Sub Regional RTEP Committee
PJM West

October 16, 2020

First Review

Baseline Reliability Projects

DLC Transmission Zone: Baseline Arsenal – Riazzi 138 kV line

Process Stage: First Review

Criteria: FERC 715 (TO Criteria)

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2020 RTEP 2025 Cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FGs: DLCO-T1, DLCO-T2

The Arsenal - Riazzi (Z-101) 138 kV line exceeds its normal rating as a result of an N-2 failure of underground cables (Z-47 and Z-48) in a common trench. This violates DLC's FERC 715 criteria in regard to managing system conditions during an N-2 underground cable common trench failure.

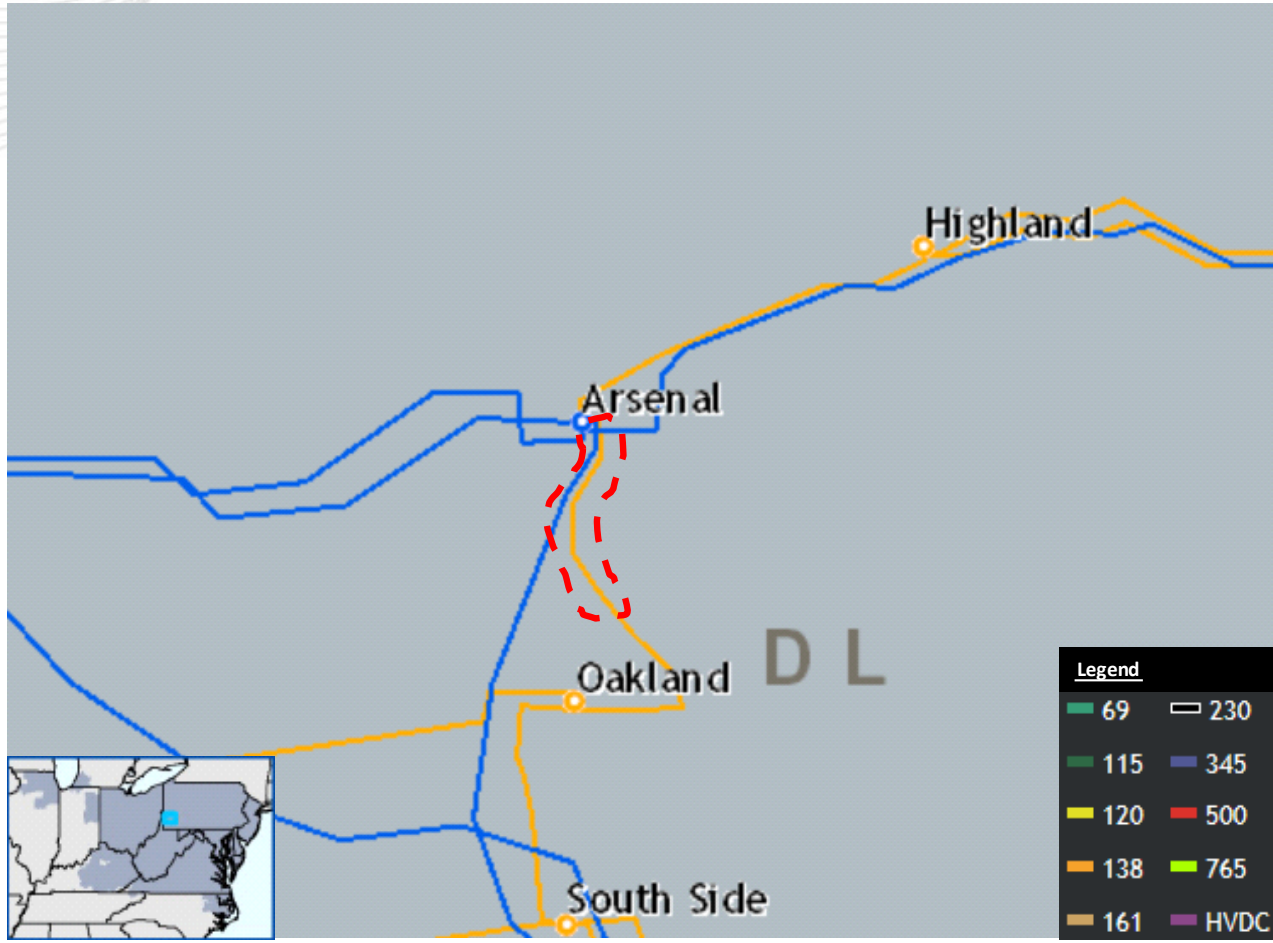
Existing Facility Rating: 185/247 SN/SE

Preliminary Facility Rating:

208/268 MVA SN/SE under normal conditions

215/273 MVA upon loss of the Z-47 (Carson - Oakland) and Z-48 (Oakland - Forbes) 138kV circuits

217/274 MVA upon loss of the 302 (Brunot Island - Carson) and 307 (Carson - Arsenal) 345kV circuits



DLC Transmission Zone: Baseline Arsenal – Riazzi 138 kV line

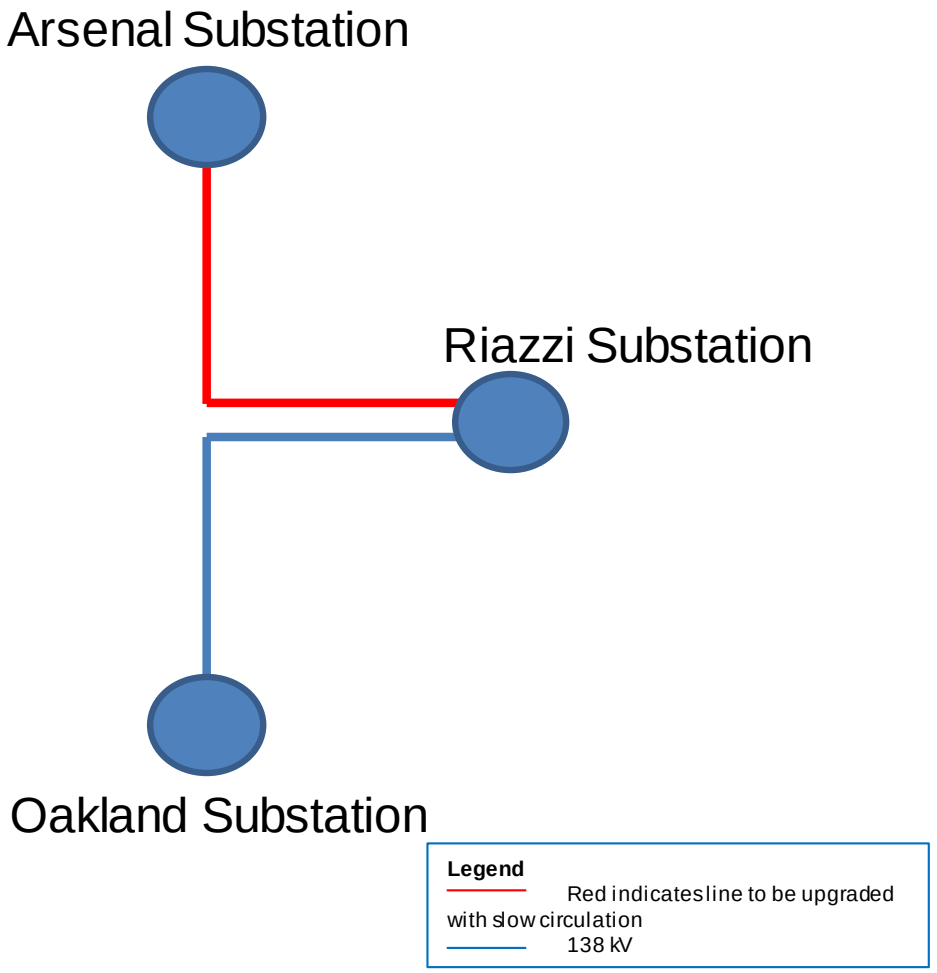
Proposed Solution:
Implement slow circulation on existing underground 138 kV high pressure fluid filled (HPFF) cable between Arsenal and Riazzi Substations

- **Estimated Cost:** $2.4M

Alternatives:
Reconductor the existing underground 138 kV cable

- **Estimated Cost:** $24M

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Bass 34.5kV Riser Replacement

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FGs: AEP - T136, AEP-T137

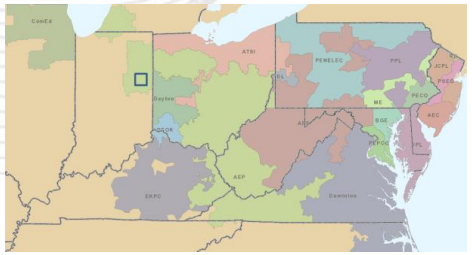
The Bass – Spy Run1 34.5kV line is overloaded for the N-1-1 contingency pair of the loss of the Robison Park – Purdue 138kV line and the loss of the Illinois Road – Industrial Park – McKinley 3 and Summit - Industrial Park - Spy Run1 138kV line, Industrial park 138/69/34.5kV transformer, and Industrial Park – Kroemer 69kV line.

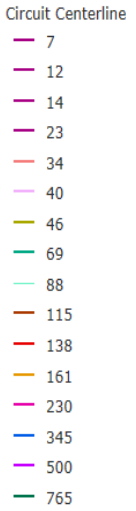
Existing Facility Rating:

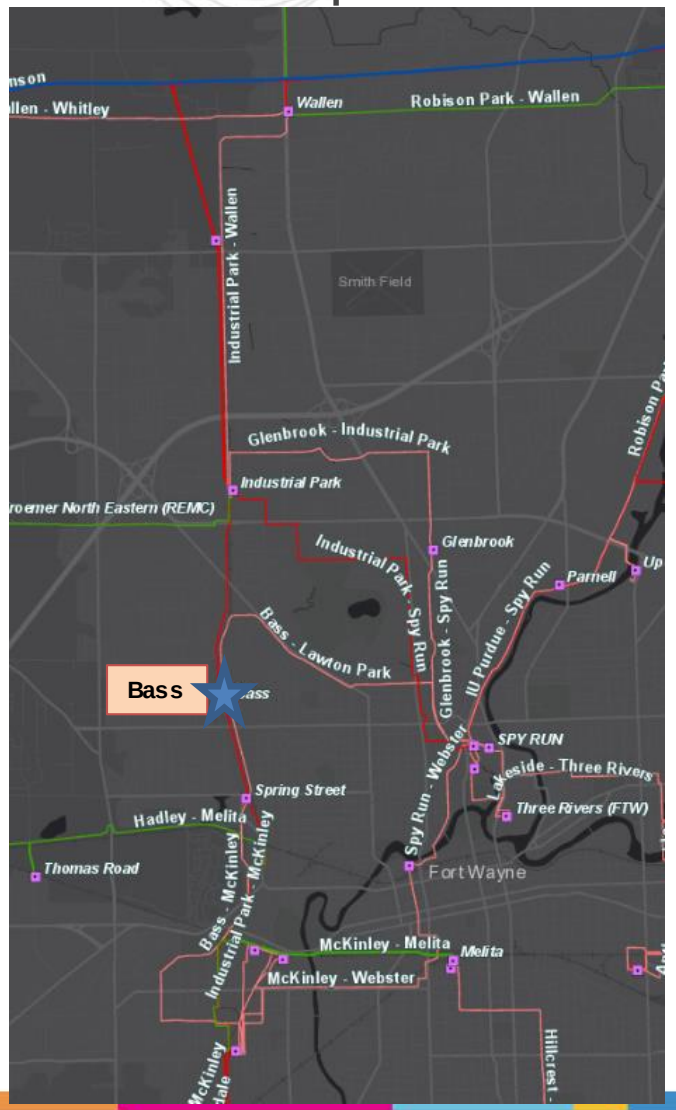
Branch	SN/SE/WN/WE (MVA)
05BASS – 05SYP RUN1	26/26/28/28

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05BASS – 05SYP RUN1	46/46/58/58







AEP Transmission Zone: Baseline Bass 34.5kV Riser Replacement

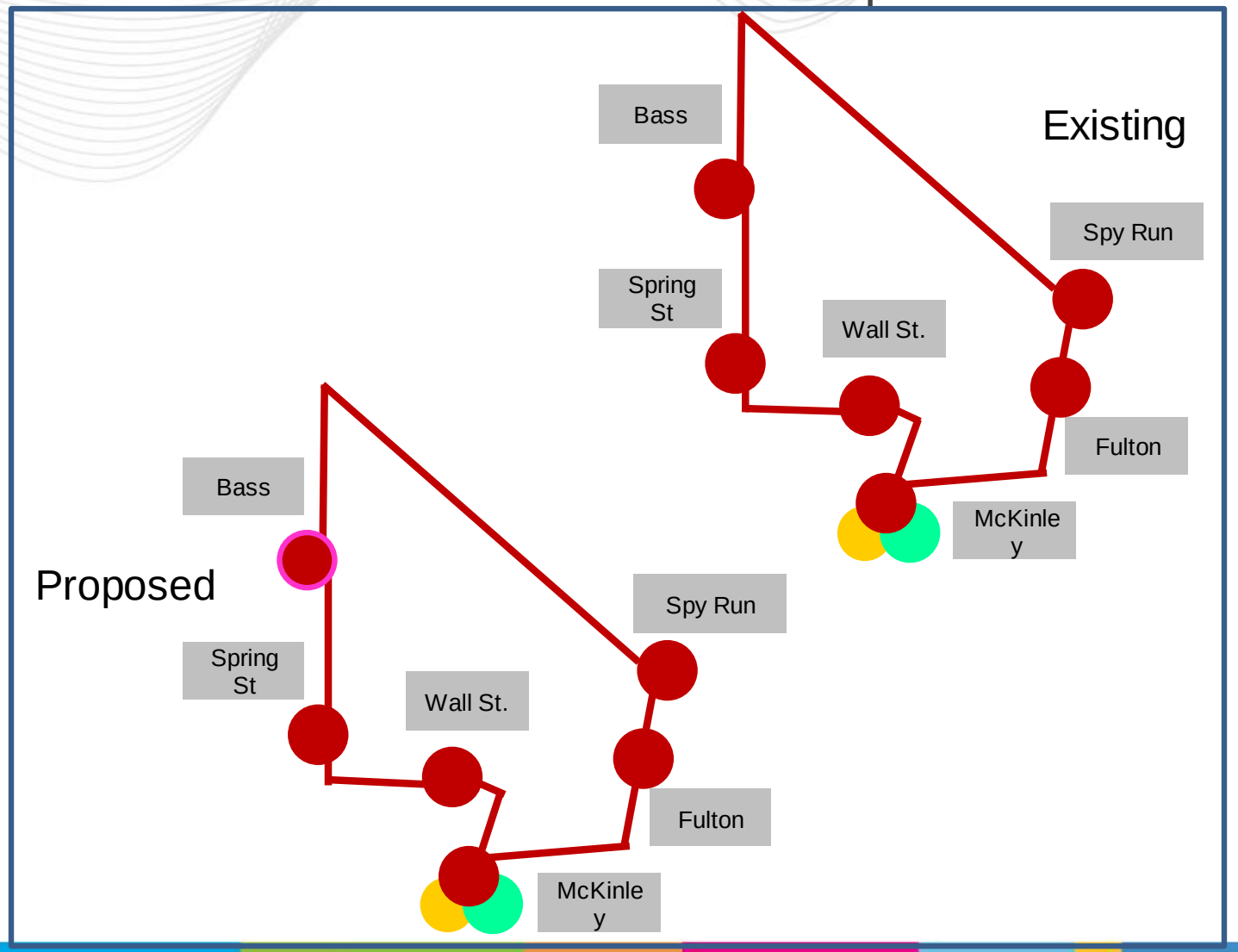
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Process Stage: First Review

Proposed Solution: Replace Risers at Bass 34.5kV Station
Estimated Cost: $0.1M

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline
Rob Park - Harlan 69kV Rebuild

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: AEP – T404

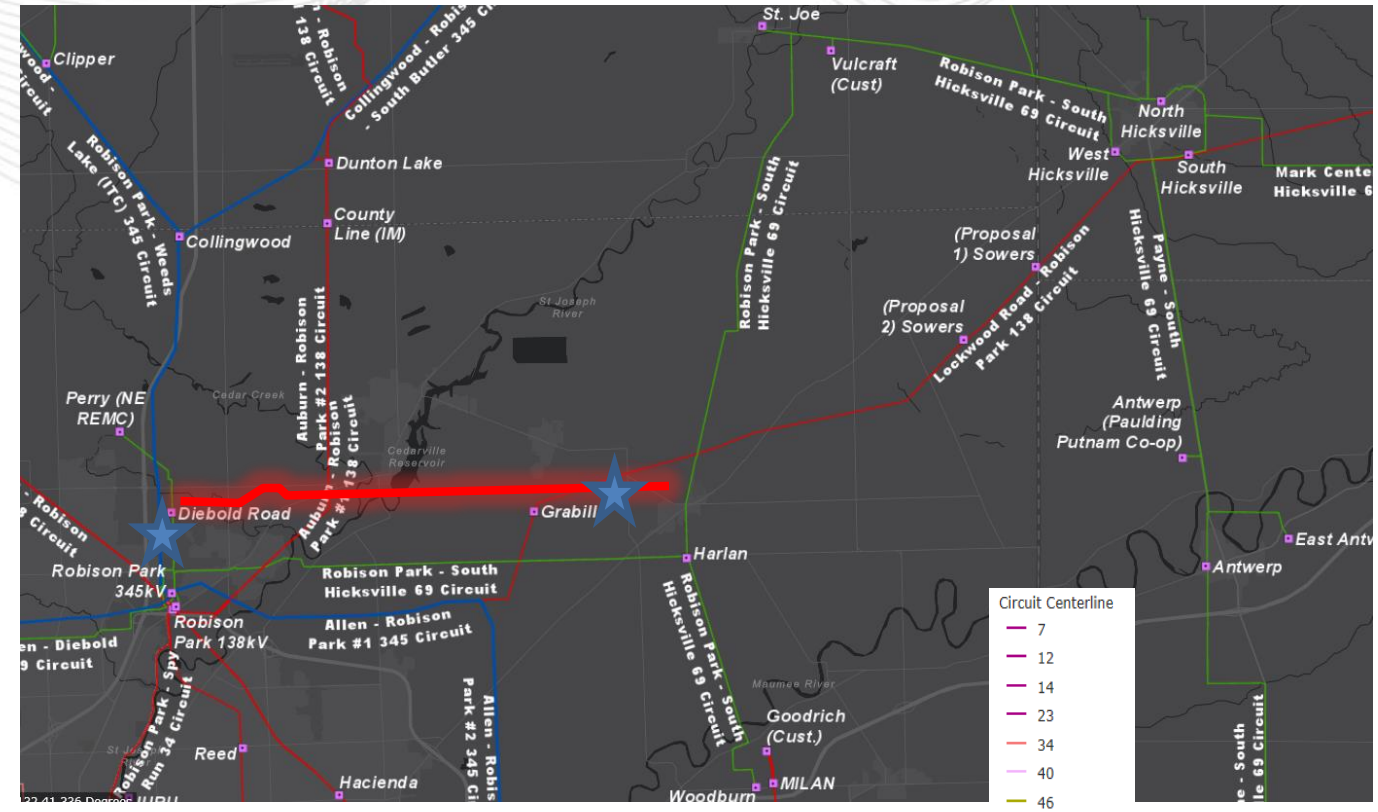
The Harlan - Robinson Park 69kV line is overloaded the N-1-1 contingency pair of the loss of Sowers - South Hicksville - Lockwood 138kV line with South Hicksville 138/69kV transformer and the loss of the Auburn – Joist – Butler 69kV line

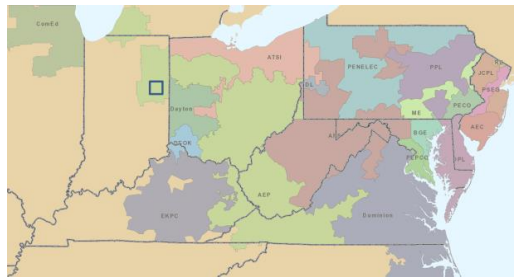
Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05HARLAN - 05ROBISONP	50/50/63/63

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05HARLAN - 05ROBISONP	79/90/100/109





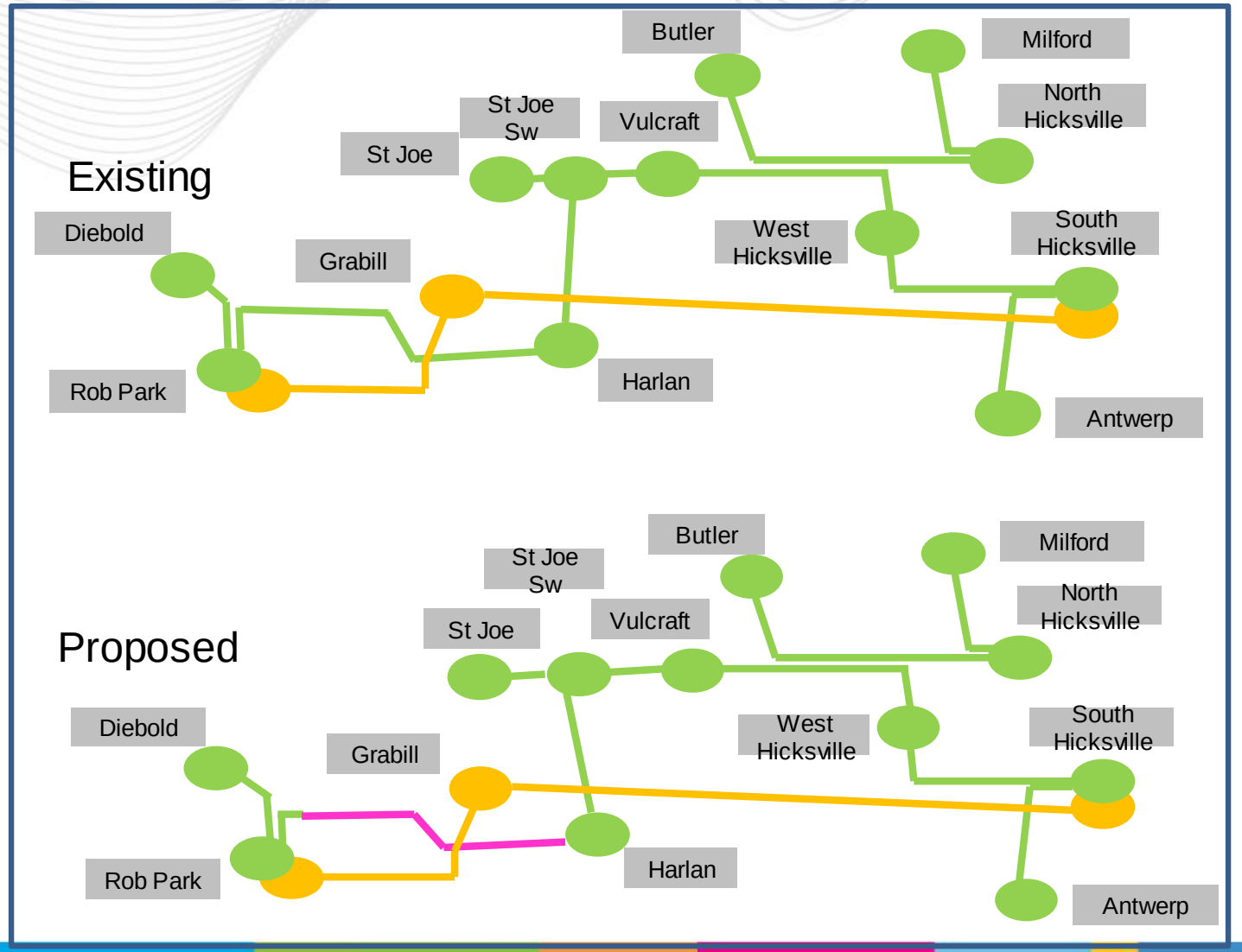
AEP Transmission Zone: Baseline
Rob Park - Harlan 69kV Rebuild

Proposed Solution: Rebuild approximately 9 miles of the Rob Park - Harlan 69kV line.
Estimated Cost: $20.9M
Ancillary Benefits: Line also identified as supplemental need AEP-2019-IM014 (Needs meeting 4/23/2019, solution meeting 9/11/2020)

Alternatives: Install 2nd 138/69 bank and protection at South Hicksville Estimated Cost: $7M

Note that the line needs to be rebuilt for condition, performance and risk reasons anyway. In this case, although it is more expensive as a straight baseline solution, it is the most cost effective solution for supplemental and baseline needs.

Required In-Service: 6/1/2025



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

AEP Transmission Zone: Baseline
Chatfield - Melmore Sag Clearance Mitigations

Process Stage: First Review

Criteria: Summer Generation Deliverability

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: GD-S293

The Chatfield – Melmore 138kV line is overloaded for the loss of the Fostor – Melmore 138kV line with the stuck breaker at Melmore.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05CHATFL – 05MELMOR	167/167/210/210

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05CHATFL – 05MELMOR	245/245/271/271

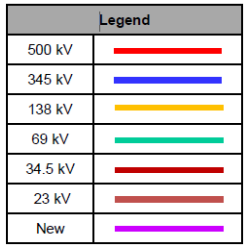
AEP Transmission Zone: Baseline
Chatfield - Melmore Sag Clearance Mitigations

Existing Configuration:

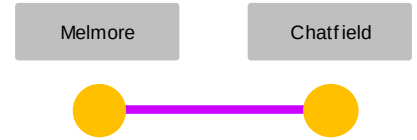
Proposed Solution: Replace 11 double circuit lattice towers on the line with taller structures to achieve adequate clearances in order to be able to operate the line at a higher rating
Estimated Cost: $4.93M
Ancillary Benefits: Structures proposed to be replaced are pre-1930's lattice.

Alternatives: None

Required In-Service: 6/1/2025



Future Configuration:



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AEP Transmission Zone: Baseline Sand Hill 138 kV Riser Upgrades

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: AEP-T295

The Sand Hill – Cricket138kV line can not be dispatched below normal rating after the loss of Sand Hill – Warton Hill #1 138kV line in N-1-1 test.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05SAND H – 05CRICKET SS 138kV	219/255/277/303

Preliminary Facility Rating:

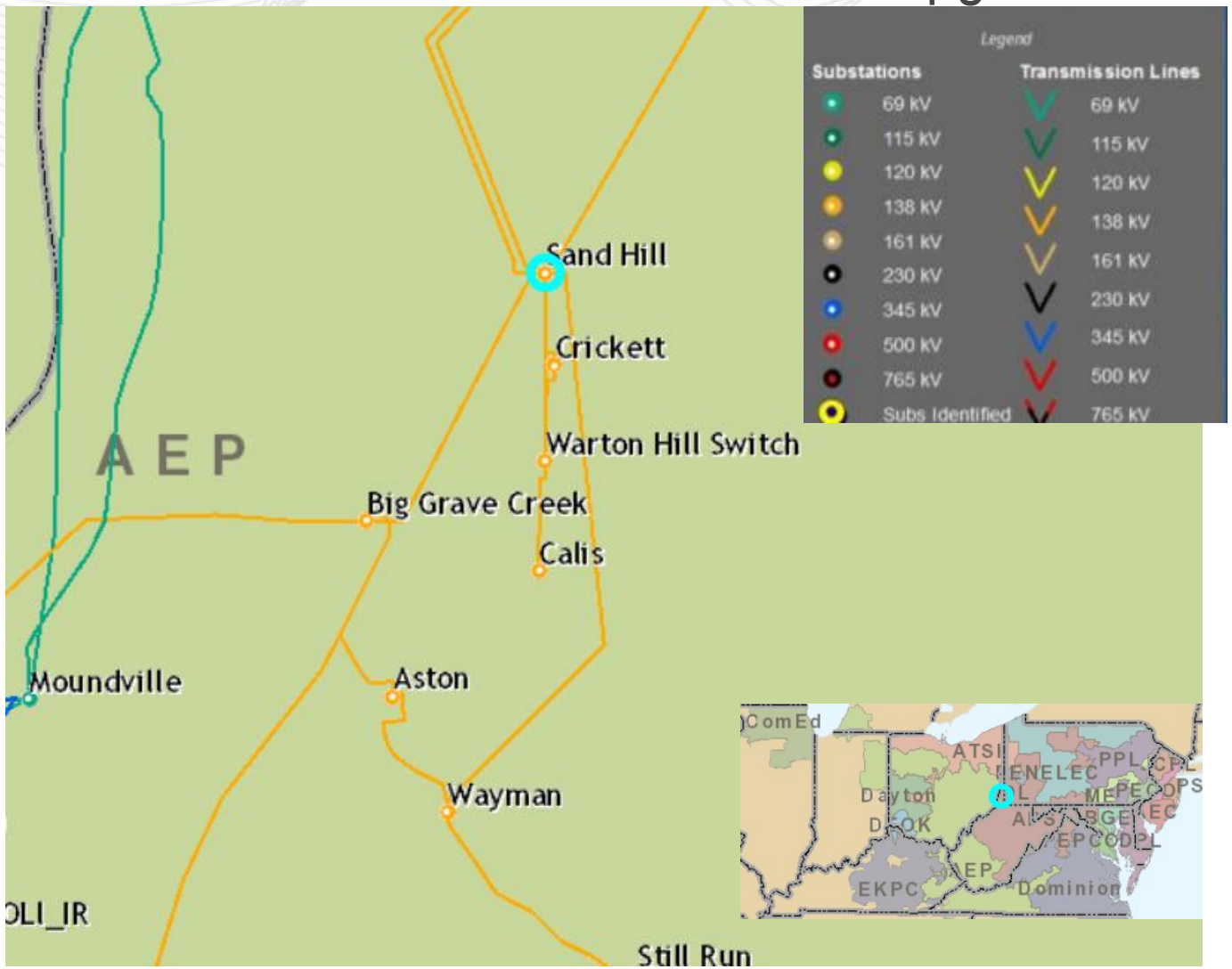
Branch	SN/SE/WN/WE (MVA)
05SAND H – 05CRICKET SS 138kV	257/341/325/404

Proposed Solution: Upgrade 795 AAC risers at Sand Hill station towards Cricket Switch with 1272 AAC

Estimated Cost: $0.04M

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Tidd Riser Upgrades

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Substation Equipment

Problem Statement:

FGs: AEP-T296, AEP-T297

One of the Tidd – Wheeling Steel 138kV lines #1 and #2 can not be dispatched below normal rating after the loss of the other line in N-1-1 test.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05TIDD – 05WHELGS 138kV	187/205/247/258

Preliminary Facility Rating:

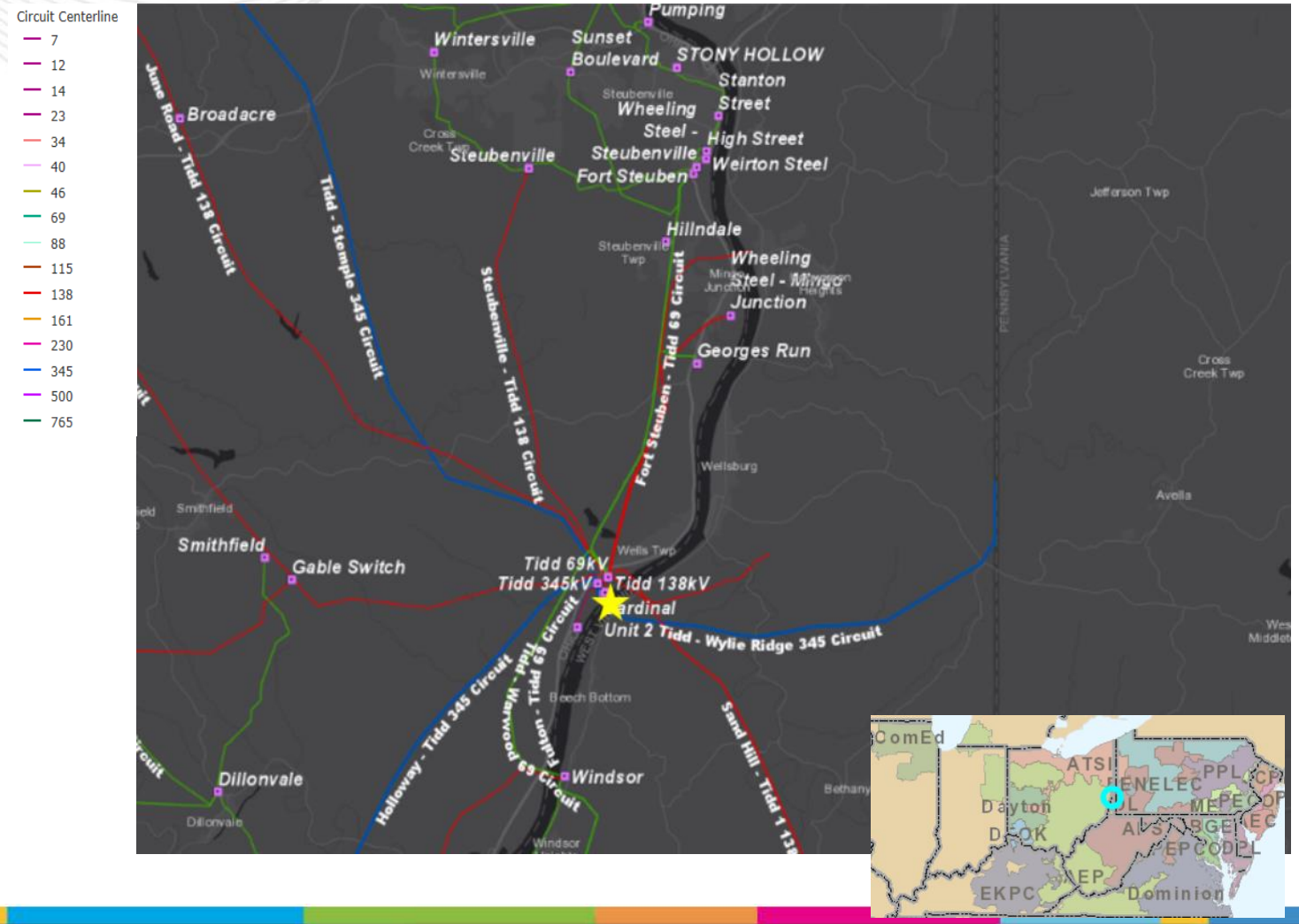
Branch	SN/SE/WN/WE (MVA)
05TIDD – 05WHELGS 138kV	205/205/258/258

Proposed Solution: Upgrade 500 MCM Cu risers at Tidd station towards Wheeling Steel; replace with 1272 AAC conductor.

Estimated Cost: $0.07M

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline
Twin Branch Hydro

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Substation Equipment

Problem Statement:

FGs: AEP-T453, AEP-T458, AEP-T459, AEP-T452, AEP-T460, AEP-T447, AEP-T442, AEP-T443, AEP-T444, AEP-T446, AEP-T445

Twin Branch 1 – Twin Branch 2 34.5kV line is overloaded for multiple N-1 contingencies and N-1-1 contingency pairs.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05TWIN BRCH1 – 05TWIN BRCH 2 34.5kV	37/37/47/47

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05TWIN BRCH1 – 05TWIN BRCH 2 34.5kV	55/62/69/76

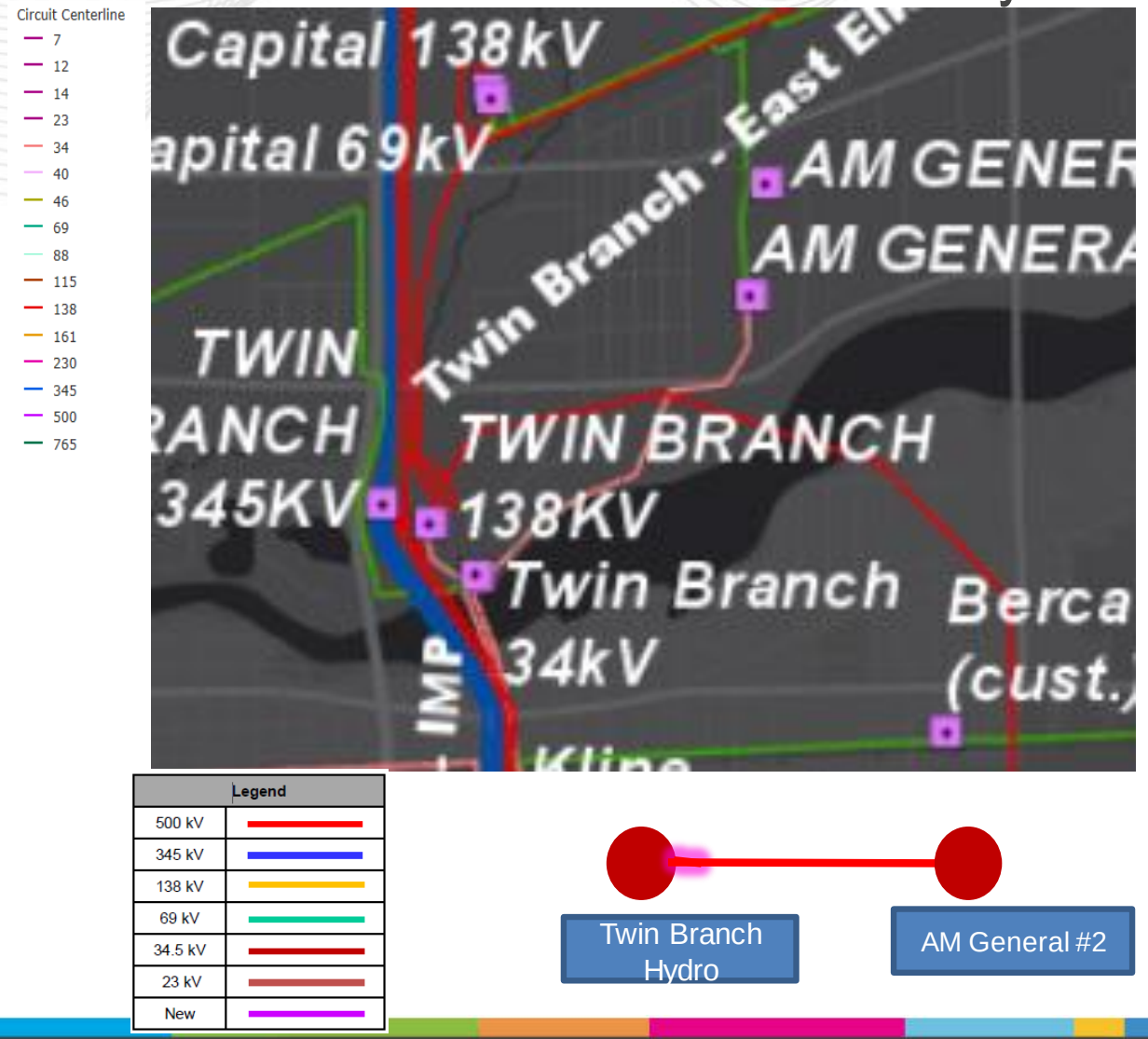
Proposed Solution: replace two spans of 336.4 26/7 ACSR on Twin Branch-AM General #2 Circuit.

Estimated Cost: $0.14M

Ancillary Benefits: First two spans of AEP-2020-IM020 (Presented 8/14/2020), Structures relocated for station work AEP-2019-IM044 (presented 11/22/2019)

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Albion CB Addition

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

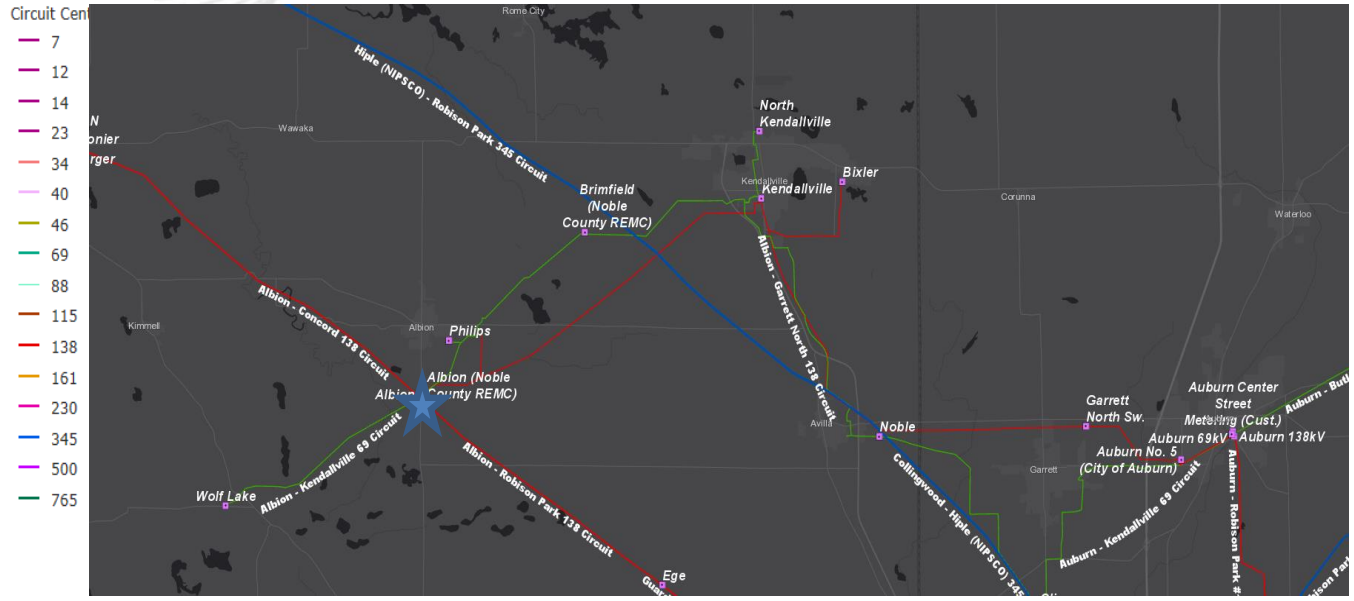
Proposal Window Exclusion: Below 200 kV

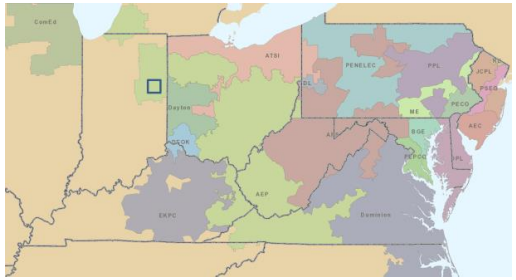
Problem Statement:

FGs: AEP-VD102 through AEP-VD113, AEP-VM133 through AEP-VM136

The voltage drop violation at Wolf Lake, Albion, Philips, Brimfield, North Kendallville, Kendallville 69kV buses for multiple N-1-1 contingency pairs.

Existing Facility Rating: N/A





AEP Transmission Zone: Baseline Albion CB Addition

Process Stage: First Review

Proposed Solution: Install low side 69kV CB at Albion transformer 1 to eliminate the critical contingency

Estimated Cost: $0.4M

Alternatives: None

Required In-Service: 6/1/2025

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

AEP Transmission Zone: Baseline
Millbrook Park 138 kV Breaker Installation

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FGs: AEP-VM1 through AEP-VM56, AEP-VM658 through AEP-VM661, AEP-VM666 through AEP-VM669, AEP-VM801, AEP-VM802, AEP-VM818, AEP-VM820, AEP-VD through AEP-VD26, AEP-VD900, AEP-VD901, AEP-VD908

The voltage magnitude and voltage drop violations at Mill Street, Sugar Hill, Friends Central Portsmouth, Cornerstone Station, Ruhlman, Rosemount, Sciotoville, Millbrook Park, Oertels Corners, Siloam, South Shore 69kV buses and South Lucasville 138kV bus for multiple N-1-1 contingency pairs.

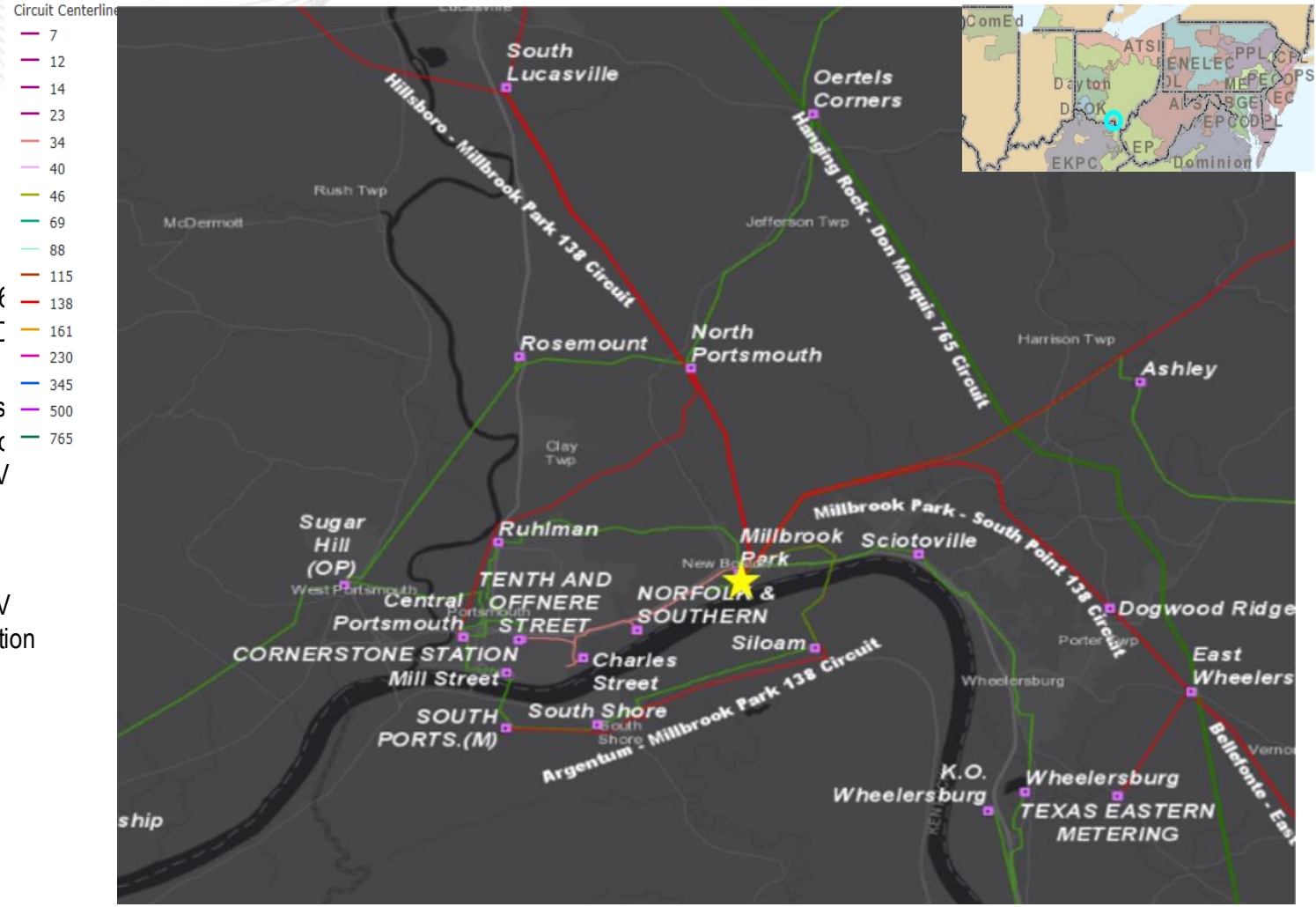
Existing Facility Rating: N/A

Proposed Solution: Install a 3000A 40 kA 138 kV breaker on high side of 138/69 kV transformer #5 at Millbrook Park station. The transformer and associated bus protection will be upgraded accordingly.

Estimated Cost: $0.63M

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline Wagenhals 138 kV Breaker Installation

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FGs: AEP-T390, AEP-T391, AEP-VD1135, AEP-VD1136, AEP-VD1137

The Easton – North Canton 69kV line is overload and voltage drop violations at Belden Village, Wayview 69KV buses for N-1-1 contingency pair of the loss of West Canton -Promway – Wayview 138kV line and the loss of Wagnenhals 138/69/23kV transformer and the Canton Center – Wagenhals-June Road 138kV line, LTV Steel – Wagenhals- North East Canton 138KV line and West Louisville – Georgetown 69kV line.

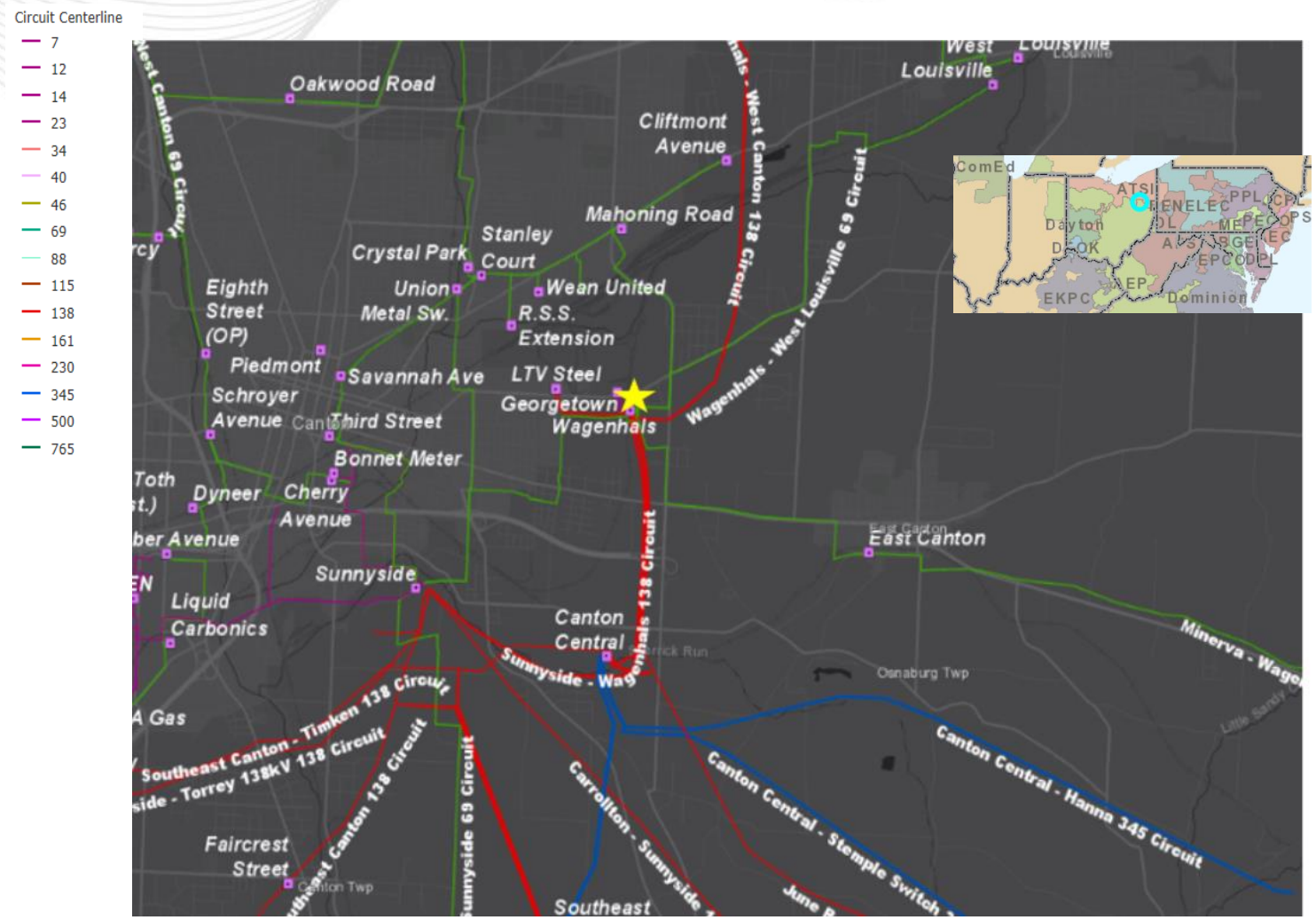
Existing Facility Rating: N/A

Proposed Solution: Install a 3000A 63 kA 138 kV breaker on high side of 138/69 kV transformer #2 at Wagenhals station. The transformer and associated bus protection will be upgraded accordingly

Estimated Cost: $1.10M

Alternatives: None

Required In-Service: 6/1/2025



AEP Transmission Zone: Baseline
West Millersburg 138kV Breaker Installation

Process Stage: First Review

Criteria: AEP 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FGs: AEP-VD975, AEP-VD976, AEP-VD977, AEP-VD978, AEP-VD979, AEP-VD980, AEP-VD981, AEP-VD982, AEP-VD458, AEP-VD459

The voltage drop violations at BILLIAR, North Fredericksburg, Shreve, Big Prairie, PAINTVSS, Drake Valley, and LOUDNVL 69kV buses for the fault South Millersburg - West Millersburg – Wooster – East Wooster 138kV line with stuck breaker at Wooster 138kV bus.

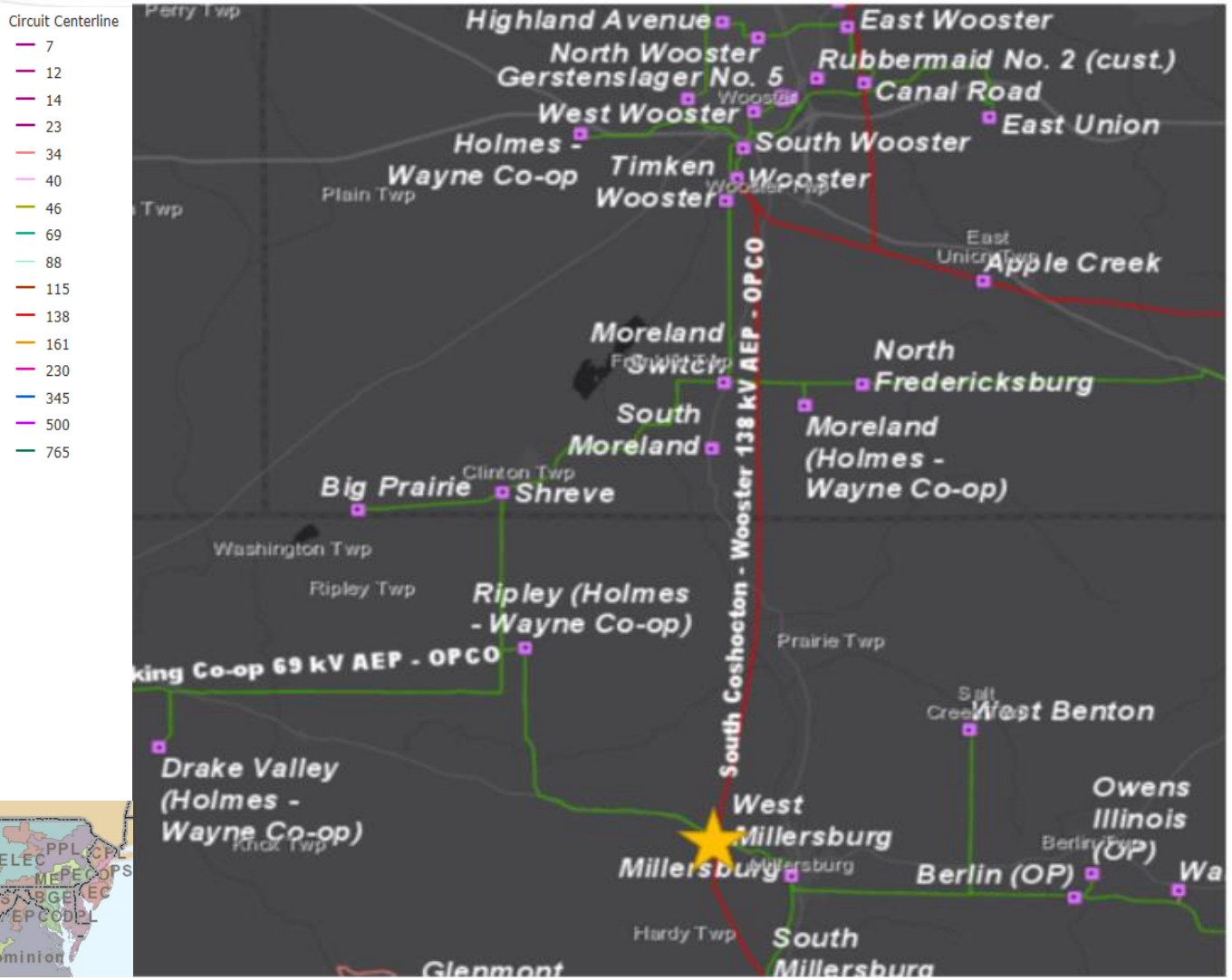
Existing Facility Rating: N/A

Proposed Solution: At West Millersburg station, replace the 138kV MOAB switch on the West Millersburg - Wooster 138kV line with a 3000A 40kA breaker.

Estimated Cost: $0.68M

Alternatives: None

Required In-Service: 6/1/2025



ATSI Transmission Zone: Baseline Pine 138 kV Reactor

Process Stage: First Review

Criteria: ATSI 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: ATSI-LLVM12, ATSI-LLVM13, ATSI-LLVM14, ATSI-LLVM15, ATSI-LLVM16, ATSI-LLVM17, ATSI-LLVM18, ATSI-LLVM19, ATSI-LLVM20, ATSI-LLVM21, ATSI-LLWM22, ATSI-LLVM107, ATSI-LLVM108, ATSI-LLVM109, ATSI-LLVM110, ATSI-LLVM111, ATSI-LLVM112, ATSI-LLVM113, ATSI-LLVM114, ATSI-LLVM115, ATSI-LLVM116

High Voltages, based on ATSI TO Criteria, observed for voltage magnitude analysis of the Light load case in the area of Pine 138 kV

Proposed Solution: Extend both the east and west 138 kV buses

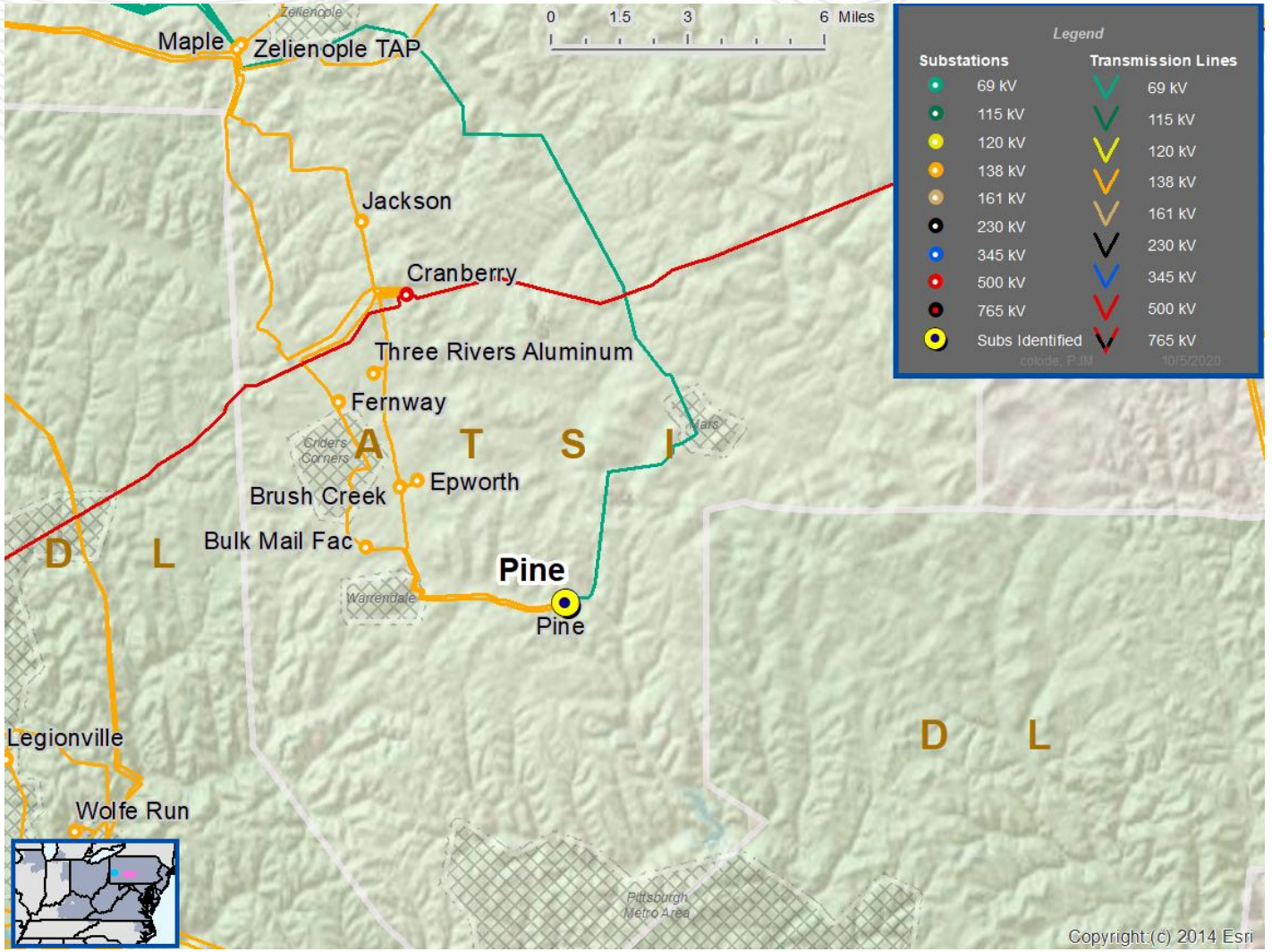
Install one (1) 138 kV breaker and associated disconnect switches

Install one 100 MVAR reactor

Estimated Cost: $3.8M

Alternatives: None

Required In-Service: 6/1/2025



ATSI Transmission Zone: Baseline Tangy 138 kV Reactor

Process Stage: First Review

Criteria: ATSI 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: ATSI-LLVM38

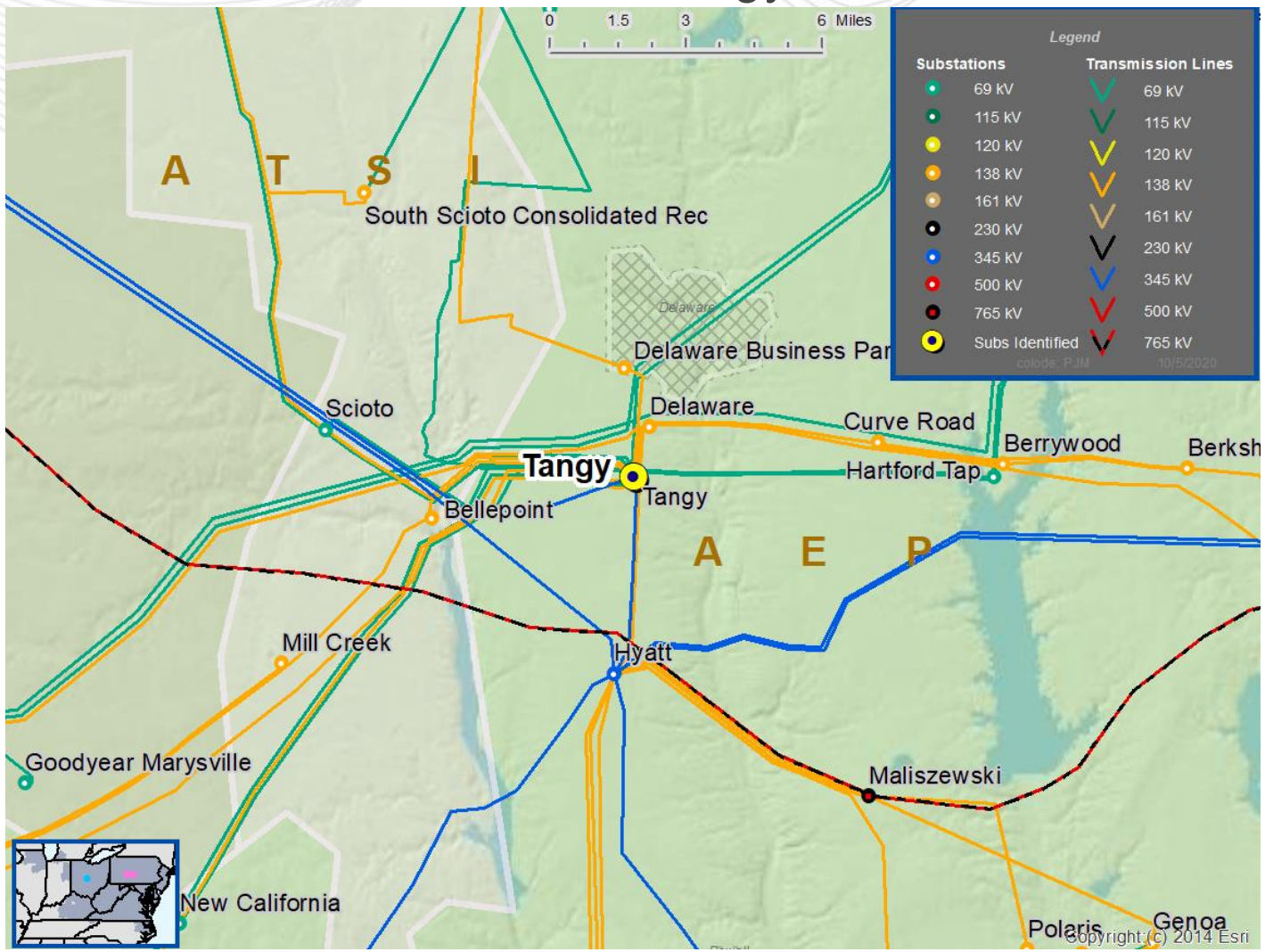
High Voltage, based on ATSI TO Criteria, observed for voltage magnitude analysis of the Light load case at Tangy 138 kV for the loss of the Gavin – Flatlick 765 kV line.

Proposed Solution: Extend 138 kV bus work to the west of Tangy Substation for the addition of the 100 MVAR reactor bay

Estimated Cost: $3.7M

Alternatives: Larger reactor at Tangy

Required In-Service: 6/1/2025



ATSI Transmission Zone: Baseline Broadview 138 kV Reactor

Process Stage: First Review

Criteria: ATSI 715 Criteria

Assumption Reference: 2025 RTEP assumption

Model Used for Analysis: 2025 RTEP cases

Proposal Window Exclusion: Below 200 kV

Problem Statement:

FG: ATSI-LLVM101, ATSI-LLVM102, ATSI-LLVM103, ATSI-LLVM104, ATSI-LLVM105, ATSI-LLVM106

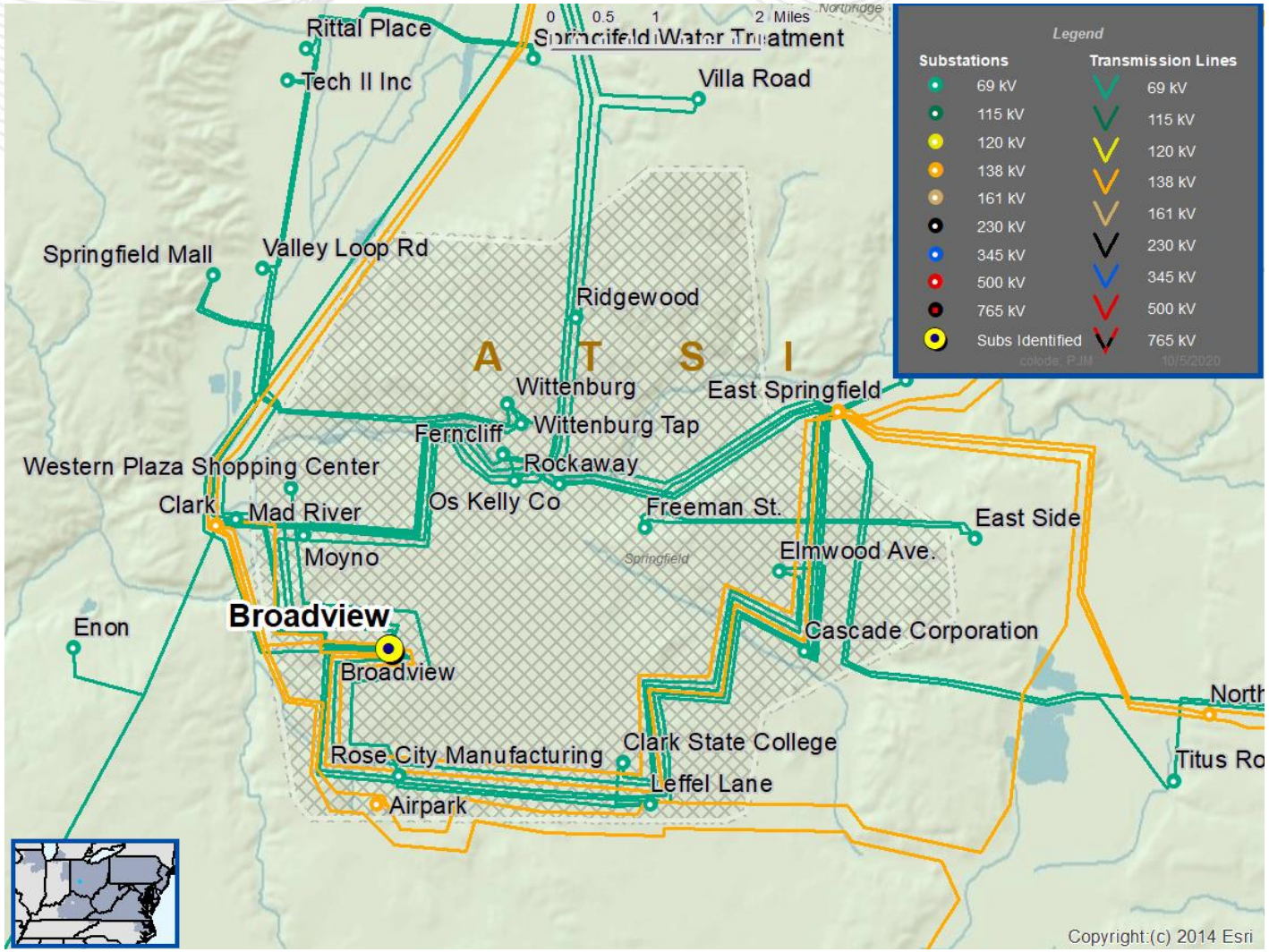
High Voltage, based on ATSI TO Criteria, observed for voltage magnitude analysis of the Light load case around Broadview, Tech + and Morefiel138 kV busses for the loss of the Edgewood – Urbana 69 kV line.

Proposed Solution: Extend the Broadview 138 kV Bus by adding two new breakers and associated equipment and install a 75 MVAR Reactor

Estimated Cost: $4.5M

Alternatives: Larger reactor at Tangy

Required In-Service: 6/1/2025



Questions?

Revision History

- V1 – 10/13/2020 – Original slides posted
- V2 – 10/15/2020 – Remove Slide #11
- V3 – 10/16/2020 – Slide #3, Corrected window exclusion
  – Slide #16, Add details for proposed solution
  – Slide #18, Updated station names in problem statement
- V4 – 11/6/2020 – Slide #14, Corrected preliminary facility rating
- V5 – 2/4/2021 – Slide #15, Added FG# AEP-VM133 through AEP-VM136