



Reliability Analysis Update

Transmission Expansion Advisory
Committee

October 11, 2018

- 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: 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): 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: 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)



2018 RTEP Analysis Update



Dominion Transmission Zone: Baseline Project

PJM Criteria Violation – N-1 High Voltage (Summer), (N1-SVH1 & N1-SVH2)

Problem Statement:

- N-1 high voltage conditions exist at 230kV Radnor Heights bus and 230kV Davis bus following a breaker-failure event (2036T2142).

Alternatives Considered:

- 2018_1-2A (\$0 M)
- 2018_1-2B (\$0.481 M)
- 2018_1-2C (\$0.537 M)
- 2018_1-2D (\$13.493 M)
- 2018_1-2E (\$3.161 M)
- 2018_1-2F (\$12.732 M)

Preliminary Recommendation:

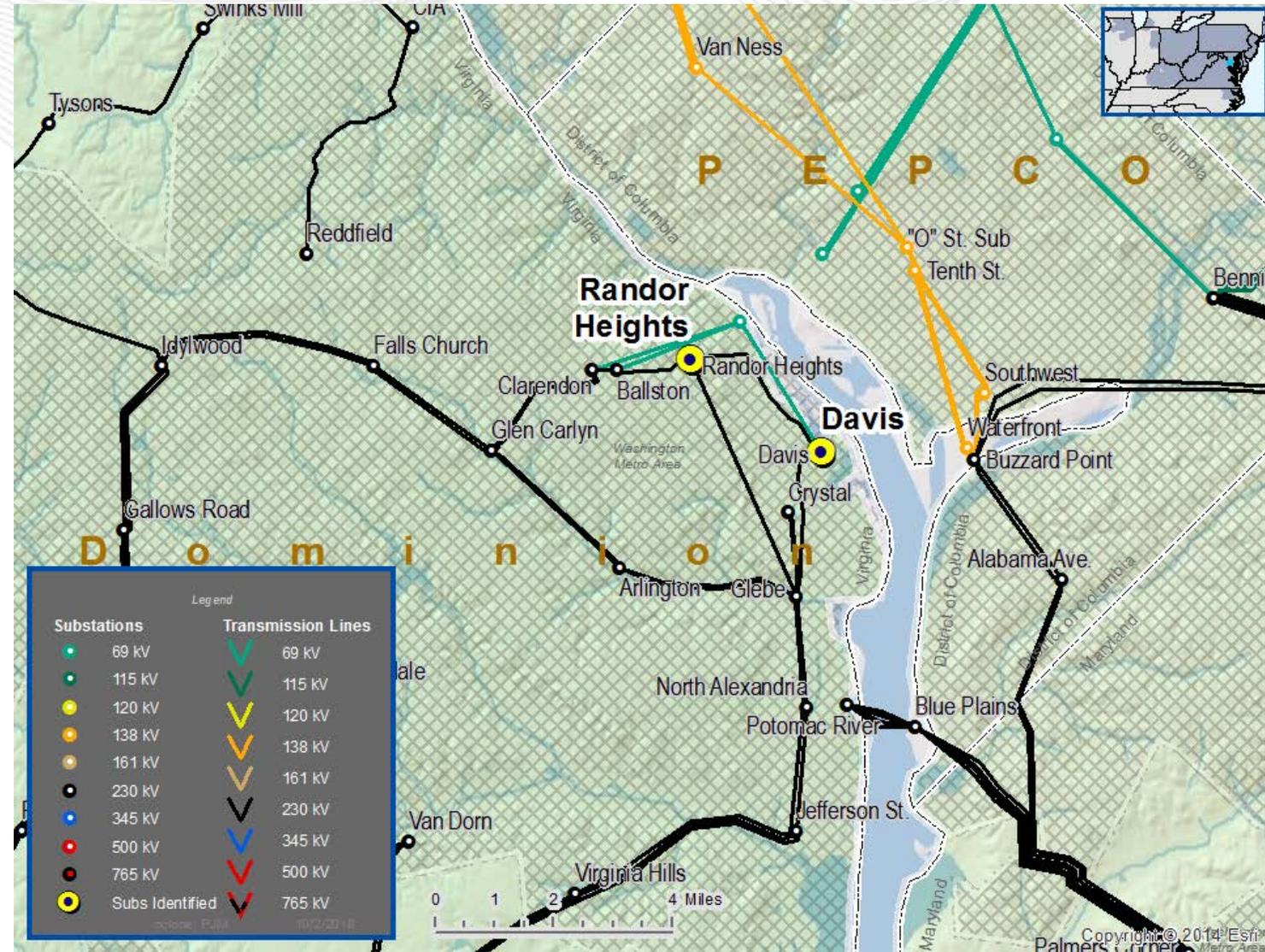
- Move spare 168 MVA 230/69 kV transformer from Jefferson Street substation to the vacant Transformer #2 bay at Davis substation. (2018_1-2C)

Estimated Project Cost : \$0.537 M

Required IS Date: 6/1/2023

Projected IS date: 6/1/2023

Status: Conceptual



Previously Presented : 09/13/2018

PJM Criteria Violation – Load Loss limit (Summer), (N1-SLD1)

Problem Statement:

- Consequential Load Loss is greater than 300MW for the loss of the Port Union 138kV Bus #2 with relay failure.

Recommended Solution:

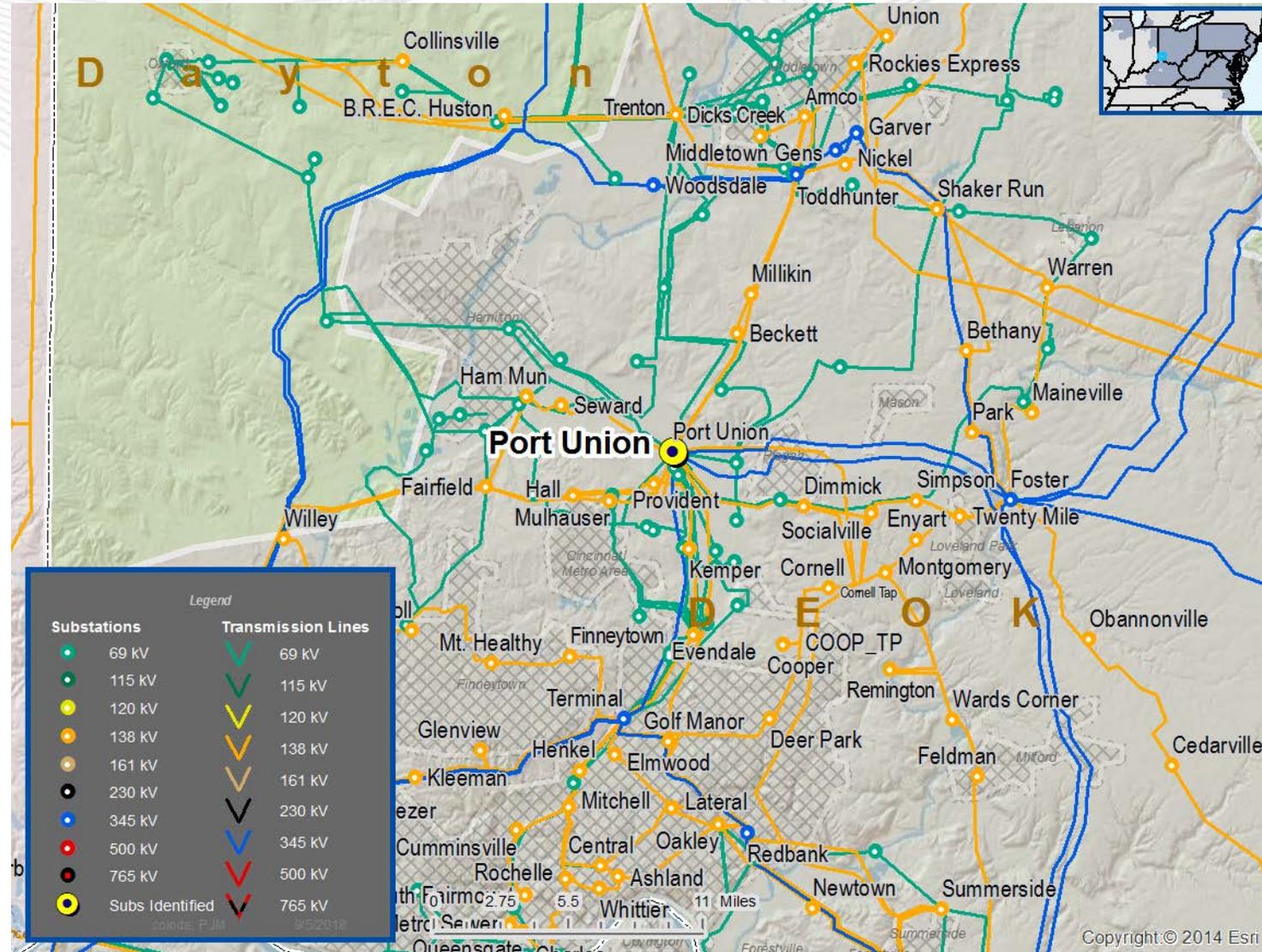
- Add redundant relay to Port Union 138kV Bus #2 (2018_1-1A). (B3050)

Estimated Project Cost : \$0.367M

Required IS Date: 6/1/2023

Projected IS date: 11/30/2022

Status: Planning





JCPL Transmission Zone: Baseline Project

Previously Presented : 09/13/2018

Generation Deliverability (Summer)

Substation Equipment

Problem Statement:

- The Raritan River – Kilmer 230 kV circuit is overloaded for a tower line outage loss of Atlantic – R11 230 kV (P1030) and Freneau – Parlin 230 kV (K1025) circuits. (FG# GD-S466)

Recommended Solution:

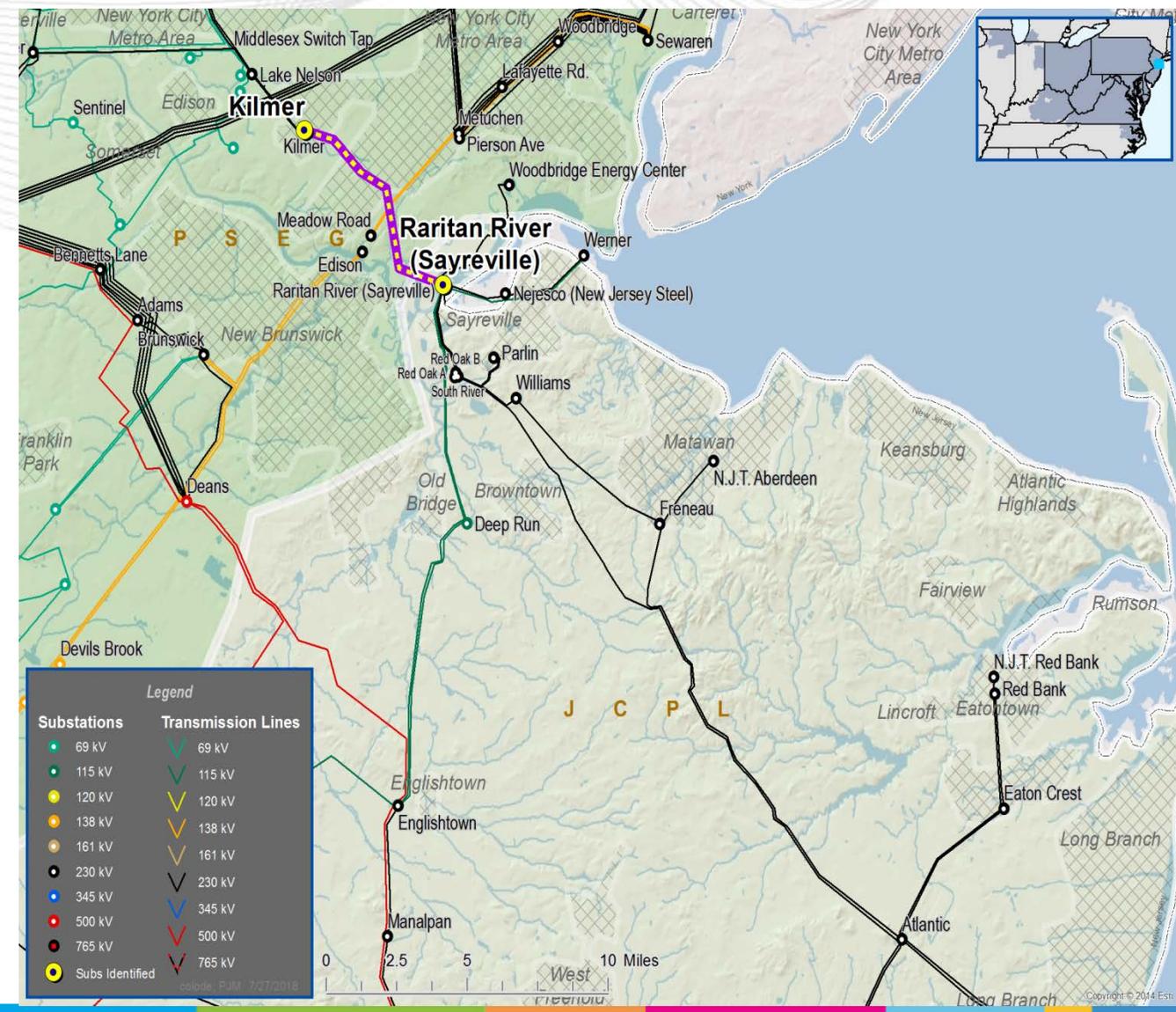
- Replace substation conductor at Raritan River 230 kV substation on the Kilmer line terminal to achieve 709N/869E MVA summer rating. (B3042)

Estimated Project Cost : \$0.0535 M

Required IS Date: 6/1/2023

Projected IS Date: 6/1/2023

Status: Conceptual



Dominion End of Life Criteria



Dominion Transmission Zone: Baseline Line #2113 Waller to Lightfoot Partial Rebuild

Baseline Reliability: TO Criteria Violation

Problem Statement: Dominion “End of Life Criteria”

Waller to Lightfoot section of 230kV Line #2113 and 115kV Line #58 were constructed on double circuit 3 pole wood H-frame structures in 1966 and 1952. 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. This section of the Line #2113 have been identified for rebuild based on the company’s End of Life criteria.

The Line #2113 runs between Lanexa Substation and Waller Substation. It provides service to Lightfoot Substation with a total of 16,881 customers. Permanent load loss is 83 MW. Waller to Lightfoot section of this line is approximately 4 miles long and has a current summer emergency rating of 470 MVA.

End-of-Life reliability assessment, with Waller to Lightfoot section removed from service, creates a radial line from Skiffes Creek to Waller with 118 MW. This is a violation of Dominion’s 100 MW planning criteria. N-1-1 study also indicates multiple thermal overload conditions.

Potential Solution:

Rebuild 4 miles of Line #2113 between Waller and Lightfoot Substation to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV utilizing single circuit steel structures. Remove this section of Line #58.

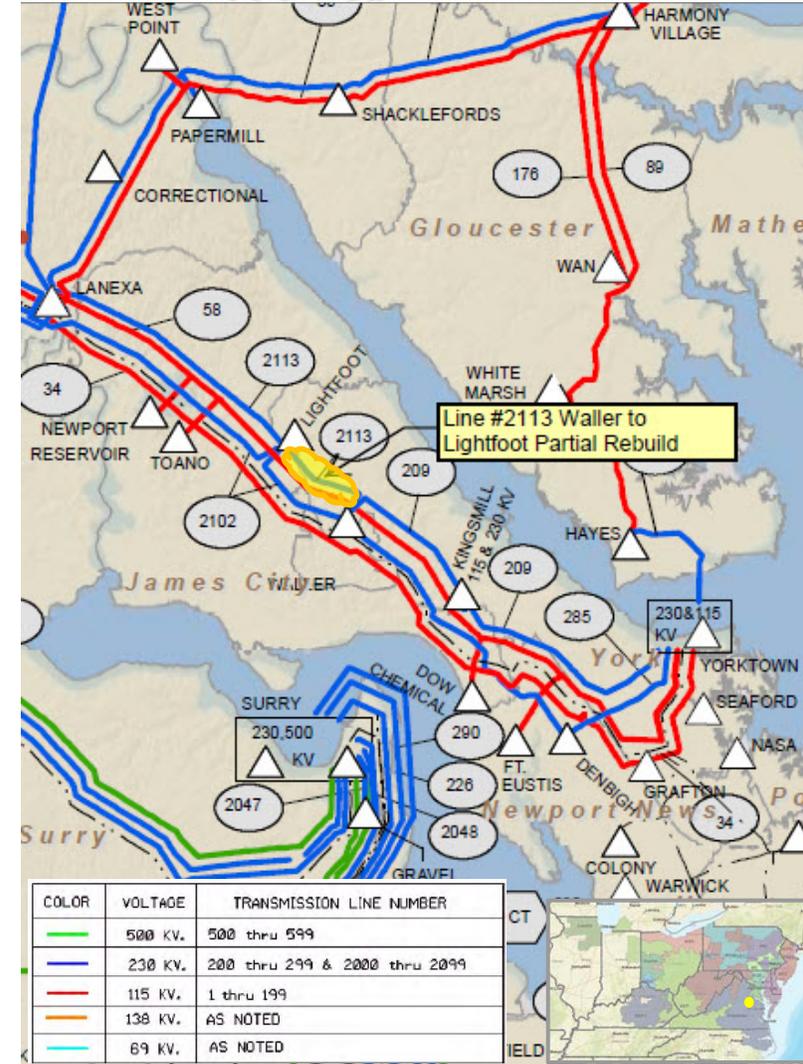
Alternative: No feasible alternatives.

Estimated Project Cost: \$4 M

Required In-service Date: Immediate Need

Projected In-service Date: 12/30/2024

Project Status: Conceptual



Baseline Reliability: TO Criteria Violation

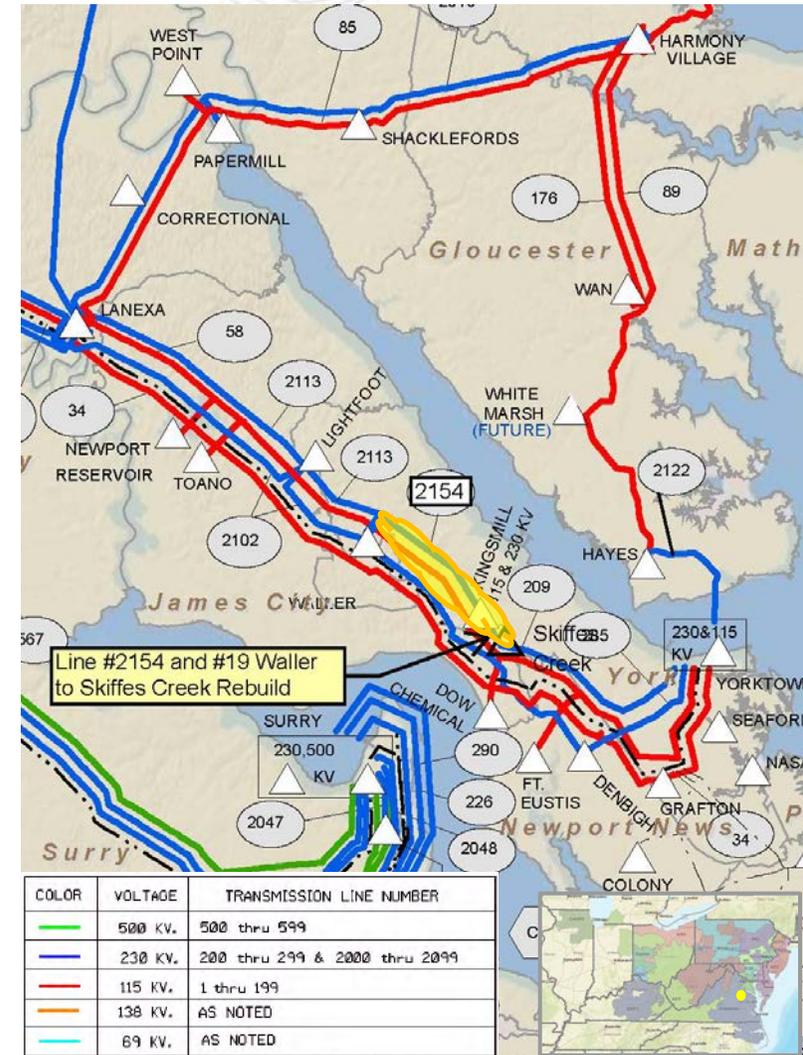
Problem Statement: Dominion “End of Life Criteria”

230kV Line #2154 from Waller to Skiffes Creek was constructed on double circuit 3 pole wood H-frame structures with 115kV Line #58 (from Waller to Kings Mill) and #19 (from Kings Mill to Skiffes Creek) in 1966 and 1952. 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. Line #2154 and #19 have been identified for rebuild based on the company’s End of Life criteria. Line #2154 has a current summer emergency rating of 470 MVA. Line #19 has a current summer emergency rating of 147 MVA.

The Line #2154 provides service to Penniman Substation and Kings Mill Substation with a total of 5,973 customers. Permanent load loss is 51 MW. The Line #19 provides service to Kings Mill substation with 7 customers. Permanent load loss is 19 MW.

End-of-Life reliability assessment, with the line #2154 removed from service, creates a radial line from Lenexa to Waller with 113.5 MW. This is a violation of Dominion’s 100 MW planning criteria. N-1-1 study also indicates multiple thermal overload conditions.

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Potential Solution:

Rebuild 6.1 miles of Line #2154 between Waller and Kings Mill to current standards with a minimum summer emergency rating of 1047 MVA utilizing single circuit steel structures. Remove this 6.1 mile section of Line #58 between Waller and Kings Mill. Rebuild the 1.6 miles of Line #2154 and #19 between Kings Mill and Skiffes Creek to current standards with a minimum summer emergency rating of 1047 MVA at 230 kV for Line #2154 and 261 MVA at 115kV for Line #19, utilizing double circuit steel structures.

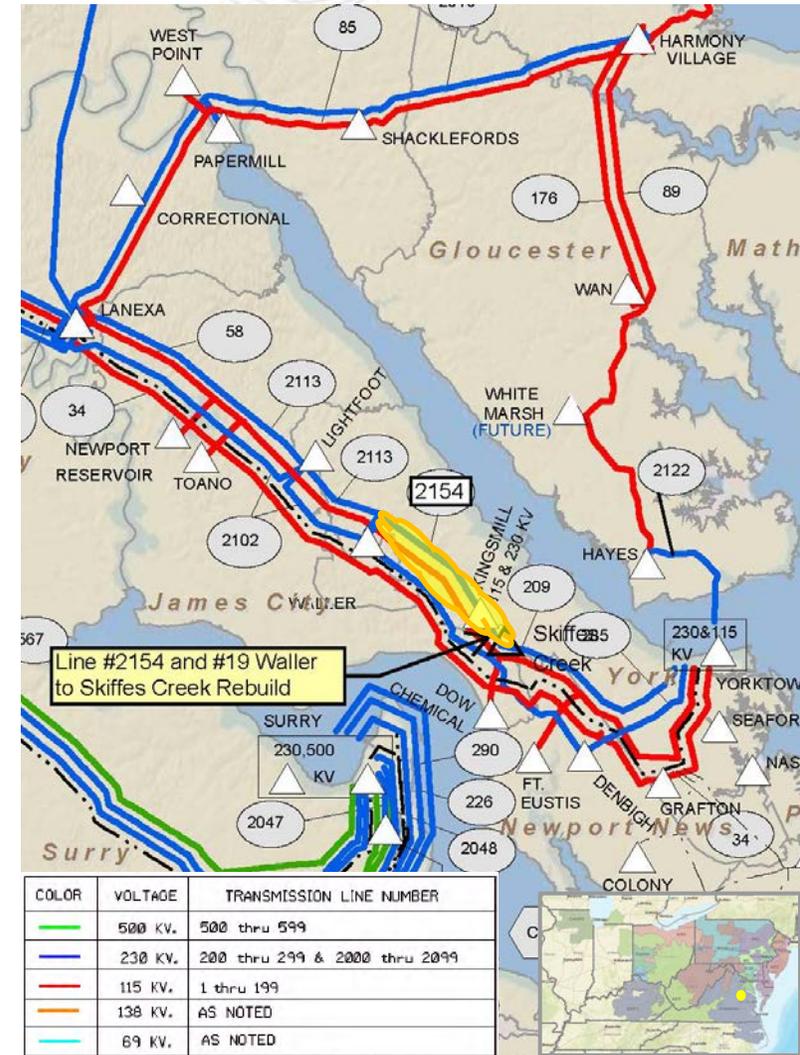
Alternative: No feasible alternatives.

Estimated Project Cost: \$10 M

Required In-service Date: Immediate Need

Projected In-service Date: 12/30/2024

Project Status: Conceptual





Dominion Transmission Zone: Baseline Partial Lines #265, #200 and #2051 Rebuild

Baseline Reliability: TO Criteria Violation

Problem Statement: Dominion “End of Life Criteria”

A 3.61 mile long section of 230 kV Line #265 between Clifton to Johnson D.P. was constructed on Cor-ten lattice-type double circuit towers. A 2.94 mile long section of 230kV Line #2051 between Clifton to Pender is on the same structures as Line #265. A 0.65 mile long section of 230kV Line #200 between Bull Run to Pender is also on the same structures as Line #265. 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.

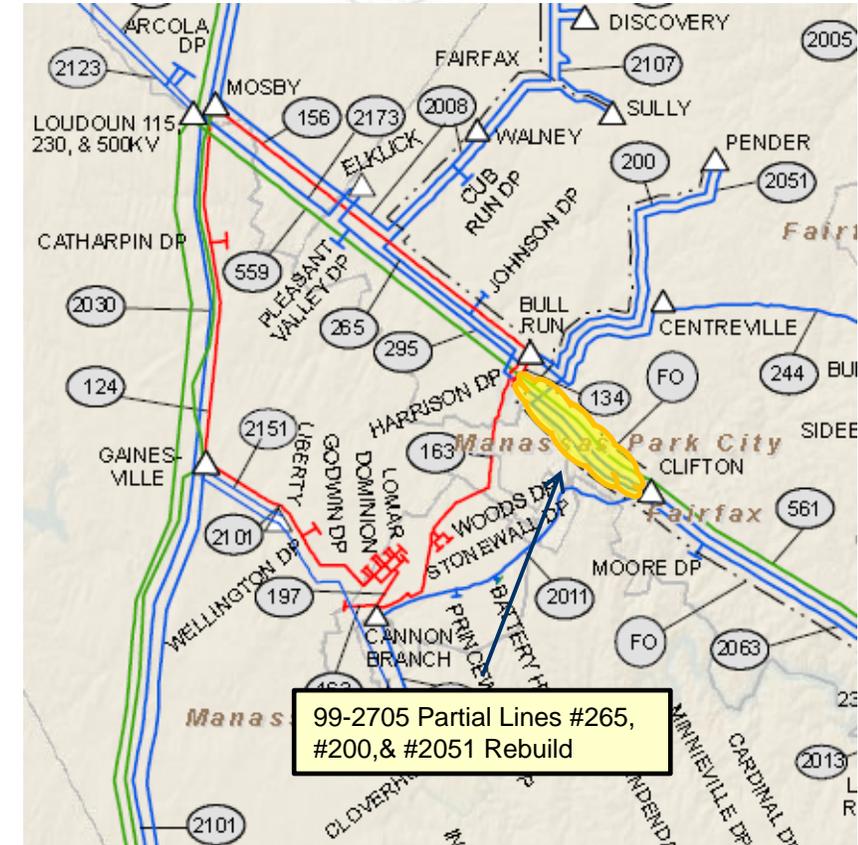
Line #265 is part of the network feed to Sully Substation feeding over 100 MW of load that is required to meet Dominion’s Transmission Planning Criteria. It also has tapped load at Johnson D.P. and Walney Substation totaling 98 MW. Line #265 between Clifton to Johnson D.P. has a current summer emergency rating of 622 MVA.

Line #200 is part of the network feed to Pender Substation feeding over 100 MW of load that is required to meet Dominion’s Transmission Planning Criteria. Line #200 between Bull Run to Pender has a current summer emergency rating of 470 MVA.

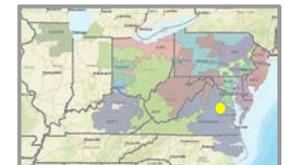
Line #2051 is part of the network feed to Pender Substation feeding over 100 MW of load that is required to meet Dominion’s Transmission Planning Criteria. Line #2051 between Clifton to Pender has a current summer emergency rating of 470 MVA.

Additionally, removing partial Lines #265, #200, and #2051 from service permanently creates numerous N-1-1 thermal violations on the transmission system.

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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





Dominion Transmission Zone: Baseline Partial Lines #265, #200 and #2051 Rebuild

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Potential Solution:

Rebuild partial Lines #265, #200, and #2051 with double circuit steel structures using double circuit conductor at current 230 kV northern Virginia standards with a minimum rating of 1200 MVA.

Alternative:

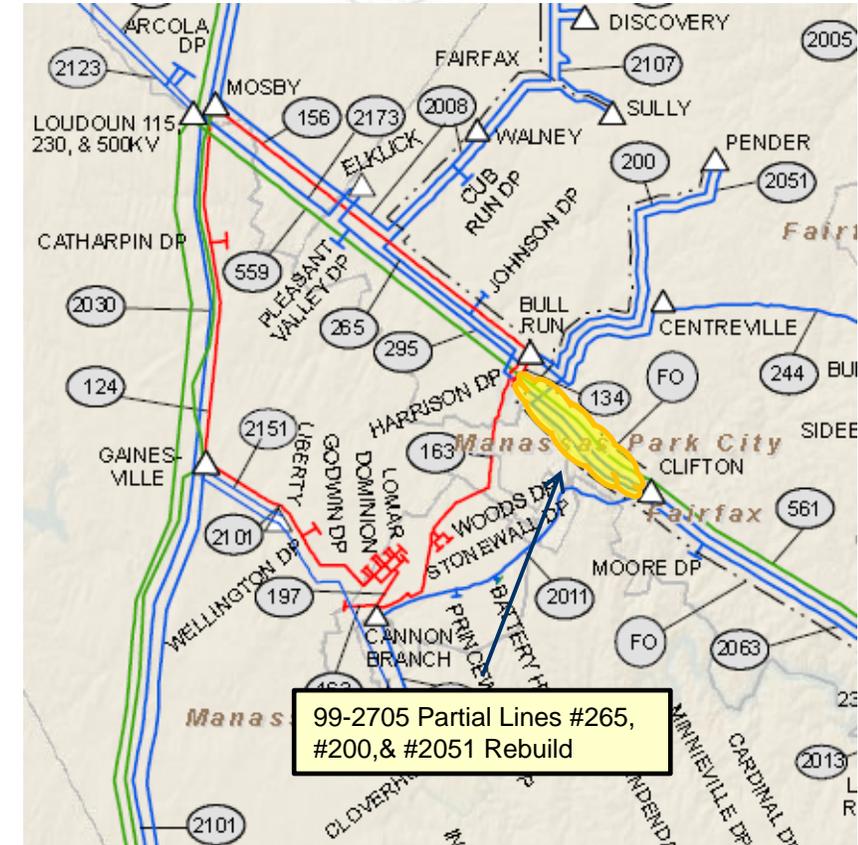
No feasible alternatives.

Estimated Project Cost: \$11.5 M

Required In-service Date: Immediate Need

Projected In-service Date: 12/31/2023

Project Status: Conceptual



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





PJM and First Energy continue to evaluate existing issues and are working on potential solutions

Short circuit Projects



Dominion Transmission Zone: Baseline Project

Problem: Short Circuit

- The Ladysmith 500kV breakers "H1T575", "H1T581", and "568T574" (will be renumbered as "H2T568") are overdutied

Significant Driver:

- B3027.1: Add a 2nd 500/230 kV 840 MVA transformer at Dominion's Ladysmith Substation

Recommended Solution:

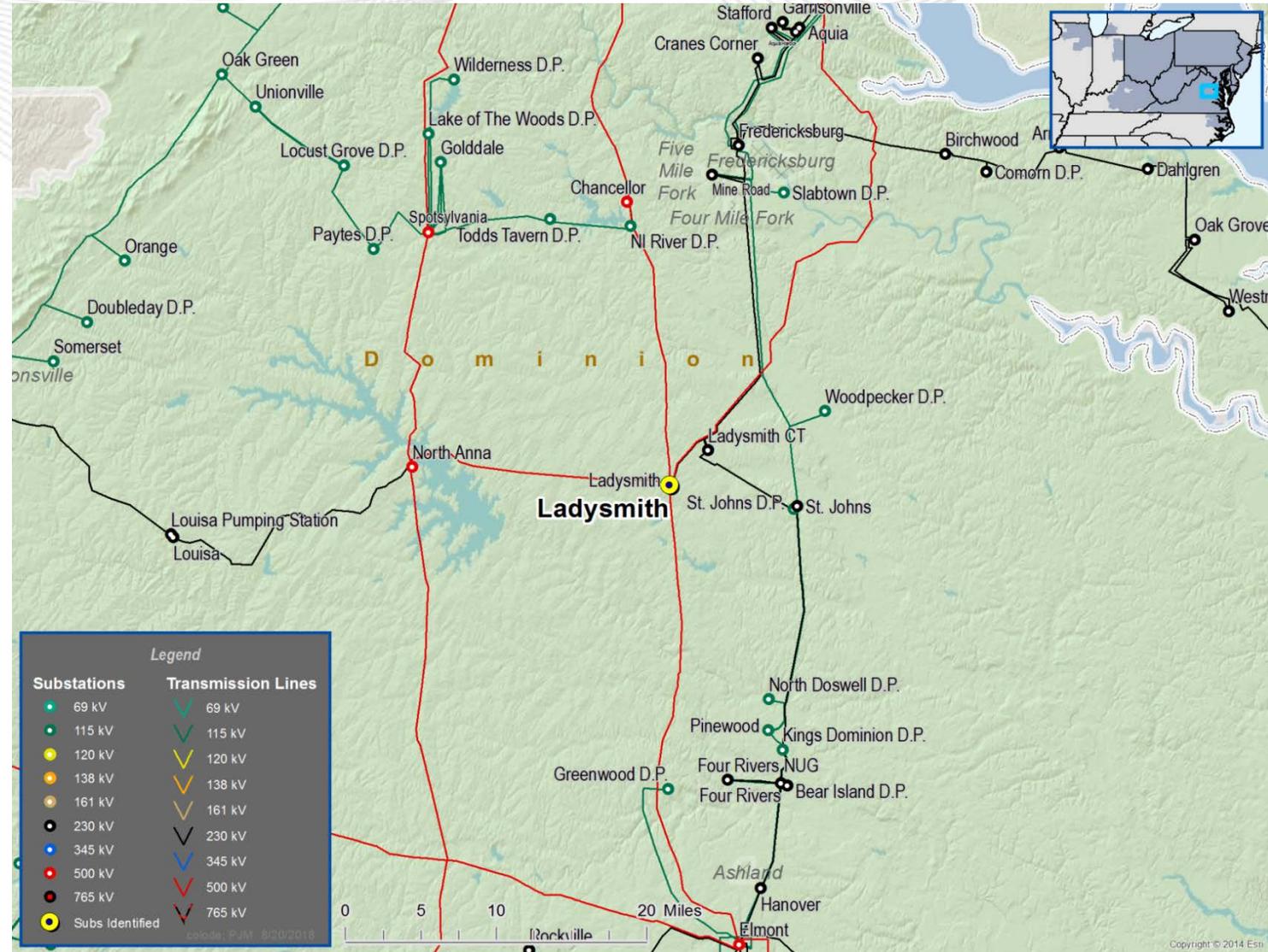
- Replace the Ladysmith 500kV breaker "H1T581" with 50kA breaker (B3027.3)
- Update the nameplate for Ladysmith 500kV breaker "H1T575" to be 50kA breaker (B3027.4)
- Update the nameplate for Ladysmith 500kV breaker "568T574" (will be renumbered as "H2T568") to be 50kA breaker (B3027.5)

Estimated Project Cost:

Replace breaker	\$1.030 M
New nameplate ratings	<u>\$0.004 M</u>
	\$1.034 M

Required IS Date: June 1, 2021

Projected IS Date: June 1, 2021



Stability Projects

PJM Stability Criteria Violation

Problem Statement:

- Instability at STA 29 Joliet for close-in delayed-cleared faults on 345kV lines 2912 and 2913.

Potential Solution:

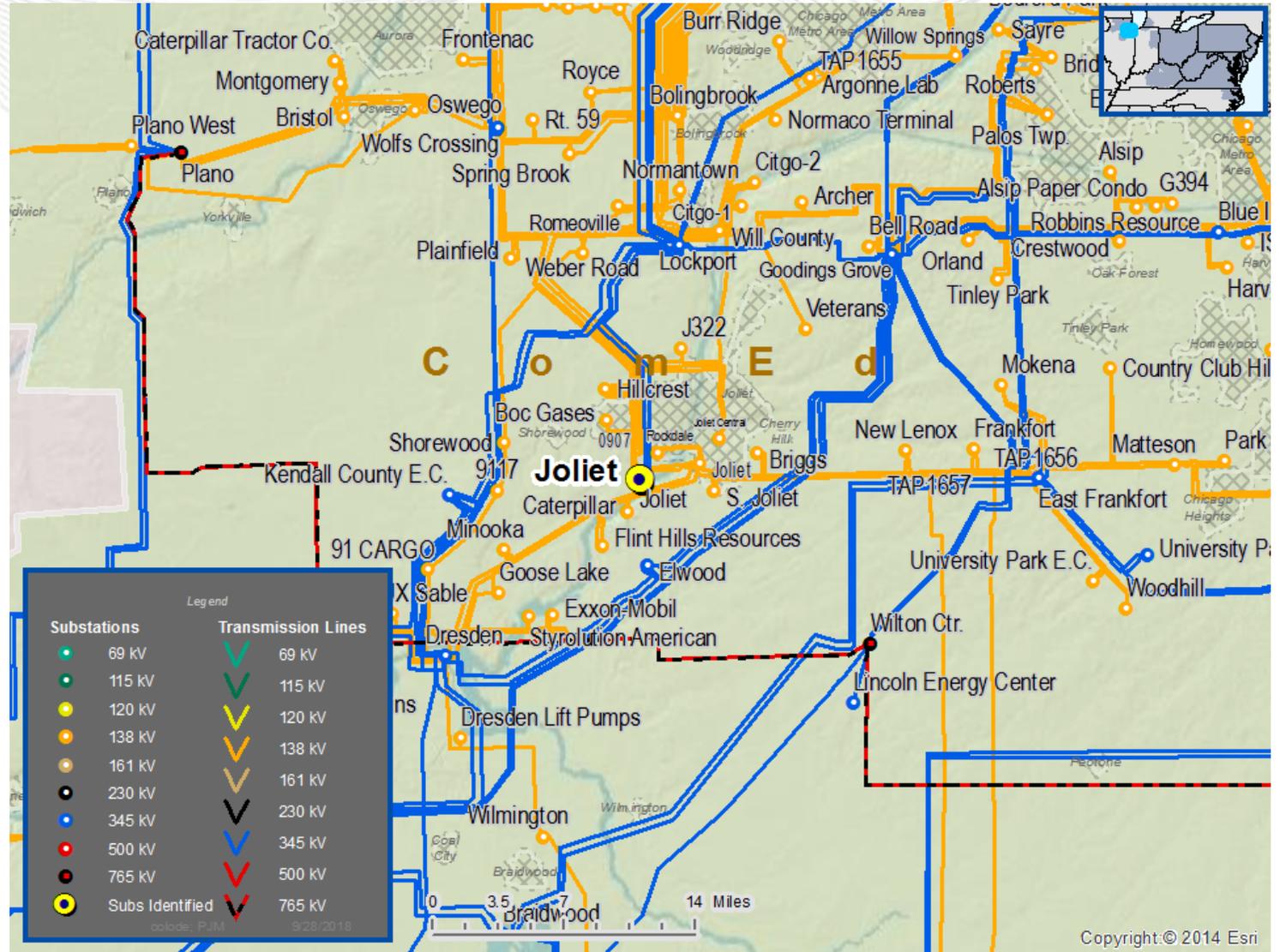
- Replacement of gang-operated 345kV line breakers on 345kV lines 2912 and 2913 with IPO breakers (b3049)

Estimated Project Cost : \$ 4.0M

Required IS Date: 06/01/2020

Projected IS date: 06/01/2021

Status: Conceptual



2018 RTEP Next Steps

- 15 year analysis
- Retirement sensitivity studies (Generation Deliverability, Summer & Winter)
- Stability Analysis

Questions?



2018

- TEAC meetings are the following Thursdays in 2018
- 1/11, 2/8, 3/8, 4/5, 5/3, 6/7, 7/12, 8/9, 9/13, 10/11, **11/8, 12/13**

- V1 – 10/05/2018 – Original Slides Posted