

Appendix: Previously Reviewed Baseline Upgrade Recommendations for the July 2020 PJM Board Review



Dominion Transmission Zone: Baseline 115kV Line #141 & #28 Rebuild

Existing (b3098) Scope and Cost Modification

Original: Baseline Project: Line #141 and Line #28 Rebuild

Revised: Balcony Falls Substation Rebuild (New Scope)

Problem Statement:

115kV Line #141 extends 9.8 miles between Balcony Falls and Skimmer. For 3.8 miles this line was constructed on a combination of double circuit Blaw Knox structures and shares with 115kV Line #28 and single circuit wood H-frame structures. Rest of line #141 is a combination of wood H-frame and Blaw Knox towers to Skimmer.

The Blaw Knox structures between Balcony Falls and Skimmer were constructed in the 1920's, are showing deterioration, and are reaching the end of their useful service life. Wood H-frame structures for both lines are experiencing ground line deterioration, cracking, splitting, or woodpecker holes and have been identified for replacement.

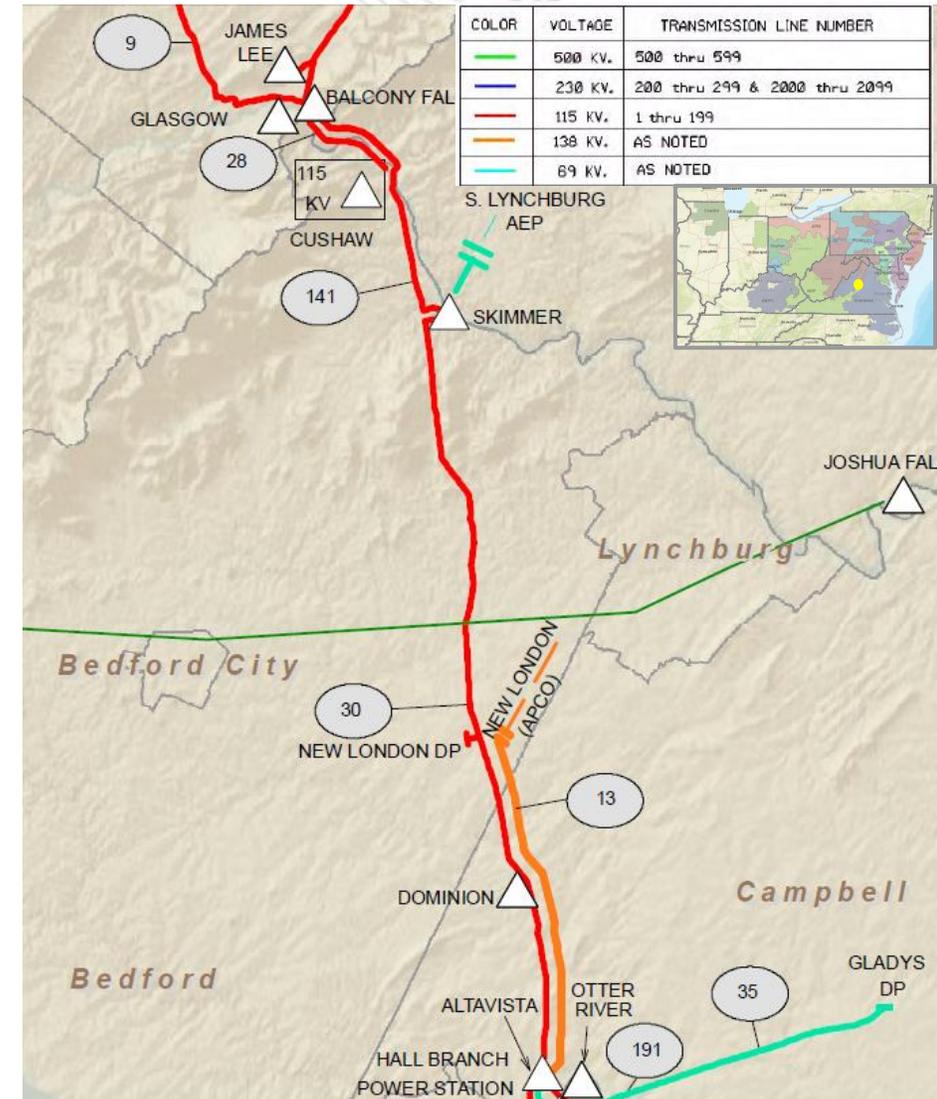
Approximately 9.2 miles of Line #141 and 3.9 miles of Line #28 have 4/0 ACSR conductor that was installed in the 1920's. Industry guidelines indicate equipment life for wood structures is 35-55 years, conductor and connectors are 40-60 years, and porcelain insulators are 50 years.

Date Originally Presented: 02/20/2019 (SRRTEP)

Original Proposed Solution

- Replace all Line #141 and Line #28 structures and both lines will be rebuilt to current standards with a minimum rating of 261MVA. (Est. cost \$20M)

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Dominion Transmission Zone: Baseline 115kV Line #141 & #28 Rebuild

Existing (b3098) Scope and Cost Modification

Original: Baseline Project: Line #141 and Line #28 Rebuild

Revised: Balcony Falls Substation Rebuild (New Scope)

Reason for Cost Increase and Scope Modification:

- a. The Balcony Falls was part of our acquisitions from APL and it appears the lattice structure that all 4 lines and the cross bus terminate on was built in 1926.
- b. Visually it appears that the galvanizing is moderately to severely worn along large portions of the structure. Our structural group does not want to make any changes that would require additional stress be placed on this structure

Revised Proposed Solution

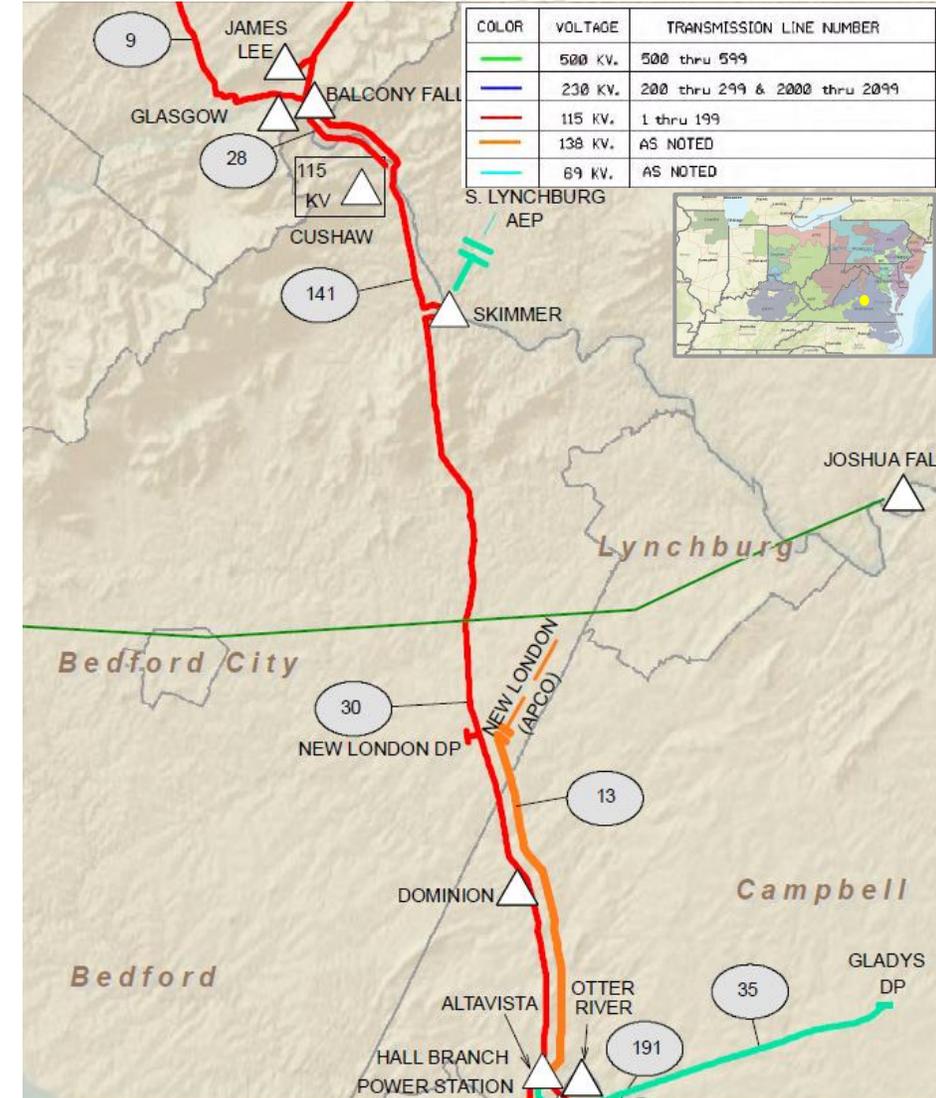
- **(Same as original solution)** Rebuild the main line #141 and line #28 to current standards. **(Est. cost \$20M)**
- **(New)** Rebuild Balcony Falls Substation **(Est. cost \$9M)**

Alternatives Considered:

No feasible alternatives

Projected IS Date: 12/31/2023

Project Status: Conceptual





APS Transmission Zone: Baseline Wylie Ridge

Process Stage: Recommended Solution

Criteria: N-1-1 Thermal

Assumption Reference: 2024 Baseline/Retool

Model Used for Analysis: 2024 Summer Baseline/Retool

Proposal Window Exclusion: Substation Equipment

Problem Statement:

For loss of Tidd – Collier 345kV and Wylie Ridge – Toronto 345 kV, the Wylie Ridge – Smith 138kV circuit overloads to 104% of its rating (229/229 SN/SE). (N2-ST1, N2-ST2)

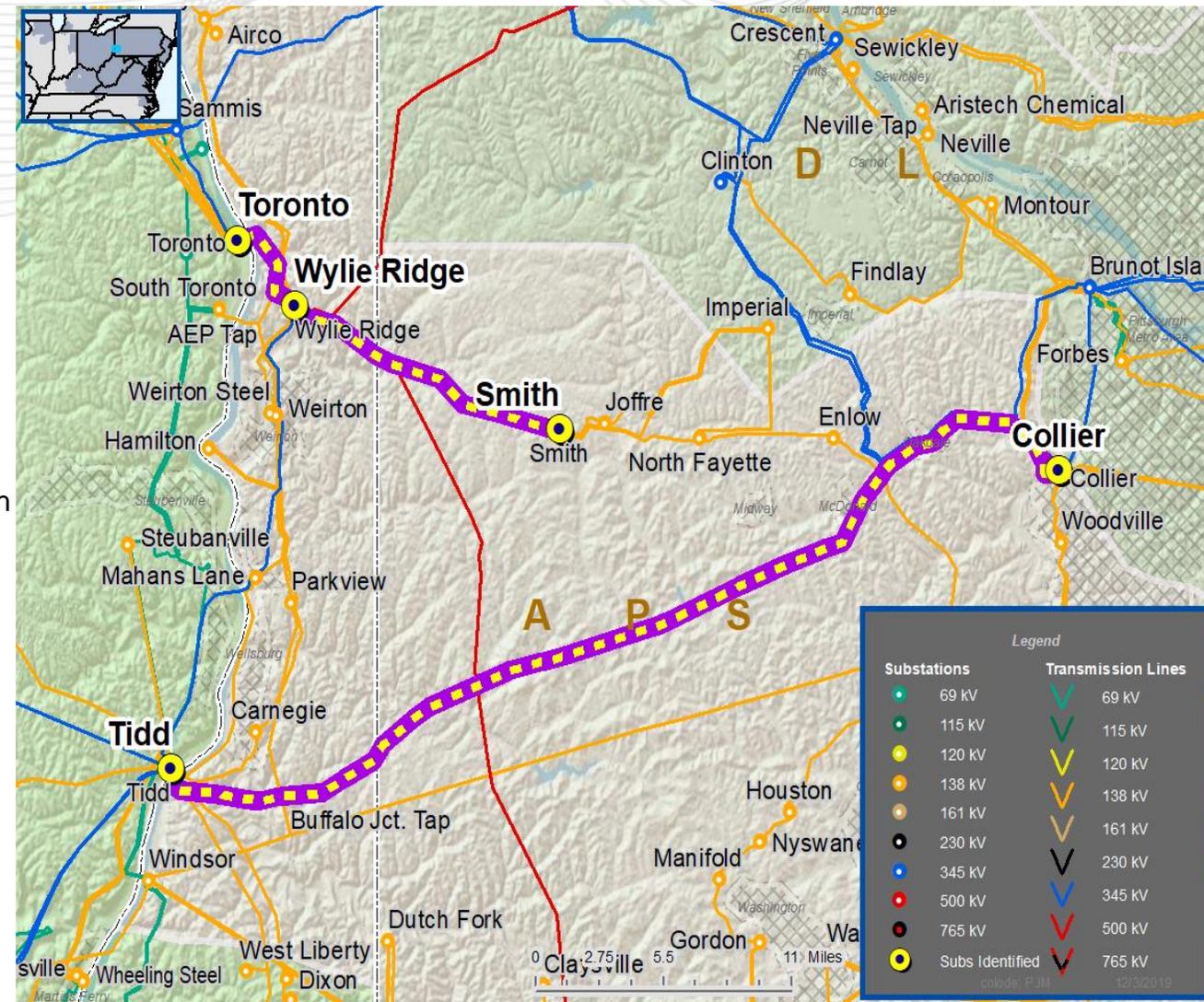
Proposed Solution (B3156):

Replace line relaying and fault detector on the Wylie Ridge terminal at Smith 138 kV Substation (New Rating: 234/297 SN/SE).

Total Estimated Transmission Baseline Cost: \$0.85M

Required IS Date: 6/1/2024

Previously Presented: 12/18/2019 SRRTEP



Process Stage: Recommended Solution

Criteria: Winter Generator Deliverability

Assumption Reference: 2024 Winter Baseline/Retool

Model Used for Analysis: 2024 Winter Baseline/Retool

Proposal Window Exclusion: Substation Equipment

Problem Statement:

For loss of Bedington - Black Oak 500 kV circuit, the Messick Rd. – Morgan 138 kV line is overloaded to 106% of its rating (229/229 WN/WE). (GD-W255, GD-W256)

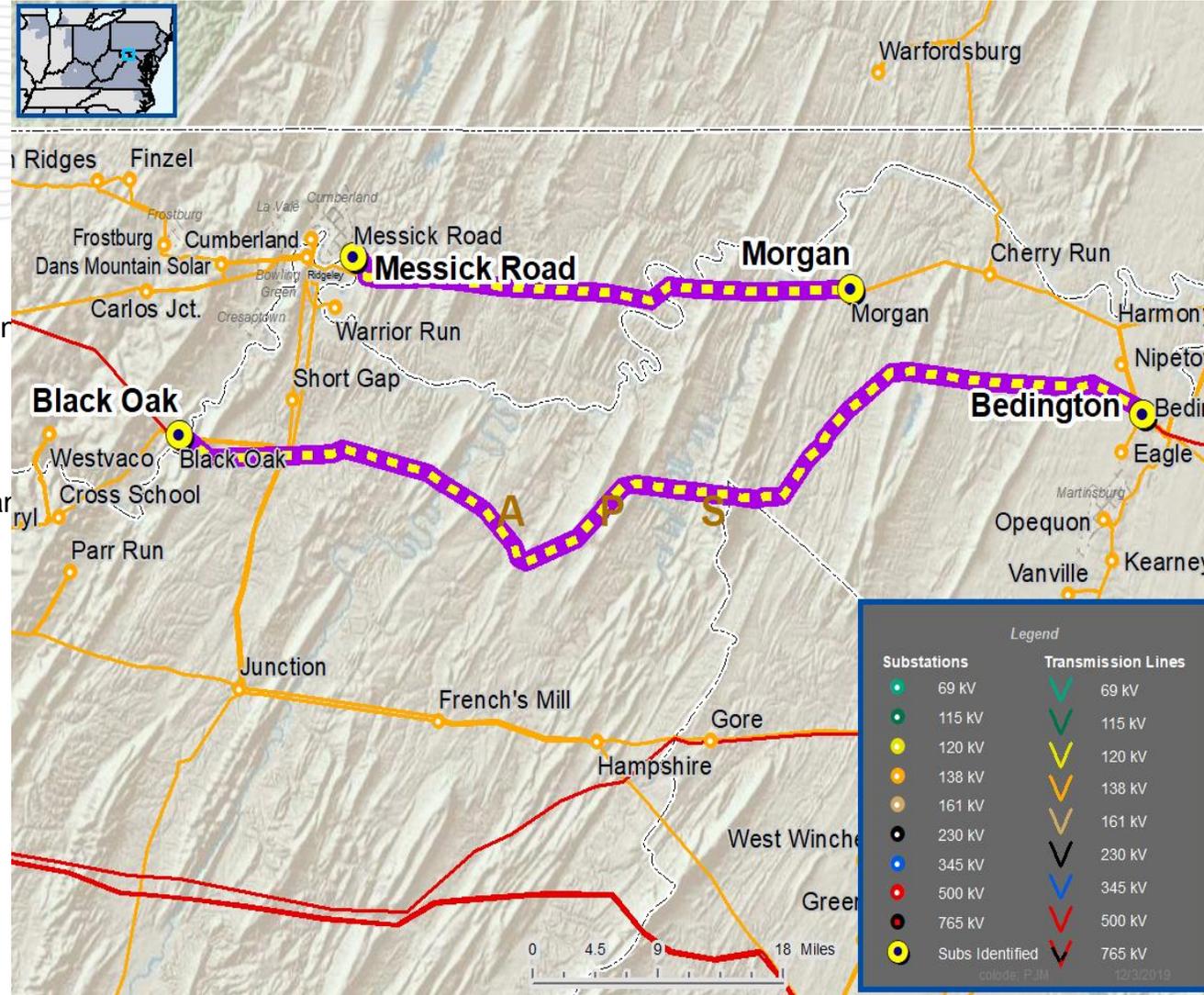
Proposed Solution(B3157):

Replace line relaying and fault detector relaying at Messick Rd. and Morgan 138 kV Substations; Replace Wave Trap at Morgan 138 kV (New Rating: 250/317 WN/WE).

Total Estimated Transmission Baseline Cost: \$0.23M

Required IS Date: 12/1/2024

Previously Presented: 12/18/2019 SRRTEP

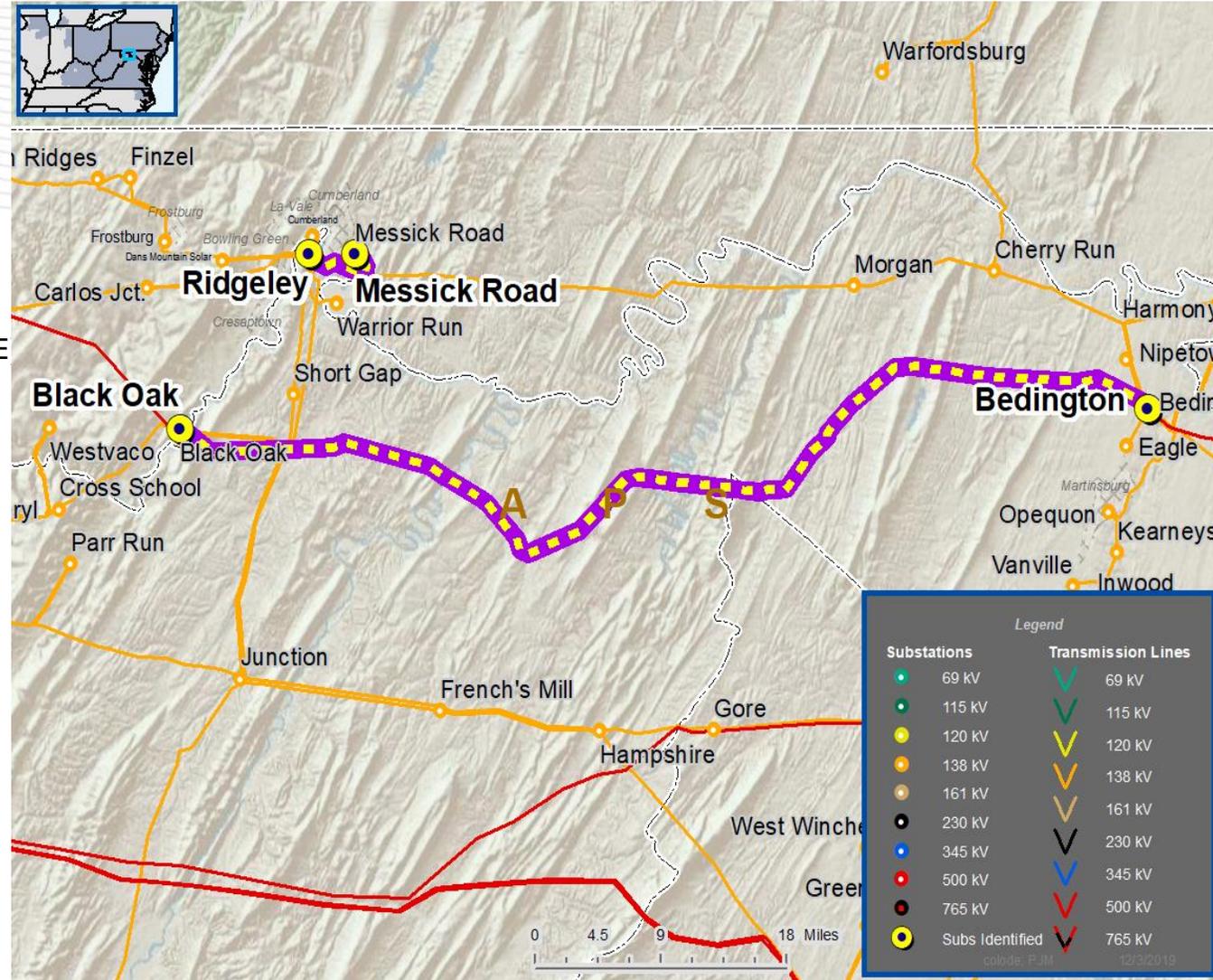


Process Stage: Recommended Solution
Criteria: Winter Generator Deliverability
Assumption Reference: 2024 Winter Baseline/Retool
Model Used for Analysis: 2024 Winter Baseline/Retool
Proposal Window Exclusion: Substation Equipment

Problem Statement:
 For loss of Beddington - Black Oak 500 kV circuit, the Messick Rd. – Ridgeley 138 kV line is overloaded to 114% of its rating (229/229 WN/WE (GD-W11, GD-W249, GD-W250)

Proposed Solution(B3158):
 Replace line relays on the Ridgeley Terminal at Messick Rd. 138 kV Substation(New Rating: 250/317 MVA WN/WE).

Total Estimated Transmission Baseline Cost: \$0.14M
Required IS Date: 12/1/2024
Previously Presented: 12/18/2019 SRRTEP





AMPT Transmission Zone: Baseline Bowling Green

Process Stage: Recommended Solution

Criteria: TO Planning Criteria

Assumption Reference: AMPT FERC 715

Model Used for Analysis: RTEP 2024 Summer

Proposal Window Exclusion: FERC 715 (TO Criteria), Below 100kV

Problem Statement:

The transmission system in and around the area of Bowling Green OH, is currently arranged as a three source network. The sources are Midway – Grand Rapids 69kV, Brim - Bowling Green Sub 5 69kV, and Maclean – Pemberville 69kV. Thermal overloads and voltage violations (see next slide) have been identified on the 69kV in the area of bowling green and Pemberville during the N-1-1 loss of Brim – Bowling Green Substation #5 69kV line, combined with either the loss of the Midway – Grand Rapids 69kV or Maclean – Pemberville 69kV line.

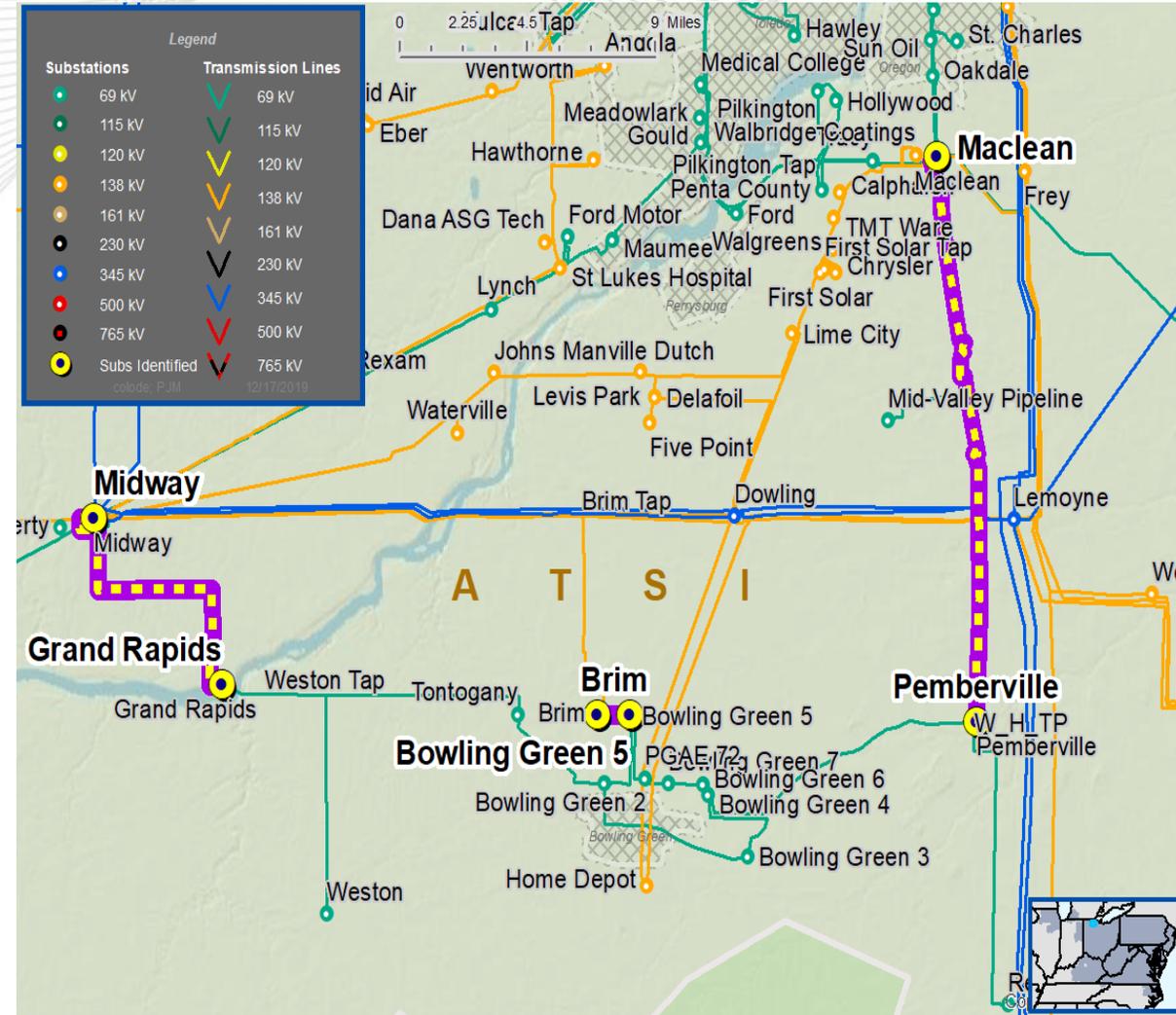
Proposed Solution (B3159):

Establish a new 138/69kV substation. Install one 138kV circuit breaker, one 138/69kV 130 MVA Transformer, three 69kV circuit breakers. Construct a 0.15 mile 138kV 795 ACSR transmission line between the FE Brim 138/69kV substation and the newly proposed AMPT substation (three steel poles). Loop the Bowling Green Sub #5 – Bowling Green Sub #2 69kV line in and out of the newly established substation.

Total Estimated Transmission Baseline Cost: \$5.7M

Required IS Date: 6/1/2024

Previously Presented: 12/18/2019 SRRTEP





N-1-1 violations in Bowling Green Area:

- Loss of Midway – Grand Rapids 69kV and Loss of Brim – Bowling Green Substation #5 results in:
 - Thermal Overloads
 - Bowling Green Substation #4 – Bowling Green Hancock Wood 69kV Line - 138%
 - Bowling Green Hancock Wood – Pemberville 69kV Line – 100%
 - Pemberville 69/34.5kV Transformer – 167%
 - Maclean – Mid Valley Pipe 2 69kV Line - 105%
 - Voltage Magnitude Violations

Bus	PEMB M	W-H TP	BG4	B10	BG6	BG7	PGE	BG5	BG3	BG2	TNTGON	WESTON	GRNDRP
Voltage (PU)	0.91	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.82	0.81	0.81	0.80	0.80

- Loss of Pemberville – Bowling Green Hancock Wood 69kV Line and Loss of Brim – Bowling Green Substation #5 results in:
 - Thermal Overloads
 - Bowling Green Substation #2 – Tontogany 69kV Line – 136%
 - Midway – Grand Rapids 69kV Line - 119
 - Voltage Magnitude Violations

Bus	W-H TP	BG4	B10	BG6	BG7	PGE	BG5	BG3	BG2	TNTGON	WESTON	GRNDRP
Voltage (PU)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.76	0.79	0.86	0.890

- Loss of Pemberville - Maclean 69kV Line and Loss of Brim – Bowling Green Substation #5 results in:
 - Thermal Overloads
 - Bowling Green Substation #2 – Tontogany 69kV Line – 119%
 - Pemberville 69/34.5kV transformer – 221%
 - Voltage Magnitude Violations

Bus	W-H TP	BG4	B10	BG6	BG7	PGE	BG5	BG3	BG2	TNTGON	WESTON	GRNDRP
Voltage (PU)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.76	0.79	0.86	0.890

- Loss of Weston - Tontogany 69kV Line and Loss of Brim – Bowling Green Substation #5 Line results in:
 - Thermal Overloads
 - Bowling Green Substation #4 – Bowling Green Hancock Wood 69kV Line - 138%
 - Bowling Green Hancock Wood – Pemberville 69kV Line – 100%
 - Pemberville 69/34.5kV Transformer – 167%
 - Voltage Magnitude Violations

Bus	W-H TP	BG4	B10	BG6	BG7	PGE	BG5	BG3	BG2	TNTGON
Voltage (PU)	0.91	0.90	0.90	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Previously Presented: 9/25/2019 SRTEP and 10/25/2019 SRTEP

Criteria: Winter Generator Deliverability and Basecase Analysis

Assumption Reference: PJM RTEP Study

Model Used for Analysis: 2024 RTEP Winter Peak Model

Proposal Window Exclusion: Substation Equipment and Below 200kV

Problem Statement:

The Haviland – East Lima 138kV line is overloaded for multiple contingencies in winter generator deliverability test and basecase analysis test. (N1-WT18, N1-WT19, N1-WT20, N1-WT21, N1-WT22, N1-WT23, N1-WT24, N1-WT25, GD-W244, GD-W3, GD-W4, GD-W5, GD-W7, GD-W8, GD-W19)



Existing Facility Ratings:

From Bus ID	From Bus Name	To Bus ID	To Bus Name	Ckt Id	SN	SE	WN	WE
242989	05E LIMA 138.00	243017	05HAVILAND1 138.00	1	143	143	143	143

Preliminary Facility Ratings:

From Bus ID	From Bus Name	To Bus ID	To Bus Name	Ckt Id	SN	SE	WN	WE
242989	05E LIMA 138.00	243017	05HAVILAND1 138.00	1	167	245	210	271



Proposed Solution:

At East Lima and Haviland 138 kV stations, replace line relays and wavetraps, on the East Lima-Haviland 138 kV facility. **In addition, replace 500 MCM Cu Risers and Bus conductors at Haviland 138 kV. (B3131)**

Reason for the additional scope: These conductors were identified as elements with ratings between the existing ratings and the desired ratings for this facility during the course of scoping the solution.

Estimated Cost: \$1.5 M

Required In-Service: 12/1/2024

Projected In-Service: 12/1/2024



Additional Scope for Project B3087

Criteria: FERC 715 Planning Criteria Violation

Model Used for Analysis: 2023 Winter RTEP

Existing Scope: (Presented: 11/29/2018, 10/25/2019 SRRTEP):

Construct a new greenfield station to the west (~1.5 mi.) of the existing Fords Branch Station, potentially in/near the new Kentucky Enterprise Industrial Park. This new station will consist of 4 -138 kV breaker ring bus and two 30 MVA 138/34.5 kV transformers. The existing Fords Branch Station will be retired. **(B3087.1)**

Estimated Cost: \$2.8 M

Construct approximately 5 miles of new double circuit 138 kV line in order to loop the New Fords Branch station into the existing Beaver Creek – Cedar Creek 138 kV circuit. **(B3087.2) Estimated Cost: \$19.9 M**
Remote end work will be required at Cedar Creek Station. **(B3087.3) Estimated Cost: \$ 0.5 M**

Additional Scope: Install a 28.8MVar switching shunt at the new Fords Branch substation **(B3087.4)**

Estimated Cost: \$ 0.5 M

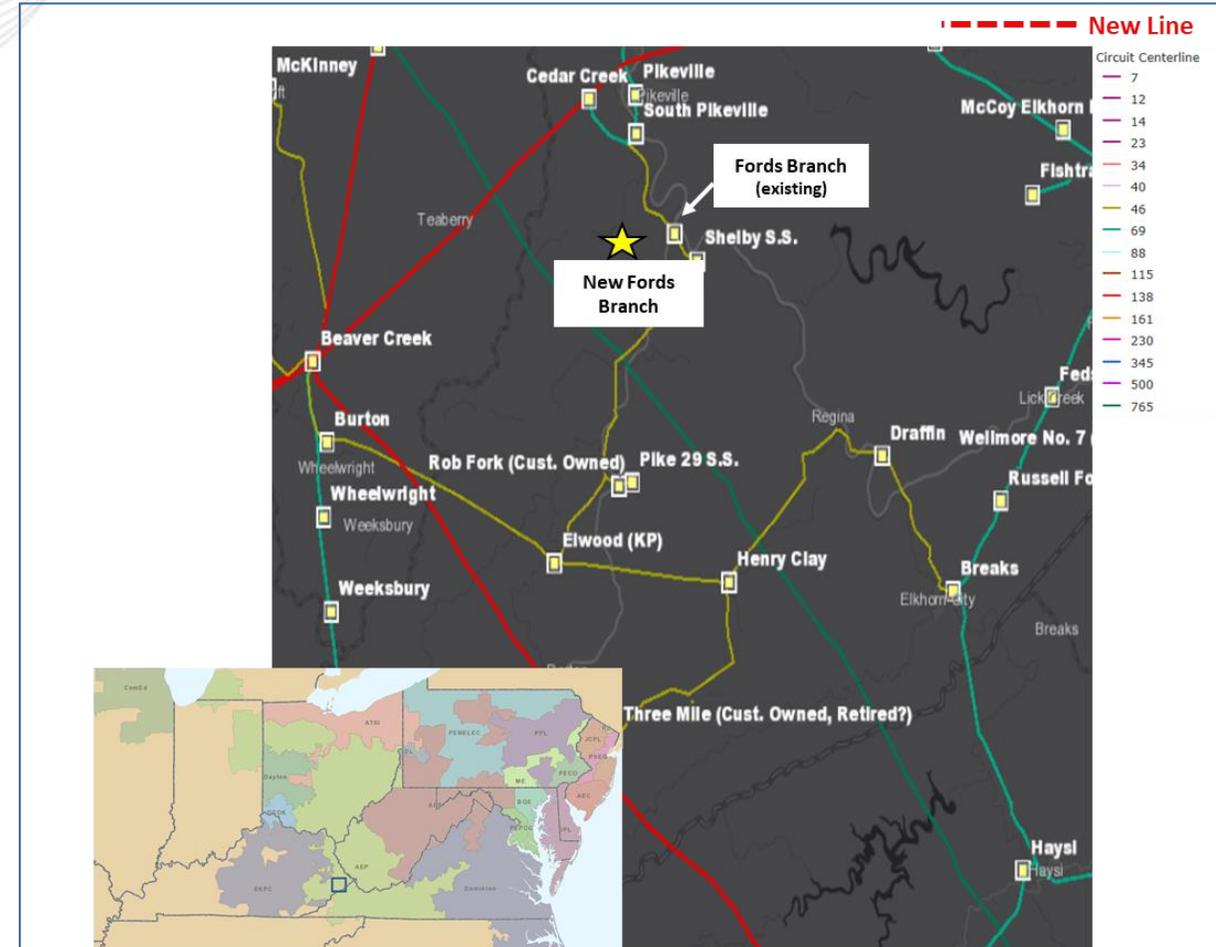
Reason for the additional scope:

- For the N-1-1 Loss of Beaver Creek Transformer #1 and the loss of Cedar Creek – Johns Creek 138kV line, voltage magnitude violations are identified at New Fords Branch substation (0.90 pu), Cedar Creek 138kV (0.90 pu).
- For the N-1-1 Loss of Beaver Creek – Kewanee (New Fords Branch) 138kV and Cedar Creek – Johns Creek 138kV line, voltage magnitude violations issues are identified at the new Fords Branch substation (0.87 pu), Cedar Creek 138kV (0.87pu), Cedar Creek 69kV (0.90 pu).

Required In-service: 12/1/2023

Projected In-service: 09/31/2022

Project Status: Scoping



Scope Change (B3099)

Previously Presented: 1/11/2019, 2/20/2019 SRTEAC

Old Scope: Install a 138 kV 3000A 40 kA circuit switcher on the high side of the existing 138/34.5 kV transformer #5 at Holston station.

Estimated Cost: \$0.7 M

New Scope: Install a 138 kV 3000A 40 kA circuit switcher on the high side of the existing 138/34.5 kV transformer #5 **and a 138 kV 3000A 40 kA circuit switcher transformer #7** at Holston station.

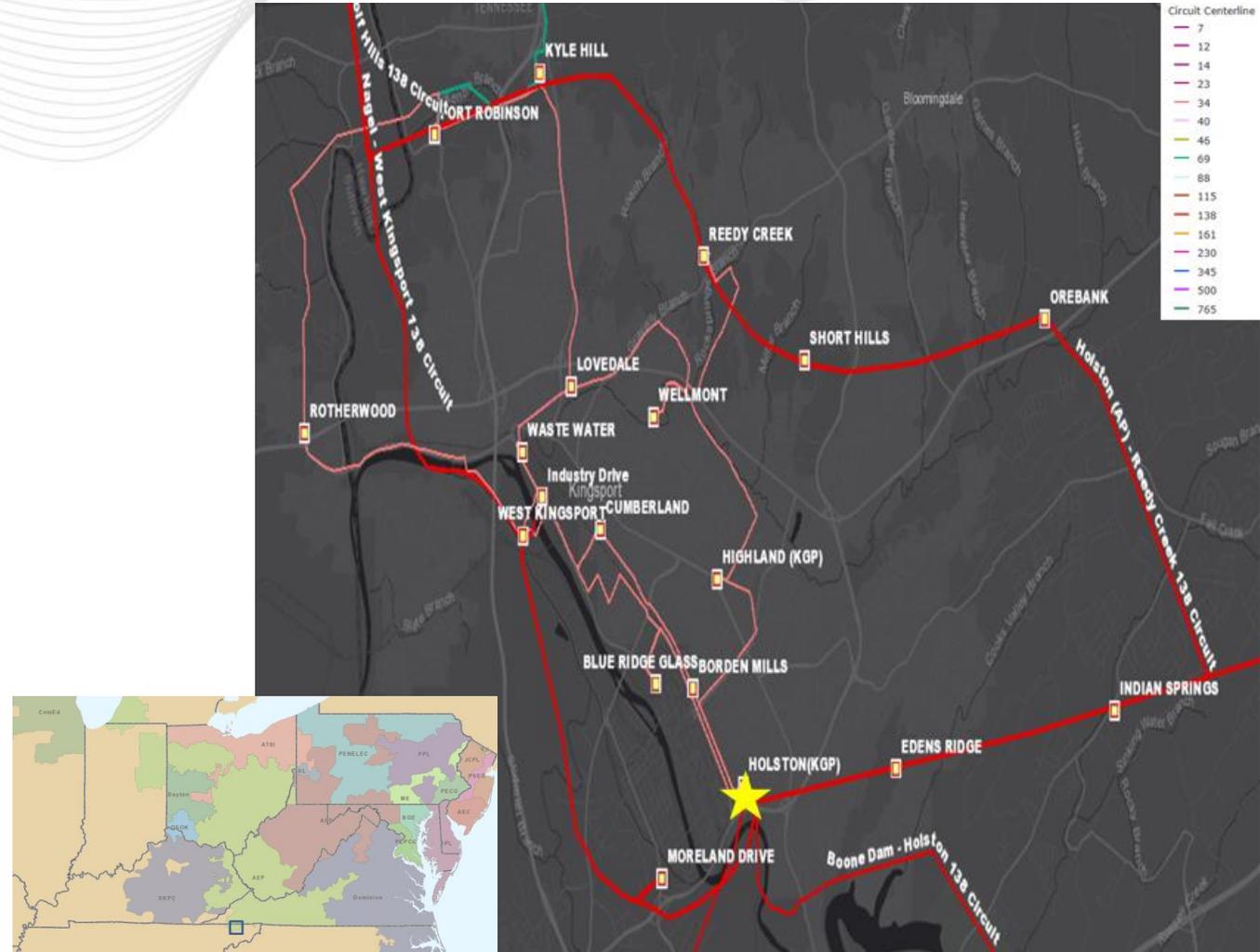
Estimated Cost: ~~\$0.7 M~~ \$1.4 M

Reason for change: Transformer 7 serves distribution customers but is located in a Transmission station. After investigating the cost responsibility for the switcher installation with Distribution, the cost should be assigned to Transmission.

Required In-service: 6/1/2022

Projected In-service: 6/1/2022

Project Status: Scoping





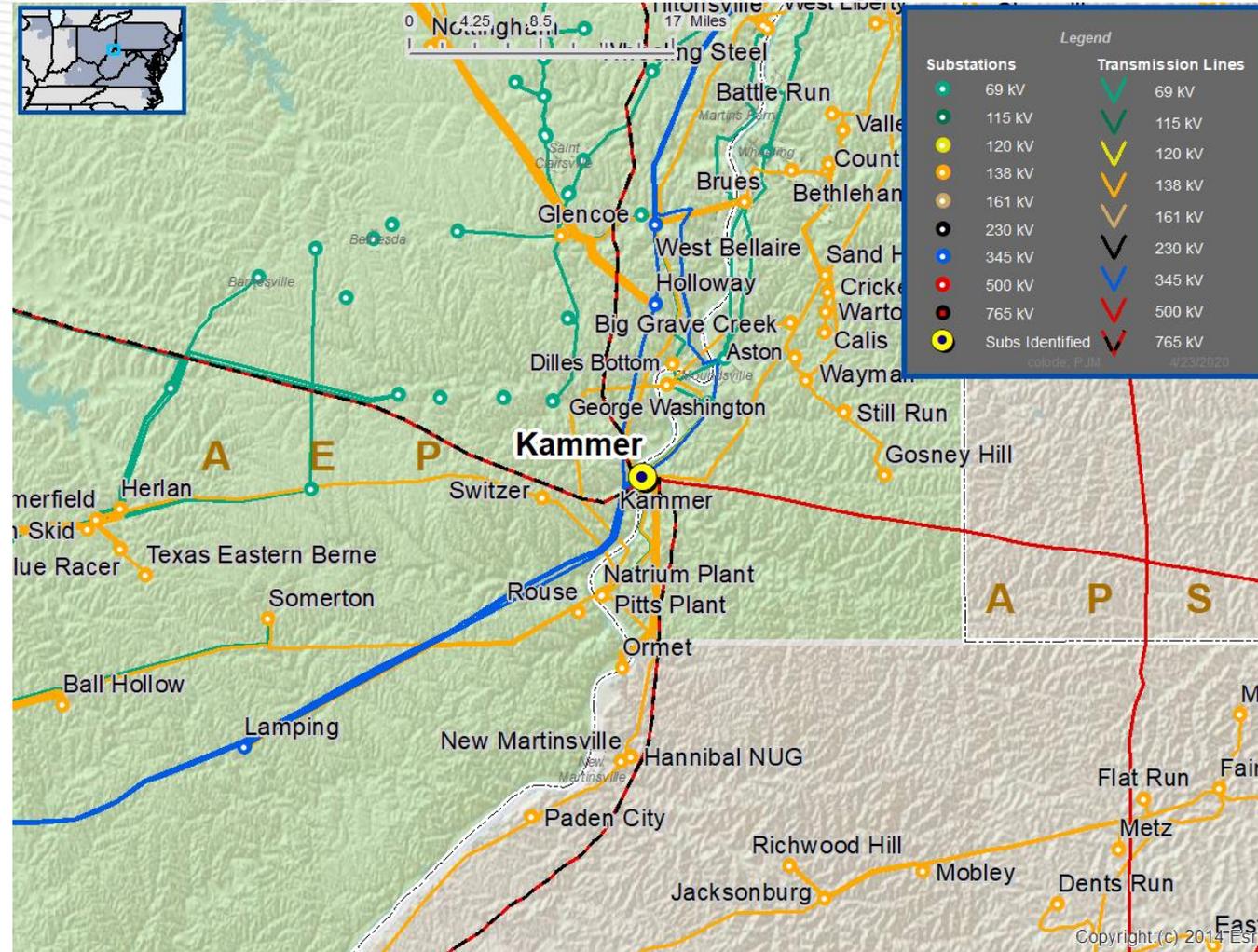
AEP Transmission Zone

Required IS Date Change (B2753.9)
Previously Presented: 6/30/2017
7/21/2017SRTEAC

B2753.9: Remove/Open Kammer 345/138 kV transformer #301

Estimated Cost: \$0M
Old Required IS Date: 5/31/2020
New Required IS Date: 9/13/2021

Reasons for the Required IS Date Change:
Opening of Kammer 345-138kV transformer 301 is to address overdutied breakers at Kammer 138kV. Due to the withdrawn queue of Y3-068, re-studied shows the breakers are overduty only after AB2-093, whose IS date is 9/13/2021.



- V1 – 05/26/2020- original slides posted