



Reliability Analysis Update

Transmission Expansion Advisory
Committee
September 12, 2019

- The following definitions explain the basis for excluding flowgates and/or projects from the competitive planning process and designating projects to the incumbent Transmission Owner.
- Flowgates/projects excluded from competition will include the underlined language on the corresponding slide.
 - Immediate Need Exclusion: Due to the immediate need of the violation (3 years or less), the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity. - Operating Agreement, Schedule 6 § 1.5.8(m)
 - Below 200kV Exclusion: Due to the lower voltage level of the identified violation(s), the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(n)
 - FERC 715 (TO Criteria) Exclusion: Due to the violation need of this project resulting solely from FERC 715 TO Reliability Criteria, the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(o)
 - Substation Equipment Exclusion: Due to identification of the limiting element(s) as substation equipment, the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(p)

2019 RTEP Analysis Update

Timeline

- Window Opened: July 3, 2019
- Window Closed: September 6, 2019

15 proposals received from 5 entities

- 1 proposal from a non-incumbent entity
- 1 proposal includes cost containment provisions
- 5 proposals include greenfield construction

Dominion End of Life Criteria



Dominion Transmission Zone: Baseline Line #569 Rebuild (End of Life Criteria)

Process Stage: Recommended Solution – Second Read

Criteria: End of Life

Assumption Reference: FERC 715

Model Used for Analysis: 2019 Series 2024 Summer RTEP

Proposal Window Exclusion: FERC 715 (TO Criteria)

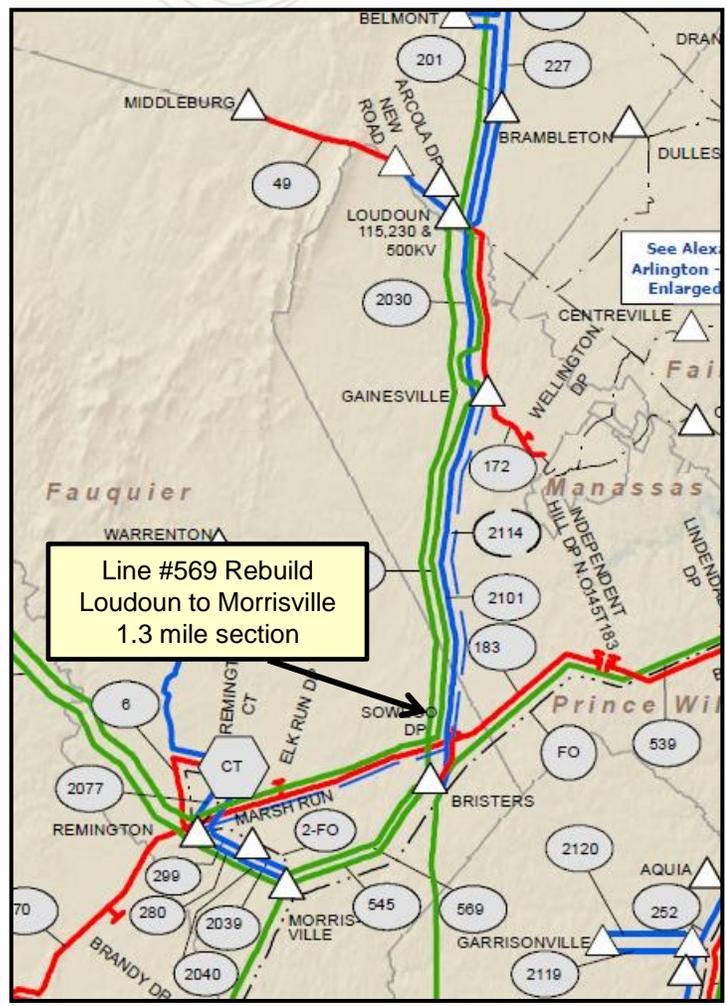
Problem Statement:

The 500 kV Line #569, from Loudoun to Morrisville, is approximately 32 miles long and 1.3 miles of this line is constructed on CORTEN structures. A third party study (Quanta) has determined that these structures are at the end of their useful life.

Reliability studies indicate that retiring Line #569 will result in thermal overloads in accordance with P6 NERC criteria violations.

Existing Facility Rating: 2913 MVA STE
Preliminary Facility Rating: 3424 MVA STE

COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2099
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED



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Dominion Transmission Zone: Baseline Line #569 Rebuild (End of Life Criteria)

Recommended Solution:

Rebuild the 1.3 mile section of Line #569 with single-circuit 500 kV structures at the current 500 kV standard. This will increase the rating of Line #569 to 3424 MVA. **(b3211)**

Estimated Project Cost: \$4.5 M

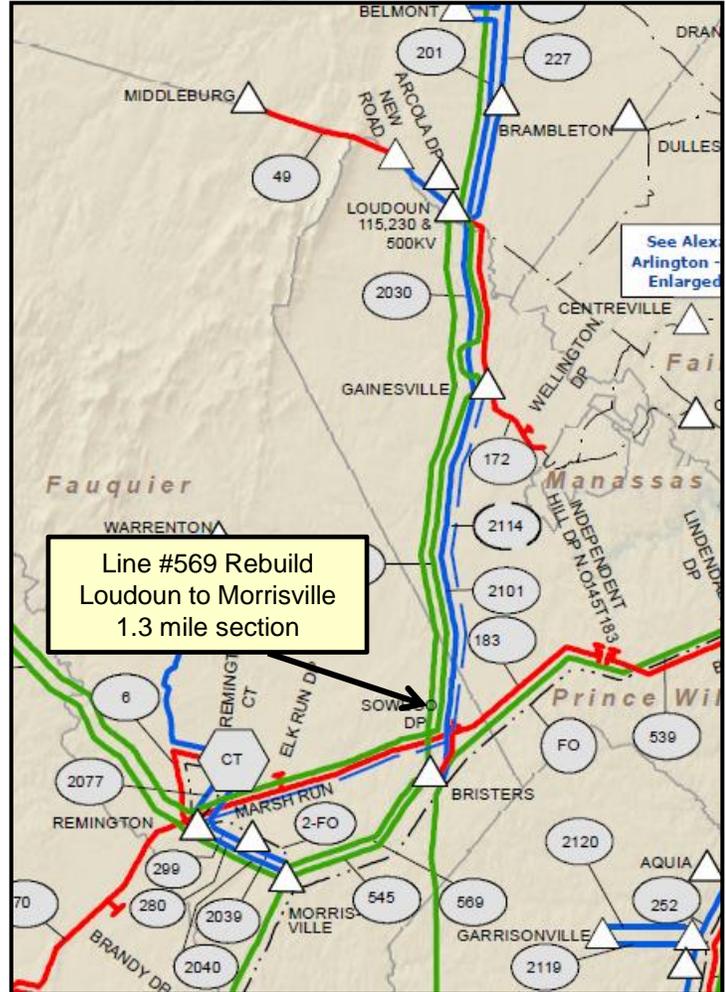
Required In-Service Date: As Soon As Possible

Projected In-Service Date: 12/31/2024

Project Status: Conceptual

Previously Presented: 8/8/2019 TEAC

COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2099
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED



Re-evaluation of the B1690 (MCRP) Project

B1690 (MCRP) project timeline:

- The B1690 was initially proposed – 3Q of 2011.
- The B1690 filing with the New Jersey Board of Public Utilities – 3Q of 2016
- B1690 Evidentiary Hearings with the New Jersey Office of Administrative Law – 2Q - 3Q of 2017
- New Jersey Office of Administrative Law decision – 1Q of 2018
- New Jersey Board of Public Utilities decision – 2Q of 2018
- PJM Re-evaluation of need – 3Q of 2018 (presented at September 2018 TEAC)
- PJM and FirstEnergy development of Alternatives – 4Q 2018 through 1Q 2019
- FirstEnergy meetings with Federal, State, and Local stakeholders – 2Q through 3Q of 2019

JCP&L Transmission Zone: Baseline Monmouth County 34.5 kV Solution

Process Stage: Second Review

Criteria: PJM and FirstEnergy Planning Criteria

Assumption Reference: Voltage Drop, Voltage Magnitude, and Loss of Load

Model Used for Analysis: 2018 Series 2021 and 2023 Summer RTEP

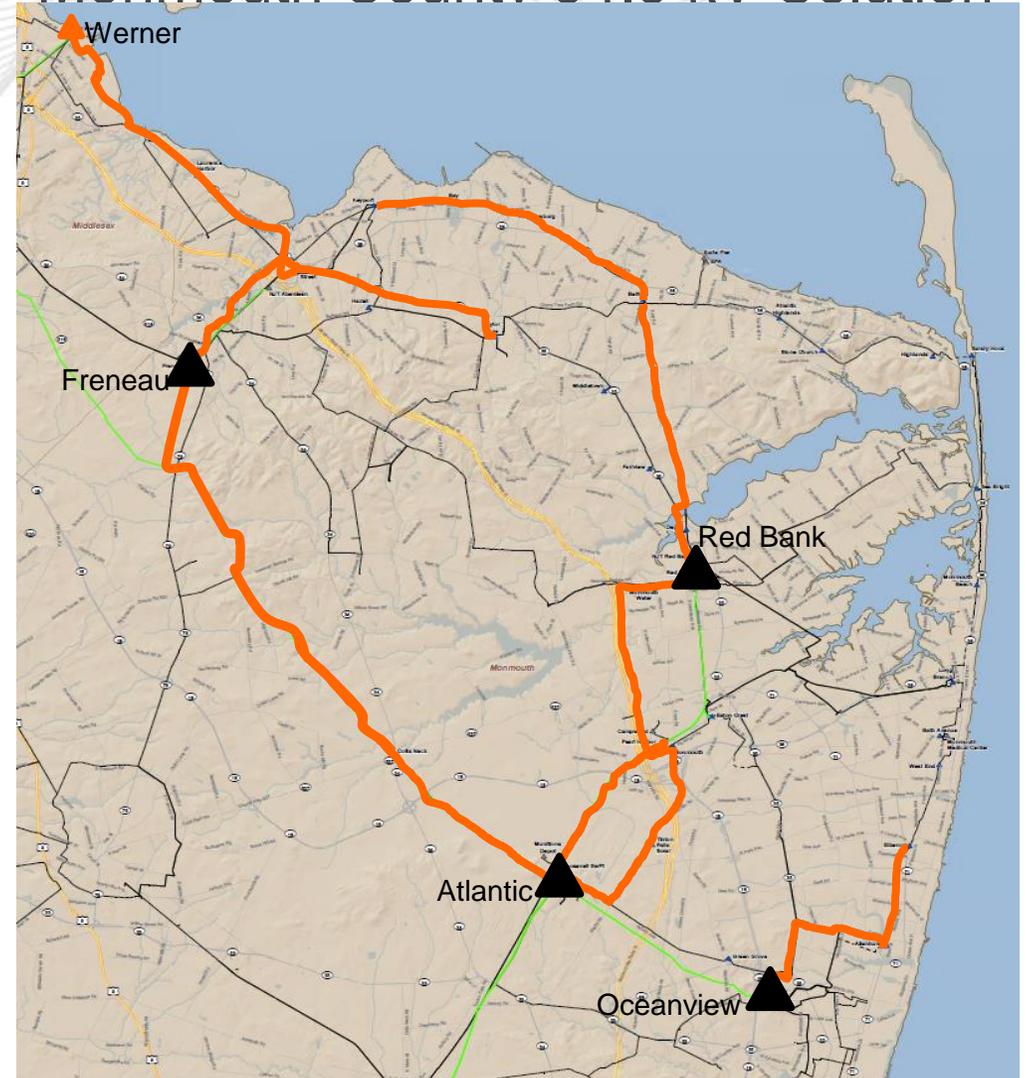
Proposal Window Exclusion: Immediate Need

Problem Statement:

- Severe voltage drop violation on the Red Bank bus for towerline outage loss of Atlantic – Red Bank 230 kV (T2020 & S1033) circuits.
- Severe voltage drop violation on the Red Bank bus for N-1-1 contingency loss of Atlantic – Red Bank 230 kV (T2020 & S1033) circuits.
- Several JCP&L 34.5 kV lines severely overloaded for the towerline outage loss of Atlantic – Red Bank 230 kV (T2020 & S1033) circuits requiring dynamic cascade analysis.
 - FirstEnergy performed dynamic cascade analysis
 - The dynamic cascade analysis resulted in tripping significant number of 34.5 kV lines and loss of >520 MW load due to voltage collapse.

Existing Facility Rating: N/A

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JCP&L Transmission Zone: Baseline Monmouth County 34.5 kV Solution

Recommended Solution:

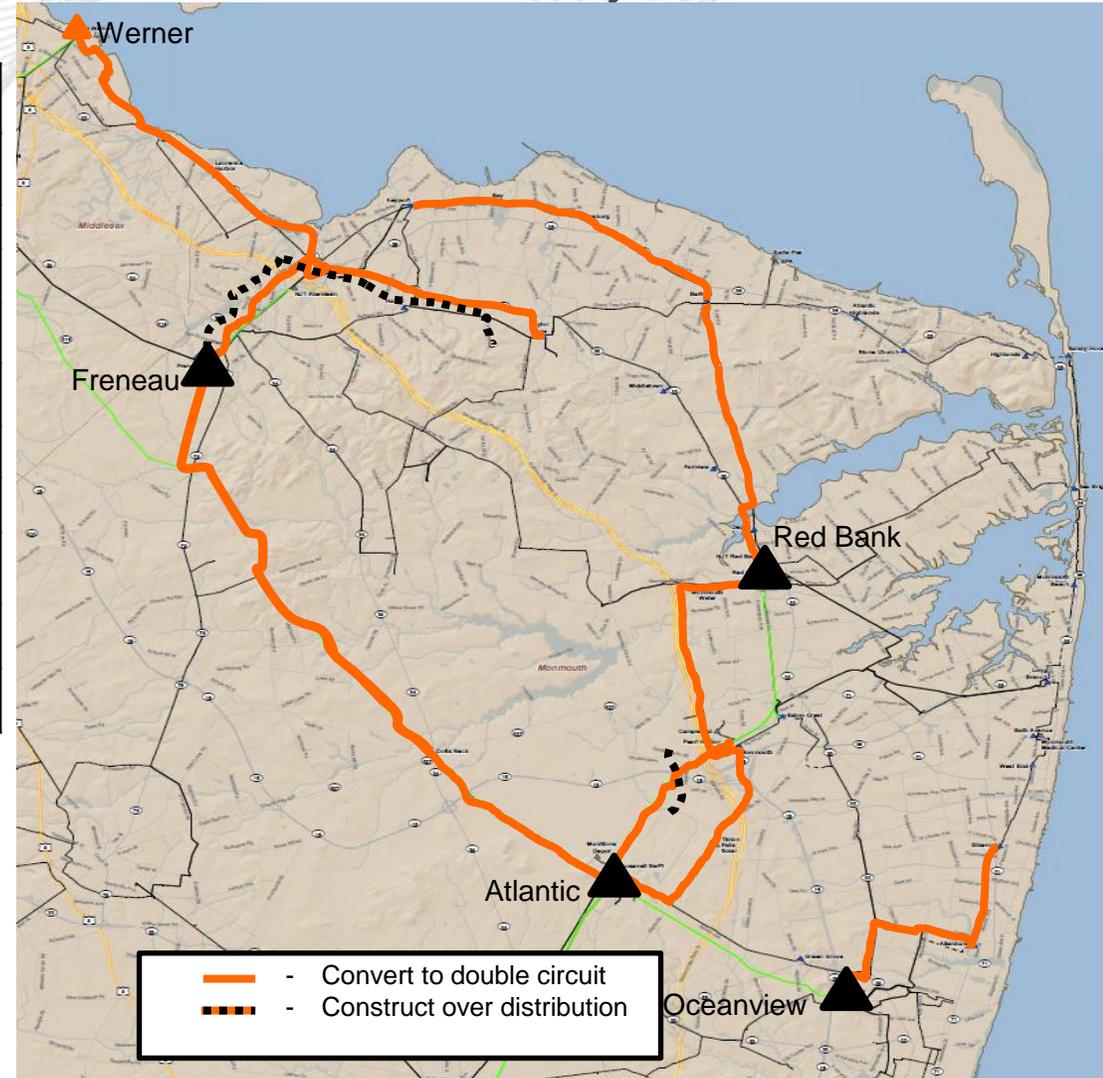
ID	Description	Projected IS Date
B3130.1	Construct a new 34.5 kV circuit from Oceanview to Allenhurst 34.5 kV (4.0 Miles) - (replaces B1690)	9/1/2021
B3130.2	Construct a new 34.5 kV circuit from Atlantic to Red Bank 34.5 kV (12.0 Miles) - (replaces B1690)	7/1/2023
B3130.3	Construct a new 34.5 kV circuit from Freneau to Taylor Lane 34.5 kV (6.5 Miles) - (replaces B1690)	12/1/2024
B3130.4	Construct a new 34.5 kV circuit from Keyport to Belford 34.5 kV (6.0 Miles) - (replaces B1690)	12/1/2022
B3130.5	Construct a new 34.5 kV circuit from Red Bank to Belford 34.5 kV (5.0 Miles) - (replaces B1690)	7/1/2026
B3130.6	Construct a new 34.5 kV circuit from Werner to Clark Street (7.0 Miles) - (replaces B1690)	12/1/2021
B3130.7	Construct a new 34.5 kV circuit from Atlantic to Freneau (13.0 Miles) - (replaces B1690)	4/1/2024
B3130.8	Rebuild/Reconductor the Atlantic to Camp Woods Switch Point (3.5 Miles) 34.5 kV circuit - (replaces B1690)	12/1/2024
B3130.9	Rebuild/Reconductor the Allenhurst to Elberon (2.0 Miles) 34.5 kV circuit - (replaces B1690)	12/1/2022
B3130.10	Install 2 nd 115-34.5 kV Transformer at Werner Substation - (replaces B1690)	6/1/2021

Estimated Project Total Cost: \$175M

Required In-Service: Immediate Need

Project Status: Conceptual

* - 44.1 miles will be converting existing single circuit to double circuit 34.5 kV construction; 9.4 miles will be adding 34.5 kV circuit to existing distribution pole lines



Short Circuit Projects

Baseline Reliability: Immediate Need Exclusion – Second Read

Problem Statement: Short Circuit

- The Whitpain 230kV breaker "125" is overdutied.

Significant Driver:

- Case Correction – Whitpain 230kV breaker "125" was incorrectly modeled as a 63kA breaker when it was a 50kA breaker in the field.

Recommended Solution:

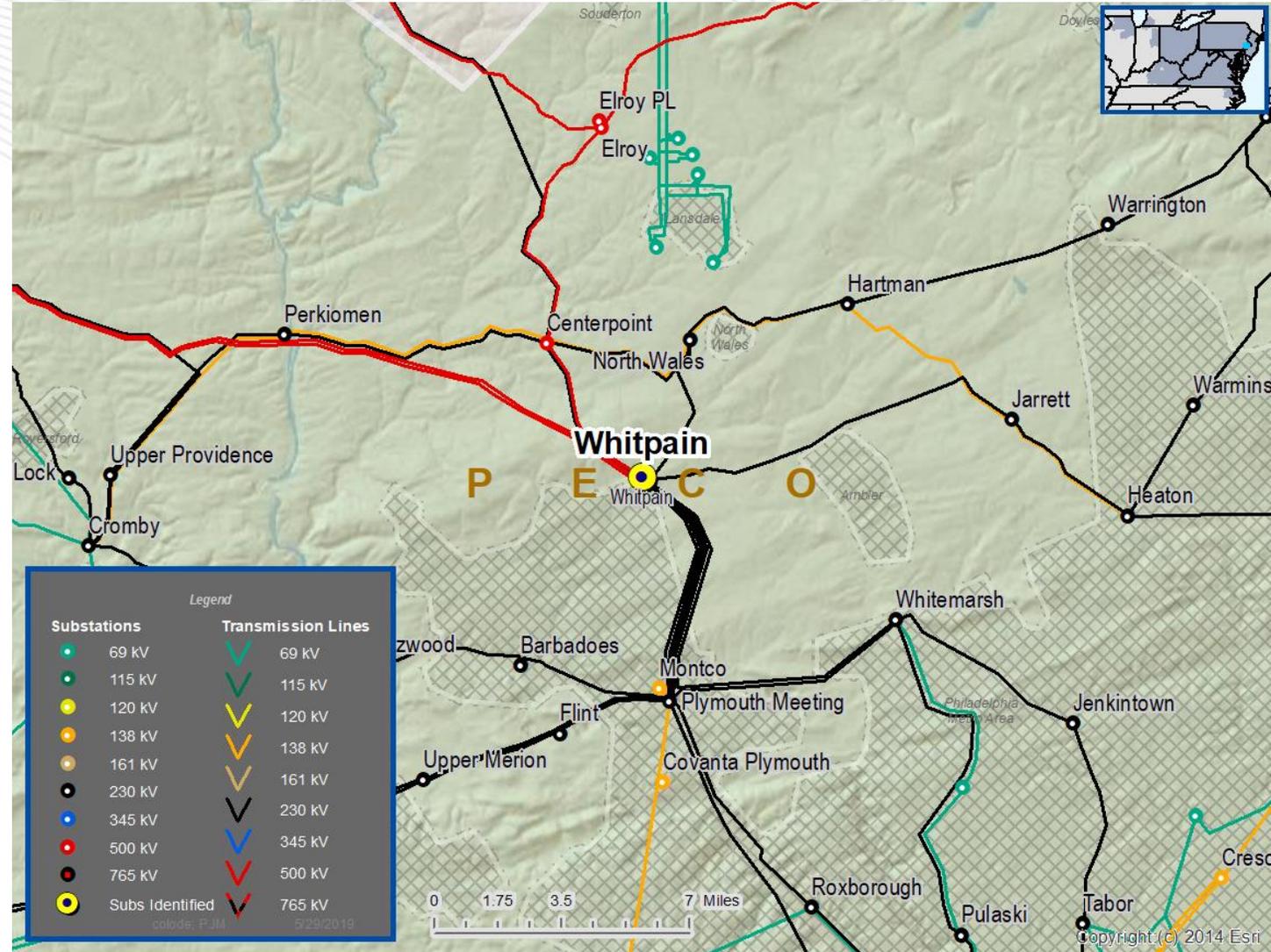
- Replace the Whitpain 230kV breaker "125" with a 63kA breaker (b3120)

Estimated Project Cost: \$0.60 M

Required In-service Date: Immediate Need

Projected In-service Date: 6/1/2021

Project Status: Conceptual



- Review Proposals associated with Short Term window violations
- Continue stability assessments
- Review impacts of withdrawn deactivations

Questions?



2019

- TEAC meetings are the following Thursdays in 2019
- **1/10, 2/7, 3/7, 4/11, 5/16, 6/13, 7/11, 8/8, 9/12, 10/17, 11/14, 12/12.**

- V1 – 09/05/2019 – Original slides posted
- V2 – 09/09/2019 – Added slide #4: 2019 RTEP Proposal Window 1 – Statistics
- V3 – 09/12/2019 – Added slides #18 – 29: Appendix Previously Reviewed Baseline Upgrade Recommendations for the October 2019 PJM Board Review

Appendix: Previously Reviewed Baseline Upgrade Recommendations for the October 2019 PJM Board Review



Western Region

Previously Presented on 5/20/2019 SRRTEP

Process Stage: Second Review

Criteria: TO Criteria violation

Assumption Reference: FERC 715

Model Used for Analysis: 2022 RTEP Summer

Proposal Window Exclusion: FERC 715

Problem Statement:

For loss of Bluff Point – Portland 69kV and Adams – Berne 69kV lines, the following violation occurs in the 2022 RTEP case:

North Portland, Trinity, Berne, South Berne, Monroe and S. Decatur drop below .92 PU with North Portland reaching .8229 PU. The Bockoven load addition (need number AEP-2018-IM005) makes these violations slightly worse.

Proposed Solution:

Jay – North Portland 138/69kV line.

Rebuild the 138kV Jay – Pennville line as double circuit 138/69kV.

Build a new 9.8 mile single circuit 69 kV line from near Pennville station to North Portland station

(B3119.1) Cost: \$38.1M

Jay 138/69/34.5kV station

Install 3 69kV breakers to create the “U” string and add a low side breaker on the Jay transformer 2.

(B3119.2) Cost: \$3.4M

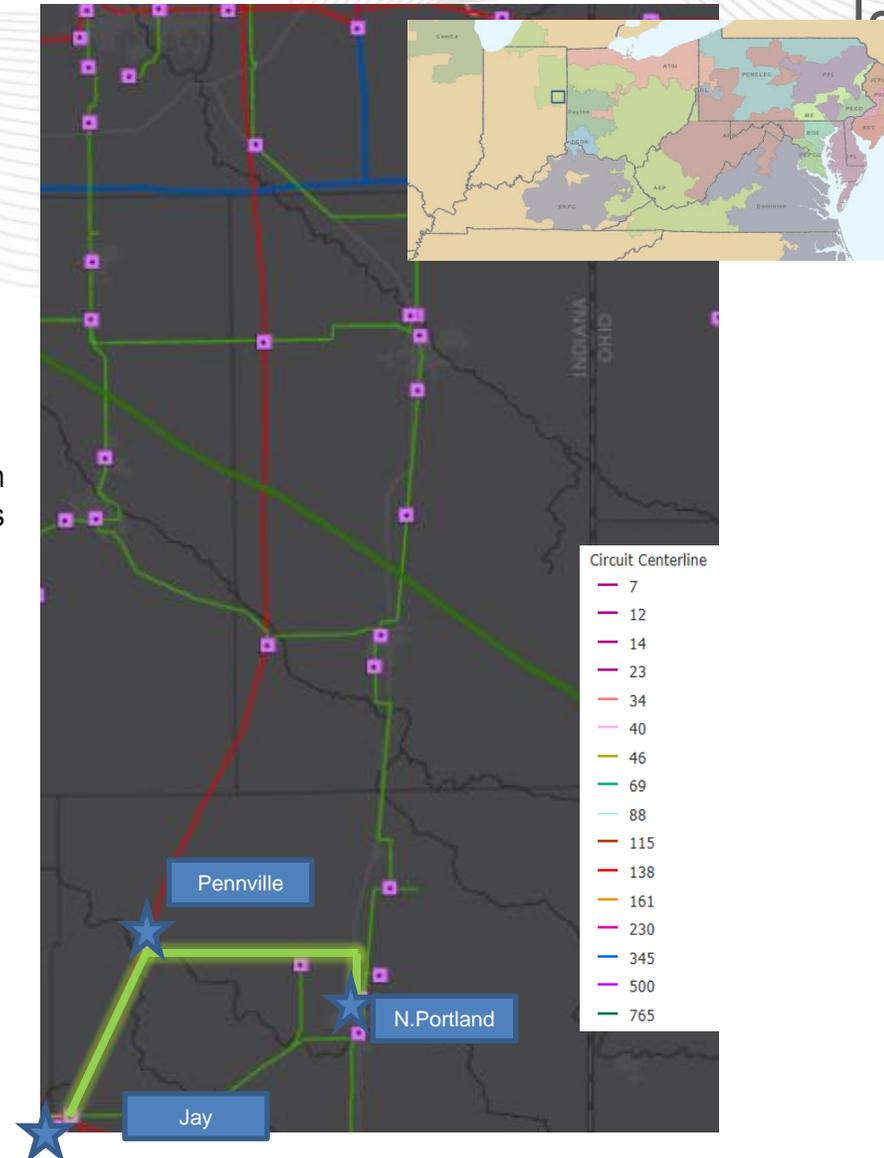
North Portland 69kV station

Install 2 69kV breakers to complete the ring and allow for the new line. **(B3119.3)** Cost: \$1.9M

Total Estimated Transmission Baseline Cost: \$43.4M

Required IS Date: 6/1/2022

Project Status: Scoping



Process Stage: Second Review

Criteria: TO Planning Criteria Violation

Assumption Reference: FERC 715

Model Used for Analysis: Summer 2023 RTEP

Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:

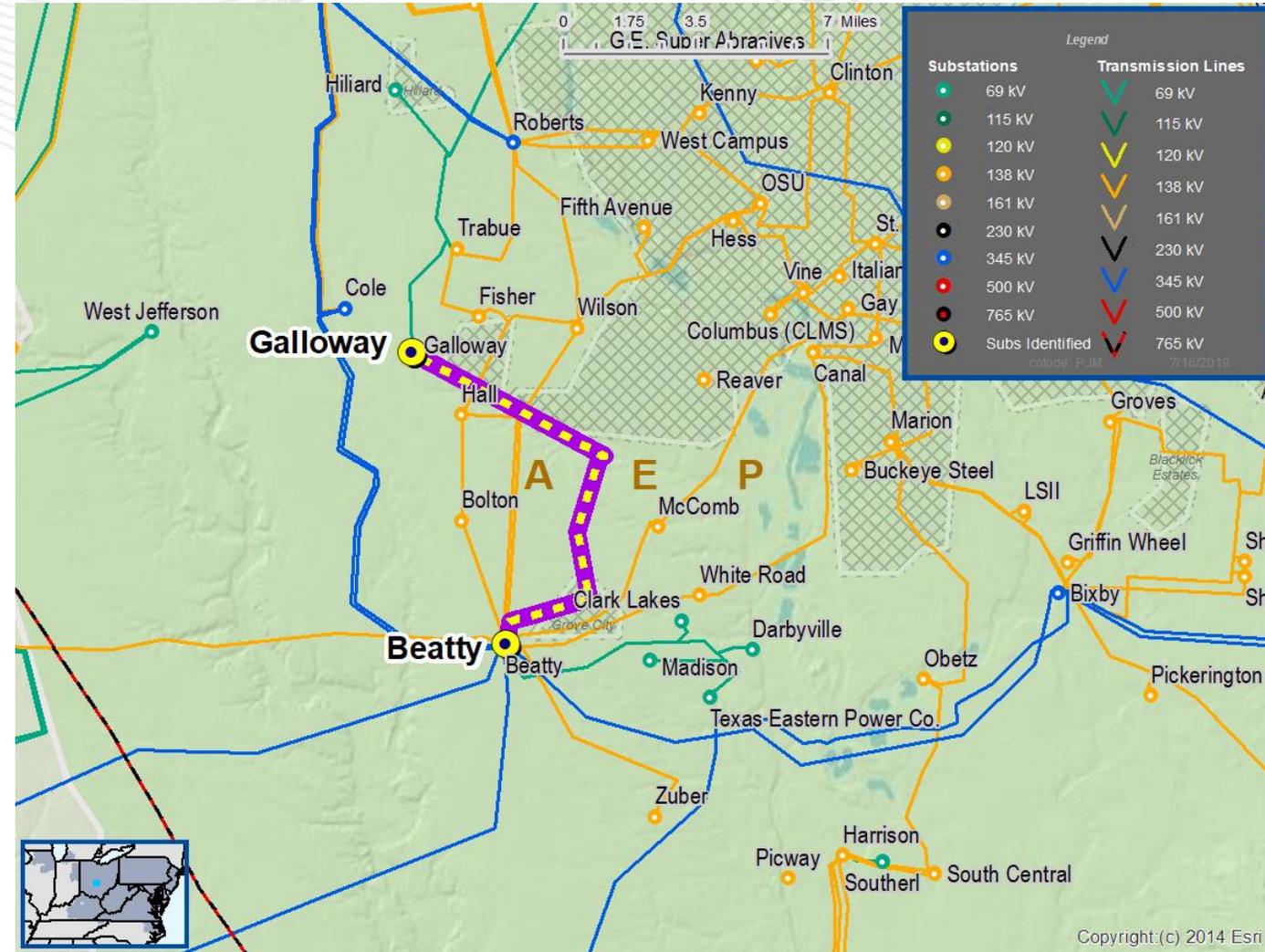
The 69 kV underground cable between Beatty and Galloway will overload to 116% of its normal rating (52 MVA) for the loss of the Trabue 138/69 kV transformer #3 or Nautilus – Trabue 69 kV circuit under N-1-0 analysis in the 2023 RTEP summer case. (118% in 2024 RTEP summer case)

Proposed Solution:

Replace approx. 0.7 miles existing 1960's vintage 69kV cable between Beatty & Galloway with 4000 kcmil XLPE Cable. (75/75/94/94 MVA) (b3210)

Estimated Cost: \$5.3 M

Required In-Service: 6/1/2023





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation (Cost Increase) Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Low Voltage (0.883 pu) and voltage drop (17% worst drop) violations at South Upper Sandusky, Harpster, Ridgedale, South Morral, Meeker, and Decliff 69kV buses for the outage of the Upper Sandusky 69kV bus in the 2021 RTEP case.

The Harpster area has had over 670,000 customer minutes of interruptions over the past three years, including 360,000 minutes on the Harpster-Decliff line. –Marion, Ohio

Recommended Solution: Construct new 138/69/34kV station and 1-34kV circuit (designed for 69kV) from new station to Decliff station, approximately 4-5.5 miles, with 556 ACSR conductor (51 MVA rating). (B2794)

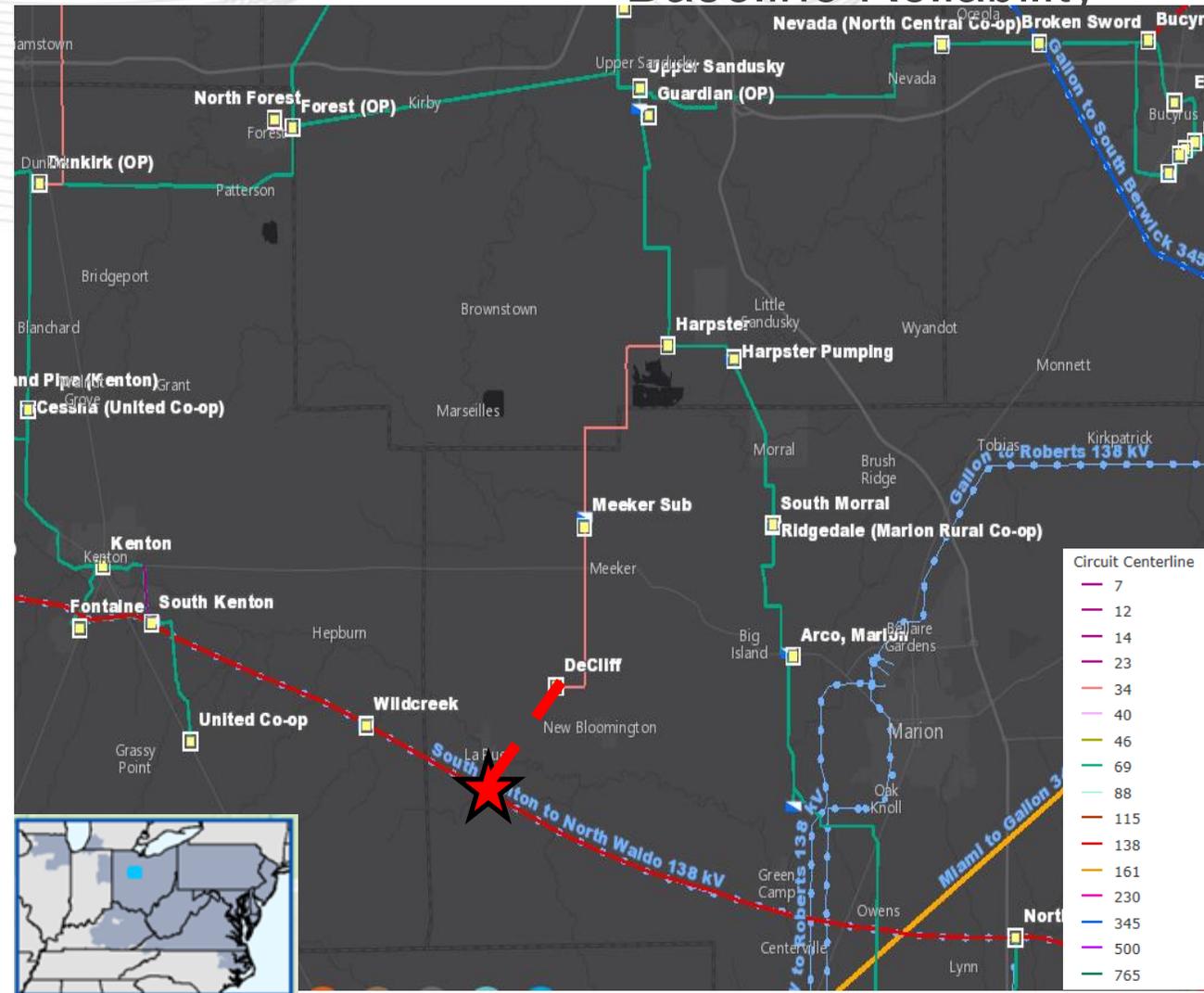
Estimated Project Cost: ~~\$12.65M~~ **\$28.9M**

Increase in costs include:

- Transmission line length increased after completion of more detailed scoping analysis. Detailed design increased number of dead end structures required, along with an escalation in labor costs. \$4.4M
- Station site selection resulted in a large increase in required civil/land mitigation and detailed scoping design increased costs. \$6.0M
- Other cost increases are due to required remote end relaying upgrades to accommodate new source/relays and ROW and property costs exceeding original estimates. \$5.85M

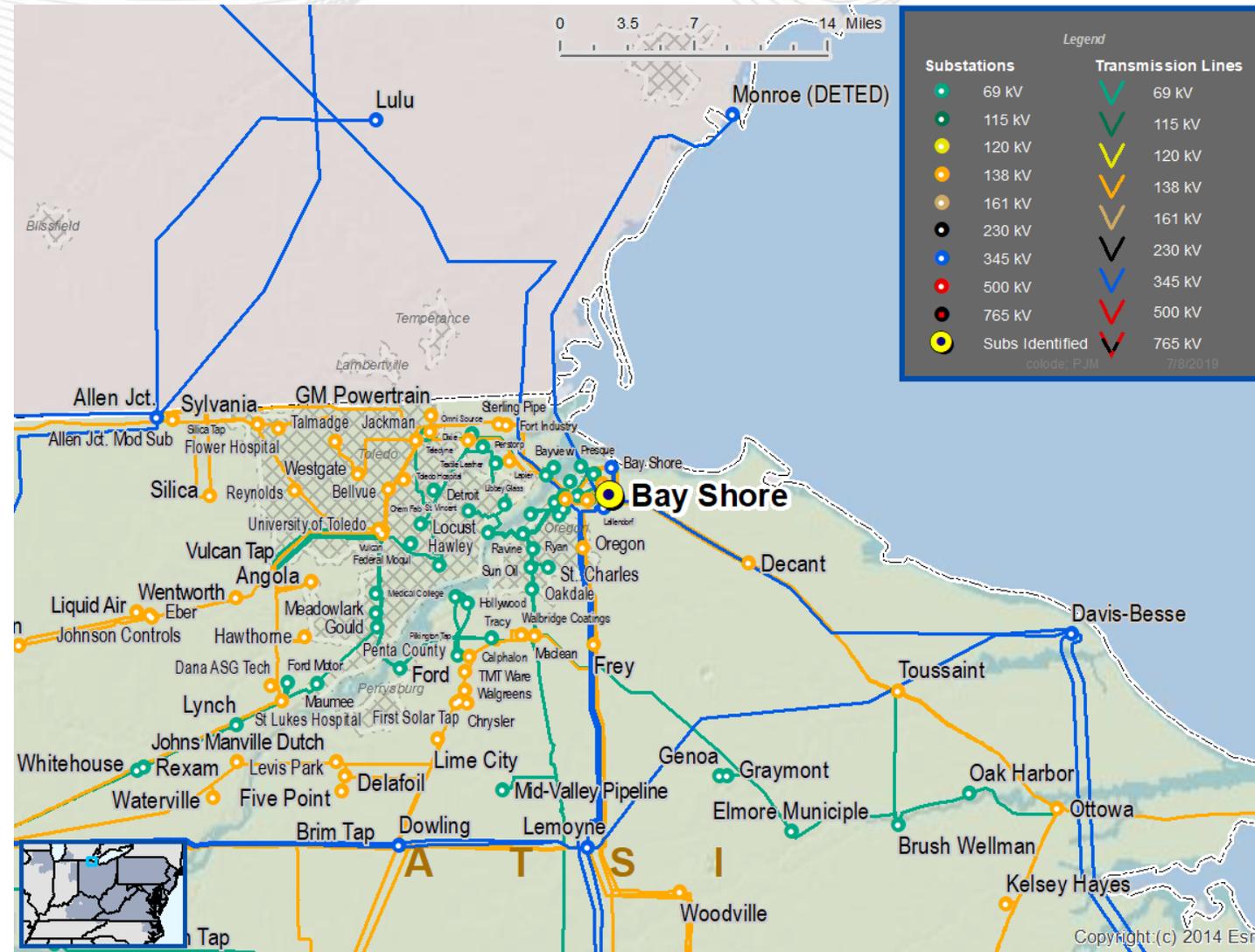
Required IS Date: 6/1/2021

Status: Scoping



Bay Shore 2, 3, and 4 – 495 MW

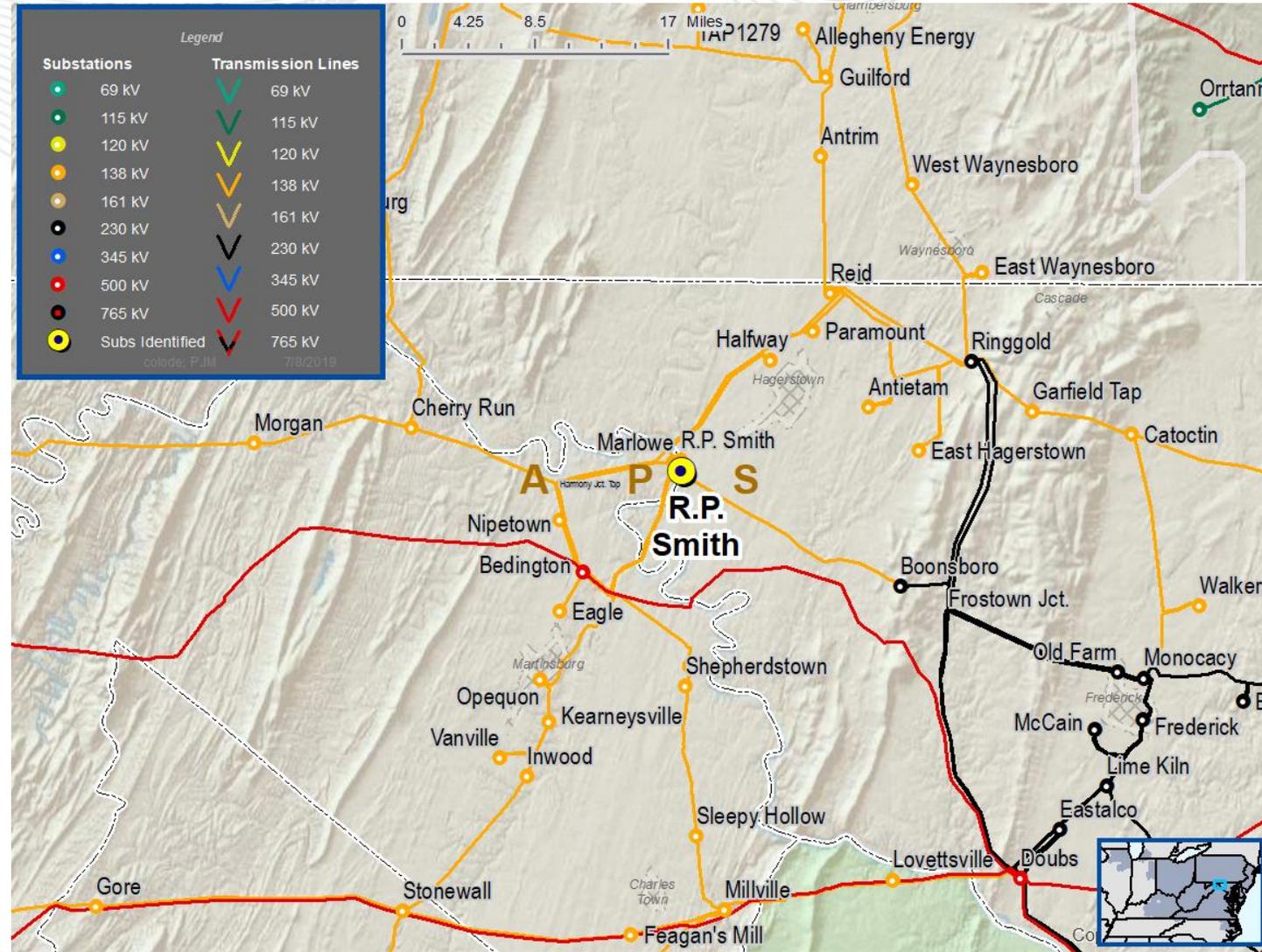
- The actual deactivation date was 09/01/2012.
 - All impacts and associated baseline projects were initially presented on 09/08/2010.
 - FE recently informed of the necessary substation work associated with deactivating the unit – B3127.
- Install new switchyard power supply to separate from existing generating station power service.
 - Separate all communications circuits.
 - Separate metering circuits from switchyard and generation station.
- **Estimated Cost: \$1.5M**
 - **Projected IS Date: 12/31/2021**



R. Paul Smith 3 and 4 – 115 MW

- The actual deactivation date was 09/01/2012.
- All impacts and associated baseline projects were initially presented on 09/08/2010.
- FE recently informed of the necessary substation work associated with deactivating the unit – B3128 for relocating 34.5 kV lines from generating station roof.

- **Estimated Cost: \$0.4M**
- **Projected IS Date: 12/31/2020**





Southern Region



Dominion Transmission Zone: Baseline 230kV Line #254 Rebuild (End of Life Criteria)

Process Stage: Recommended Solution

Criteria: End of Life

Assumption Reference: FERC 715

Model Used for Analysis: 2018 Series 2023 Summer RTEP

Proposal Window Exclusion: FERC 715 (TO Criteria)

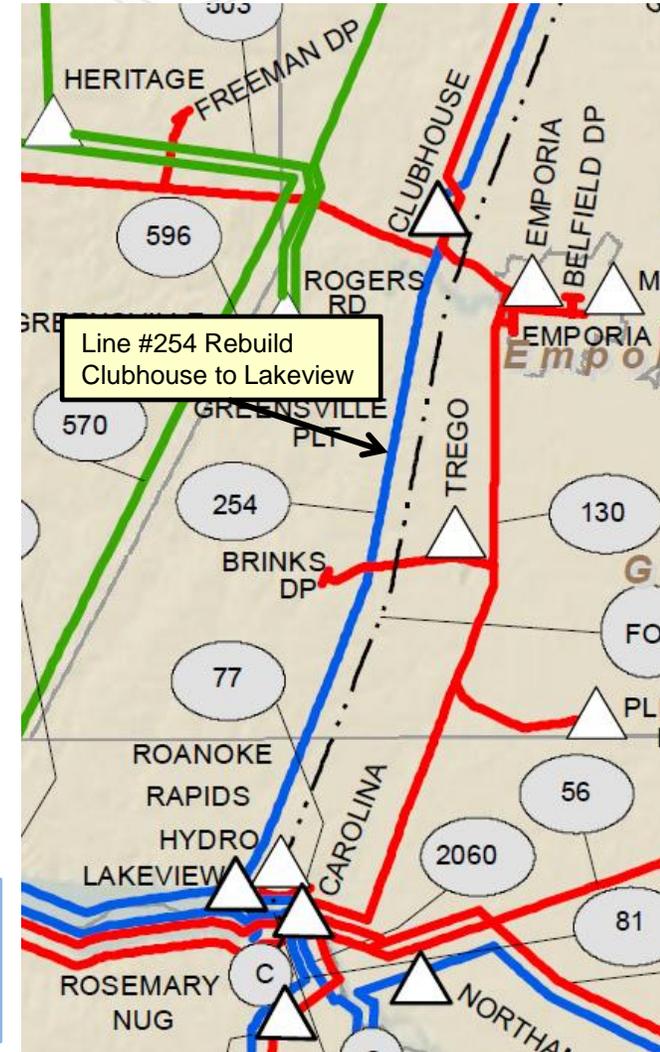
Problem Statement:

The 230kV Line #254, from Clubhouse to Lakeview, is approximately 18 miles long and was constructed on wooden H-frame structures in 1962. Industry guidelines indicate equipment life for wood structures is 35-55 years, conductor and connectors are 40-60 years and porcelain insulators are 50 years.

Reliability studies indicate that retiring Line #254 will result in thermal overloads in accordance with P1, P2, P4, P6, and P7 NERC criteria violations. There is also an operational performance need for Line #254, as generator AB2-100 would be left unserved if the line were retired.

Existing Facility Rating: 399 MVA STE

Preliminary Facility Rating: 1047 MVA STE



COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2099
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED



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Dominion Transmission Zone: Baseline 230kV Line #254 Rebuild (End of Life Criteria)

Recommended Solution:

Rebuild 230kV Line #254 with single-circuit wood pole equivalent structures at the current 230kV standard with a minimum rating of 1047 MVA. (b3121)

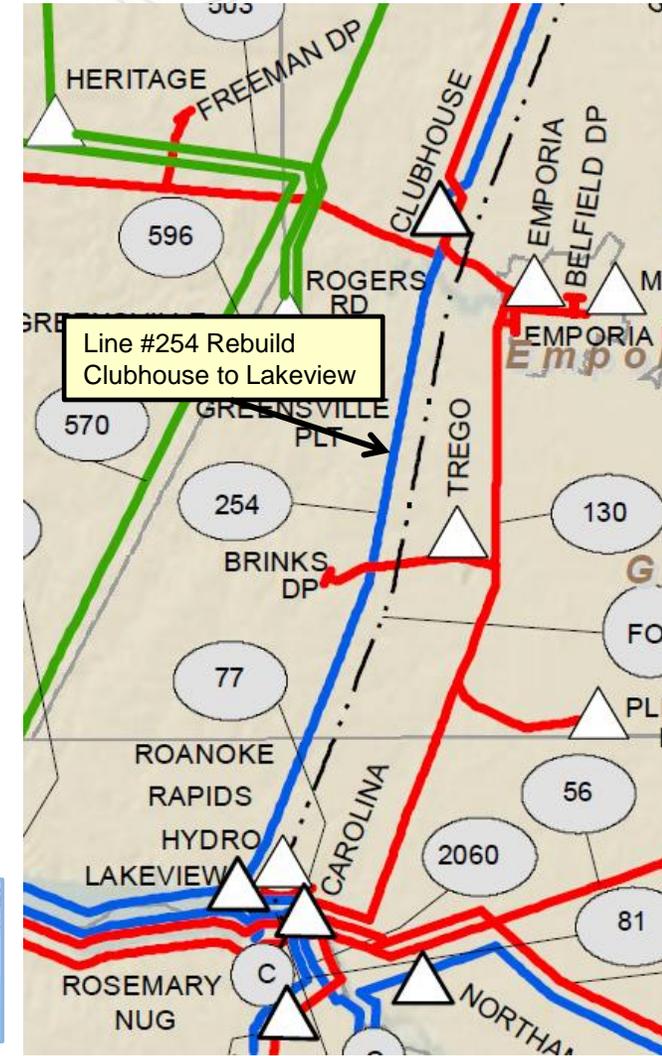
- **Estimated Cost:** \$27.0 M

Required In-Service: Immediate Need

Projected In-Service: 12/31/2024

Project Status: Conceptual

Previously Presented: 6/13/2019 TEAC



COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
Green	500 KV.	500 thru 599
Blue	230 KV.	200 thru 299 & 2000 thru 2099
Red	115 KV.	1 thru 199
Orange	138 KV.	AS NOTED
Cyan	69 KV.	AS NOTED



Process Stage: Recommended Solution

Criteria: End of Life

Assumption Reference: FERC 715

Model Used for Analysis: 2018 Series 2023 Summer RTEP

Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:

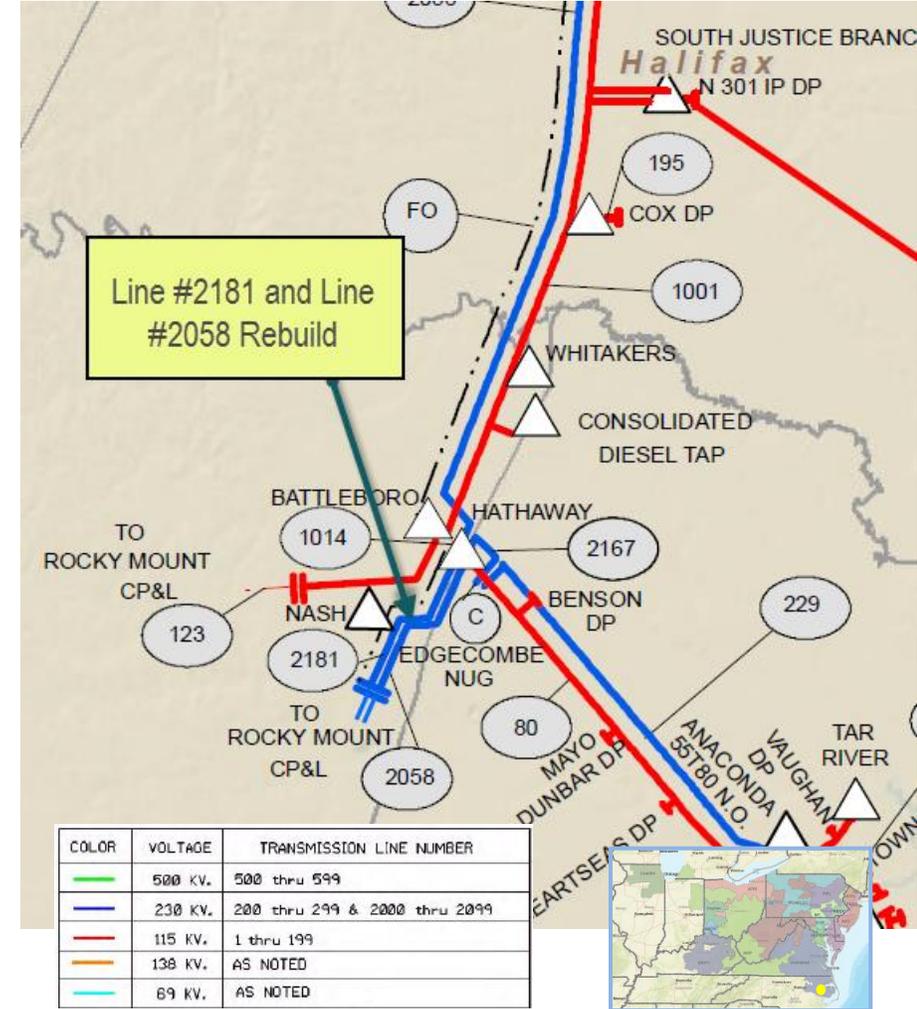
The 230kV Line #2181 and Line #2058 Hathaway – Rocky Mount (Duke Energy Progress) was constructed on Cor-ten lattice-type double circuit towers in the 1960s for approximately 4.1 miles. These towers have been shown to have inherent corrosion problems that continuously deteriorate the steel members. These lines have been identified to be rebuilt as part of Dominion’s End of Life criteria.

The Line #2181 provides service to Nash and City of Rocky Mount #4 substations with approximately 16 MW and 54 MW tapped load.

With Lines #2181 and #2058 removed from service, N-1 loss of Line #218 Everetts – Greenville (Duke Energy Progress) overloads Line #123 Battleboro – Rocky Mount (Duke Energy Progress) (NERC Category P1 – Single Contingency).

Existing VACAR South Operating Limits Procedure identifies these tie-lines between Dominion and Duke Energy Progress as possible overloads under certain system conditions.

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Dominion Transmission Zone: Baseline 230kV Line #2181 and 230kV Line #2058 Rebuild (End of Life Criteria)

Existing Facility Ratings: 478 MVA STE

Preliminary Facility Rating: Hathaway - Nash: 1047 MVA STE Line #2181
 Nash – City of Rocky Mount: 478 MVA STE (Limited by Duke) Line #2181
 Hathaway – City of Rocky Mount: 478 MVA STE (Limited by Duke) Line #2058

Recommended Solution:

Rebuild 230kV Line #2181 and Line #2058 Hathaway – Rocky Mount (Duke Energy Progress) with double circuit steel structures using double circuit conductor at current 230kV standards with a minimum rating of 1047 MVA. (b3122)

- **Estimated Cost:** \$13.0 M

Required In-Service: Immediate Need

Projected In-Service: 12/31/2024

Project Status: Conceptual

Previously Presented: 6/13/2019 TEAC

