Sub Regional RTEP Committee
South

June 9, 2017

Subregional RTEP (SRRTEP) Meeting Format Update

- Response to stakeholder feedback
- Today's Presentation approach
  - First Review (baseline and supplemental by transmission owner zone)
  - Second Review (baseline and supplemental by transmission owner zone)
- Additional Information
- Meeting Frequency

Baseline Reliability and Supplemental Project First Review

Dominion Transmission Zone Baseline Project

Baseline Project: New 230-115kV Switching Station to Serve Windsor DP (REC)

Problem Statement: DOM "End of Life Criteria"

- 115kV Line #139 Everetts to Windsor has 336 ACSR conductor constructed on wood H-frames in the 1951 timeframe. Line #139 serves one delivery point Windsor DP (Roanoke EC). This line needs to be rebuilt to current standards or provide another source for Windsor DP based on Dominion's "End of Life" criteria.

- Permanent MW load loss for removal of this line is 10 MW.

Potential Solution:

- Build a new 230-115kV switching station connecting to 230kV network Line #2014 (Earleys – Everetts). Purchase land and install three single phase 30 MVA 230-115kV transformers (and a spare) with a high and low side breaker. Provide a 115kV source from the new station to serve Windsor DP. Remove Line #139 19.5 miles (15.5 miles Everetts – Windsor, 1.1 mile Windsor to idle line, 2.9 miles idle line).

  Estimated Project Cost: $11.5 M

Alternatives:

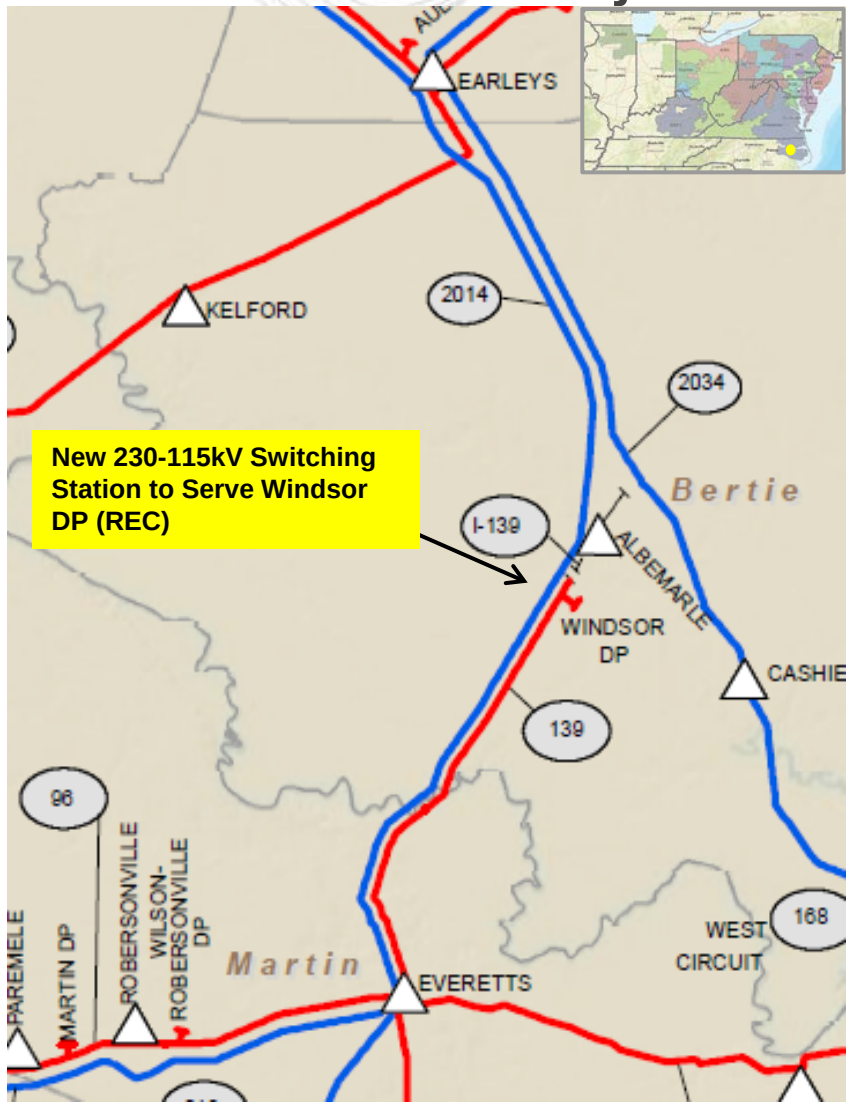
- Rebuild 115kV Line #139 from Everetts to Windsor, 15.5 miles, with single circuit steel structures. The conductor used (636 ACSR) will be at current standards with a summer emergency rating of 262 MVA at 115kV.

  Estimated Project Cost: $20 M

Possible IS Date: 12/30/2022

Project Status: Conceptual

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



Dominion Transmission Zone Baseline Project

Existing b2649 Cost Increase and Scope Modification

Baseline Project: Line #130 Rebuild Clubhouse to Carolina (End of Life Criteria)

Problem Statement: DOM "End Of Life Criteria" Violation

- End of Life Criteria – The Clubhouse to Carolina 115kV line was constructed on wood H-frames and single poles in 1955. This line serves Mecklenburg delivery points Brink, Belfield and Emporia.
- System Impact Assessment – Permanent MW load loss for removal of this line is 42 MW.
- When this criteria violation was identified, the need date was already in the immediate timeframe. This is an immediate need project based on "End of Life" criteria.

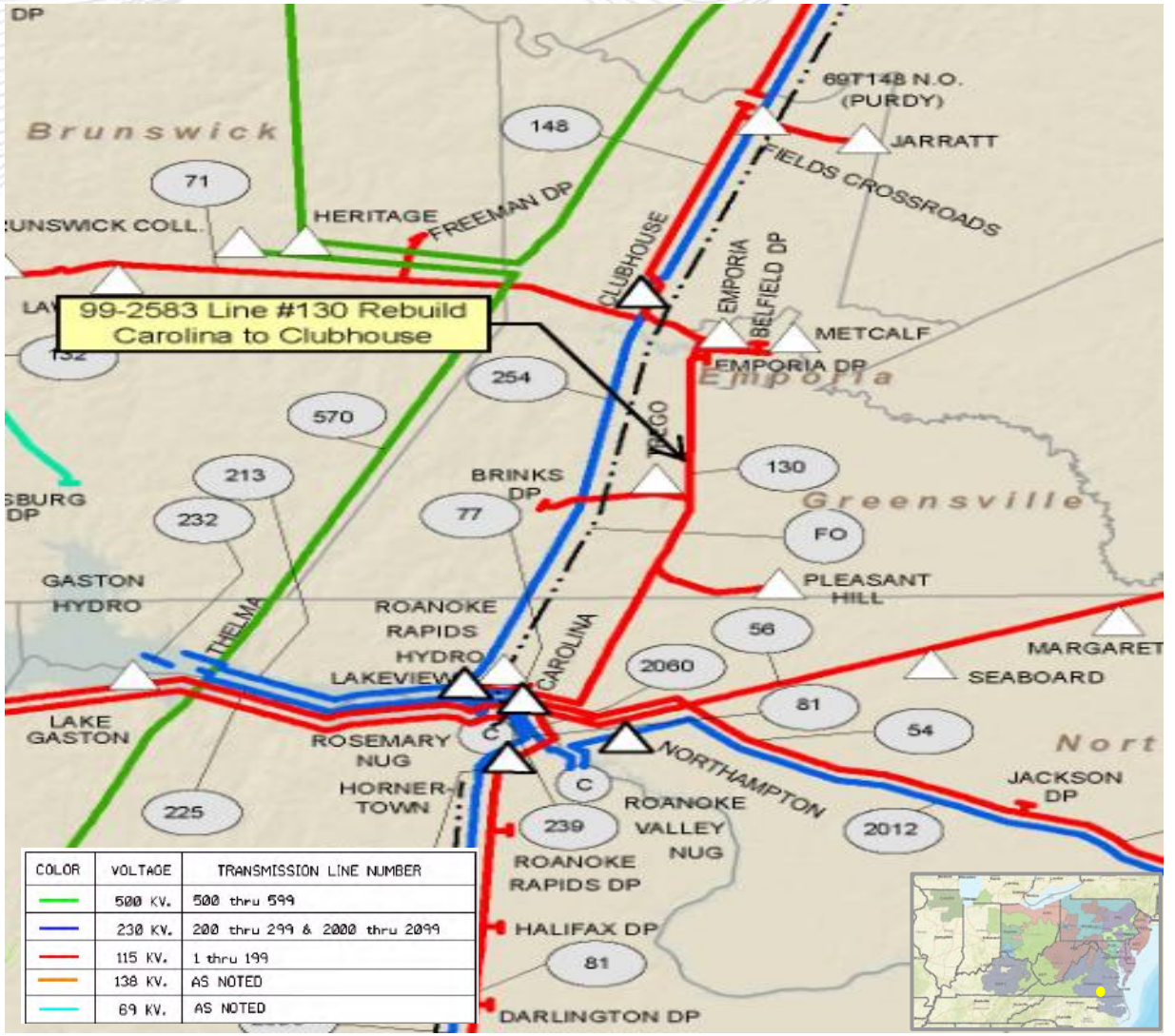
Alternatives Considered:

- Given the immediate need timing of the violation, alternatives that would require new lines to be built were not considered.

Proposed Immediate Need Solution:

Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

- Rebuild Line #130 between Clubhouse and Carolina (19.9 miles) to current standards using 768 ACSS conductor with a summer emergency rating of 394 MVA at 115kV and steel H-frame construction.



Dominion Transmission Zone Baseline Project

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Existing b2649 Scope Change & Cost Increase

Reason for Cost Increase and Scope Modification:

- Add rebuild of 1.7 mile tap to Metcalf and Belfield DP (MEC) due to poor condition. The existing summer rating of the tap is 48 MVA and existing conductor is 4/0 ACSR on wood H-frames. The proposed new rating is 176 MVA using 636 ACSR conductor. ($3,569,000)
- Add rebuild of 4.1 mile tap to Brinks DP (MEC) due to wood poles built in 1962. The existing summer rating of the tap is 48 MVA and existing conductor is 4/0 ACSR and 393.6 ACSR on wood H-frames. The proposed new rating is 176 MVA using 636 ACSR conductor. ($8,212,000)
- Both tap rebuilds require a temporary line.
- Proposed permanent construction is steel H-frames.

Previous Estimated Project Cost: $27.0 M

Revised Estimated Project Cost: $38.9 M

Projected IS Date: 12/31/2019

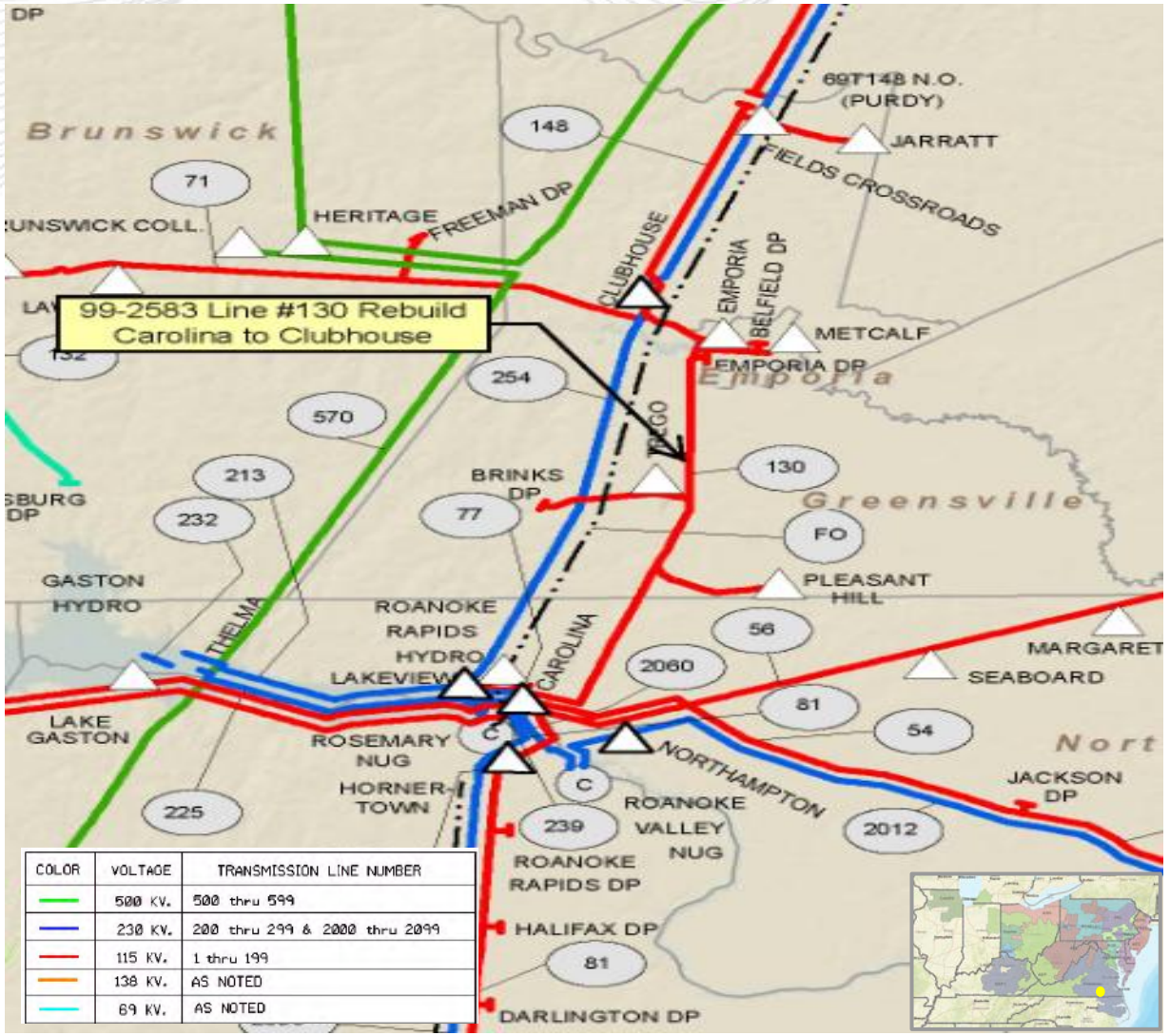
Project Status: Engineering

Original Subregional Date: 07/29/2015

Original Subregional Cost: $26.7M

Latest TEAC Date: 09/10/2015

Latest TEAC Cost: $27.0M



Dominion Transmission Zone Supplemental Project

Supplemental Project: Brunswick 115-69kV Transformer #2 Upgrade

Problem Statement:

- Brunswick 115-69kV 22 MVA transformer #2 needs to be replaced as a result of Dominion's ongoing transformer health assessment (THA) process. This process considers design characteristics, past electrical test results, dissolved gas-in-oil test results, age, ongoing maintenance issues, and past failures of similar designed transformers.

- This transformer was manufactured in 1951 by Westinghouse.

- Drivers for replacement are – age and THA

Potential Solution:

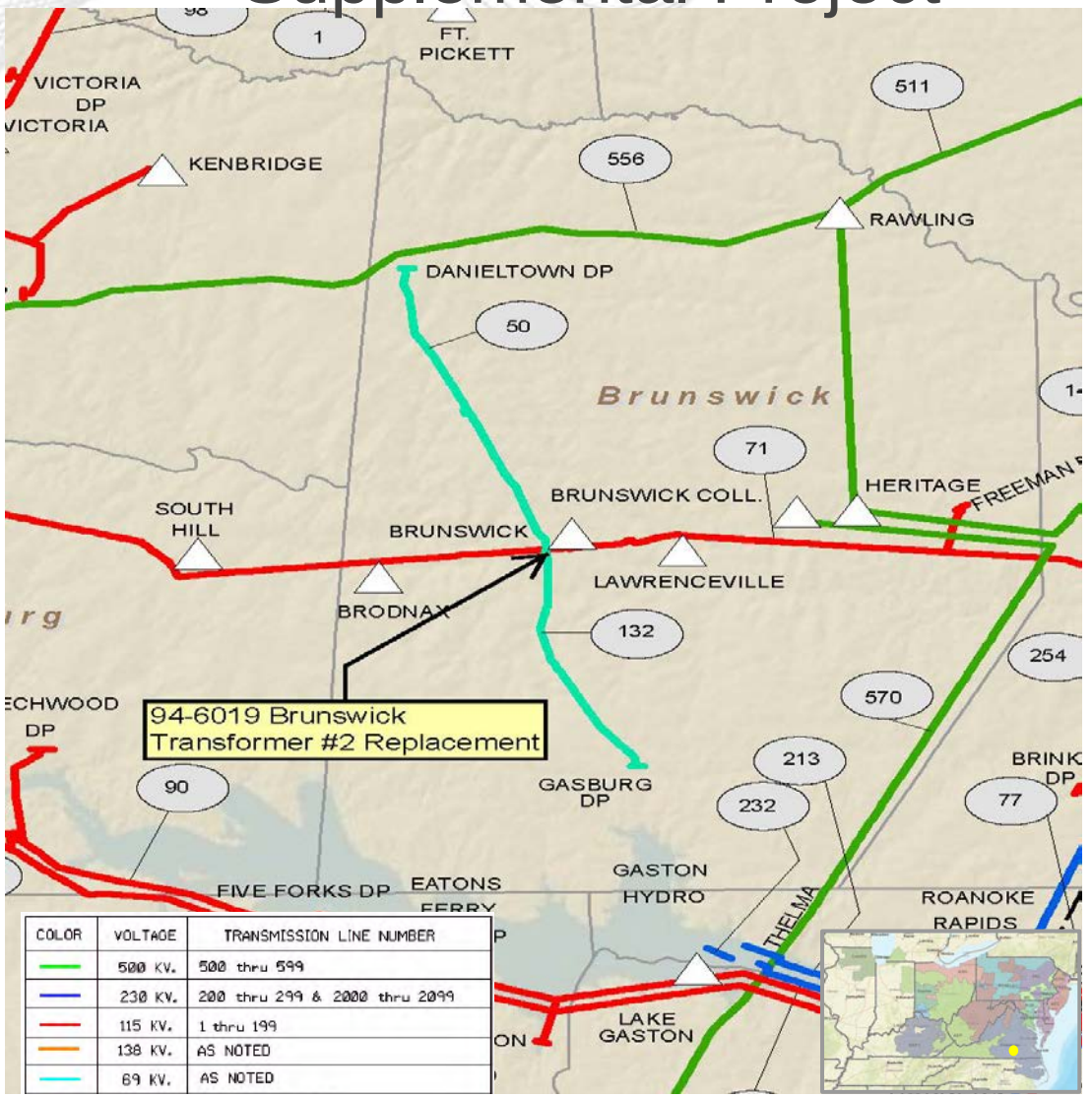
- Replace Brunswick transformer #2 with a 30 MVA transformer.
- Expand station and relocate A frame structure to accommodate replacement transformer.
- Expand control house to move transformer controls inside the control house.

Alternatives: No feasible alternatives

Estimated Project Cost: $2.9 M

Possible IS Date: 06/15/2018

Project Status: Engineering



Dominion Transmission Zone Supplemental Project

Supplemental Project: Tarboro 230-115kV Transformer #3 Upgrade

Problem Statement:

- Tarboro 230-115kV 112 MVA transformer #3 needs to be replaced as a result of Dominion's ongoing transformer health assessment (THA) process. This process considers design characteristics, past electrical test results, dissolved gas-in-oil test results, age, ongoing maintenance issues, and past failures of similar designed transformers.

- This transformer was manufactured in 1972 by Westinghouse. It was remanufactured in 2003 following failures in 1975, 1994 & 2002.

- Drivers for replacement are – age, previous remanufacture following failures, increased trend of combustible gas generation, and reduced BIL.

Potential Solution:

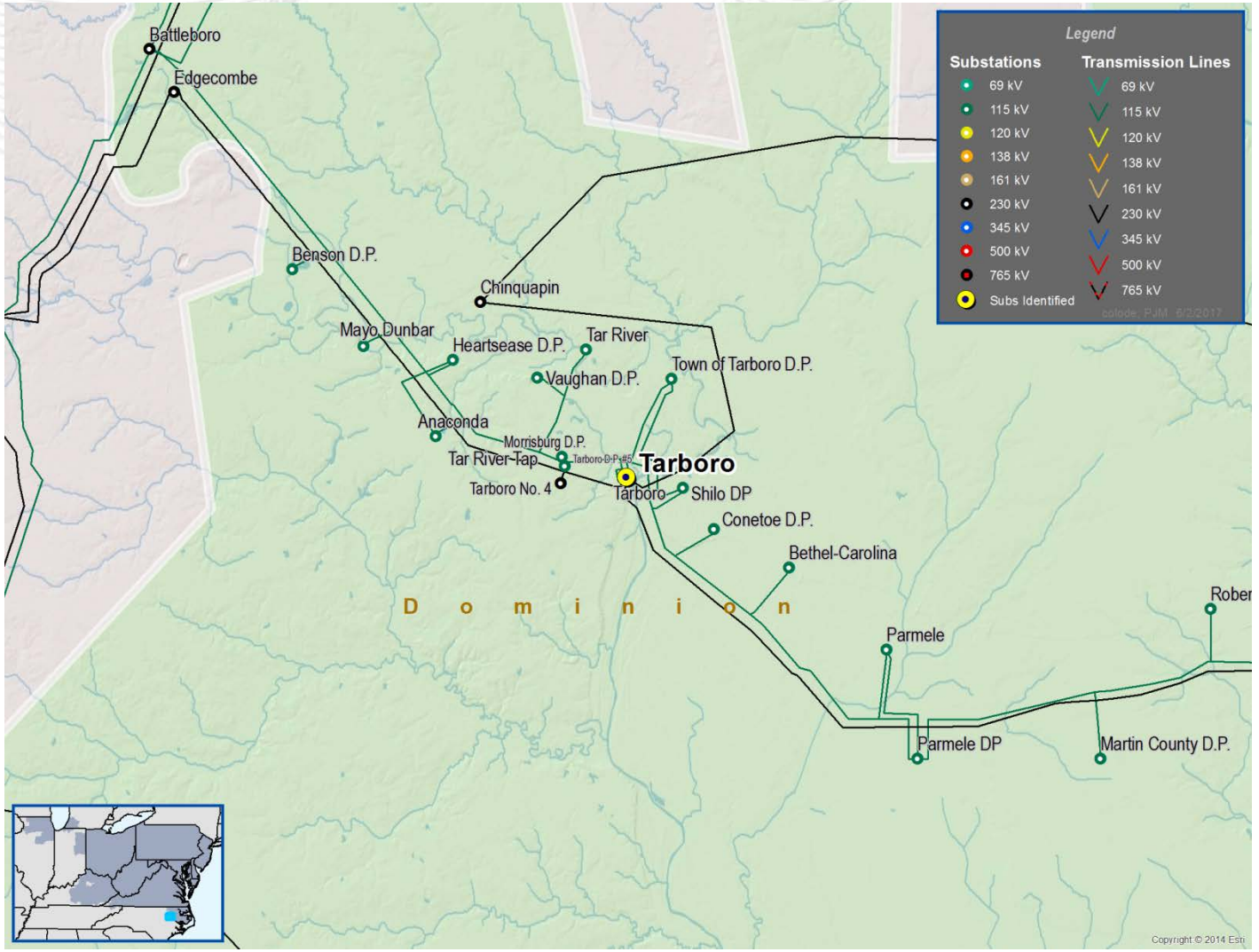
- Replace Tarboro transformer #3 with a 168 MVA transformer.

Alternatives: No feasible alternatives

Estimated Project Cost: $2.9 M

Possible IS Date: 12/29/2017

Project Status: Engineering



Dominion Transmission Zone Supplemental Project

Supplemental Project: Tarboro 230-115kV Transformer #4 Upgrade

Problem Statement:

- Tarboro 230-115kV 112 MVA transformer #4 needs to be replaced as a result of Dominion's ongoing transformer health assessment (THA) process. This process considers design characteristics, past electrical test results, dissolved gas-in-oil test results, age, ongoing maintenance issues, and past failures of similar designed transformers.

- This transformer was manufactured in 1974 by McGraw Edison.

- Drivers for replacement are – age, reduced BIL, transformers previously manufactured by McGraw Edison are considered suspect due to previous transformer failures.

Potential Solution:

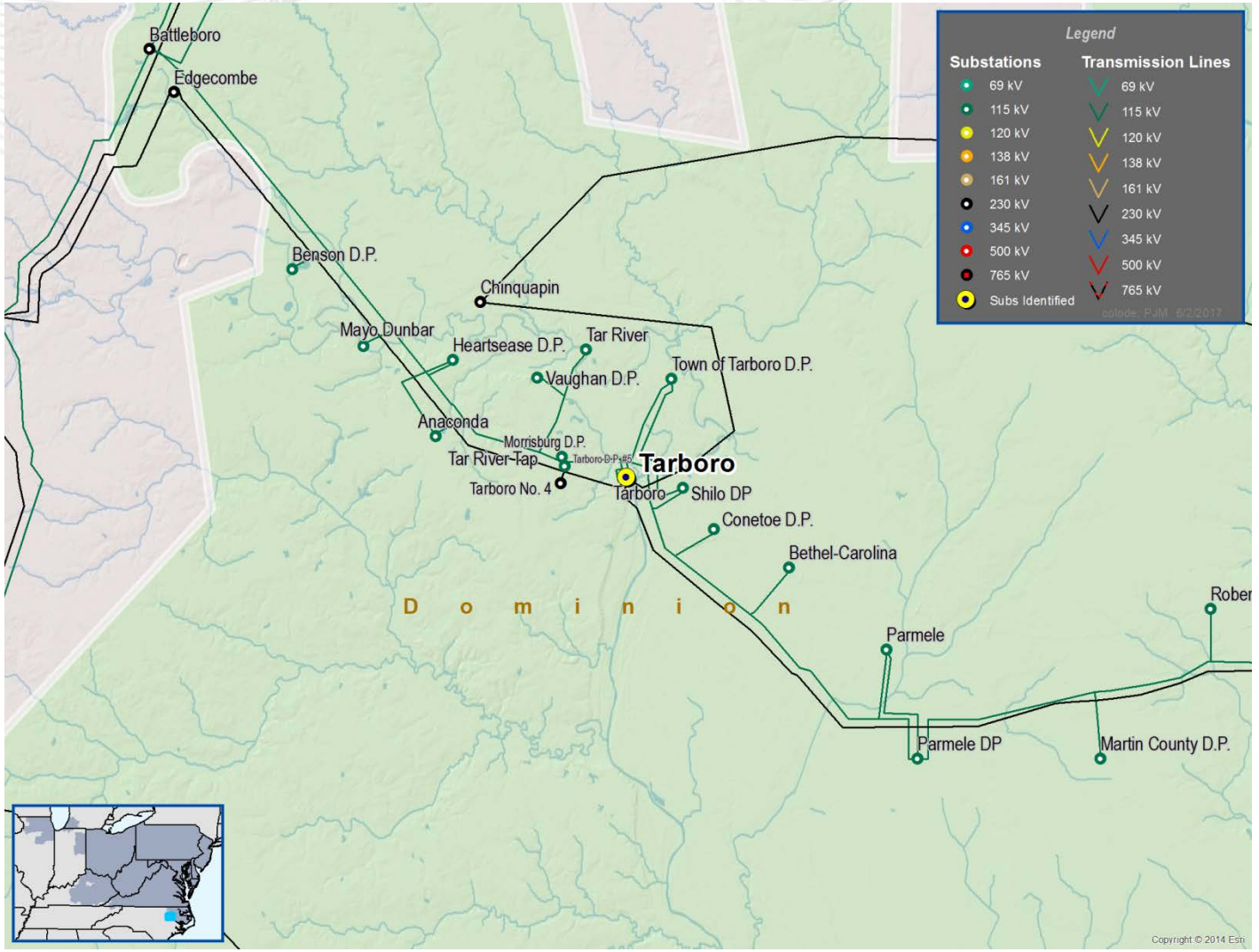
- Replace Tarboro transformer #4 with a 168 MVA transformer.

Alternatives: No feasible alternatives

Estimated Project Cost: $2.9 M

Possible IS Date: 12/30/2017

Project Status: Engineering



Baseline Reliability and Supplemental Project Second Review

Dominion Transmission Zone Baseline Project

Baseline Project: Line #120 Dozier to Thompsons Corner Partial Rebuild (End of Life Criteria)

Problem Statement: DOM "End of Life Criteria"

Date Project Last Presented: 4/25/2017 SRRTEP

- A 7 mile segment of 115kV Line #120 located approximately between Dozier and Thompsons Corner Substations was constructed on wood H-frame structures in 1955 . The existing summer emergency rating of this line segment is 147 MVA. Current conductor used is 477 ACSR.

- This line segment needs to be rebuilt to current standards based on Dominion's "End of Life" criteria.

- Permanent MW load loss for removal of this line is 100MW.

Recommended Solution:

- The 7 mile section from Dozier to Thompsons Corner of line #120 will be rebuilt to current standards using 768.2 ACSS conductor with a summer emergency rating of 346 MVA at 115kV. Line is proposed to be rebuilt on single circuit steel monopole structures. **(b2800)**

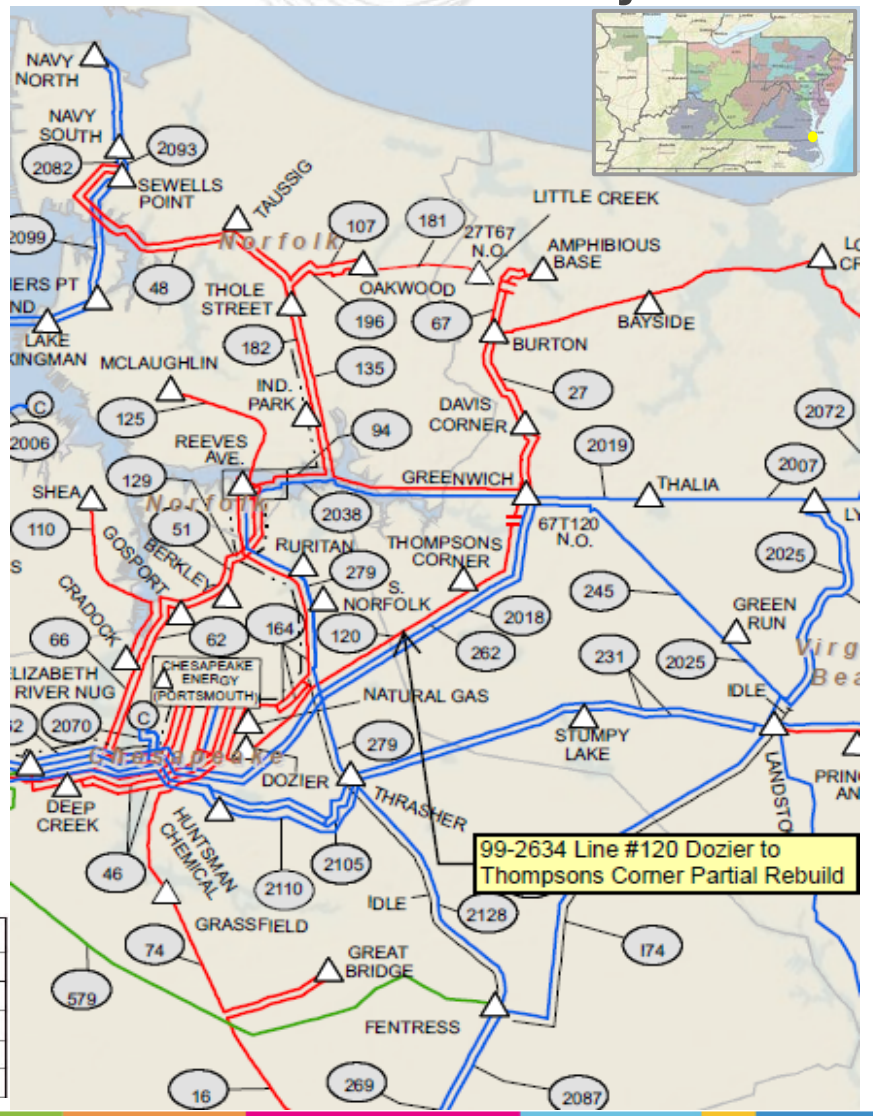
Alternatives: No feasible alternatives

Estimated Project Cost: $6.5 M

Projected IS Date: 12/30/2021

Project Status: Conceptual

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



Dominion Transmission Zone Baseline Project

Baseline Project: Line #76 and #79 Yorktown to Peninsula Rebuild (End of Life Criteria)

Problem Statement: DOM "End of Life Criteria"

Date Project Last Presented: 4/25/2017 SRRTEP

- 115kV Lines #76 and #79 from Yorktown to Peninsula are 11 miles long and were constructed on double circuit 3 pole wood H-frame structures in 1957. The existing summer emergency rating of these lines are 193 MVA. Current conductor used includes 477 ACSR and 636 ACSR.

- This line needs to be rebuilt to current standards based on Dominion's "End of Life" criteria.

- Permanent MW load loss for removal of these lines is 30 MW.

Recommended Solution:

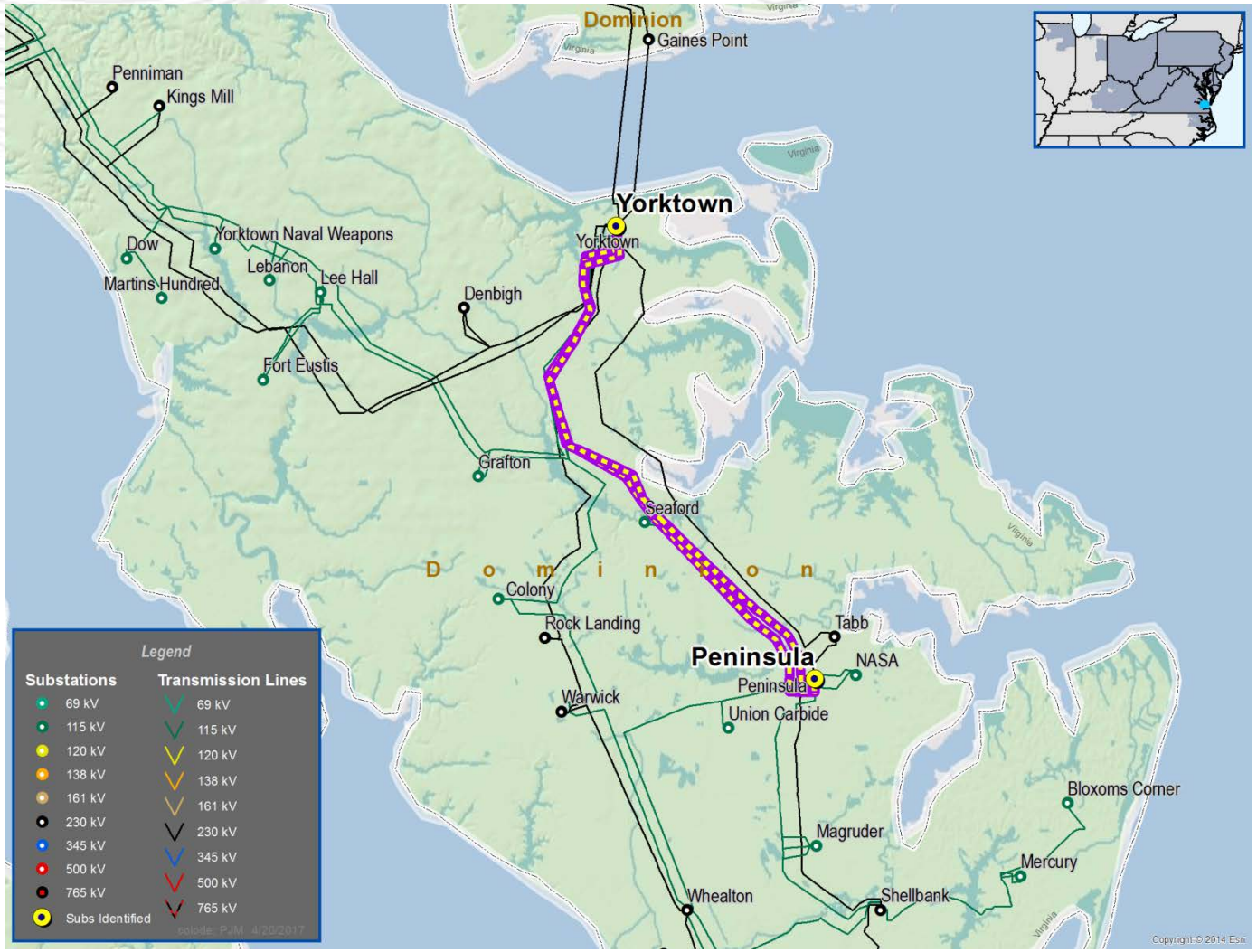
- Line #76 and #79 will be rebuilt to current standard using 768.2 ACSS conductor with a summer emergency rating of 346 MVA at 115kV. Proposed structure for rebuild is double circuit steel monopole structure. (**b2801)**

Alternatives: No feasible alternatives

Estimated Project Cost: $22.0 M

Projected IS Date: 12/30/2020

Project Status: Conceptual



Dominion Transmission Zone Baseline Project

Baseline Project: Line #101 Rebuild Mackeys to Creswell (End of Life Criteria)

Problem Statement: DOM "End of Life Criteria"

Date Project Last Presented: 4/25/2017 SRRTEP

- 115kV Line #101 from Mackeys to Creswell (14 miles) was constructed on wood H-frames in the 1970-1975 timeframe. The conductor has broken stranding consistent across entire line. The existing summer emergency rating of this line is 152 MVA. Current conductor used is 545.6 ACAR 15/7 ACAR.
- This line needs to be rebuilt to current standards based on Dominion's "End of Life" criteria.
- Permanent MW load loss for removal of this line is 21 MW.
- The MW–mile for line #101 is 518 MW-mile based on the Winter 2025/26 projection. Dominion's 700 MW-mile radial line criteria would be violated if 8 MW or more of new load were added in the future.

Recommended Solution:

- Rebuild Line #101 from Mackeys to Creswell, 14 miles, with double circuit steel structures. Install one circuit with provisions for a second circuit. Provisions for a future second circuit would allow networking of the line (Mackeys – Creswell) if the 700 MW-mile level was exceeded. The conductor used will be at current standards (636 ACSR) with a summer emergency rating of 262 MVA at 115kV. Additional right-of-way is required for the temporary line. **(b2876)**

Estimated Project Cost: $40 M

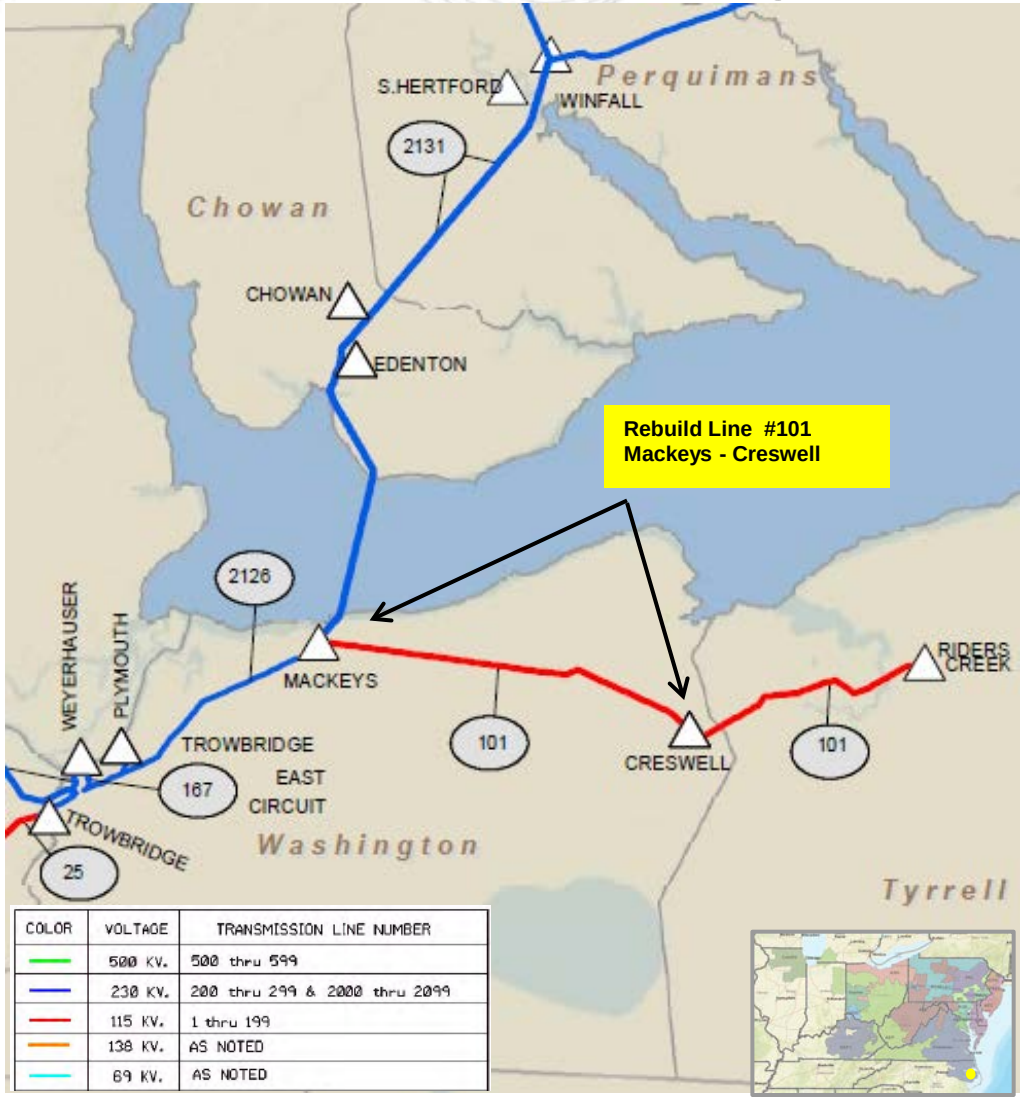
Alternatives:

- Rebuild line #101 from Mackeys to Creswell, 14 miles, with single circuit structures. The conductor used will be at current standards (636 ACSR) with a summer emergency rating of 262 MVA at 115kV.
- Additional right-of-way is required for the temporary line. This alternative would not address the future 700MW-mile violation.

Estimated Project Cost: $26 M

Projected IS Date: 12/30/2022

Project Status: Conceptual



Dominion Transmission Zone Baseline Project

Baseline Project: Line #112 Rebuild Fudge Hollow to Lowmoor (End of Life Criteria)

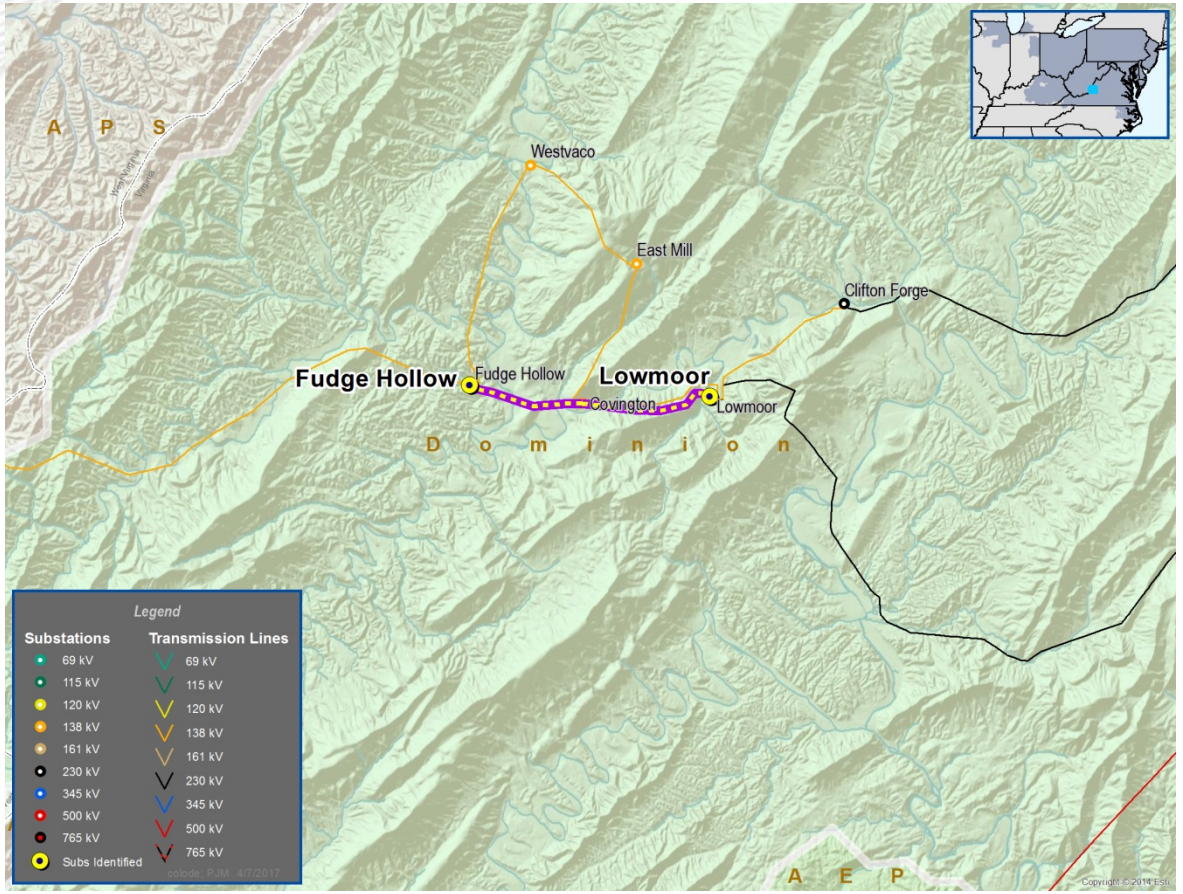
Problem Statement: DOM "End of Life Criteria"

Date Project Last Presented: 4/25/2017 SRRTEP

- 138kV Line #112 from Fudge Hollow to Lowmoor line was constructed in 1929 and includes thirty-three Blaw Knox steel lattice towers that span 5.16 miles. These structures have experienced severe corrosion at grade and their grillage style foundations are no longer considered a dependable system to resist uplift forces that occur during a wind event. The existing summer emergency rating of this line is 207 MVA. Current conductor used for this line includes 4/0 ACSR, 721 ACAR, 336 ACSR, and 1109 ACAR.
- Of this distance, a 1.24 mile section includes double circuit towers that are shared with Line #161.
- Line #112 serves 9,778 customers including 3,586 fed by Co-op. The loss of a double circuit structure for this line would result in the additional loss of line numbers #161, #109, and #155 along with East Mill, Fudge Hollow, Covington, and Westvaco substations. In 2016 the peak load at Westvaco was 94 MW on August 18th.
- This line is part of the transmission loop between Westvaco and Lexington and needs to be rebuilt to current standards based on Dominion's "End of Life" criteria.

Recommended Solution:

- Rebuild Line #112 from Fudge Hollow and Lowmoor (5.16 miles) to current standards (636 ACSR) with a summer emergency rating of 314 MVA at 138kV. Steel tower and double circuit steel monopole replacement structures are being considered. **(b2877)**



Alternatives: No feasible alternatives

Estimated Project Cost: $8 M

Projected IS Date: 10/31/2020

Project Status: Conceptual

Tap Line Reliability Improvements

Dominion Transmission Zone - Tap Line Reliability Improvements

- Dominion will continue focusing on rebuilding transmission tap lines over the next several years.
- Target is older lines with many being constructed over 40 to 50 years ago.
- Improve reliability and service to wholesale customer delivery points.
- Projects to be classified as Supplemental Projects.
- To be completed in scheduled years contingent upon budget allocations.

2017-2019 – Dominion Tap Line Improvements

- Gretna Tap (MEC), 69kV Line #173, 0.05 mile
- Brands (SVEC), 115kV Line #102, 1.05 mile
- Hooper (SEC), 115kV Line #158 (to be #1007), 0.05 mile
- Wilson-Robersonville (EMEMC), 115kV Line #96, 0.1 mile
- Drakes Branch (SEC), 115kV Line #1012 (was #154), 0.68 mile
- Godwin (NOVEC), 115kV Line #172, 0.01 mile
- Minnieville [Cardinal] (NOVEC), 115kV Line #145, 0.05 mile
- Beechwood (MEC), 115kV Line #90 (to be #1004), 4.51 miles
- Columbia (CVEC), 115kV Line #4, 4.00 miles

2020 – Dominion Tap Line Improvements

- Hickory Grove (MEC), 115kV Line #31 (to be #1022), 8.25 miles
- Moran (MEC), 115kV Line #158, 0.1 mile
- Omega (MEC), 115kV Line #127, 0.05 mile
- Clarksville (MEC), 115kV Line #193, 1.32 miles
- Brandy (REC), 115kV Line #70, 0.05 mile
- Sams Head (HEMC), 115kV Line #126, 0.01 mile
- Stonewall (NOVEC), 115kV Line #163, 0.12 mile
- Lindendale (NOVEC), 115kV, Line #145, 0.07 mile

2021 – Dominion Tap Line Improvements

- Mt. Jackson (SVEC), 115kV Line #128, 0.05 mile
- Box Elder (CEC), 115kV Line #68, 0.05 mile
- Handsom (CEC), 115kV Line #140, 0.05 mile
- Bear Island (REC), 230kV Line #2044, 0.05 mile

Questions?

Email: RTEP@pjm.com

Revision History

06/05/2017 – V1 – Original version posted to PJM.com.