human ear's response to sounds.

The data provided in Tables 1 and 2 of Appendix A was used as input into the SESEnviroPlus program which produced the lateral profiles of the audible noise from corona. Because the equations that predict audible noise were created from empirical measurements, the accuracy of the model is as good as these measurements that produced the original equations. In additions the model is as good as the accuracy of the parameters input to the model (e.g. the actual elevation of the transmission line at a particular location rather than the average elevation of the entire project). Therefore given these potential uncertainties, the resulting plots are within a few percent of the true value for the conditions modeled.

1.7 Audible Noise Modeling Results

Figure 9 shows the audible noise modeled for the proposed Project as an H-Frame configuration with 14'-6" phase spacing. The audible noise values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline of ROW on both sides, respectively.

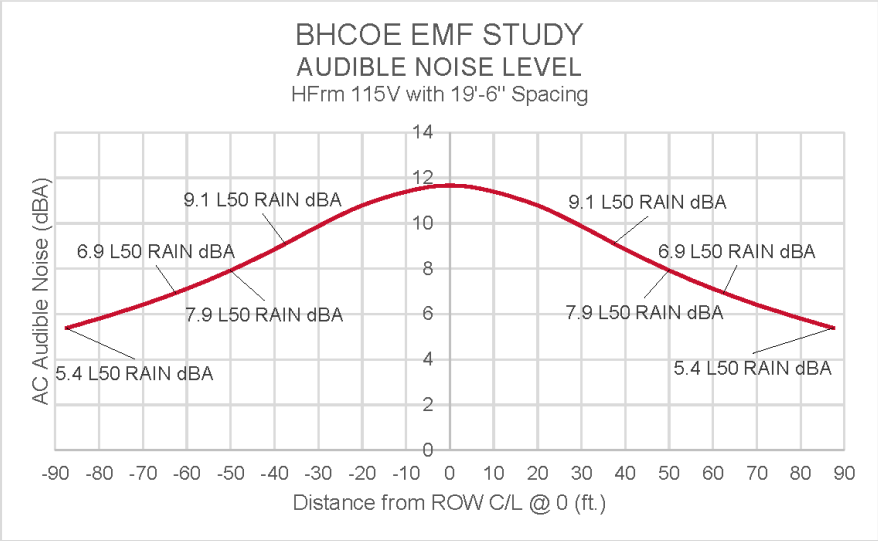
Figure 9 H-Frame Configuration with 115kV Phase Spacing AN Chart



a) Note: a change in load current will not change the Audible Noise (AN) as it is related to the voltage which is steady for the most part, therefore only one plot for each summer and winter load condition is needed.

Figure 10 shows the audible noise modeled for the proposed Project as an H-Frame configuration with 19'-6" phase spacing. The audible noise values were labeled on the plot for the varying ROW widths of 75', 100', and 125'; so the edge of ROW would be 37.5', 50.0', and 62.5' from the centerline on both sides, respectively.

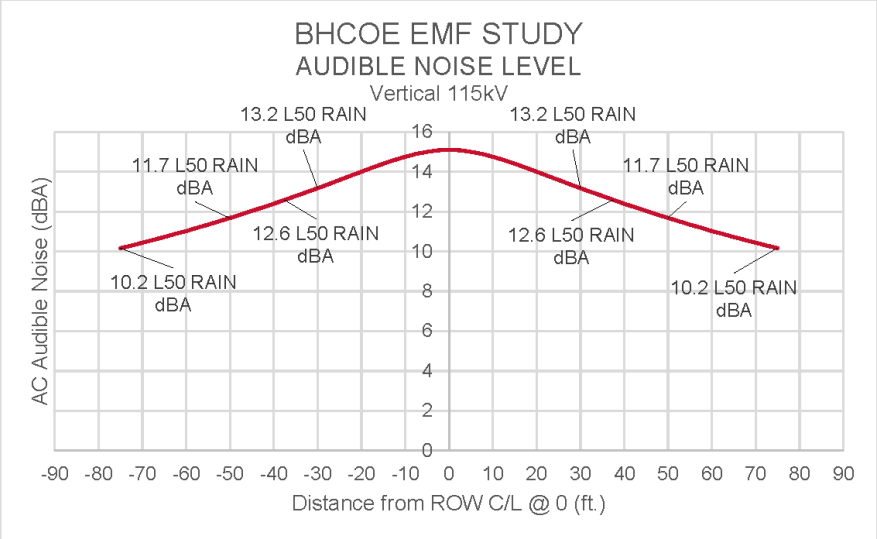
Figure 10 H-Frame Configuration with 230kV Phase Spacing AN Chart



a) Note: a change in load current will not change the Audible Noise (AN) as it is related to the voltage which is steady for the most part, therefore only one plot for each summer and winter load condition is needed.

Figure 11 shows the audible noise modeled for the proposed Project as a Vertical configuration. The audible noise values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

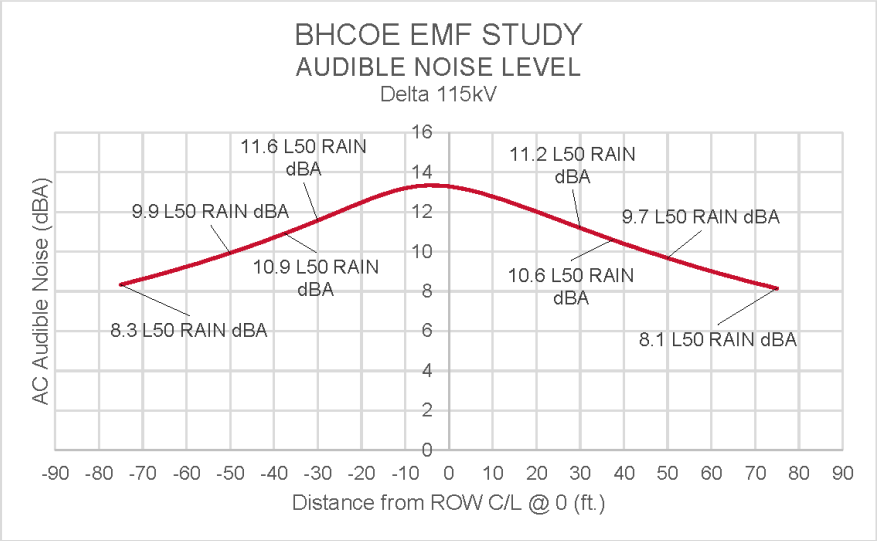
Figure 11 Vertical Frame Configuration AN Chart



a) Note: a change in load current will not change the Audible Noise (AN) as it is related to the voltage which is steady for the most part, therefore only one plot for each summer and winter load condition is needed.

Figure 12 shows the audible noise modeled for the proposed Project as a Delta configuration. The audible noise values were labeled on the plot for the varying ROW widths of 60', 75', and 100'; so the edge of ROW would be 30.0', 37.5', and 50.0' from the centerline of ROW on both sides, respectively.

Figure 12 Delta Frame Configuration AN Chart



a) Note: a change in load current will not change the Audible Noise (AN) as it is related to the voltage which is steady for the most part, therefore only one plot for each summer and winter load condition is needed.

Summary

Magnetic Field Summary

Per CPUC Rule 3106 (e) for magnetic fields, only the edge of the transmission line ROW is considered. All pole configurations are below the suggested 150 mG threshold at the edge of ROW with the exception of the 75 ft. ROW with 19'-6" pole spacing, H-frame construction. This configuration would require further study and possible mitigation to reduce the EMF levels at the edge of ROW. All other configurations studied in this report require no further action.

Audible Noise Summary

Per CPUC Rule 3106 (f) for audible noise, only 25' from the edge of the transmission line ROW is considered for 115 kV lines. All four (4) pole configurations are well below the suggested 50 dBA for a residential level threshold throughout the entire ROW and including 25' from the ROW edge, so no further action is required.

References

Code of Colorado Regulations, Secretary of State, State of Colorado, Colorado Public Utilities Commission (CPUC), Rules Regulating Electric Utilities, 4 CCR 723-3.

Electric Power Research Institute (EPRI), Transmission Line Reference Book 345 kV and Above "Red Book", Second Edition, 1982, Electric Power Research Institute, Palo Alto, California.

EMF, Electric and Magnetic Fields Associated with the Use of Electric Power, June 2002, National Institute of Environmental Health Sciences and National Institutes of Health, NIEHS/DOE EMF RAPID Program.

National Electric Safety Code (NESC C2 – 2012); The Institute of Electrical and Electronics Engineers, Inc., New York, New York.

115kV Transmission Lines
Magnetic Fields and Audible Noise

Appendix

Appendix A: Tables

Table 1: Electrical Parameters

Pole Configuration	Conductor	Shield Wire	OPGW	FAC-008 Loading (Amps)
H-Frame w/ 14'-6" Phase Spacing	Single 795 Drake ACSR	3/8" EHS	0.443"	1110 S/1376 W
H-Frame w/ 19'-6" Phase Spacing	Single 795 Drake ACSR	3/8" EHS	0.443"	1110 S/1376 W
Vertical	Single 795 Drake ACSR	3/8" EHS	N/A	1110 S/1376 W
Delta	Single 795 Drake ACSR	3/8" EHS	N/A	1110 S/1376 W

Source: Source: Emails from BHCOE, dated 3/3/18 & 3/29/18.
S = Summer and W = Winter

115kV Transmission Lines
Magnetic Fields and Audible Noise

Table 2: Line Design Information

Pole Configuration	Phase (Left to Right) or (top to bottom)	Horizontal Location (ft.)	Height (ft.)	Minimum Ground Clearance (ft.)
H-Frame with 14'-6" phase spacing	A	-14'-6"	22'-0"	22'-0"
	B	0'-0"	22'-0"	22'-0"
	C	14'-6"	22'-0"	22'-0"
	OPGW	-8'-0"	34'-0"	
	Shield Wire	8'-0"	34'-0"	
H-Frame with 19'-6" phase spacing	A	-19'-6"	22'-0"	22'-0"
	B	0'-0"	22'-0"	22'-0"
	C	19'-6"	22'-0"	22'-0"
	OPGW	-8'-0"	34'-0"	
	Shield Wire	8'-0"	34'-0"	
Vertical	A	-6-0"	46'-0"	22'-0"
	B	-6'-0"	34'-0"	22'-0"
	C	-6'-0"	22'-0"	22'-0"
	Shield Wire	0.7'-0"	56'-6"	
Delta	A	-6'-0"	42'-0"	22'-0"
	B	6'-0"	32'-0"	22'-0"
	C	-6'-0"	22'-0"	22'-0"
	Shield Wire	0.7'-0"	52'-6"	

Note: All dimensions are looking ahead on line from the centerline of the line.

115kV Transmission Lines
Magnetic Fields and Audible Noise

Table 3: Magnetic Field and Audible Noise Values

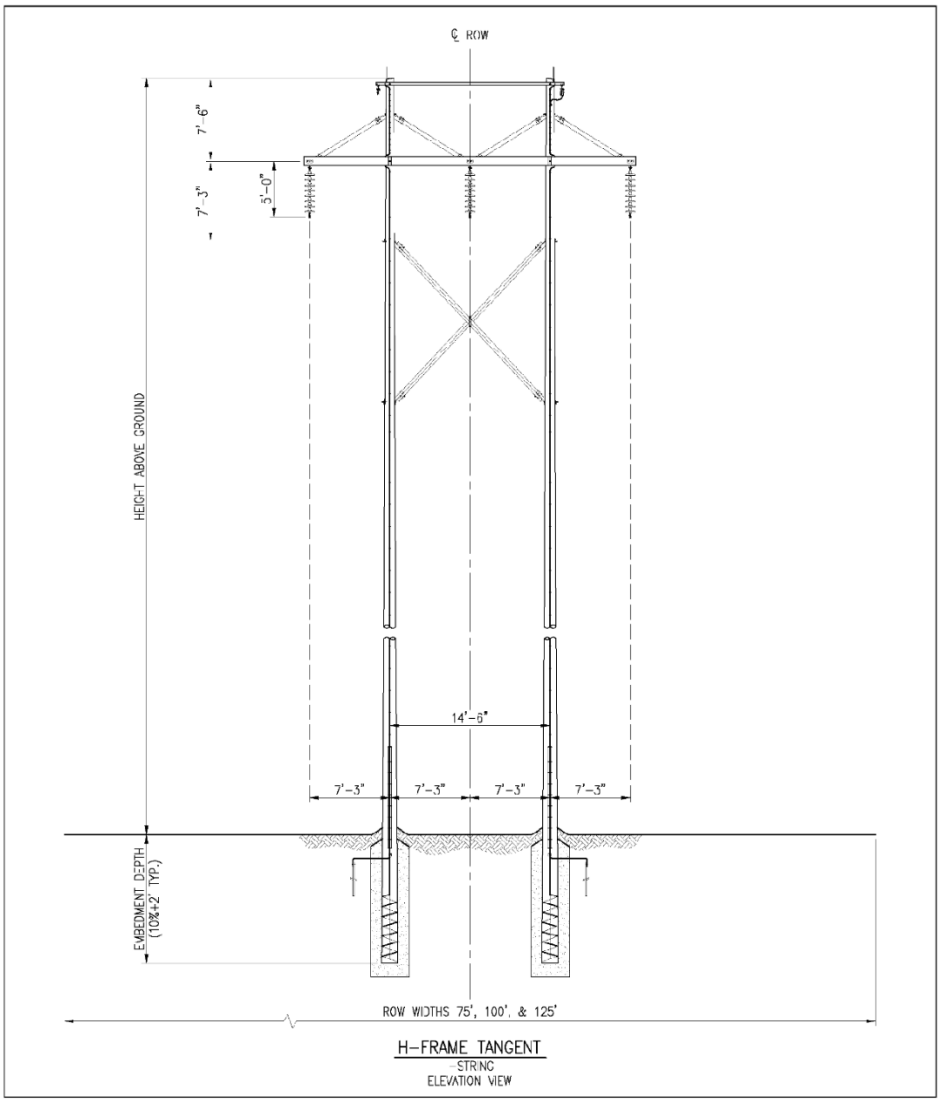
Distance	Magnetic Fields (Summer) 1110 A	Magnetic Fields (Winter) 1376 A	Audible Noise (Summer) 1110 A	Audible Noise (Winter) 1376 A
	H-Frame Configuration with 14'-6" Phase Spacing			
25.0 ft. from ROW Edge	24.1 mG	29.8 mG	8.0 L50 Rain dBA	8.0 L50 Rain dBA
62.5 ft. from ROW C/L	45.9 mG	56.9 mG	9.5 L50 Rain dBA	9.5 L50 Rain dBA
50.0 ft. from ROW C/L	69.5 mG	86.1 mG	10.5 L50 Rain dBA	10.5 L50 Rain dBA
37.5 ft. from ROW C/L	114.4 mG	141.8 mG	11.6 L50 Rain dBA	11.6 L50 Rain dBA
	H-Frame Configuration with 19'-6" Phase Spacing			
25.0 ft. from ROW Edge	33.0 mG	40.9 mG	5.4 L50 Rain dBA	5.4 L50 Rain dBA
62.5 ft. from ROW C/L	64.0 mG	79.4 mG	6.9 L50 Rain dBA	6.9 L50 Rain dBA
50.0 ft. from ROW C/L	98.3 mG	121.9 mG	7.9 L50 Rain dBA	7.9 L50 Rain dBA
37.5 ft. from ROW C/L	163.6 mG	202.8 mG	9.1 L50 Rain dBA	9.1 L50 Rain dBA
	Vertical Configuration			
25.0 ft. from ROW Edge	22.8 mG	28.2 mG	10.2 L50 Rain dBA	10.2 L50 Rain dBA
50.0 ft. from ROW C/L	43.3 mG	53.7 mG	11.7 L50 Rain dBA	11.7 L50 Rain dBA
37.5 ft. from ROW C/L	63.9 mG	79.2 mG	12.6 L50 Rain dBA	12.6 L50 Rain dBA
30.0 ft. from ROW C/L	82.7 mG	102.5 mG	13.2 L50 Rain dBA	13.2 L50 Rain dBA
	Delta Configuration			
25.0 ft. from ROW Edge	22.4 mG	27.8 mG	8.3 L50 Rain dBA	8.3 L50 Rain dBA
50.0 ft. from ROW C/L	45.4 mG	56.3 mG	9.9 L50 Rain dBA	9.9 L50 Rain dBA
37.5 ft. from ROW C/L	70.0 mG	86.8 mG	10.9 L50 Rain dBA	10.9 L50 Rain dBA
30.0 ft. from ROW C/L	93.1 mG	115.4 mG	11.6 L50 Rain dBA	11.6 L50 Rain dBA

Note: EMF values shown above are the highest on either side of their respective output plots when they are different

Appendix B Pole Diagrams

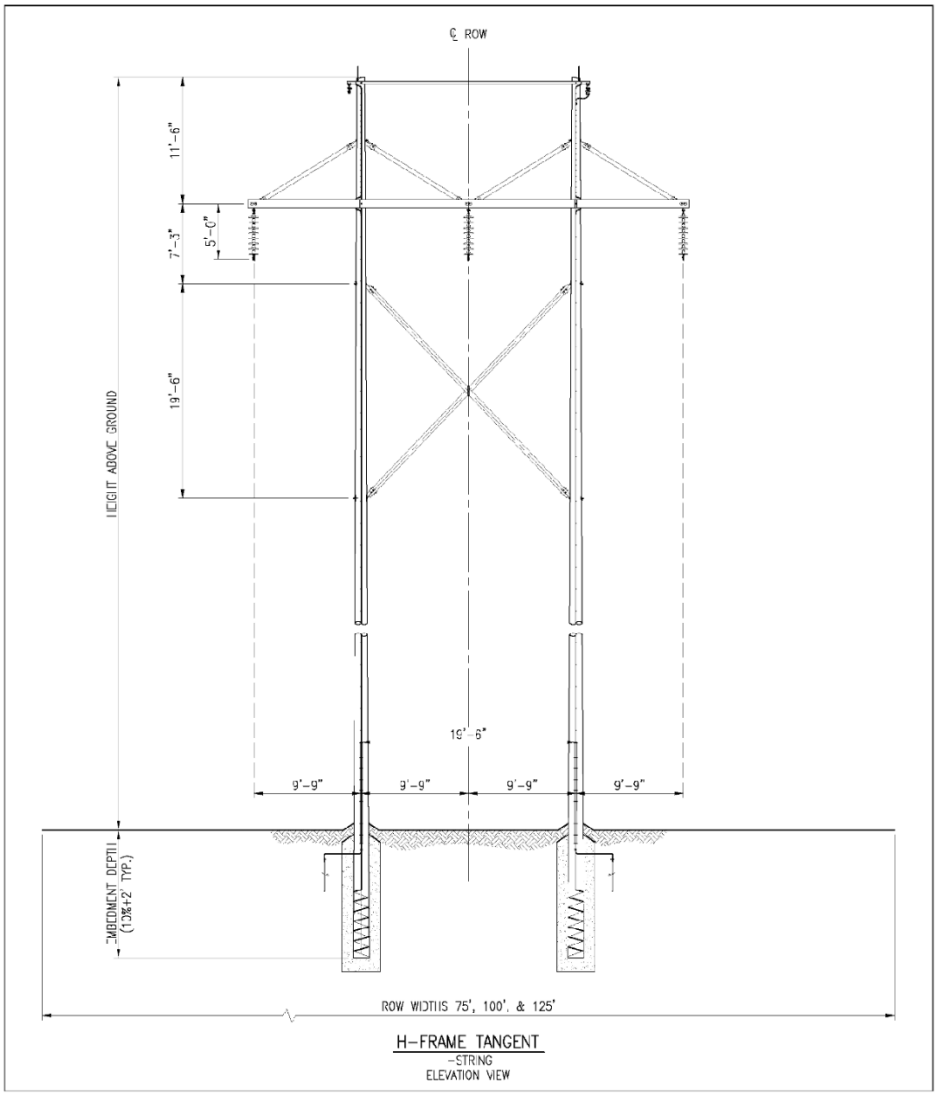
115kV Transmission Lines
Magnetic Fields and Audible Noise

Figure 13 (H-Frame with 14'-6" Phase Spacing)



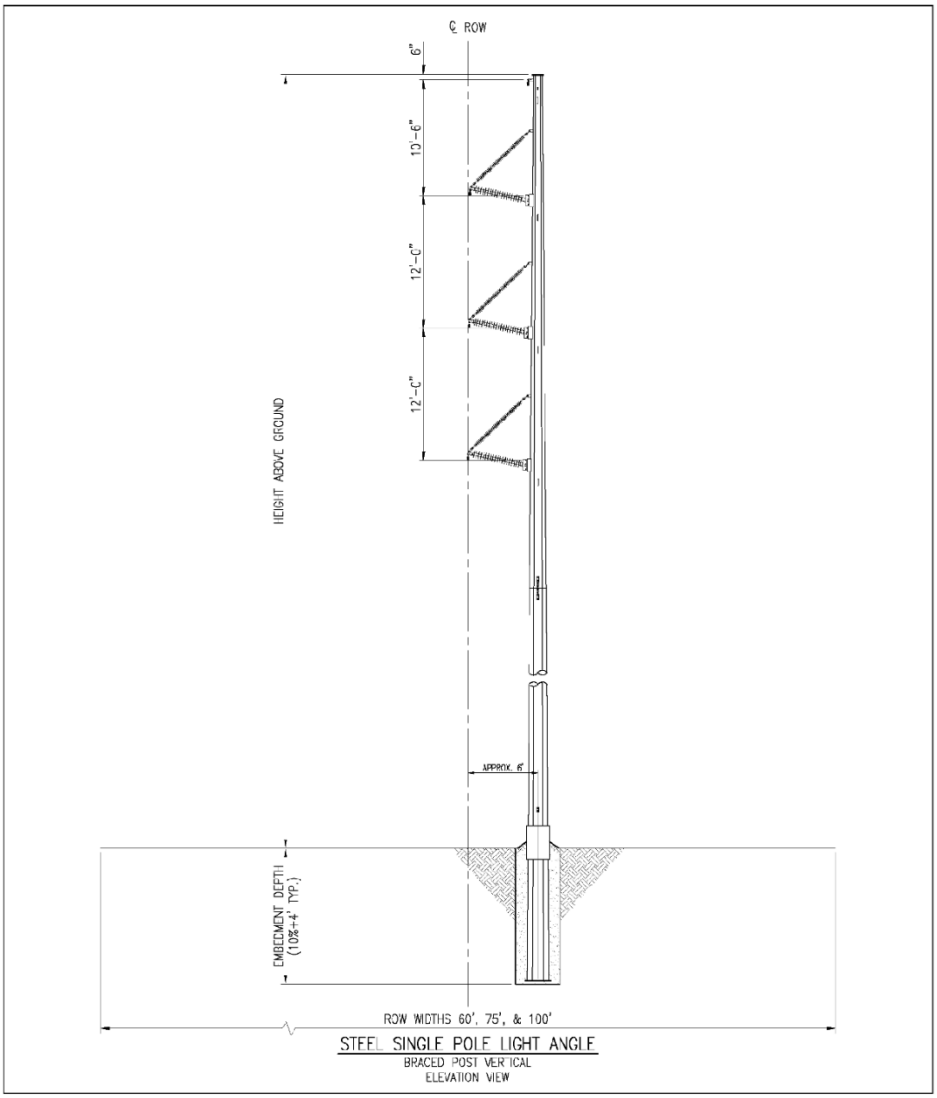
115kV Transmission Lines
Magnetic Fields and Audible Noise

Figure 14 (H-Frame with 19'-6" Phase Spacing)



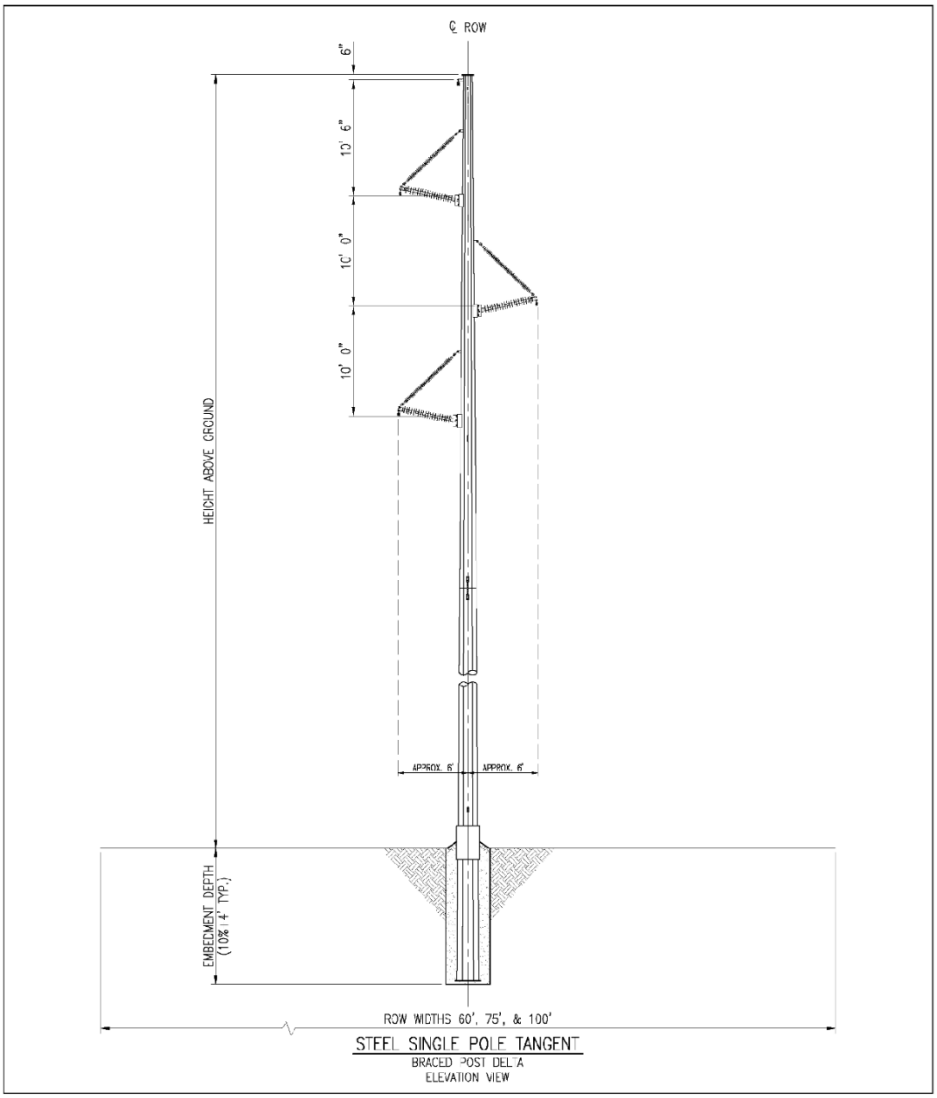
115kV Transmission Lines
Magnetic Fields and Audible Noise

Figure 15 (Vertical Configuration)



115kV Transmission Lines
Magnetic Fields and Audible Noise

Figure 16 (Delta Configuration)



Proceeding No. 24M-0005E
Black Hills Colorado Electric, LLC d/b/a Black Hills Energy
2024 Rule 3206 Report – Appendix C – TCA Rider Recovery Projects

New Planned TCA Projects Pursuant to Decision C21-0814 in Proceeding No. 21AL-0516E

Canon Plant 115/13.8 kV Transformer #2: This project will add an additional 50 MVA distribution transformer to the existing Canon Plant substation. This project is a reliability driven project to meet the needs to current and long-term load growth. To meet the planned in-service date of 2026, a transformer will need to be ordered in 2023. Non wires alternatives were considered as a solution to support load in an outage situation but were not chosen due to cost and ability to support long term load growth. Forecasted spend for 2024 is minimal, $10,000, with an overall cost of $1.0 million to cover the TCA Rider Recoverable portion of this project. The transformer and all 13.8kV is not included within this estimate. The estimate for the entire project is $4.3 million.