PJM Identified Issues and Planned Solutions Near the MISO Seam

4th Quarter Review - 2022

February 17, 2023

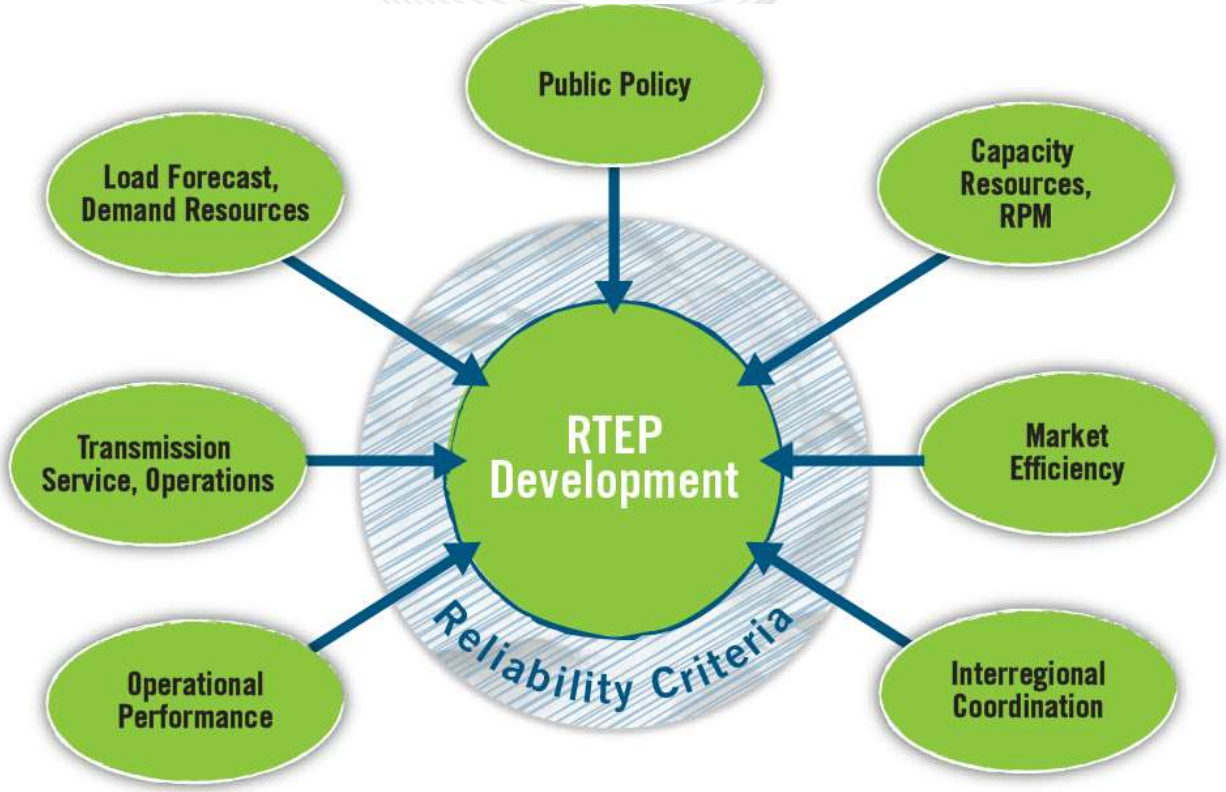
Notes

- This slide deck provides a summary of significant transmission projects near the PJM – MISO seam which have been added or modified in 2022
  - **It is not a comprehensive review of all planned projects**
- Where projects were presented on multiple occasions, efforts were made to only include the latest information
- For additional information:
  - TEAC: http://pjm.com/committees-and-groups/committees/teac.aspx
  - Subregional RTEP Committee – Western: http://pjm.com/committees-and-groups/committees/srrtep-w.aspx

Links for Various Information related to PJM Planning

- Transmission Expansion Advisory Committee (TEAC)/PJM RTEP Windows
  - http://www.pjm.com/committees-and-groups/committees/teac.aspx
- Interregional Planning
  - http://www.pjm.com/planning/interregional-planning.aspx
- Queue (future) Generation
  - https://pjm.com/planning/services-requests/interconnection-queues.aspx
- Generation Deactivation
  - http://www.pjm.com/planning/generation-deactivation.aspx
- Competitive Planning Process
  - https://www.pjm.com/planning/competitive-planning-process.aspx

System Expansion Drivers for RTEP



Open Issues

Open Issues

PJM currently has no open issues for which potential solutions have not been identified

- New reliability issues will be identified in Q2, 2023
- Preliminary market efficiency issues will be identified in Q4, 2022 (24 month cycle)
- New operational performance or public policy issues will be identified on an ad-hoc basis

Identified Issues: Market Efficiency

Preliminary Issues identified in anticipation of the 2022/2023 Long Term Window
(24-month Market Efficiency cycle)

2020/21 Long-Term Window 1

Analysis Completed

- Cluster No. 1 (APS) - French's Mill to Junction 138 kV
  - Analysis completed: Proposal 756, terminal equipment upgrades at the French's Mill and Junction 138 kV substations, with a projected in-service date of 4/1/22, selected as the preferred solution. 1st Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 2 (PECO) - Plymouth Meeting to Whitpain 230 kV
  - Analysis completed: Proposal 704, terminal equipment upgrades at the Plymouth Meeting and Whitpain 230 kV substations, with a projected in-service date of 6/1/25, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 3 (PPL) - Juniata to Cumberland 230 kV
  - Analysis completed: Proposal 218, reconductor the Juniata-Cumberland 230 kV line, with a projected in-service date of 12/1/23, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 4 (DOM) - Charlottesville to Proffit 230 kV
  - Analysis completed: Proposal 651, series reactor on the Charlottesville-Proffit 230 kV line, with a projected in-service date of 6/1/23, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.

2020/21 Long-Term Window
2nd Read

Cluster 1: Junction – French's Mill 230 kV (APS)

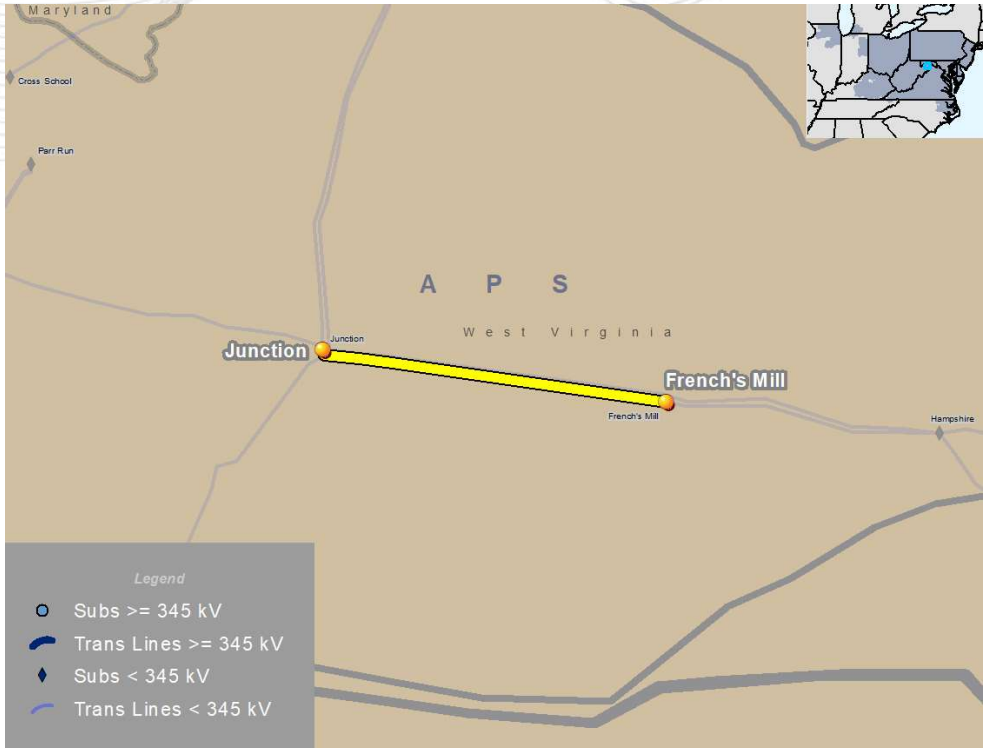
- Proposal 756, terminal equipment upgrades at the Junction and French's Mill 138 kV substations, selected as the preferred solution:
  - Addresses the target congestion and has the highest B/C Ratio, 119.03.
  - Lowest Cost: $0.77 million.
  - Projected in-service date: 4/1/2022.
  - Passes all PROMOD sensitivity scenarios.
  - Reliability analysis has been completed and no reliability violations identified associated with this solution.

- 1st Read presented at the TEAC meeting from 11/30/2021.

- PJM staff intends to submit Proposal 756 to be approved by the PJM Board for inclusion in the Regional Transmission Expansion Plan.

Proposal No. 756 (French's Mill - Junction Terminal Upgrades)

Project ID: 202021_756
Proposed Solution: Replace terminal equipment on the French's Mill-Junction 138 kV line.
Project Type: Upgrade
kV Level: 138 kV
In-Service Cost ($M): $0.77
In-Service Date: 4/1/2022
B/C Ratio = 119.03
Target Zone: APS
ME Constraints: Junction to French's Mill 138 kV
Notes: Redacted Public Proposal 756



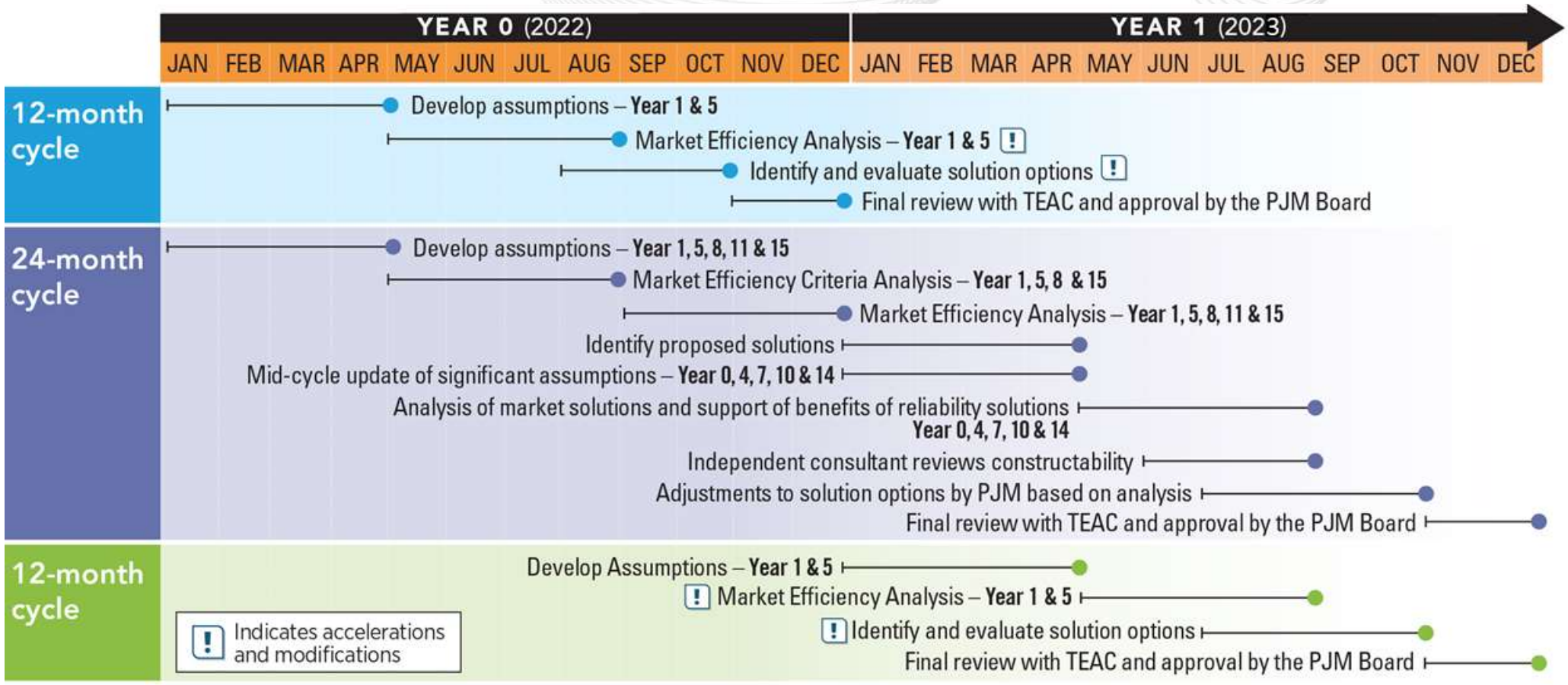
2020/21 Long-Term Window 1 - Next Steps

– Final recommendation to the PJM Board for review and approval.

Proposal ID#	Proposal Baseline #	Project Description	Project Type	Transmission Owner	In-Service Date	Construction Cost ($MM)	B/C Ratio Metric	B/C Ratio	Percent Congestion Alleviated
218	b3698	Juniata-Cumberland 230kV Line Reconductor	Upgrade	PPL	12/1/2023	$9.00	Low voltage	11.28	100%
651	b3702	Charlottesville-Proffit 230kV Line Series Reactor	Upgrade	DOM	6/1/2023	$11.38	Low voltage	16.05	99.52%
704	b3697	Plymouth Meeting-Whitpain 230kV Terminal Upgrades	Upgrade	PECO	6/1/2025	$0.62	Low voltage	75.30	99.91%
756	b3701	French's Mill-Junction 138kV Terminal Upgrades	Upgrade	APS	4/1/2022	$0.77	Low voltage	119.03	100%

2022/23 Market Efficiency Cycle

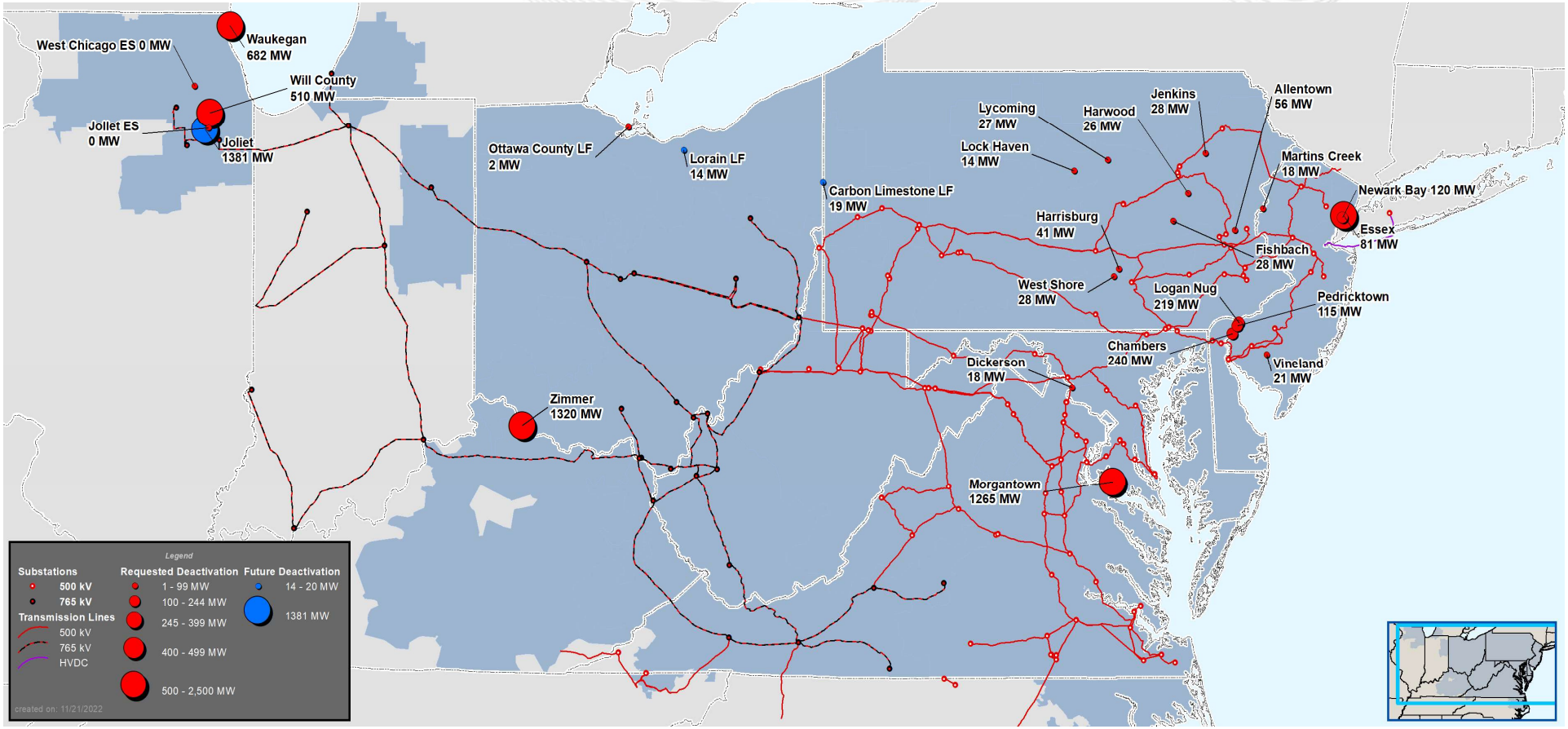
Market Efficiency Timeline



- New 2022/23 24-month cycle started January 2022.
- Current PJM Market Efficiency Base Case posted on the PJM Market Efficiency page (PROMOD 11.4 XML format).
- Updated Market Efficiency Base Case to be posted before the start of 2022/23 Long-Term Market Efficiency Window.
- 2022/23 Long-Term Market Efficiency Window to open at beginning of 2023 once the congestion drivers are finalized.

Generation Deactivation Notification Update (Between 4/1/2022 and 11/1/2022)

Retirements



Deactivation Status

Unit(s)	Fuel Type	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Lorain 1 LF (14 MW)	Methane	ATSI	4/1/2023	Reliability analysis underway
Joliet 6,7 & 8 (1381 MW)	Natural Gas	ComEd	6/1/2023	Reliability analysis complete; no impacts identified
Carbon Limestone LF (19.3 MW)	Methane	ATSI	11/15/2022	Reliability analysis complete. No violation identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Dickerson CT1 (18 MW)	Oil	PEPCO	10/23/2022	Reliability analysis complete; no impacts identified
Vineland West CT (21.61MW)	Oil	ACE	10/14/2022	Reliability analysis complete; no impacts identified
Morgantown CT1 & CT2 (14 MW)	Oil	PEPCO	10/1/2022	Reliability analysis complete; no impacts identified
Will County 4 (510 MW)	Coal	ComEd	06/30/2022	Reliability analysis complete; no impacts identified
Chambers CCLP (240 MW)	Coal	ACE	06/07/2022	Reliability analysis complete; no impacts identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Allentown CT1, CT2, CT3 & CT4 (56 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
Essex 9 (81 MW)	Natural Gas	PSEG	6/1/2022	Reliability analysis complete; no impacts identified
Harrisburg CT1,CT2 & CT3 (41.1 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
Martins Creek CT 3 (18 MW)	Oil	PPL	6/1/2022	Reliability analysis complete; no impacts identified
New Bay Cogen CC (240 MW)	Natural Gas	PSEG	6/1/2022	Reliability analysis complete; upgrades expected to be completed in future, but interim operating measures identified and unit can deactivate as scheduled

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Pedricktown Cogen CC (115.3 MW)	Natural Gas	AEC	5/31/2022	Reliability analysis complete; no impacts identified
Harwood 1 & 2 (25.2 MW)	Natural Gas	PPL	5/31/2022	Reliability analysis complete; no impacts identified
Morgantown Unit 1 & 2 (1,232.7 MW)	Coal	PEPCO	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Logan (219 MW)	Coal	ACE	5/31/2022	Reliability analysis complete; no impacts identified
Ottawa County Project (1.7 MW)	Methane	ATSI	5/31/2022	Reliability analysis complete; no impacts identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Waukegan 7 & 8 (682.4 MW)	Coal	ComEd	5/31/2022	Reliability analysis complete; no impacts identified
Zimmer 1 (1320 MW)	Coal	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Joliet Energy Storage (0 MW)	Battery	ComEd	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
West Chicago Energy Storage (0 MW)	Battery	ComEd	4/29/2022	Reliability analysis complete; no impacts identified
Fishbach CT 1 & CT 2 (28 MW)	Oil	PPL	4/1/2022	Reliability analysis complete; no impacts identified

Deactivation Status

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Jenkins CT1 & CT2 (27.6 MW)	Oil	PPL	5/31/2022	Reliability analysis complete; no impacts identified
Lock Haven CT 1 (14 MW)	Coal	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
West Shore CT1 & CT2 (28 MW)	Battery	PPL	5/31/2022	Reliability analysis complete and upgrades expected to be completed in time for unit to deactivate as scheduled.
Williamsport-Lycoming CT1 & CT2 (26.6 MW)	Battery	PPL	4/29/2022	Reliability analysis complete; no impacts identified

Generation Deactivation link:
https://www.pjm.com/planning/services-requests/gen-deactivations

Generation Deactivation: Baseline Reliability

Problem Statement: Generation Deliverability – Sammis 5,6, and 7 and Pleasant 1 and 2

- Thermal violation: Beaver - Hayes 345 kV line
- Contingency: N-1

Recommended Solution (New B3714)

At Beaver:
- Replace four 345kV disconnect switches with 3000A disconnect switches;
- Replace substation conductors between bus bar and wave trap;
- Replace line drop and stranded conductor; and
- Upgrade transformer protection relays at two breakers.

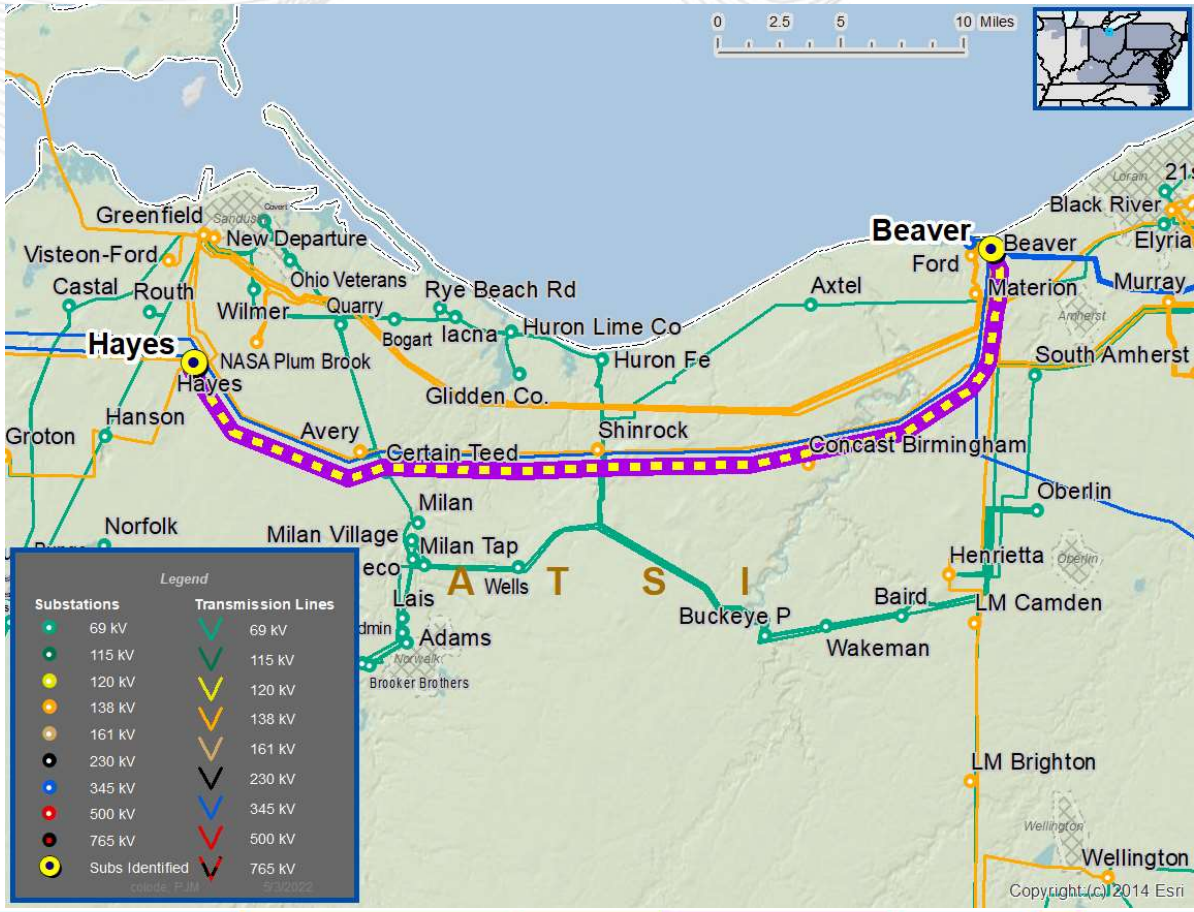
At Hayes:
- Relay settings changes.

- Current Rating: 1380 MVA SN/ 1646 MVA SE
- New Rating: 1542 MVA SN/ 1878 MVA SE

Required IS Date: 06/01/2023
Projected IS Date: 06/01/2024

Estimated Cost: $2.1M

* Operating measures identified to mitigate reliability impacts in interim.

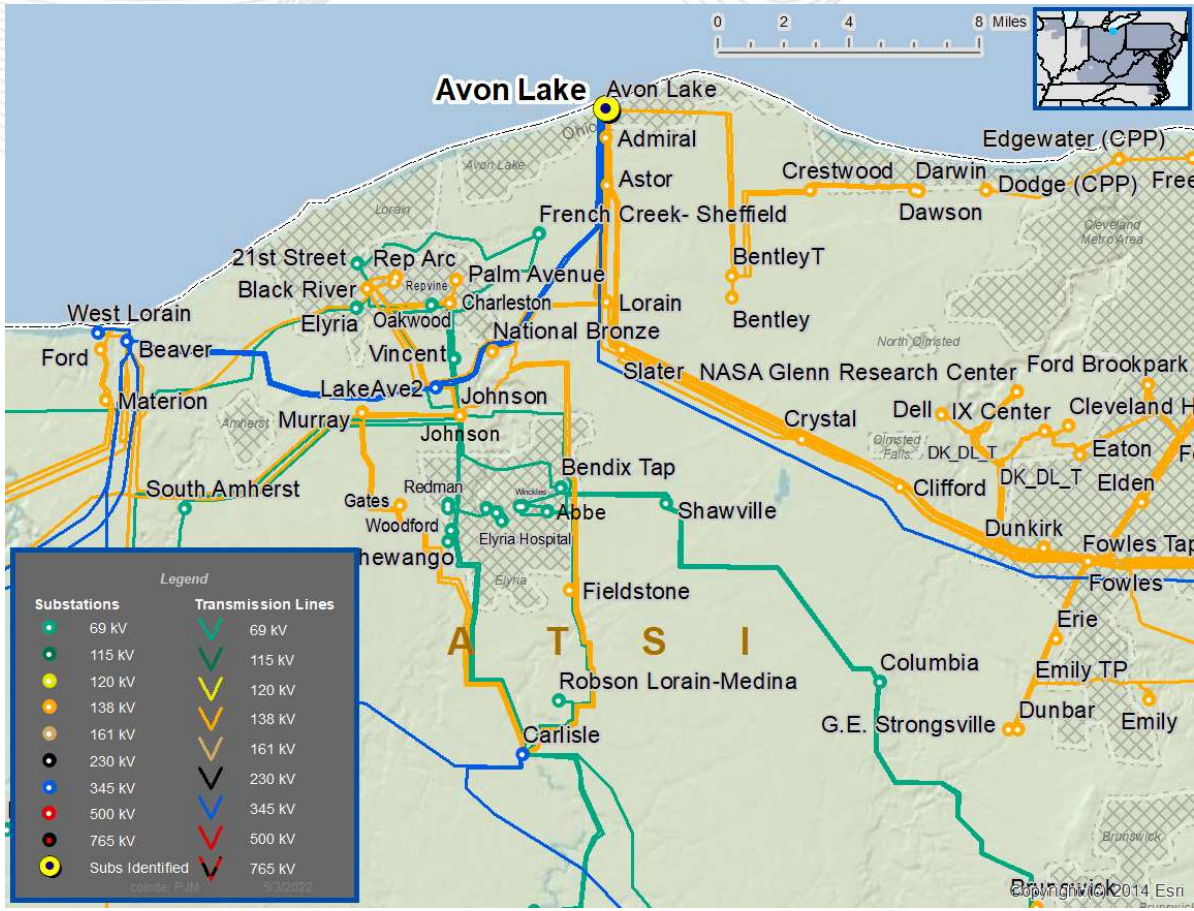


Avon Lake 9 and 10 deactivations – 648 MW

- The actual deactivation date was 03/31/2022.
- All impacts and associated baseline projects were presented on 08/10/2021.
- FE recently informed of the necessary substation work associated with deactivating the unit – **B3713**.

  - Disconnect and remove from the Avon Lake Substation to the plant :
    - five 138 kV bus tie lines & associated equipment; and
    - one 345 KV bus tie line & associated equipment;
  - Adjust relay settings at Avon Lake, Avon, and Avondale substation;
  - Remove fiber to the plant;
  - Reroute existing/install new fiber between the 345 kV and 138 kV yards to re-establish relay protection; and
  - Remove SCADA RTU, communications, and associated equipment from plant.

Estimated Cost: $2.5M
Projected IS Date: 04/28/2023

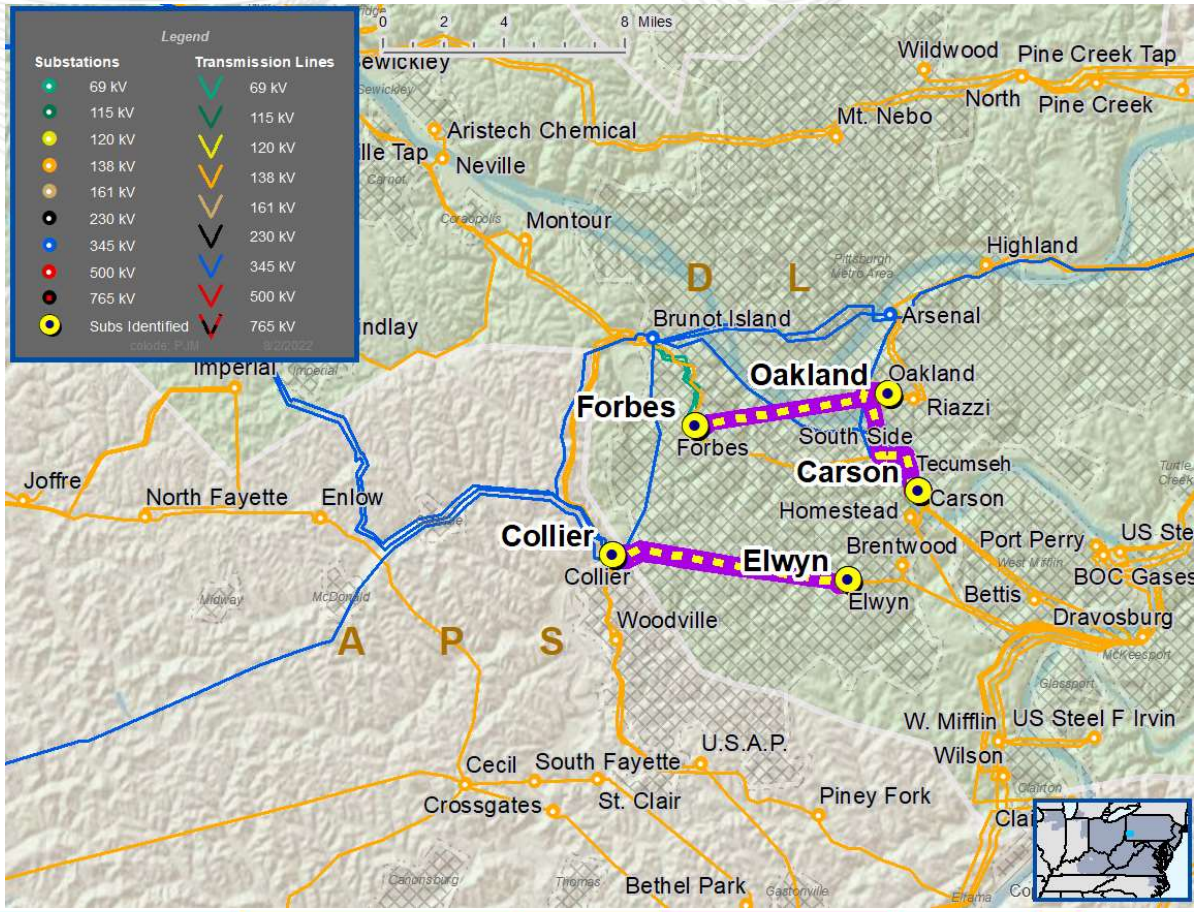


Cheswick Deactivation - 567.5 MW

- The unit was deactivated on 03/31/2022.
- The study results and associated baseline projects were presented on 08/10/2021.
- The missing N-1-1 thermal violations driven by Cheswick deactivation were identified during the review of the analysis results with 2023 summer and 2027 summer load flow models developed in 2022.
- The further investigation confirmed that there was the issue in the study file used for the N-1-1 thermal analysis performed in 2021.

Problem Statement:

- Thermal violation:
  - Collier - Elwyn #1 138 KV
  - Collier - Elwyn #2 138 KV
  - Forbes - Oakland138 KV
  - Carson - Oakland 138 KV
- Contingency: Various N-1-1



Recommended Solution

B3717.1: Install a series reactor on Cheswick - Springdale 138 kV line.

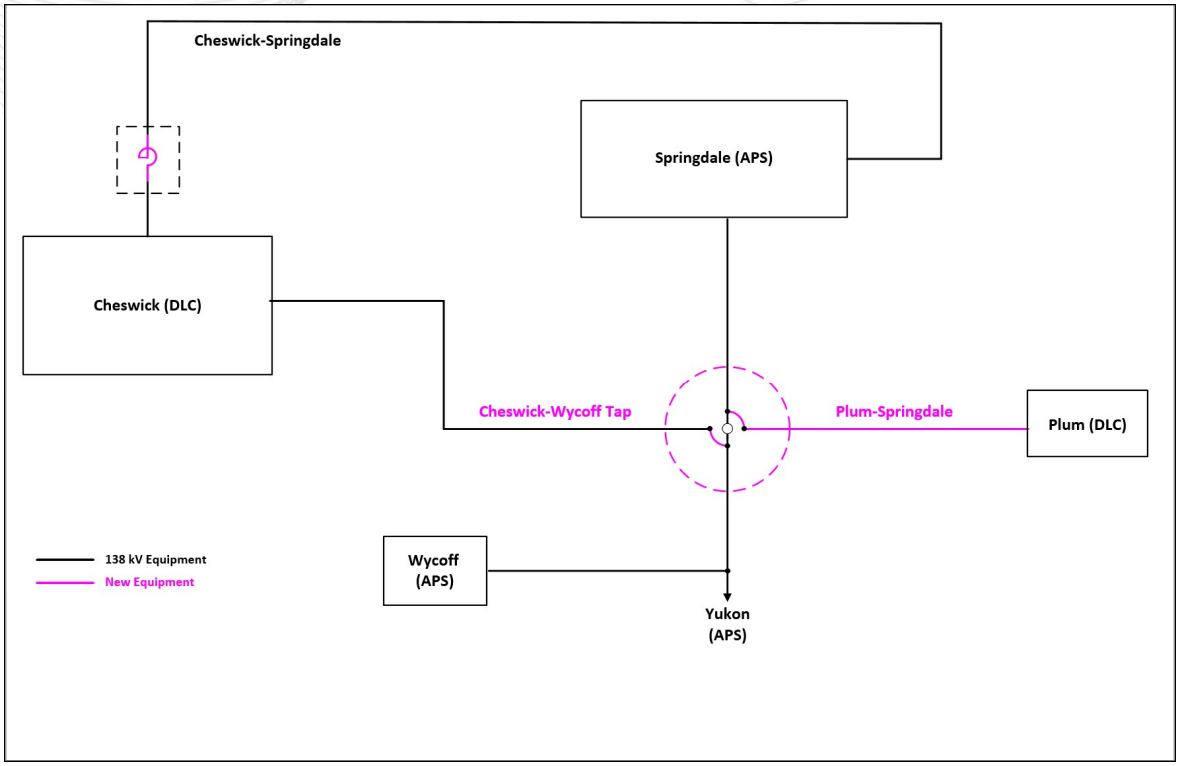
B3717.2: Transmission Line Rearrangement

- Replacement of four structures and reconductor DLCO portion of Plum – Springdale 138 kV line.
- Associated communication and relay setting changes at Plum and Cheswick.
- Current Rating: 220 MVA SN/ 248 MVA SE
- New Rating: 288 MVA SN/ 343 MVA SE

Projected ISD: 12/31/2024*

Estimated Cost: B3717.1 - $9M, B3717.2: $15M

* Operating measures identified to mitigate reliability impacts in interim.



No Identified Issues: Operational Performance

PJM 2021 RTEP Update

FERC 1000 Process

- Per the PJM Operating Agreement, multiple proposal windows were conducted for all reliability needs that were not Immediate Need reliability upgrades or were otherwise ineligible to go through the window process.
- 5 Order 1000 proposal windows opened during the 2021 RTEP cycle
  - Proposal Window No.1 Long-Term - 120 day window
  - Proposal Window SAA – 120 day window
  - Proposal Window No.1 - 60 day window
  - Proposal Window No.2 - 30 day window
  - Proposal Window No.3 – 30 day window

Update to 2021 Proposal Window 1 Cluster 2 & 3

Cluster 2 - Shawville transformer Evaluation Progress

Problem Statement:

The Shawville 230/115/17.2 kV transformer #2A is overloaded for multiple contingencies.

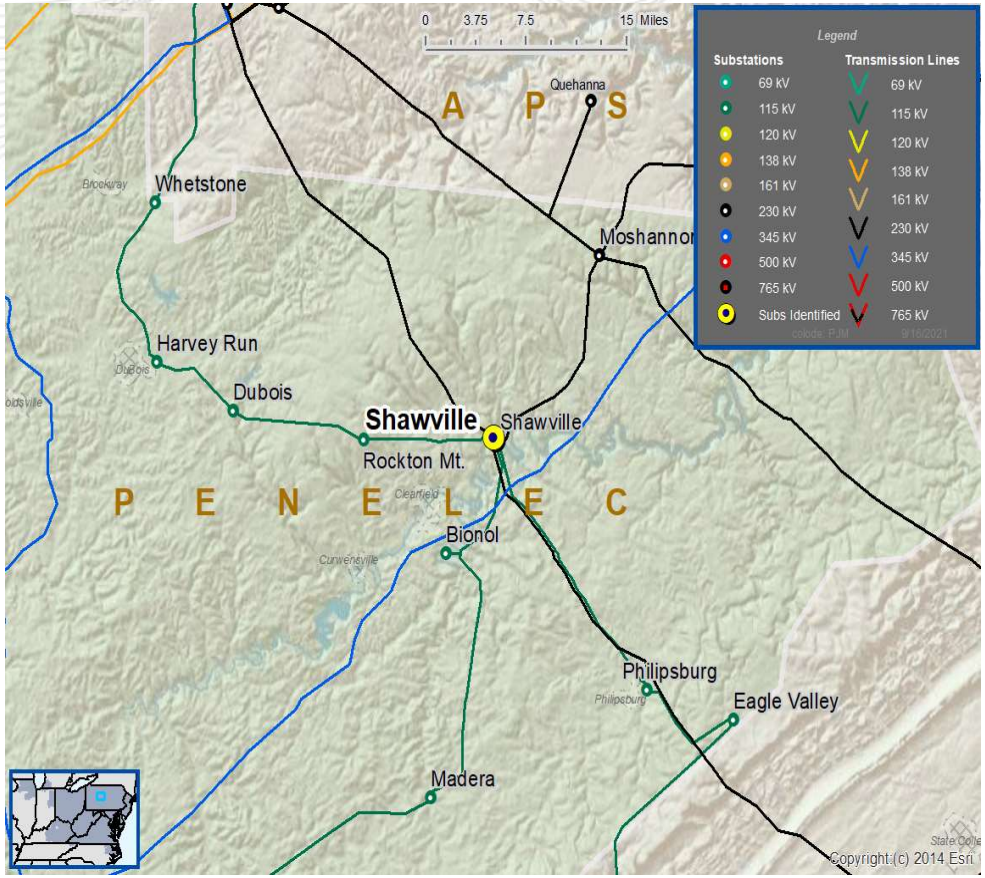
Violations were posted as part of the 2021 Window 1: FG# N1-LLT20, N1-LLT21, GD-LL45, GD-LL46

Proposed Solutions:

Proposal ID 306 - Replace the Shawville 2A 230/115-17.2 kV Transformer with a larger unit. ($5.4 M)

Proposal ID 100 - Install a new 230/115 kV transformer and associated facilities. Replace the Plant's 2B 115-17.2 kV transformer with a larger 230/17.2 kV transformer. ($8.775M)

- The preferred solution is Proposal ID 100. The project involves reconfiguring the Shawville bus and changing POI for one of the Shawville generation unit. PJM is working with GO to make sure the project doesn't have adverse impact on the generator.



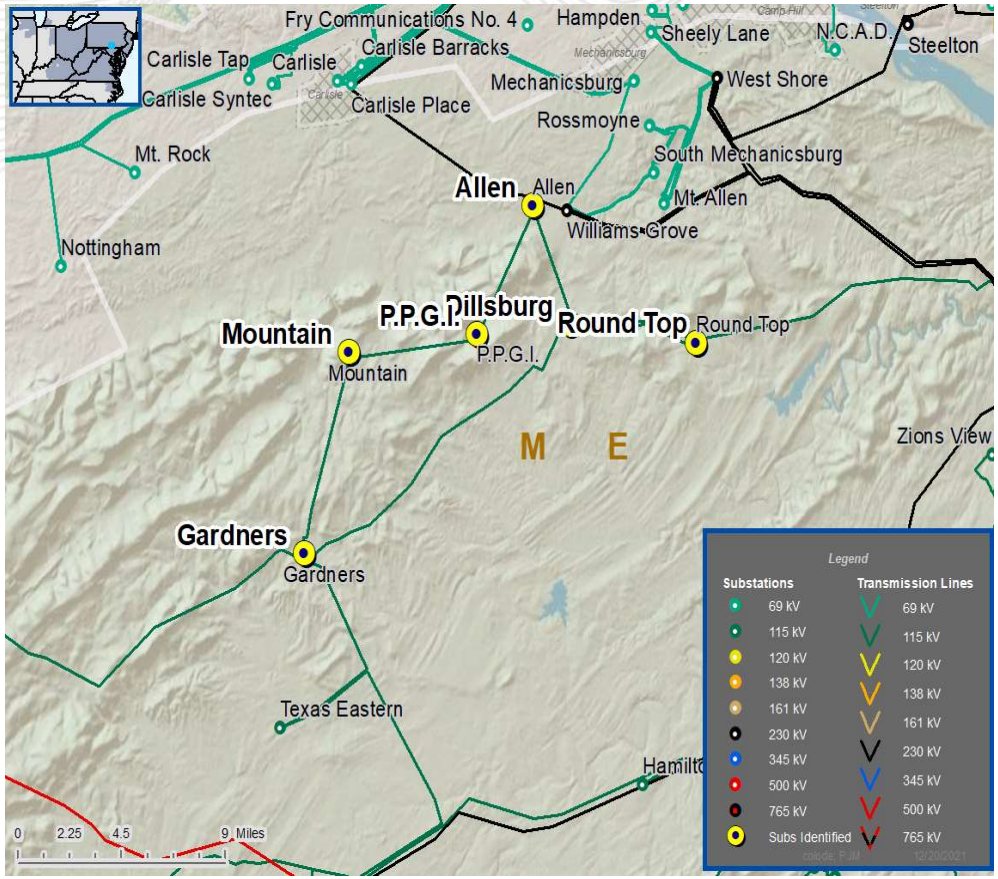
Cluster 2 - Allen area voltage Evaluation Progress

Problem Statement:

Voltage magnitude and voltage drop violation at several 115 kV stations in the Allen (MetEd) vicinity for N-1-1 contingencies.

	# of Flowgates
Violations were posted as part of the 2021 Window 1	N2-SVM8, N2-SVM9, N2-SVM10, N2-SVM11, N2-SVM12, N2-SVM13, N2-SVM16, N2-SVM17, N2-SVM18, N2-SVM19, N2-SVM26, N2-SVM27, N2-SVD1, N2-SVD2, N2-SVD3, N2-SVD4, N2-SVD5, N2-SVD6, N2-SVD7, N2-SVD8, N2-SVD9, N2-SVD10, N2-SVD11, N2-SVD12, N2-SVD15, N2-SVD16

- PJM received 10 proposals from four entities.
- Cost ranges between $12M and $32.2M
- PJM completed reliability evaluation.
- PJM is working on constructability evaluation



ATSI Transmission Zone: Baseline
Hayes 345/138 kV Tr #2

Process Stage: Second Review

Criteria: Generation Deliverability

Assumption Reference: 2026 RTEP assumption

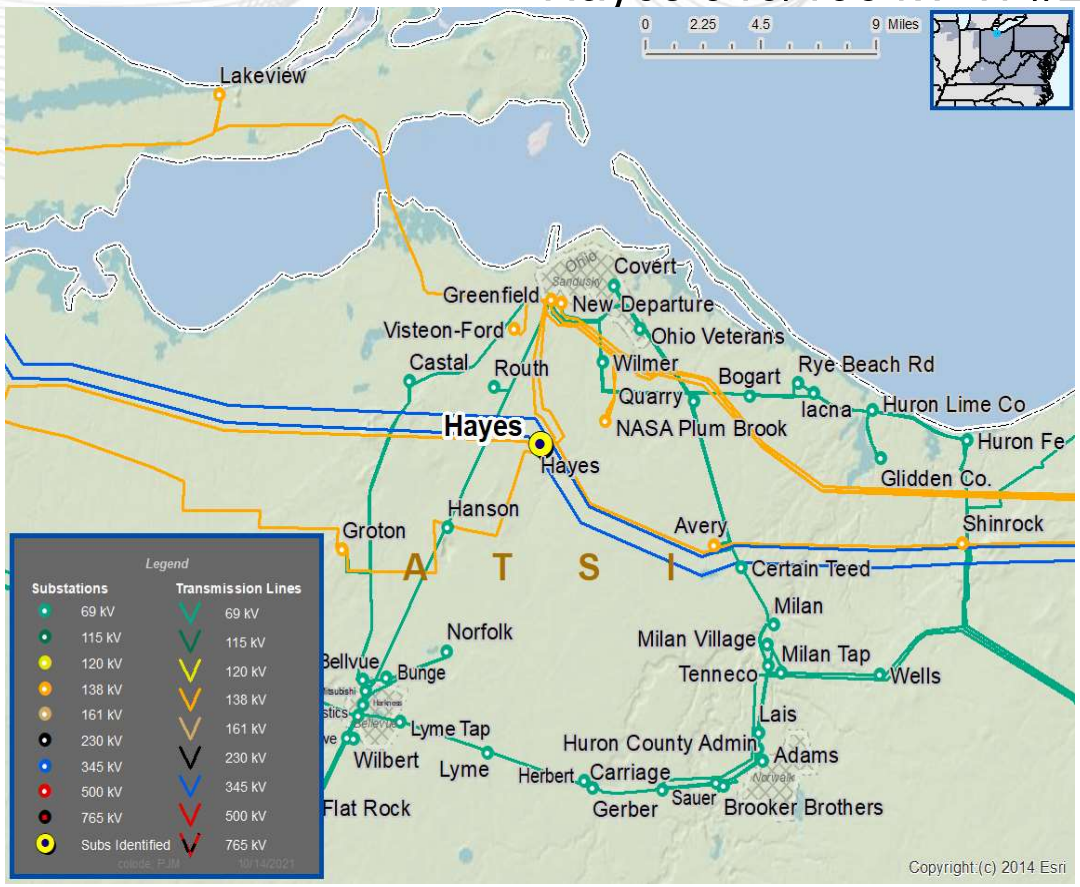
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

GD-S712

In 2026 RTEP summer case, the Hayes 345/138 kV Tr # 1 is overloaded due to a tower contingency.



ATSI Transmission Zone: Baseline
Hayes 345/138 kV Tr #2

Proposed solution:

Install a second 345/138 kV transformer at Hayes, 448 MVA nameplate rating. Add one 345 kV circuit breaker (3000A) to provide transformer high side connection between breaker B-18 and the new breaker. Connect the new transformer low side to the 138 kV bus. Add one 138 kV circuit breaker (3000A) at Hayes 138 kV substation between B-42 and the new breaker. Relocate the existing 138 kV No. 1 capacitor bank between B-42 and the new breaker. Protection Per FE standard. **(b3682)**

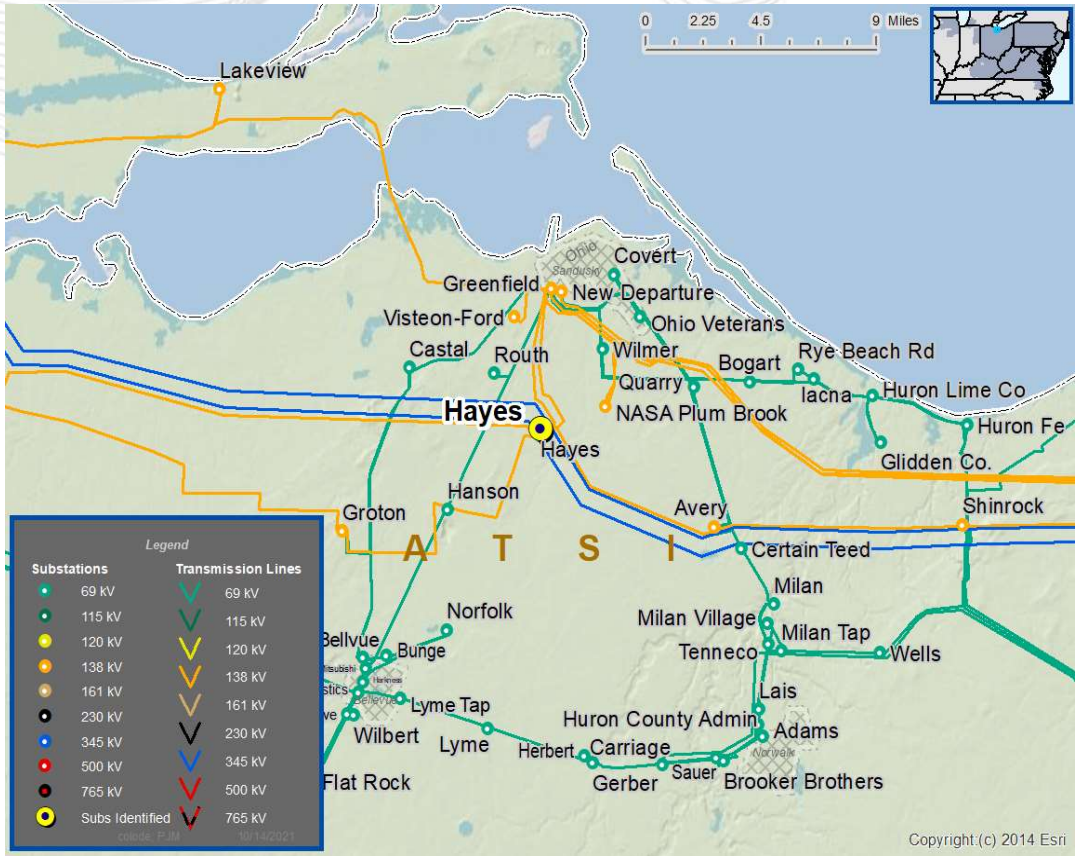
Additional Benefits: Mitigates the thermal overload on the Hayes No1 345/138 kV Transformer and provides additional capacity.

Total Estimated Cost: $7.59M

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2026

Previously presented: 11/02/2021



APS Transmission Zone: Baseline
Shingletown 230 kV

Process Stage: Second Review

Criteria: PJM N-1-1 Criteria

Assumption Reference: 2026 RTEP assumption

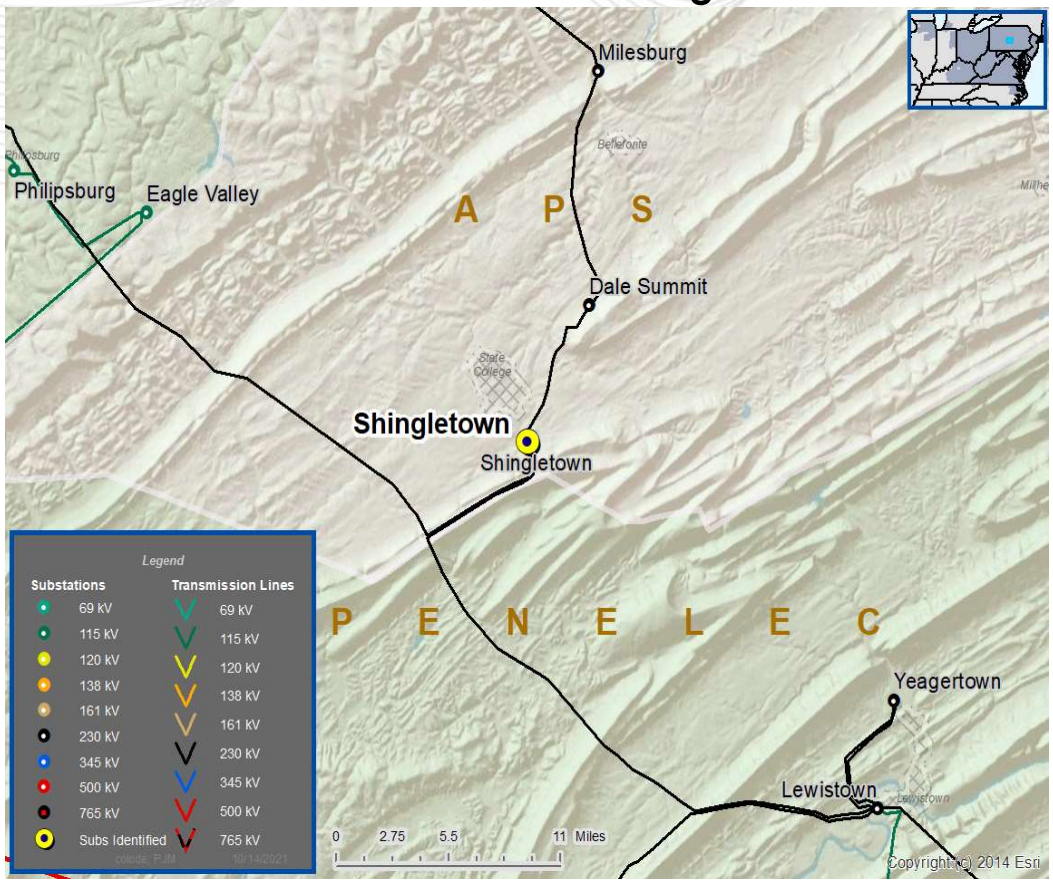
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

APS-VD45 & APS-VD46

In 2026 RTEP summer case, the Shingletown 230 kV voltage drop violation occurs due to a N-1-1 contingency.



APS Transmission Zone: Baseline
Shingletown 230 kV

As part of the 2021 RTEP Window # 1, the projects listed below are proposed to address the voltage drop APS-VD45 & APS-VD46 violations.

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
919	West Penn	Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker.	1.66
779	West Penn	Convert Shingletown 230 kV Substation into a six-breaker ring bus.	11.92
608	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Yeagertown substation by creating a new 230 kV line.	77.59
560	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Elimsport substation by creating a new 230 kV line.	135.54

Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker and disconnect switches, removing existing 230 kV switches, replacing 46 kV disconnect switches, replacing limiting substation conductor, and installing/replacing relays. **(b3681)**

Total Estimated Cost: $1.66M

Required IS Date: 06/01/2026
Projected IS Date: 06/01/2025
Previously Presented: 11/02/2021

Penelec Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Light Load Generation Deliverability and N-1

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Shawville 230/115/17.2 kV transformer #2A is overloaded for multiple contingencies.

Violations were posted as part of the 2021 Window 1: FG# N1-LLT20, N1-LLT21, GD-LL45, GD-LL46

Existing Facility Rating: 114SN/149SE, 147WN/178WE MVA

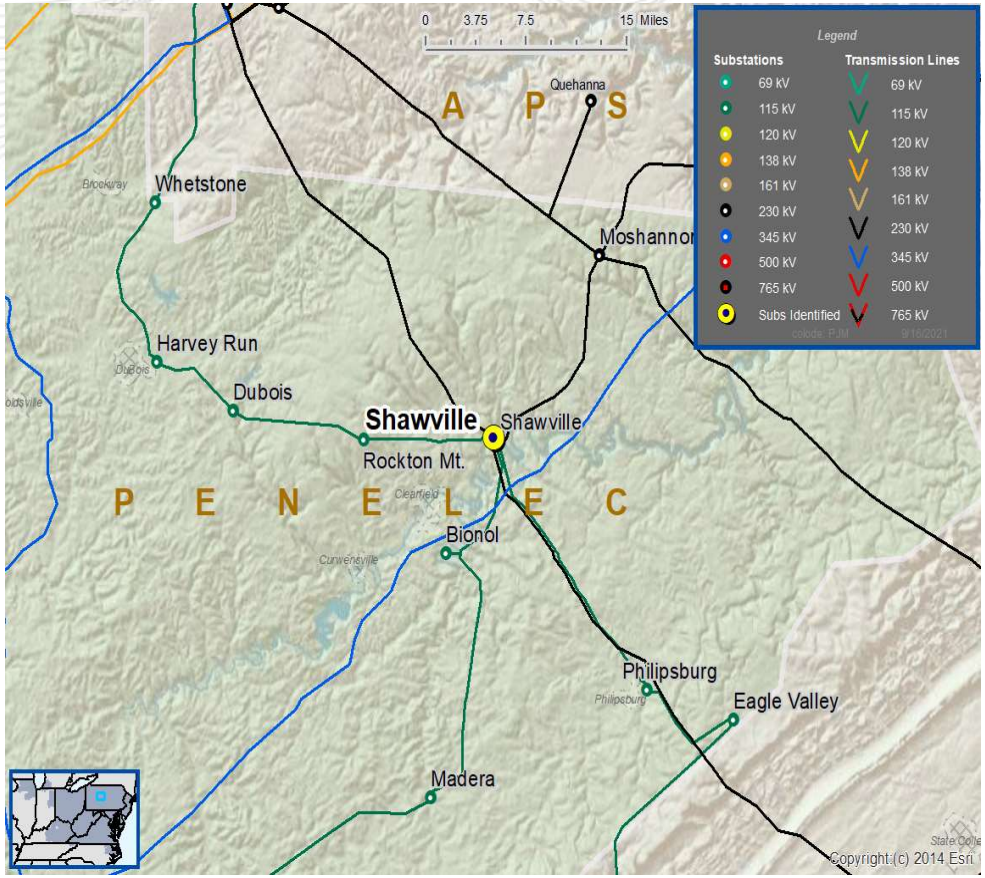
Proposed Facility Rating: 422SN/471SE, 530WN/544WE MVA

Recommended Solution:
Proposal ID 100 **-** Install a new 230/115 kV transformer and associated facilities. Replace the Plant's 2B 115-17.2 kV transformer with a larger 230/17.2 kV transformer. (B3708)

Estimated Cost: $8.775 M

Alternatives: Proposal ID 306 **-** Replace the Shawville 2A 230/115-17.2 kV Transformer with a larger unit. ($5.4 M)

Required In-Service: 6/1/2026



MetEd Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer N-1-1 Voltage

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

Voltage magnitude and voltage drop violation at several 115 kV stations in the Allen (MetEd) vicinity for N-1-1 contingencies.

	# of Flowgates
Violations were posted as part of the 2021 Window 1	N2-SVM8, N2-SVM9, N2-SVM10, N2-SVM11, N2-SVM12, N2-SVM13, N2-SVM16, N2-SVM17, N2-SVM18, N2-SVM19, N2-SVM26, N2-SVM27, N2-SVD1, N2-SVD2, N2-SVD3, N2-SVD4, N2-SVD5, N2-SVD6, N2-SVD7, N2-SVD8, N2-SVD9, N2-SVD10, N2-SVD11, N2-SVD12, N2-SVD15, N2-SVD16

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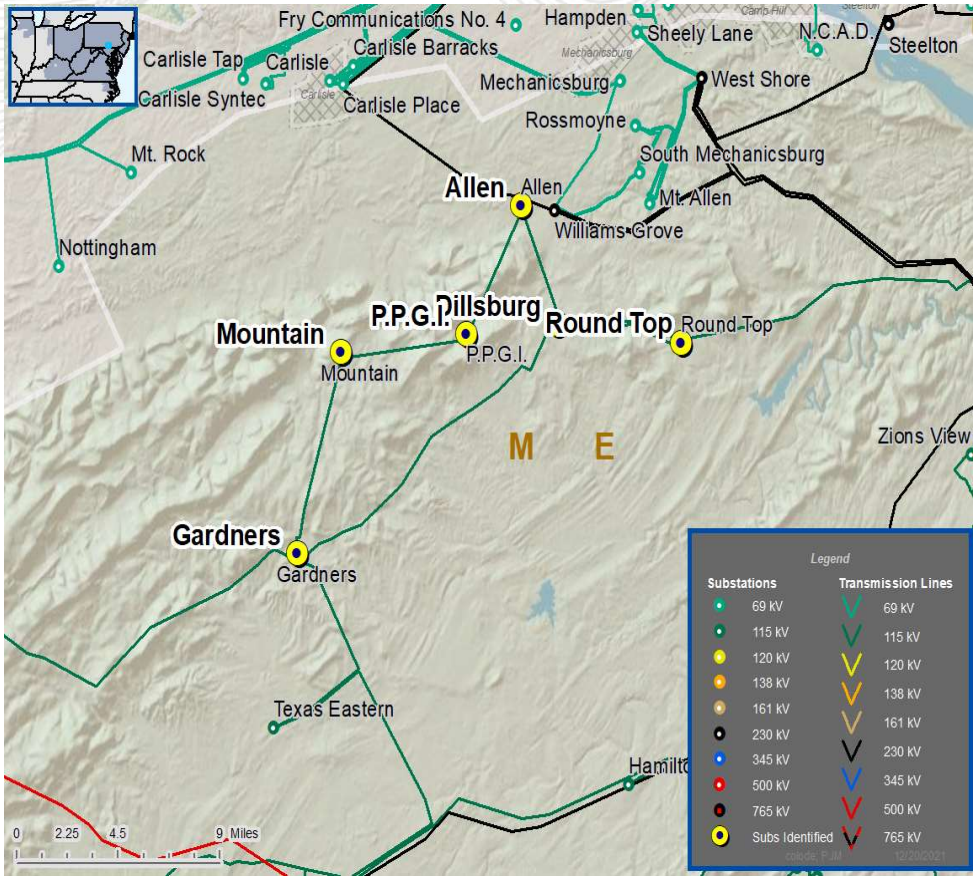


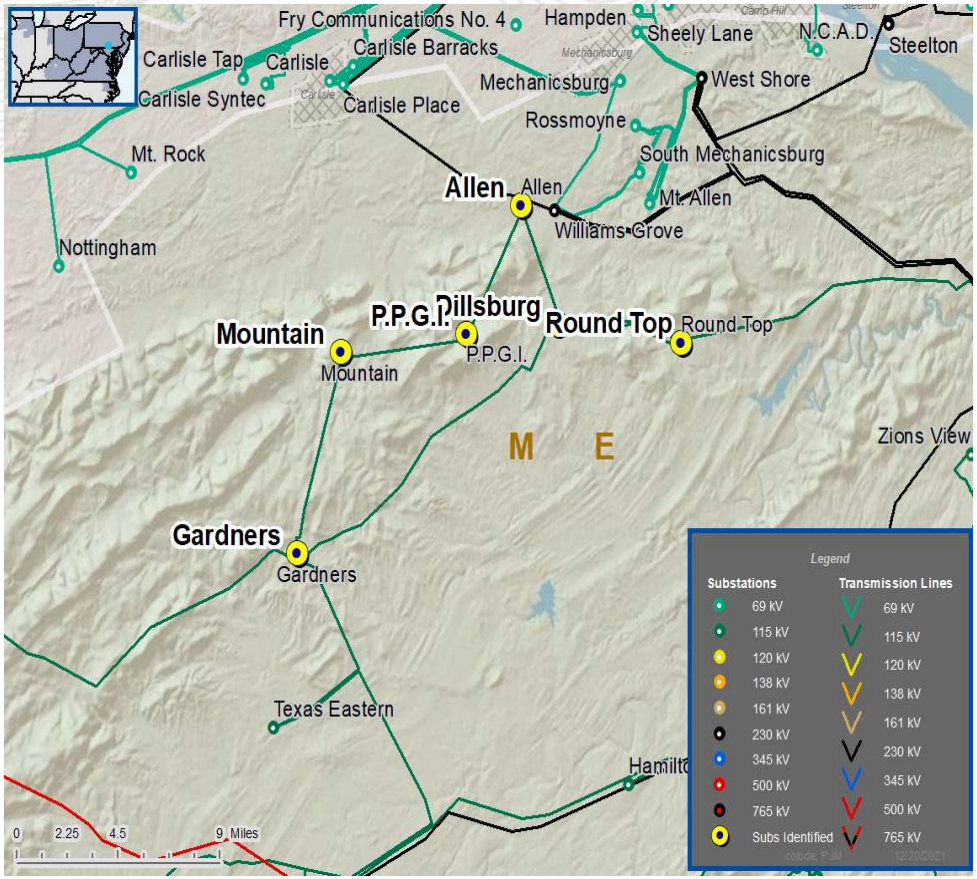
MetEd Transmission Zone: Baseline

Recommended Solution:

Proposal ID 99 : At the existing PPL Williams Grove Substation, install a new 300 MVA 230/115 kV transformer. Construct a new ~3.4 mile 115 kV single circuit transmission line from Williams Grove to Allen Substation. Install a new Allen four breaker ring bus Switchyard near the existing METED Allen Substation on adjacent property presently owned by FE. Terminate the Round Top - Allen and the Allen-PPGI 115 kV lines into the new switchyard. (B3715)

Estimated Cost: $17.82 M

Required In-Service: 6/1/2026



PJM RTEP 2021 Window 2

2021 RTEP Window 2

- Window opened on 11/03/2021
- Window closed on 01/12/2022
- For this Window, PJM seeks technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 10 total proposals submitted from 3 different entities
  - 4 Greenfield
  - 6 Upgrades
- Cost Estimates: Approximate range from $4.2M to $62M
- 2 Proposals identified with Cost Containment

Proposal ID #	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate
176	UPGRADE	Reconductor 345kV E. Frankfort to Crete to St John transmission line	35.7	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
805	GREENFIELD	Cedar Run 345kV Transmission Project	16.7	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
253	UPGRADE	Rebuild 345 kV Lines 6607/6608 East Frankfort - Crete and 94507/97008 Crete - St. John	62.6	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6, GD-W2-259,GD-W2-258
994	UPGRADE	Install Series Inductor on Line 94507 Crete - St. John	12	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6, GD-W2-259,GD-W2-258
408	UPGRADE	Install 345 kV Bus Tie Circuit Breaker at Dresden Station	4.26	ComEd	345	Winter Gen Deliv	GD-W2-W211, GD-W2-W214, GD-W2-51
442	GREENFIELD	East Spring 345kV Transmission Project	10.4	ComEd	345	Winter Gen Deliv	GD-W2-W211, GD-W2-W214
977	UPGRADE	Rebuild 345 kV double circuit Lines 94507 and 97008 Crete - Indiana	17.1	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6, GD-W2-259,GD-W2-258
727	UPGRADE	Swap 345kV transmission line at Green Acres and reconductor Crete to St John 345kV line	22.03	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
117	GREENFIELD	Series reactor along Crete-St John 345 kV line and reconductor Crete to St John 345kV line	27.08	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6
335	GREENFIELD	Loop-in Bloom –Davis 345kV line at New NEET proposed Illinois Substation + Loop-in NEET owned Crete- St John 345 kV line at new NEET proposed State Line 345 kV sub	47.12	ComEd	345	Winter Gen Deliv	GD-W2-W5, GD-W2-W6

ComEd Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Winter Generation Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Winter retool case

Proposal Window Exclusion: None

Problem Statement:

The Dresden 345/138 kV No. 81 transformer is overloaded for an N-2 outage.

Violations were posted as part of the 2021 Window 2: FG# GD-W2-W211, GD-W2-W214

Existing Facility Rating: 403SN/442SE, 420WN480WE MVA

Proposed Facility Rating: No change to transformer rating, 63 kA circuit breaker

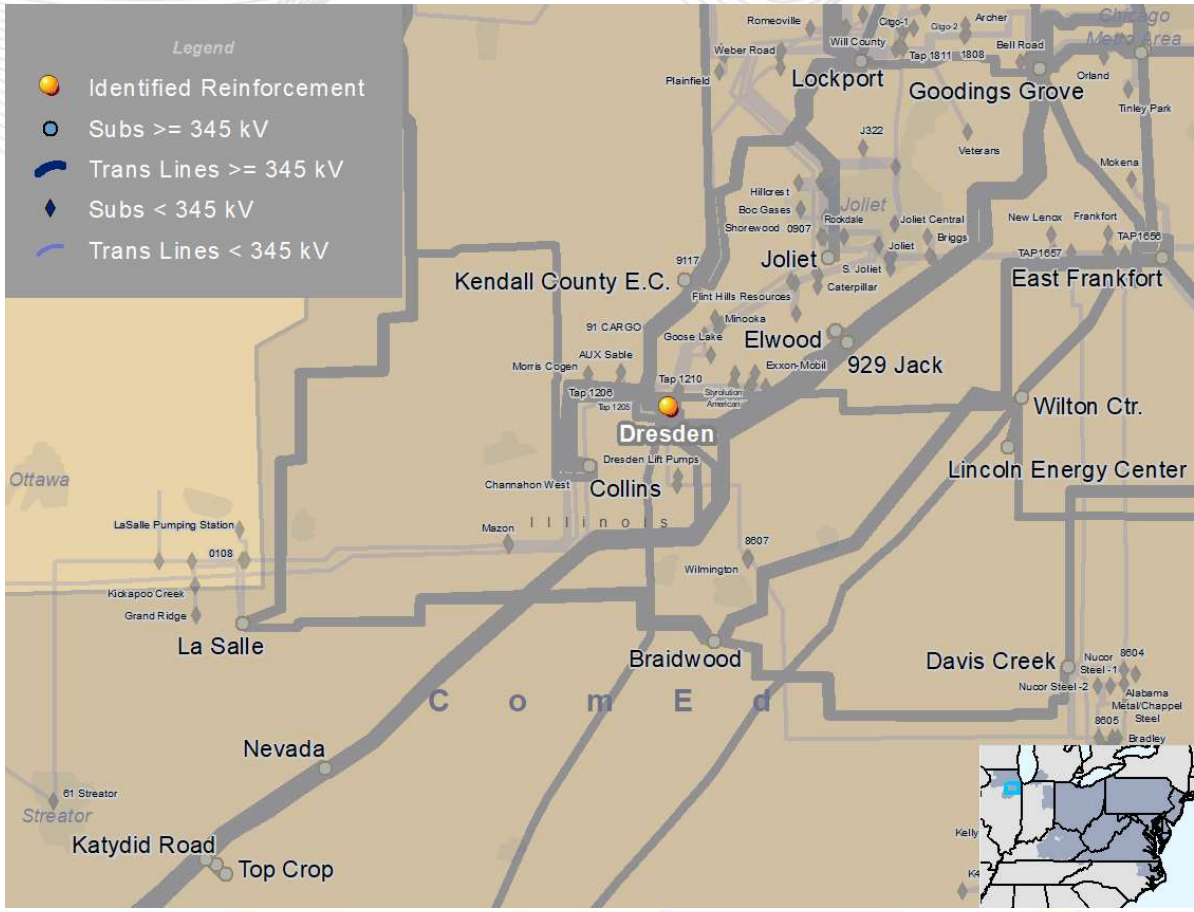
Proposed Solution:

Proposal ID 408 **-** Install 345 kV bus tie 5-20 circuit breaker in the ring at Dresden station in series with existing bus tie 5-6. **(b3711)**

Estimated Cost: $4.26 M

Alternatives: Proposal ID 442 - Interconnect the Katydid Road-Goodings Grove Blue and AB1-122-Mole Creek 345 kV circuits at a new East Spring 345 kV substation. ($10.4 M)

Required In-Service: 12/1/2026



2022 RTEP Update

FERC 1000 Process

- Per the PJM Operating Agreement, multiple proposal windows were conducted for all reliability needs that were not Immediate Need reliability upgrades or were otherwise ineligible to go through the window process.
- 3 FERC Order 1000 proposal windows opened during the 2022 RTEP cycle
  - 2022 Multi Driver Window 1- 60 day window
  - 2022 RTEP Window 1 - 60 day window
  - 2022 RTEP Window 2 - 30 day window

2022 RTEP Multi Driver Window 1 Update

2022 RTEP Multi Driver Window 1

- 2022 RTEP Multi-Drive Window 1 (60 days window) opened on June 7, 2022 and was closed August 8, 2022.
  - The Multi Drive-Window 1 was conducted to address reliability and market efficiency problems identified on the 2027 RTEP year case.
  - For this Window, PJM sought technical solutions, also called proposals, to resolve potential reliability criteria violations on multi-driver facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
  - 14 total proposals submitted from 3 different entities (includes 3 carry-over proposals from 2021 Proposal Window 2)
    - 8 Greenfields
    - 6 Upgrades
  - Cost Estimates: Approximate range from $215K – 127M
  - PJM's reliability evaluation for the proposals is underway is expected to be completed sometime in December of 2022.

2022 RTEP Window 1 Update

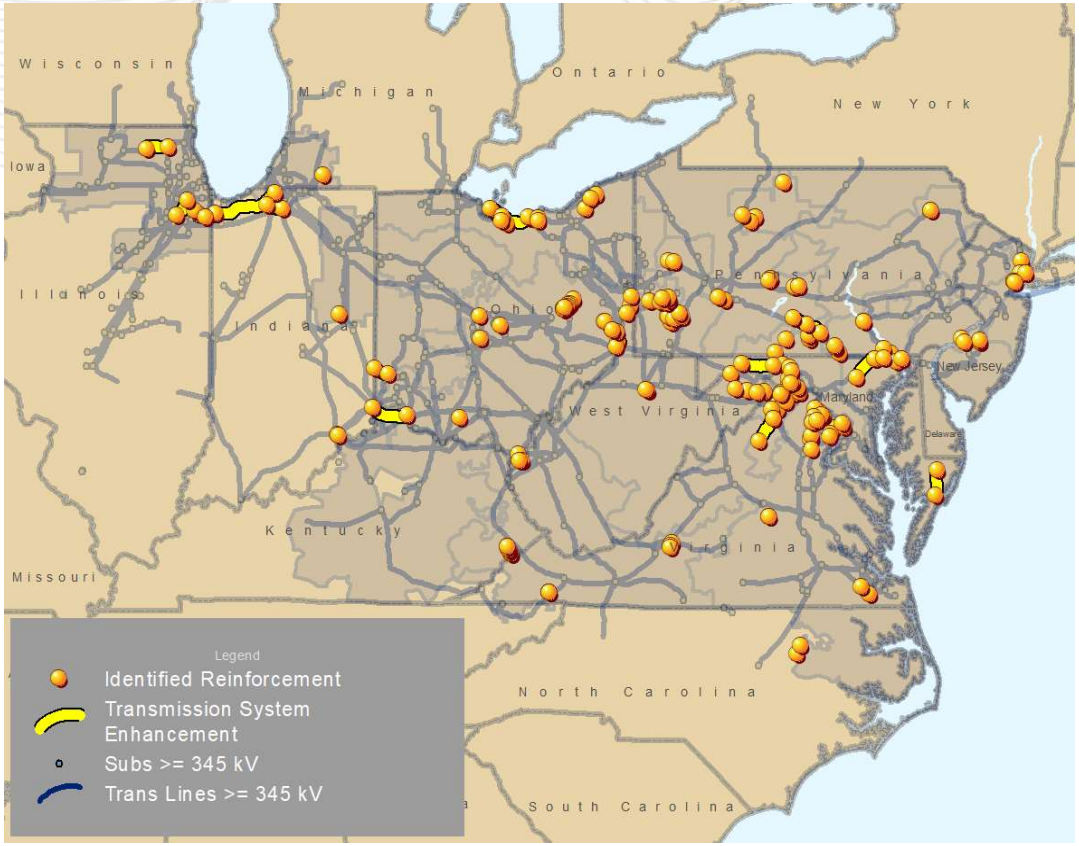
- PJM as part of the annual Regional Transmission Expansion Plan conducted studies and identified needs on 852 flowgates. PJM determined 269 of those flowgates were eligible for competition, and 583 of the flowgates were excluded from the competition for various reasons.
  - Window opened on 7/01/2022
  - Window closed on 8/30/2021

Overview of 2027 RTEP Results

Overview of 2027 Results
Total of 852 flowgates identified

- 269 flowgates are eligible
  - 19 in the PJM Mid-Atlantic Region
  - 250 in the PJM Western Region

- 583 flowgates excluded
  - 407 due to the below 200kv Exclusion
  - 39 due to Substation Equipment Exclusion
  - 20 due to Immediate Need Exclusion
  - 13 are addressed in the Multi Drive window 1
  - 63 in Dominion and are either addressed with an immediate Need or will be addressed in the 2022 Window 2
  - 41 due to other variety reasons

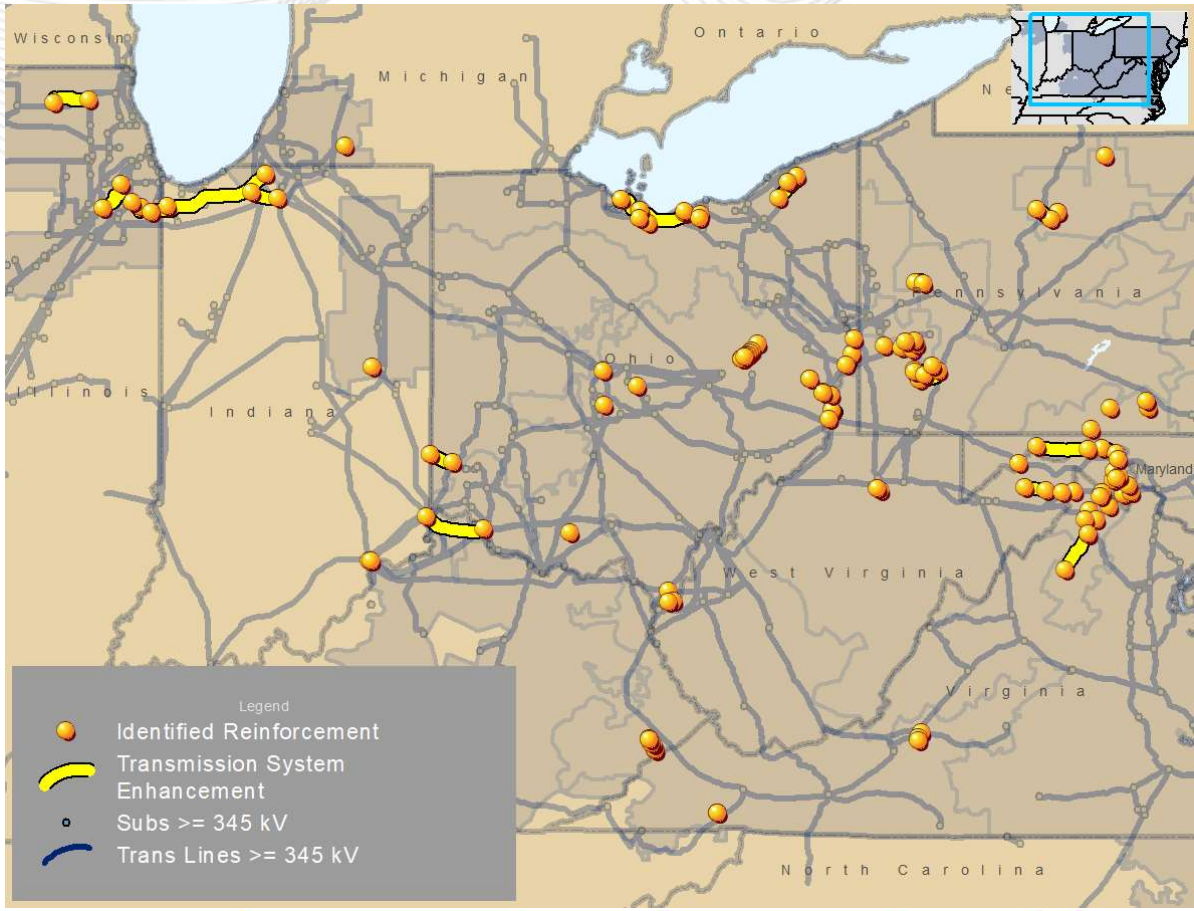


250 Eligible Flowgates

- 2 Light Load Baseline Generation Deliverability
- 2 Light Load N-1 Voltage Magnitude
- 5 Summer Generation Deliverability
- 41 Summer N-1-1 Voltage Drop
- 2 Winter Generation Deliverability
- 198 Winter N-1-1 Voltage Drop

357 Flowgates Excluded from the Window

- 11 FERC 715 Thermal
- 39 FERC 715 Voltage Magnitude
- 48 FERC 715 Voltage Drop
- 1 FERC 715 Short Circuit
- 20 Short Circuit
- 34 Summer Generation Deliverability
- 7 Summer N-1 Thermal
- 20 Summer N-1 Voltage Drop
- 16 Summer N-1 Voltage Magnitude
- 9 Summer N-1-1 Thermal
- 18 Winter Generation Deliverability
- 13 Winter N-1 Thermal
- 46 Winter N-1 Voltage Drop
- 40 Winter N-1 Voltage Magnitude
- 35 Winter N-1-1 Voltage Magnitude



- For this Window, PJM sought technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 17 total proposals submitted from 7 different entities (see https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20220906/item-09b---reliability-analysis-update.ashx)
  - 6 Greenfield
  - 11 Upgrades
- Cost Estimates: Approximate range from $0.26k to $386.73M
- 7 Proposals identified with Cost Containment

- PJM completed the evaluation for majority of the proposals, and the projects already went through the stakeholder review process. The projects will go to the December PJM board meeting for approval.
- The evaluation for the remaining proposed projects is in progress and is expected to be completed by the end of December 2022.

2022 RTEP Window 2 Update

- 2022 RTEP Window 2 (30 days window) opened on November 1, 2022 and is anticipated to be closed on December 1, 2022
  - Window 2 is required to address the remaining Window 1 violations in the Dominion area after inclusion of the Immediate Need solution.

15 Year Analysis Result

- Long-term deliverability analysis will identify the need to include in the RTEP:
  - New 230 kV or 345 kV circuits to support load growth in years 6 through 8
  - Right-of way acquisition for any new 230 kV or 345 kV circuits to support load growth in years 9 and 10
  - New 500 kV or greater circuits to support load growth in years 6 through 12
- PJM identified five 230 kV overload in years 7 ~ 10, and one 500 kV overload in years 9

Season	Contingency	From Bus	From Name	To Bus	To Name	CKT	KVs	Areas	100% Year
Summer	Single	200675	26E.TWANDA	200924	26CANYON	1	230/230	226/226	2030
Summer	Single	314068	6OX	314054	6KEENE M	1	230/230	345/345	2032
Summer	Single	314004	6ASHBURN	314010	6BEAMEAD	1	230/230	345/345	2030
Summer	Single	314072	6PL VIEW	314004	6ASHBURN	1	230/230	345/345	2029
Summer	Single	314006	6ASHBURA	314010	6BEAMEAD	1	230/230	345/345	2029
Winter	Single	200064	PCHBTM1S	200004	CNASTONE	1	500/500	230/232	2031

  - East Towanda – Canyon and Peach Bottom – Conastone overload could be addressed by line reconductor
  - All the other overloads will be addressed by 2022 RTEP immediate need solutions in Dominion

2022 Multi-Driver Proposal Window 1

- Window opened on 6/7/2022 and closed on 8/8/2022
  - Received 14 total proposals submitted from 3 different entities.
  - Cost Estimates: Approximate range from $215K – 127M.

FG#	Constraint	FROM AREA	TO AREA
MDW1-ME-01	Dumont to Stillwell 345 kV	AEP	NIPSCO
MDW1-ME-02	Olive to University Park North 345 kV	AEP	CE
MDW1-ME-03,MDW1-ME-04	E Frankfort to Crete to St John 345 kV	CE	NIPSCO

- Tentative Schedule
  - Market Efficiency analysis coordinated with PJM Transmission Planning.
  - Currently reviewing the PROMOD modeling information for completeness.
  - Preliminary evaluation to begin early September and expected to complete by end of the year.

2022 Multi-Driver Proposal Window 1

- PJM will open 2022 Multi-Driver Proposal Window 1 to address reliability and market efficiency needs on the following facilities:
  - Crete-St. John 345 kV
  - Crete-E. Frankfort 345 kV
  - University Park N-Olive 345 kV
  - Stillwell-Dumont 345 kV
- While this will not be reflected in the 2022 RTEP window, due to the area sensitivity, the following queue project changes will be included in the multi-driver window:
  - U3-021/AB2-096 (withdrawn) will be removed
  - AB1-089 (recently signed an ISA) will be included
- PJM will coordinate with MISO when evaluating the proposals.
- The 60 day window will open on June 7, 2022 and close on August 8, 2022.

- There is an overlap in flowgates from 2021 Proposal Window 2 and this 2022 Multi-Driver Proposal Window 1.
- If a proposing entity wishes to submit a modification to their proposal submitted in the 2021 Proposal Window 2, a new proposal must be submitted through the 2022 Multi-Driver Proposal Window 1.
- Unless communicated to PJM that an entity wishes to withdraw its proposal from consideration, PJM will evaluate them as potential solutions to the needs posted in this window and will apply the existing deposits.
- A proposing entity must communicate to PJM if it wishes to withdraw a proposal to avoid future billing.

Base Case Preliminary Results - Simulated Congestion [1]

Constraint [3]	Congested Area	Type	Historical 2021 Day Ahead Congestion	Historical 2022 (through Sep) Day Ahead Congestion	Simulated 2027 Congestion	Simulated 2030 Congestion	Comment
Black Oak-Bedington Interface		Inter	$ -	$ 72,436,702	$ 54,119,278	$ 97,404,855	2022 Reliability Window 1 – Black Oak 500kV Voltage Drop
BC-PEPCO Interface		Inter	$ 4,065	$ 262,743	$ 27,128,125	$ 1,488,360	-
Safe Harbor-Graceton 230 kV	PPL-BGE	Line	$ 25,862,337	$ 18,926,344	$ 23,435,336	$ 16,239,930	2022 Reliability Window 1
Messick Road to Morgan 138 kV	APS	Line	$ -	$ -	$ 19,167,071	$ 36,863,712	2022 Reliability Window 1
Dumont-Stillwell 345 kV	AEP-NIPS	M2M	$ 2,034,732	$ 2,381,596	$ 11,568,222	$ 13,427,287	2022 Multi-Driver Window 1
AP South Interface		Inter	$ 465,361	$ 55,483,098	$ 7,885,910	$ 19,389,792	-
AEP-DOM Interface		Inter	$ 323,916	$ 23,390,296	$ 7,393,603	$ 30,019,220	-
Olive-University Park 345 kV	AEP-CE	M2M	$ -	$ 75,167	$ 4,918,360	$ 12,482,576	2022 Multi-Driver Window 1
Lincoln-Straban 138 kV	METED	Line	$ 375,627	$ 2,033,549	$ 3,194,140	$ 8,875,815	2022 Reliability Window 1
Germantown-Straban 138 kV	METED	Line	$ 323,093	$ 2,856,930	$ 2,935,052	$ 10,166,810	2022 Reliability Window 1

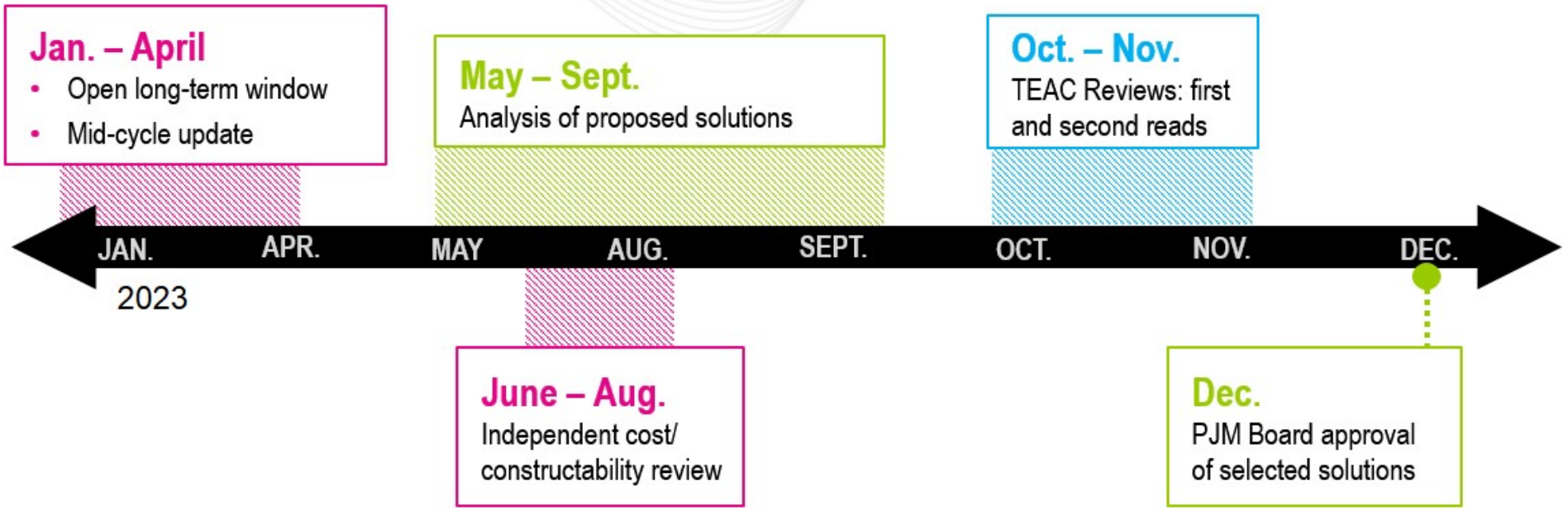
Notes:

1) Preliminary results, not final congestion drivers. List of constraints and congested areas may change in the final base case.

2) Table identifies correlated historical constraints with 2027 PROMOD simulated congestion in the same area/group.

3) Included only flowgates with hr bindings > 25 hrs. and annual simulated congestion > $1 million.

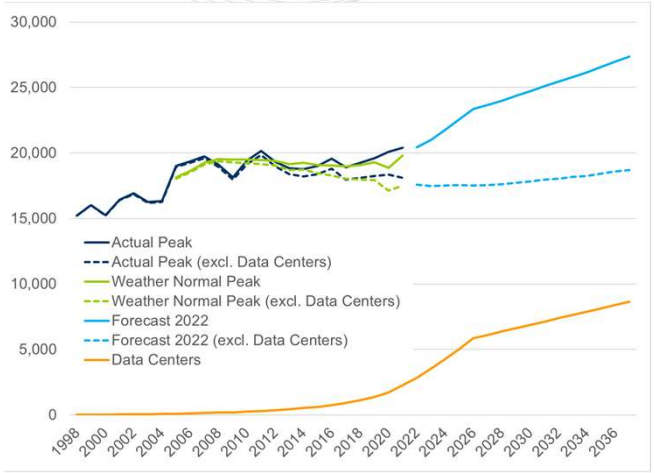
2022/23 Long-Term Window – Timeline

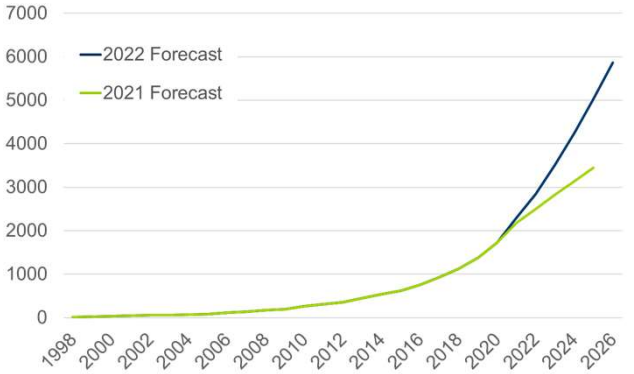


2022 Reliability Analysis – Immediate Need

Background

- At the June 7th TEAC, PJM presented information concerning the load growth that the Dominion area has been experiencing in the data center alley area around the Dulles airport.
- The data center loads reflect an annualized growth rate of 3%.
- Forecasted data center additions for the 2022 Load Forecast provided by Dominion and NOVEC were noticeably higher than in the prior year.
- At the July 12th TEAC, PJM indicated that due to the highly concentrated load growth in the data center alley area, numerous reliability violations were observed in the 2024 and 2025 timeframes despite planned supplemental and baseline upgrades.
- Without further transmission upgrades in the 2024/2025 timeframe, the area will not have sufficient transmission capability to serve the load.
- PJM announced an Immediate Transmission Development need (without a window) to serve the new load in the 2024/25 timeframe.





Dominion Transmission Zone: Baseline Data Center Alley

Process Stage: Second Review

Criteria: Summer N-1, GenDeliv, N-1-1 Thermal & 300 MW Load Loss

Assumption Reference: 2027 RTEP assumption

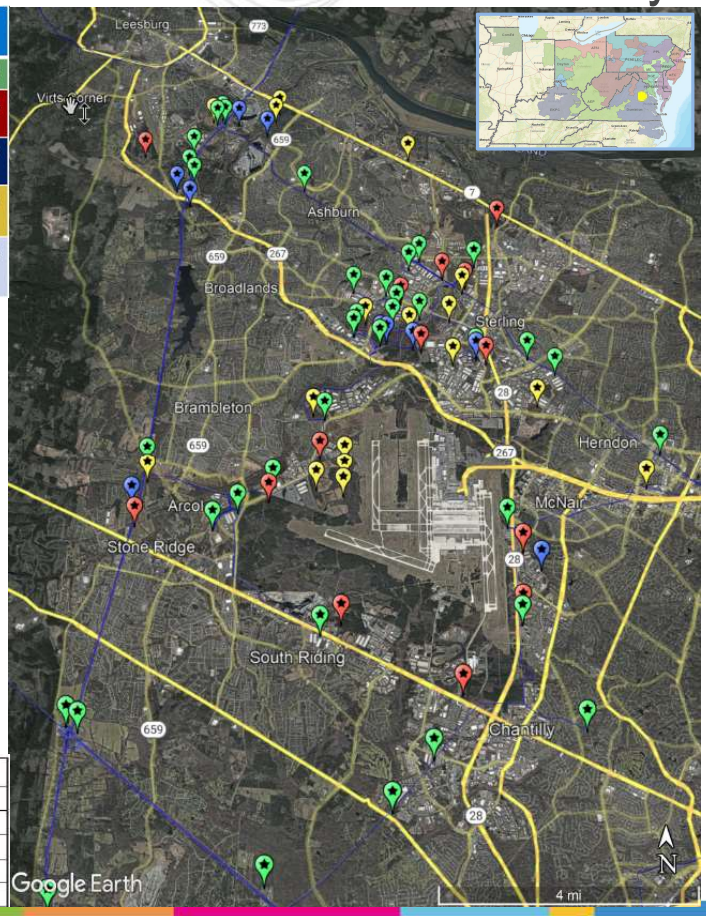
Model Used for Analysis: 2027 RTEP summer case

Proposal Window Exclusion: Immediate Need

Problem Statement:

- Various thermal issues and load loss in the Data Center Alley area around Dulles airport.
  - N-1: 2022W1-N1-ST16-18, 2022W1-N1-ST20, 2022W1-N1-ST23
  - GenDeliv: 2022W1-GD-S588, 2022W1-GD-S1028, 2022W1-GD-S622, 2022W1-GD-S35
  - N-1-1: 2022W1-N2-ST12-51
  - N-1-1 Load Loss: 2022W1-N2-SLD1, 2022W1-N2-SLD2

	Dominion Energy	NOVEC	Total
Existing	28	7	35
Design/ Construction	11	3	14
In Planning Stage	6	3	9
Inquiry Stage	10	6	16
Total	55	19	74



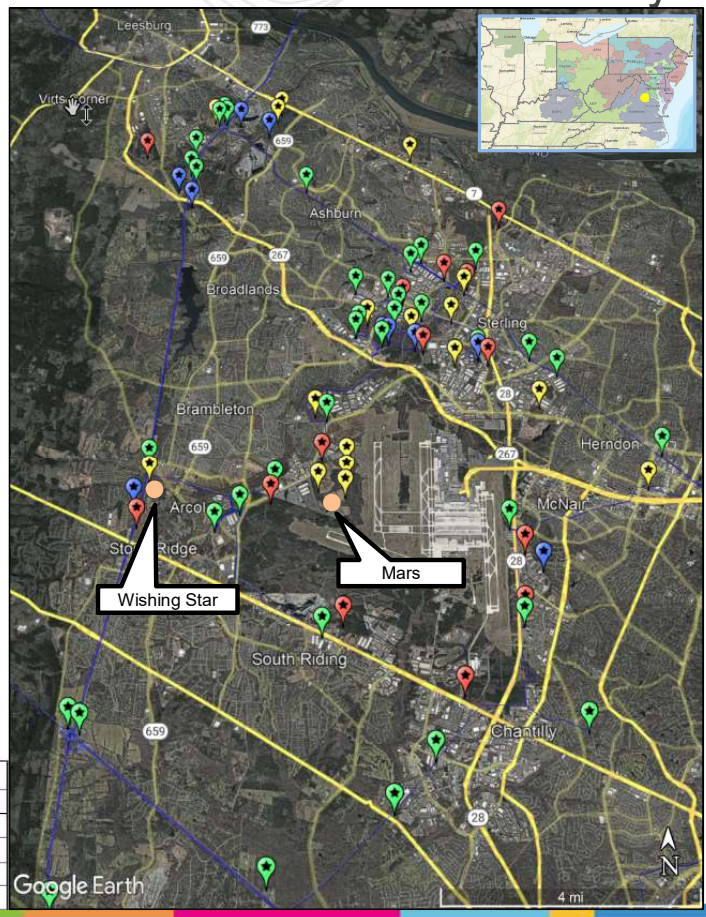
COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Continued on next slide…

Dominion Transmission Zone: Baseline
Data Center Alley

Recommended Solution: **Option 3 (5-2, Wishing Star, 2 TXs)**

- Build a new 500/230kV substation called Wishing Star near Brambleton substation.
- Cut and extend 500kV Line #546 (Brambleton-Mosby) and 500kV Line #590 (Brambleton-Mosby) to the proposed Wishing Star substation. Lines to terminate in a 500kV breaker and a half configuration.
- Install one 500/230kV 1440MVA transformer at Wishing Star substation.
- Build a new 500/230kV substation called Mars near Dulles International Airport.
- Construct double circuit 500kV and 230kV circuit transmission lines for approximately 3.5 miles from Wishing Star substation to Mars substation. New right-of-way will be needed for the transmission lines. New conductor to have a minimum summer normal rating of 4357MVA at 500kV and 1573MVA at 230kV.
- Install one 500/230kV 1440MVA transformer at Mars substation.
- ~~Upgrade 230kV bus to 4000A, 80 kA equipment at Brambleton substation~~
- ~~Replace (4) 230kV breakers at Loudoun substation~~
- Cut and loop 230kV Line #2079 (Sterling Park - Dranesville) into Davis Drive substation and install two GIS 230kV breakers. (Overlap with supplemental need DOM-2021-0032)



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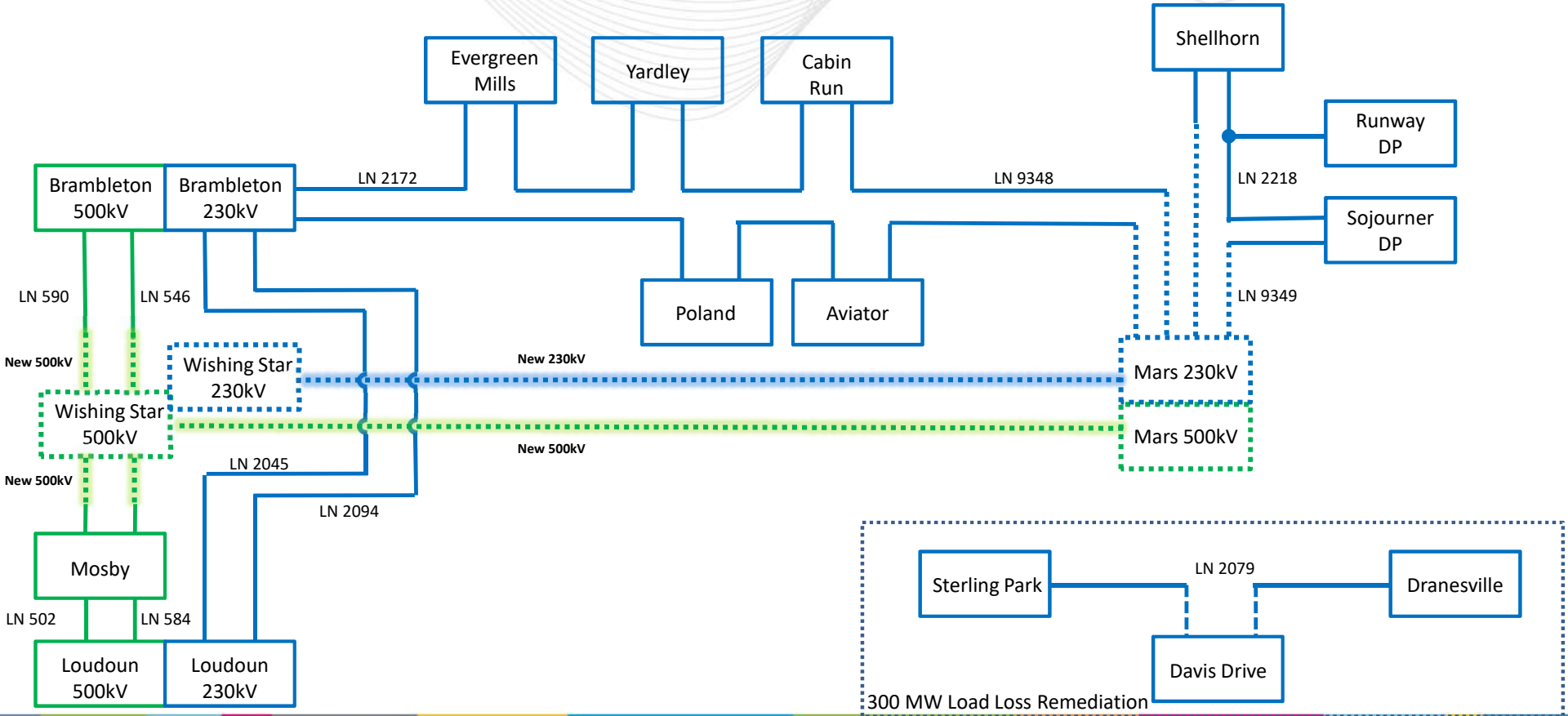
Dominion Transmission Zone: Baseline
Data Center Alley



Dominion Transmission Zone: Baseline
Data Center Alley

Recommended Solution: Option 3 (5-2, Wishing Star, 2 TXs)

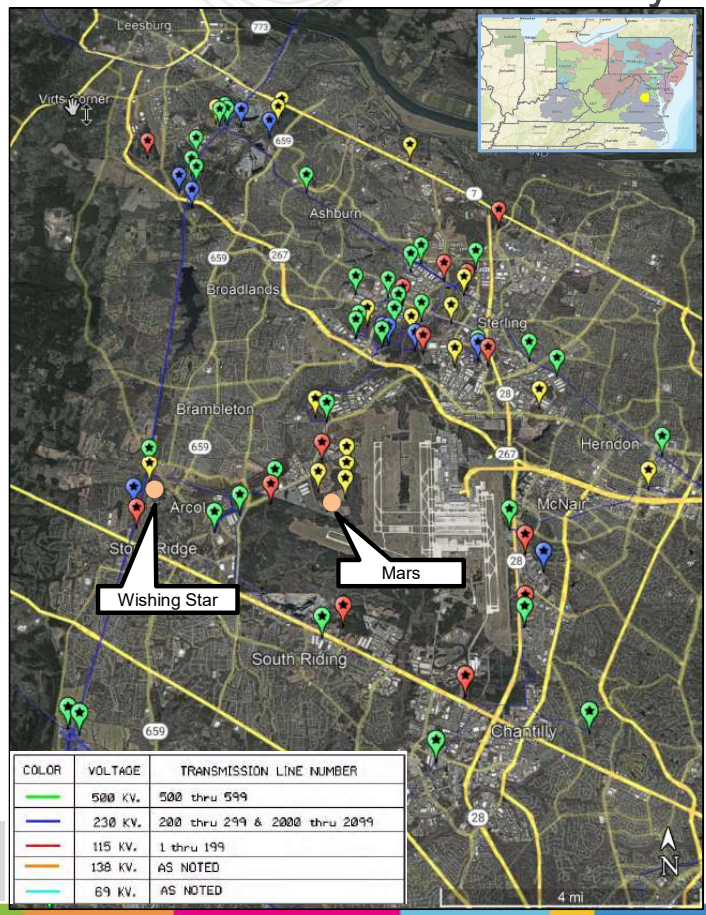
Additional project scope required to clear capacity out of the new 500/230kV Wishing Star and Mars substations:

- Reconductor the following 230kV lines to achieve a summer rating of 1574 MVA:

230kV Line	Length (mi)	Existing Rating SN/SE/WN/WE (MVA)	Preliminary Rating SN/SE/WN/WE (MVA)
#2214 Buttermilk - Roundtable	0.62	1047/1047/1160/1160	1574/1574/1648/1648
#2031 Enterprise - Greenway - Roundtable	1.52	1047/1047/1160/1160	1574/1574/1648/1648
#2186 Enterprise - Shellhorn	0.64	1047/1047/1160/1160	1574/1574/1648/1648
#2188 Lockridge - Greenway - Shellhorn	2.17	1047/1047/1160/1160	1574/1574/1648/1648
#2223 Lockridge - Roundtable	0.84	1047/1047/1160/1160	1574/1574/1648/1648
#2218 Sojourner - Runway - Shellhorn	3.98	1047/1047/1160/1160	1574/1574/1648/1648
#9349 Sojourner - Mars	1.61	1047/1047/1160/1160	1574/1574/1648/1648

- Upgrade terminal equipment to remove the single element derates on the following 500kV lines:

500kV Line	Existing Rating (Derate) SE/SLD/WE/WLD (MVA)	Preliminary Rating SE/SLD/WE/WLD (MVA)
#584 Loudoun – Mosby Ckt 1	2858/3144/3403/3637	3967/4562/4832/5196
#502 Loudoun – Mosby Ckt 2	2809/2931/3403/3524	3967/4562/4832/5196



SN / SE / SLD : Summer Normal / Summer Emergency / Summer Load Dump
WN / WE / WLD: Winter Normal / Winter Emergency / Winter Load Dump

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Dominion Transmission Zone: Baseline
Data Center Alley

Total Estimated Cost: ~~$603.0 M~~ $627.62 M

- Wishing Star substation: $210.0 M[(1)] **(b3718.1)**
- Mars substation: $197.0 M[(1)] **(b3718.2)**
- 500kV and 230kV line extensions: $164.0 M[(1)] **(b3718.3)**
- ~~Brambleton substation upgrades: $ 12.0 M~~
- ~~Loudoun breaker replacements: $ 5.00 M~~
- 230kV Line #2214 Buttermilk – Roundtable reconductor: $ 4.79 M **(b3718.4)**
- 230kV Line #2031 Enterprise - Greenway - Roundtable reconductor: $ 5.89 M **(b3718.5)**
- 230kV Line #2186 Enterprise - Shellhorn reconductor: $ 3.96 M **(b3718.6)**
- 230kV Line #2188 Lockridge - Greenway - Shellhorn reconductor: $ 3.80 M **(b3718.7)**
- 230kV Line #2223 Lockridge - Roundtable reconductor: $ 2.59 M **(b3718.8)**
- 230kV Line #2218 Sojourner - Runway - Shellhorn reconductor: $ 6.51 M **(b3718.9)**
- 230kV Line #9349 Sojourner - Mars reconductor: $ 1.43 M **(b3718.10)**
- 500kV Line #502 terminal equipment upgrades: $ 6.27 M **(b3718.11)**
- 500kV Line #584 terminal equipment upgrades: $ 6.38 M **(b3718.12)**
- 230kV Line #2079/Davis Drive upgrades: $ 15.0 M **(b3718.13)**

Projected In-Service: 6/1/2025
Required In-Service: 6/1/2025

Previously Presented: 8/6/2022

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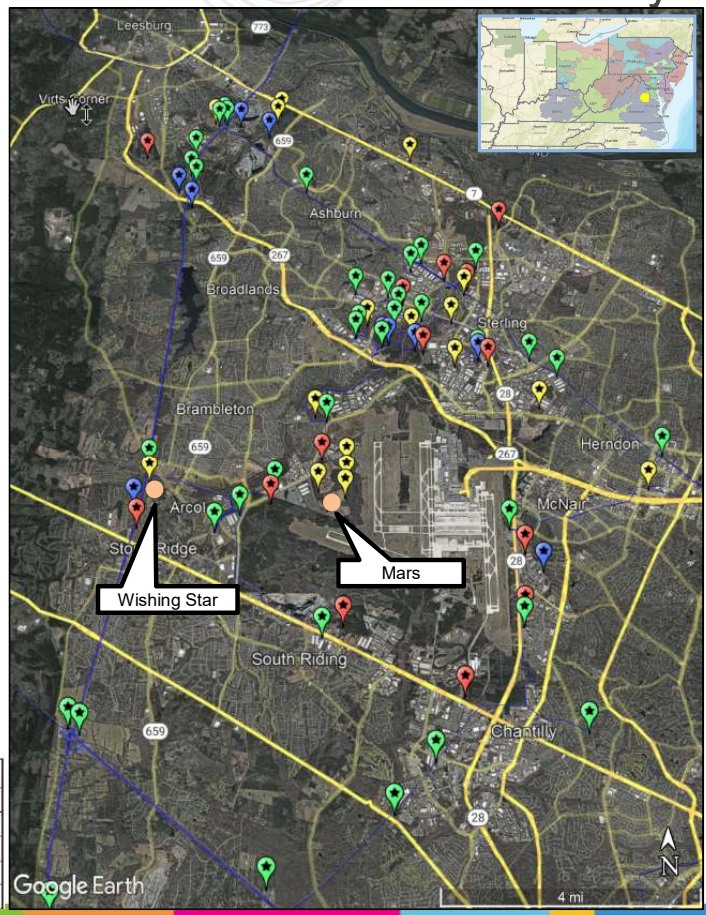
(1) Total Risk/Contingency/Escalation Cost of $92 M spread across project components.



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	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
Data Center Alley

Alternatives:

- **Option 1 (Double Circuit 230 kV):** Build a new 500/230kV substation called Wishing Star. Cut and extend 500kV Line #546 and 500kV Line #590 to the proposed Wishing Star substation. Install two 500/230kV transformers at Wishing Star substation. Build a new 500/230kV substation called Mars. Construct double circuit 230kV – 230kV circuit transmission lines from Wishing Star substation to Mars substation. **Estimated Cost:** $481.0 M
  - Option not selected due to limitations on transfer capability with 2x230kV feeds going into to Mars substation to serve load.

- **Option 2 (5-2, Brambleton Option):** Build a new 500/230kV substation called Mars. Construct double circuit 500kV – 230kV circuit transmission lines from Brambleton substation to Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** $416.0 M
  - Option not selected due to routing constraints out of Brambleton substation in addition to land limitations within and around Brambleton for substation expansion.

- **Option 4 (Line #546 & # 2094 Line Extensions):** Build a new 500/230kV substation called Mars. Remove 500kV Line #546 termination at Brambleton and extend line to Mars substation. Remove 230kV Line #2094 at Brambleton and extend line to Mars substation. Construct double circuit 500kV – 230kV circuit transmission lines from Brambleton substation to Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** $393.0 M
  - Option not selected due to adverse impacts on north-south backbone capability (both 500kV and 230kV N-S corridor lines). Will also limit options to further reinforce system to accommodate future load growth.

- **Option 5 (Double Circuit 500kV-500kV):** Build a new 500/230kV substation called Mars. Construct double circuit 500kV – 500kV circuit transmission lines by cutting 500kV Line #546 and looping into Mars substation. Install two 500/230kV transformers at Mars substation. **Estimated Cost:** $462.0 M
  - Option was not selected due to Right of Way limitations, crossing over 230kV lines coupled with FAA height restrictions around the Dulles airport.

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Planned Projects: Baseline Reliability

ComEd Transmission Zone: Baseline

Process Stage: Second Review
Criteria: Winter Generation Deliverability
Assumption Reference: 2027 RTEP assumption
Model Used for Analysis: 2027 RTEP winter case
Proposal Window Exclusion: Substation Equipment Exclusion

Problem Statement:
The Elwood-Goodings Grove 345 kV line is overloaded for an N-2 outage.
Violation was posted as part of the 2022 Window 1: FG# 2022W1-GD-W371

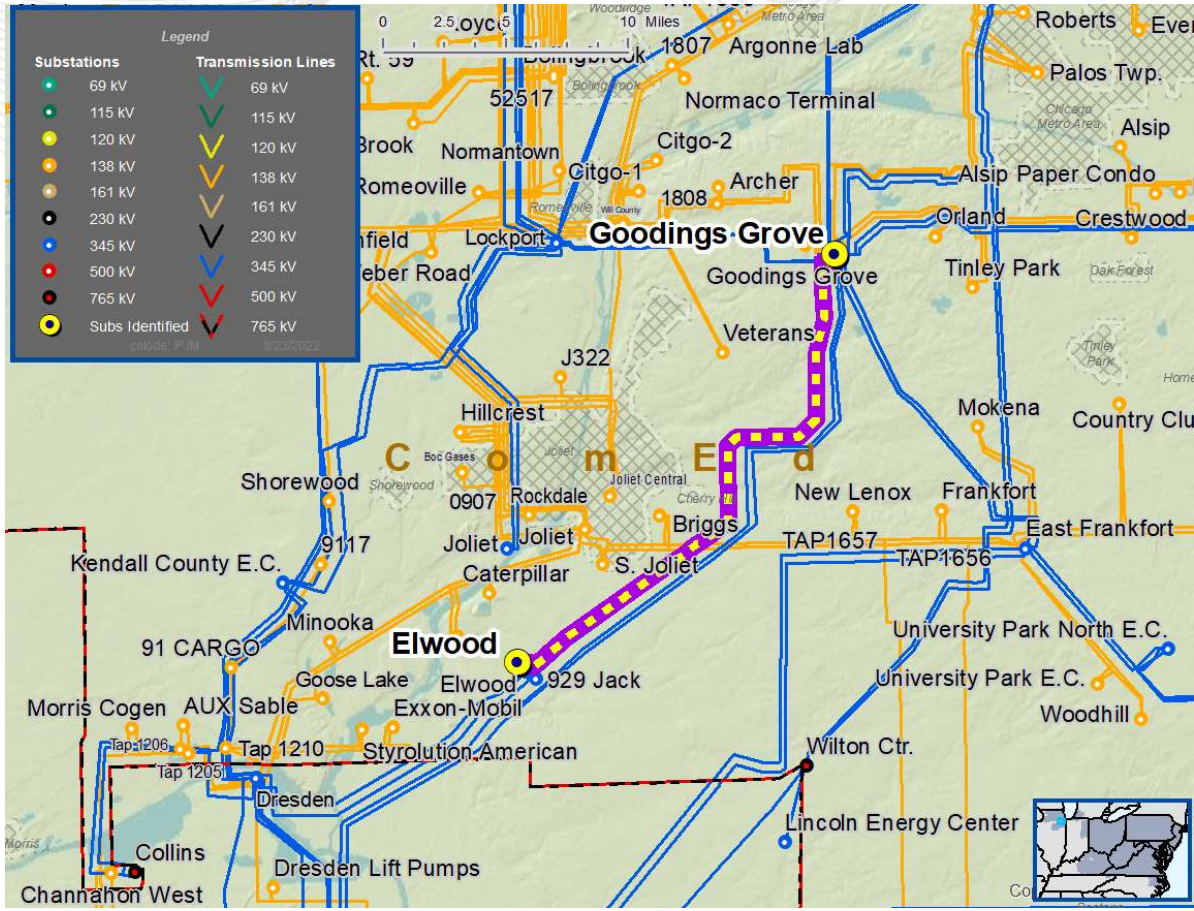
Existing Facility Rating: 1334SN/1528SE/1837SSTE/1912SLD, 1590WN/1781WE/1912WSTE/1912WLD MVA
Proposed Facility Rating: 1334SN/1528SE/1837STE/2084SLD, 1590WN/1781WE/2051WSTE/2325WLD MVA

Recommended Solution:
Replace the 1600A bus disconnect switch at Goodings Grove on L11622 Elwood-Goodings Grove 345 kV. **(b3725)**

Estimated Cost: $0.5 M

Alternatives: None

Required In-Service: 12/1/2027
Projected In-Service: 12/1/2027

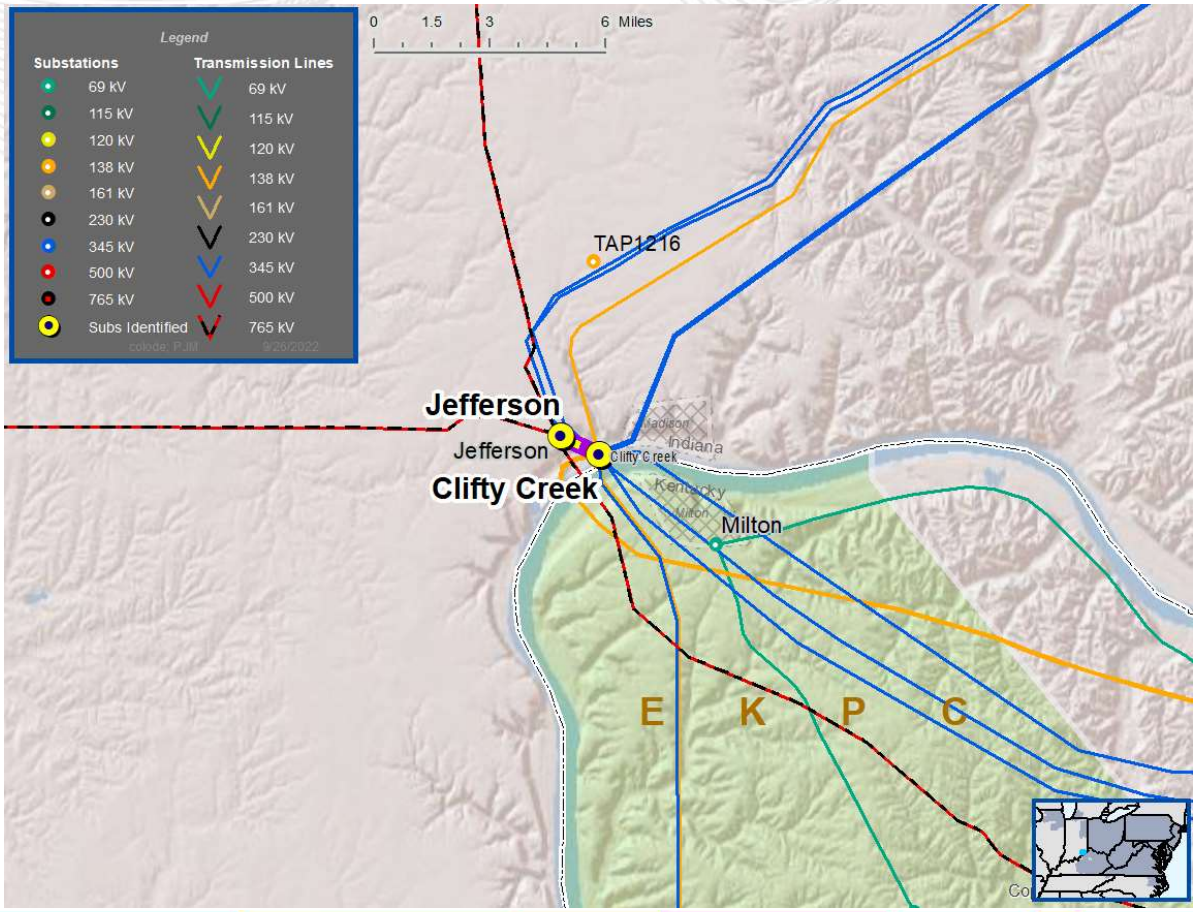


Process Stage: Recommended Solution
Criteria: Summer Generator Deliverability
Assumption Reference: 2027 RTEP assumption
Model Used for Analysis: 2027 RTEP Summer case
Proposal Window Exclusion: None
Problem Statement:
2022W1-GD-S632

In 2027 RTEP Summer case, The Jefferson – Clifty 345KV line is overload for a N-2 contingency in generator deliverability test.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05JEFRSO – 06CLIFTY 345kV	2056/2255/2669/2833



AEP Transmission Zone: Baseline
Clifty Creek Switch Replacements

As part of the 2022 RTEP Window #1, the project listed in the table below is proposed to address the following violations: 2022W1-GD-S632

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
965	AEP	Replace four Clifty Creek 345 kV 3000 A switches with 5000 A 345 kV switches. Anticipated SN/SE rating for the branch section to be addressed (242865 to 248000) by the project is 2354/2354 MVA.	0.852

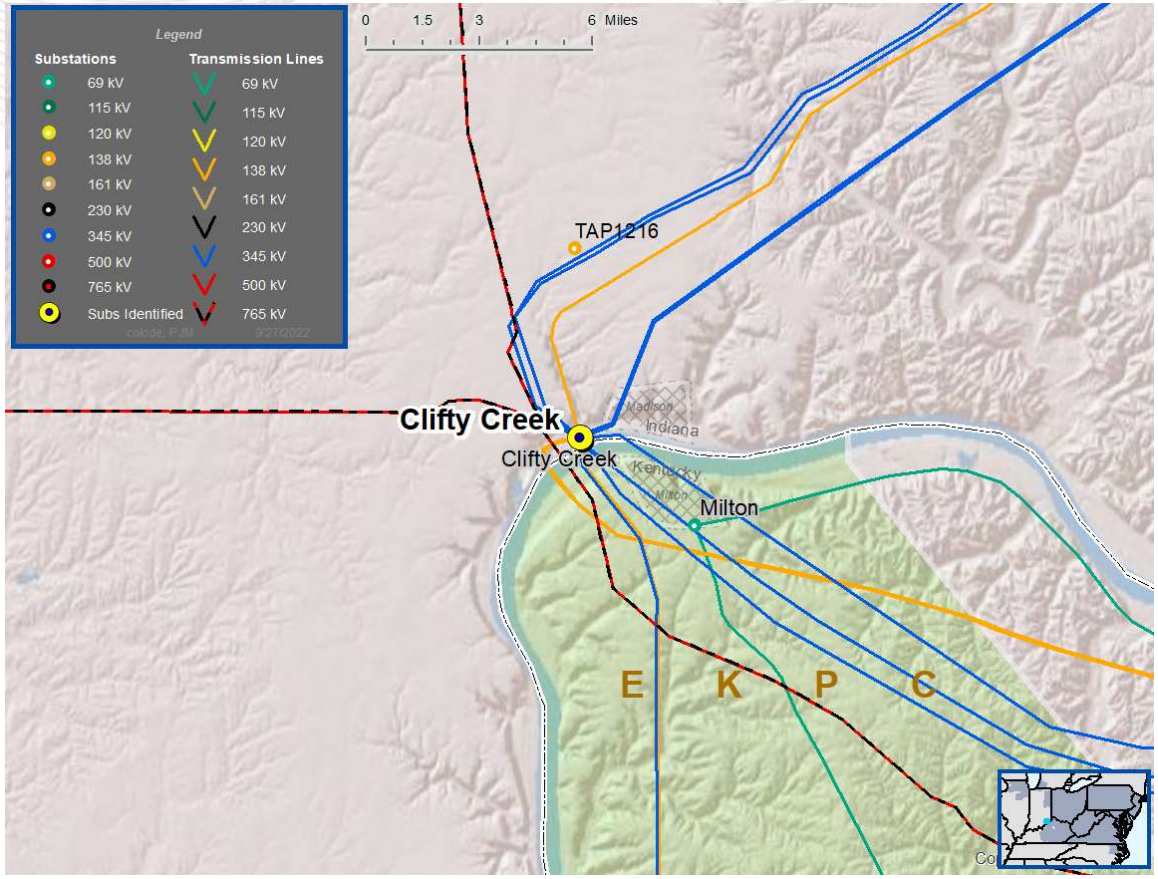
Recommended Solution: Proposal #2022_W1-965

Replace four Clifty Creek 345 kV 3000 A switches with 5000 A 345 kV switches. **(B3728)**

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05JEFRSO – 06CLIFTY 345kV	2354/2354/2991/2991

Estimated Cost: $0.852M
Required IS Date: 6/1/2027
Projected IS Date: 6/30/2024
Previously Presented: 10/4/2022



APS Transmission Zone: Baseline
Black Oak Substation

Process Stage: Recommended solution

Criteria: Summer and Winter N-1-1 baseline Analysis

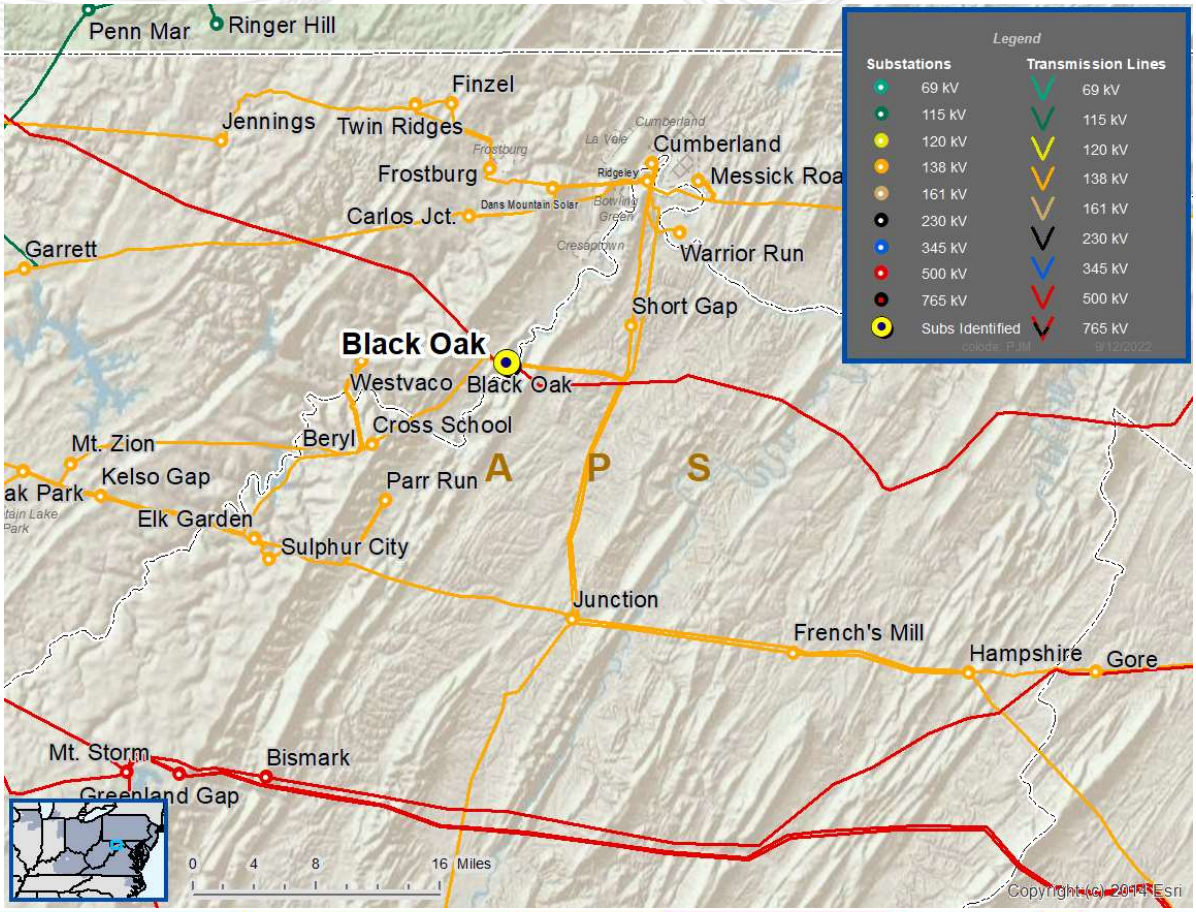
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP winter case

Proposal Window Exclusion: None

Problem Statement: 2022W1-N2-SVD1 through 2022W1-N2-SVD41, 2022W1-N2-VD1 through 2022W1-N2-VD198

In the 2027 RTEP Summer and Winter case, there are several Voltage drop violations at the Black Oak 500 kV substation.



APS Transmission Zone: Baseline
Black Oak Substation

As part of the 2022 RTEP Window #1, the project listed in the table below is proposed to address the following violations: 2022W1-N2-SVD1 through 2022W1-N2-SVD41, 2022W1-N2-VD1 through 2022W1-N2-VD198

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
21	APS	Black Oak 500 kV Substation: Install New Bay Position for SVC and Install Transformer High Side Breaker	17.37

Recommended Solution: Proposal #2022_21

- Install two new 500 kV breakers on the existing open SVC string to create a new bay position. Relocate & Re-terminate facilities as necessary to move the 500 kV SVC into the new bay position.
- Install a 500 kV breaker on the 500/138 kV #3 transformer. Upgrade relaying at Black Oak Substation . **(b3726)**

Total Estimated Cost: $17.37M

Required IS Date: 6/1/2027
Projected IS Date: 6/1/2027
Previously Presented: 10/4/2027

Update for Existing Projects

Baseline Reliability Projects

APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

B3710: Previously presented on 04/22/2022 SRRTEP-W

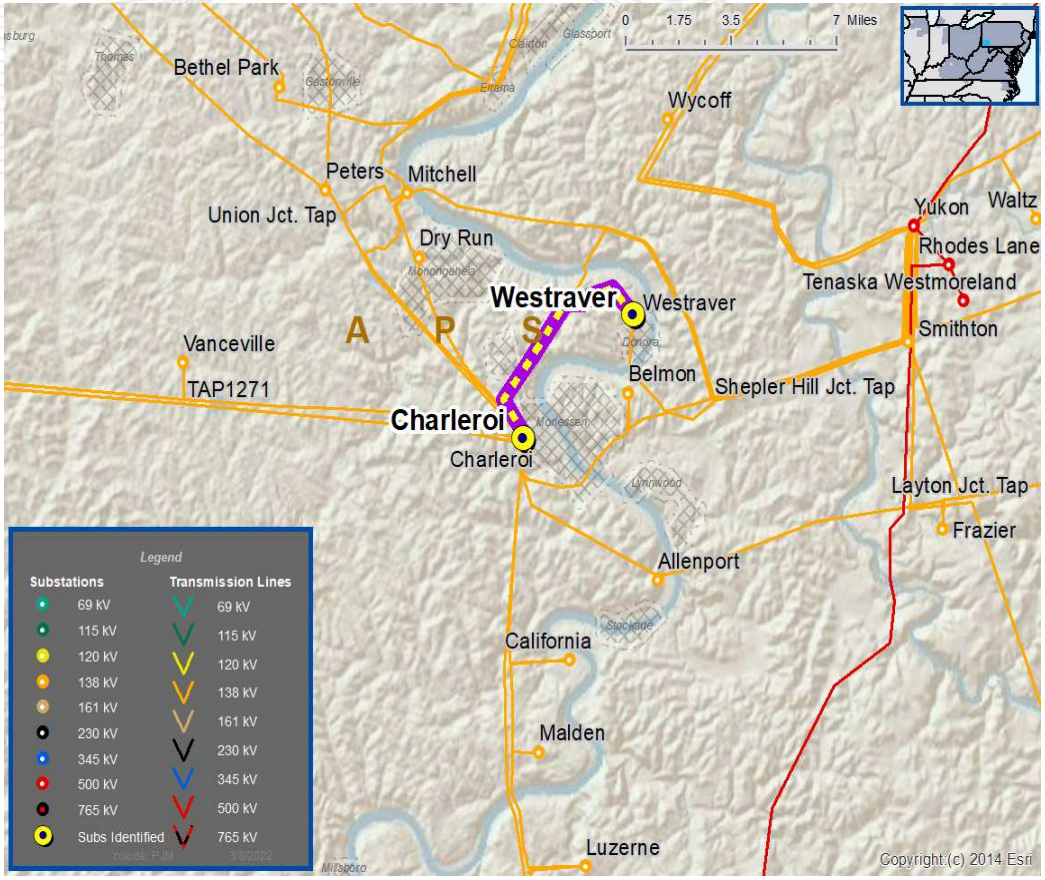
Problem Statement:

In 2026 RTEP Summer case, Yukon to AA2-161 Tap 138 kV lines are overloaded due to single contingencies.

Original Proposed Solution:

Expand the future AA2-161 138 kV six (6) breaker ring bus into an eleven (11) breaker substation with a breaker-and-a-half layout by constructing five (5) additional breakers and expanding the bus. Loop the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation. Relocate terminals as necessary at AA2-161. Upgrade terminal equipment (wavetrap, substation conductor) and relays at Yukon, Huntingdon, Springdale, Charleroi, and the AA2-161 substation.

Transmission Estimated Cost: $14.37M

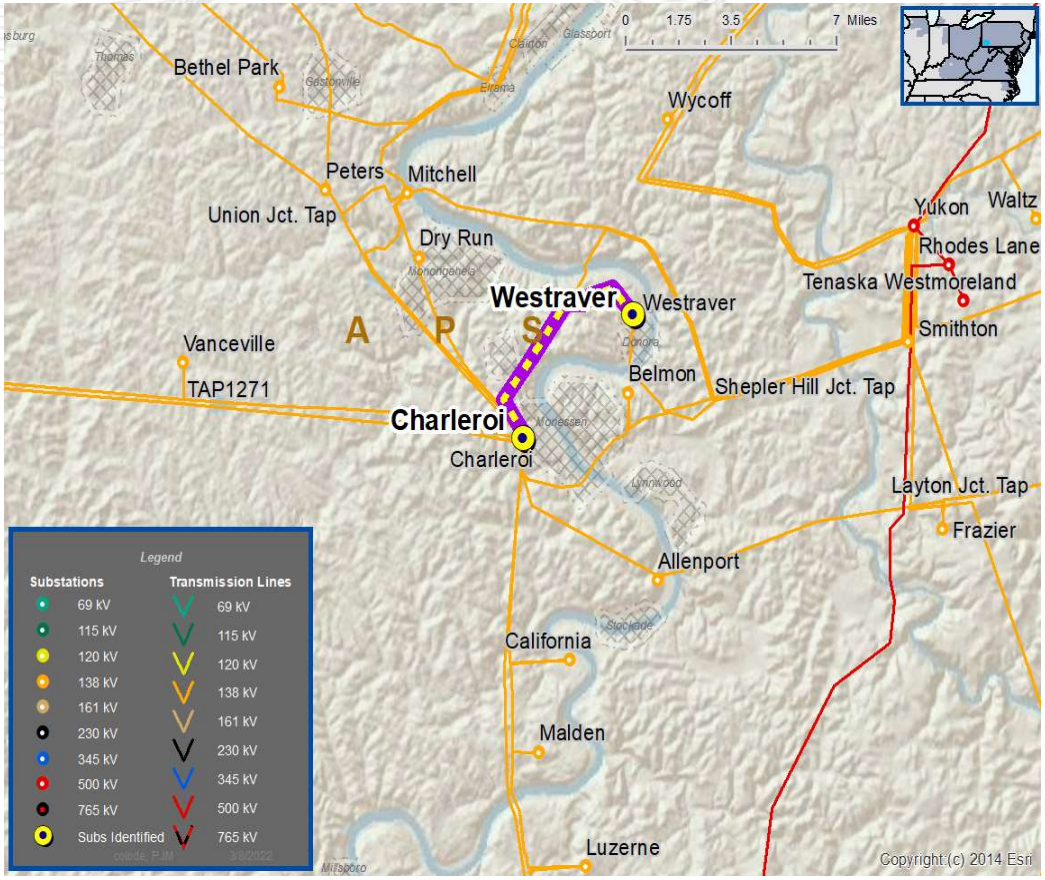


APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

During 2027 RTEP analysis, it was determined that the topology change caused the new AA2-161 to Charleroi line to be overloaded. The new overload is conductor limited and the cost to upgrade 12.8 miles is $32 M.

As a result, the cost-effective solution is to alternatively reconductor Yukon to AA2-161 ckt 1 & 2 while maintaining the existing topology. The cost to upgrade is $10.64 M.

	Scope	Cost (M)
B3710 (original)	b3710 (Expand AA2-161 & Loop Yukon – Charleroi #2 138 kV Line into Station)	$14.37
B3710 (original)	Reconductor 12.8 miles from AA2-161 to Charleroi	$32.01
B3710 (Scope change)	Reconductor both Yukon – AA2-161 138 kV Lines	$10.64



APS Transmission Zone: Baseline
B3710 Scope Change: AA2-161 to Yukon ckt 1 and 2 138 kV

Recommended Solution:

Reconductor AA2-161 to Yukon 138 kV lines ckt 1 and 2 with 954 ACSS conductor.

Total Estimated Transmission Cost: $10.64M

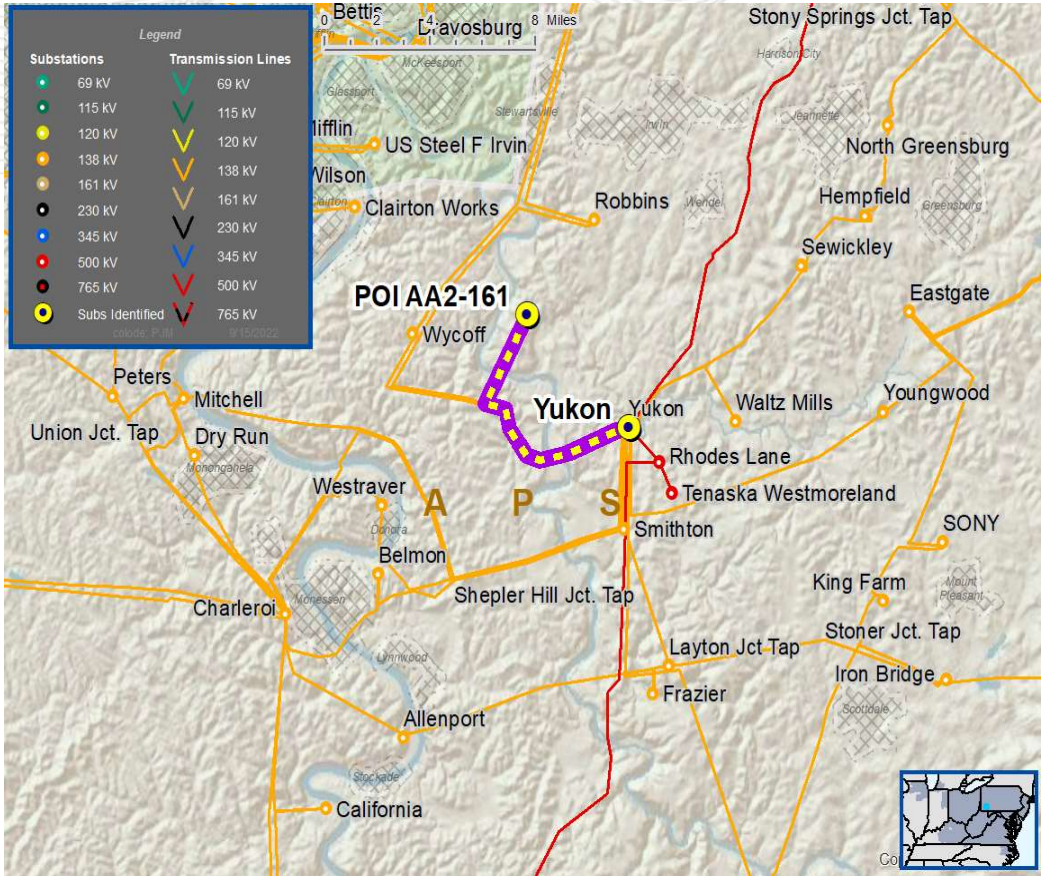
Ancillary Benefits: None

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
AA2-161 – Yukon Ckt 1 and 2	501/577/501/607

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2026



ComEd Transmission Zone: Baseline
B3317 Cancellation: Waukegan 138kV Substation

B3317: Previously presented on 5/21/2021 SRRTEP-W meeting

Problem Statement:

Waukegan 138kV Substation: Mitigate existing instabilities at 138kV STA16 Waukegan for close-in three-phase faults with breaker failure. ComEd has been using out-of-step-relay as a temporary solution. A permanent solution is needed.

B3317 Scope:

Modify backup relay clearing times at the 138kV STA16 Waukegan station.

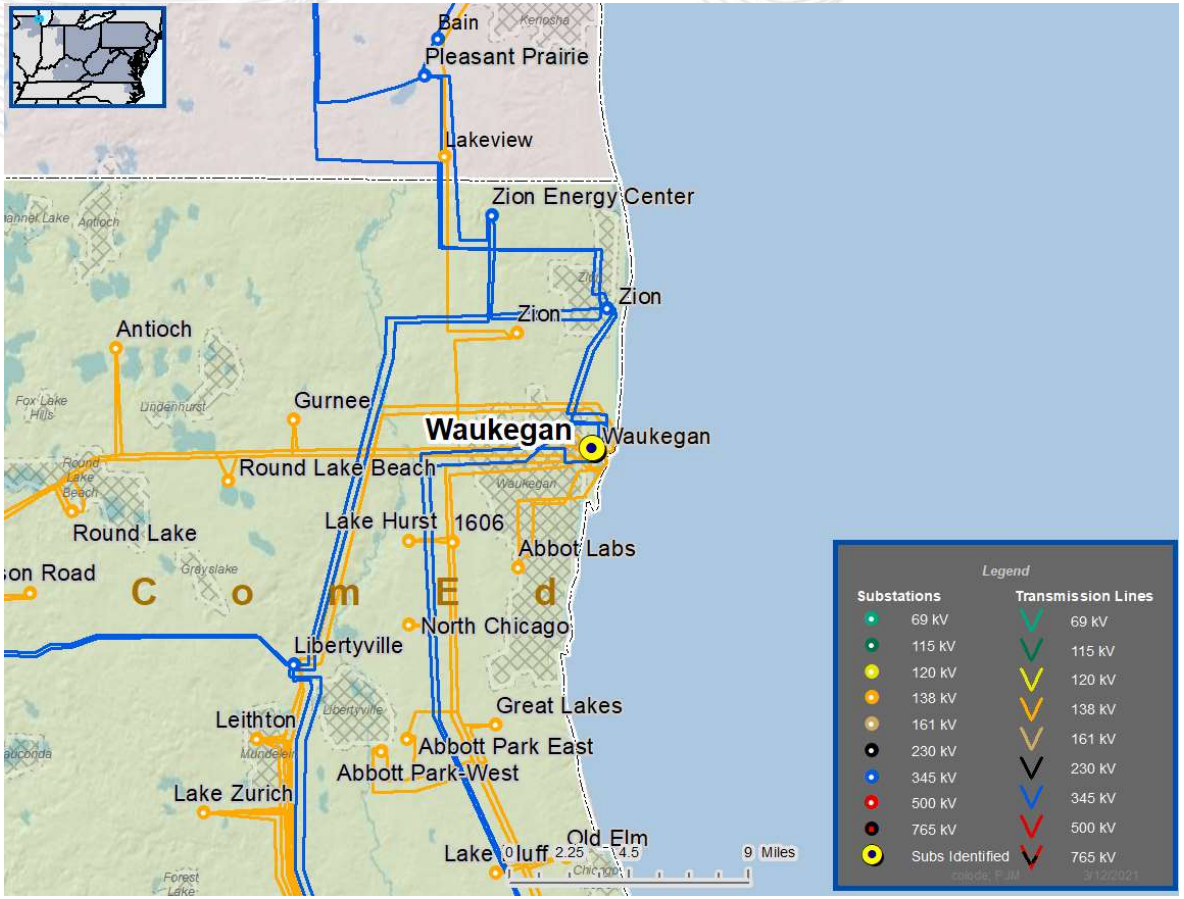
Estimated Cost: $0.255 M

Required In-Service: 6/1/2023

Projected In-Service: 6/1/2023

Reason for Cancellation:

The Waukegan generation retired on May 31, 2022, and the baseline is no longer needed as it was a stability related project for these generators.



Recommended Solution

Baseline Reliability Projects

APS Transmission Zone: Baseline
Messick Road to Ridgeley 138 kV Upgrades

Process Stage: Recommended Solution

Criteria: RTEP Generation Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

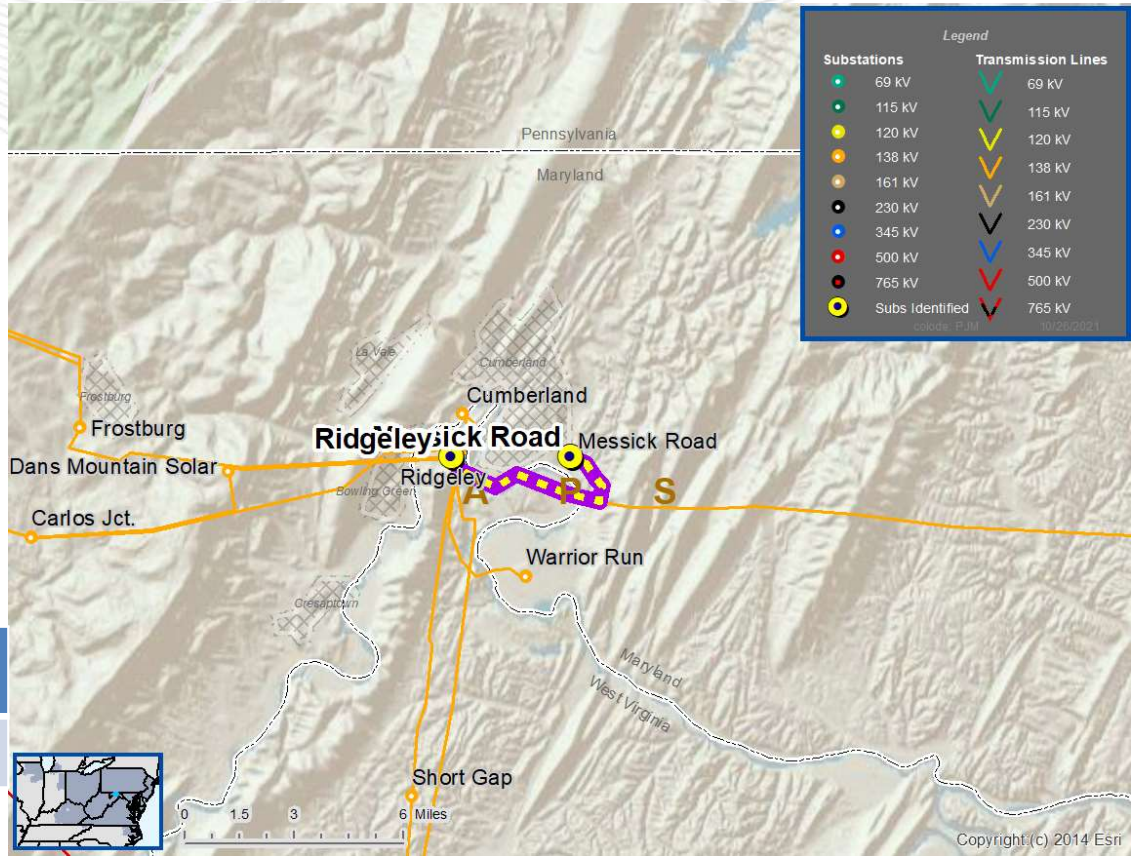
Problem Statement:

FG: GD-S446 and GD-S448

In 2026 Summer RTEP case, Messick Road to Ridgeley 138 kV line is overloaded due to multiple breaker contingencies.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
01RIDGLY - 01MESSCK 138 kV	221/268/250/287



APS Transmission Zone: Baseline
Messick Road to Ridgeley 138 kV Upgrades

Recommended Solution: Reconductor the existing 556.5 ACSR line segments on the Messick Road-Ridgeley WC4 138 kV line with 954 45/7 ACSR to achieve 308/376 MVA SN/SE and 349/445 MVA WN/WE ratings. Replace the remote end equipment for the Messick Road-Ridgeley WC4 138 kV line.**(B3683)**

Transmission Estimated Cost: $11.2M

Preliminary Facility Rating:

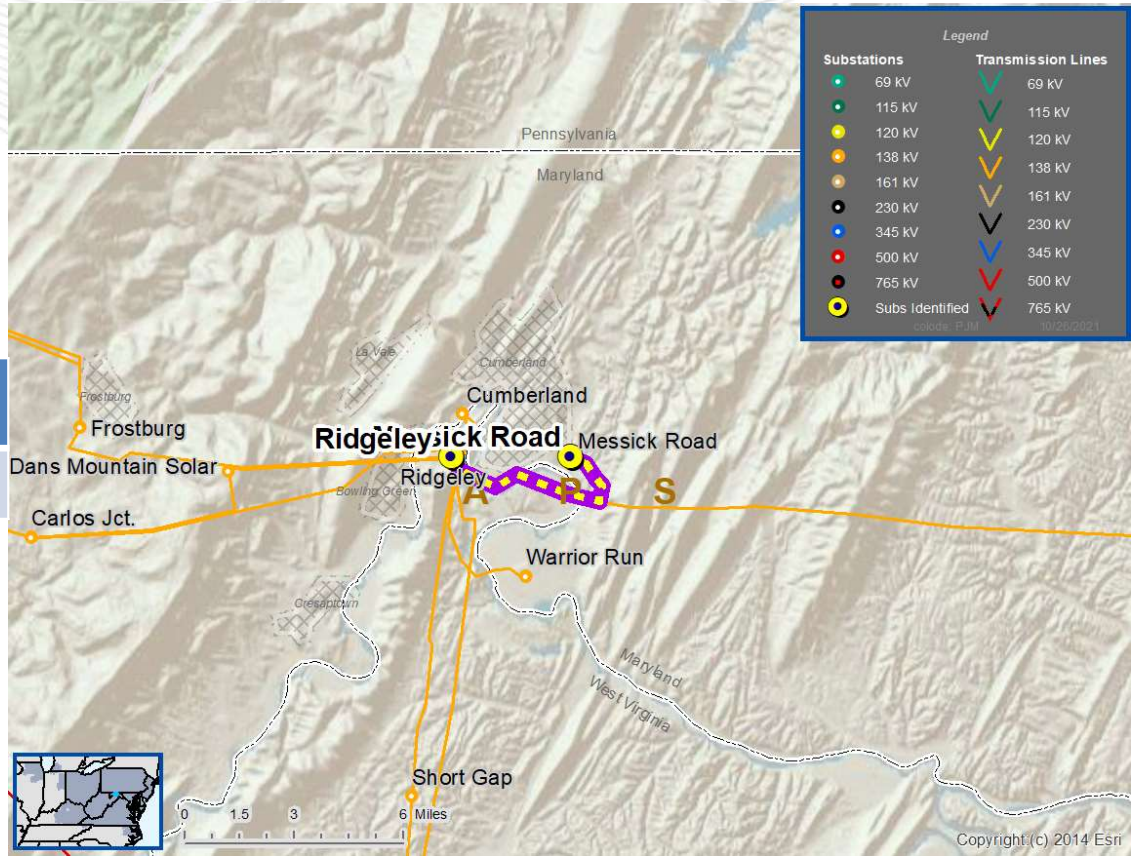
Branch	SN/SE/WN/WE (MVA)
01RIDGLY - 01MESSCK 138 kV	308/376/349/445

Ancillary Benefits: This facility is commonly seen to overload for the loss of various 500 kV lines. This upgrade will result in less operational switching to alleviate N-1 overloads.

Alternatives: No cost effective alternative identified.

Required IS date: 06/01/2026

Projected IS date: 06/01/2026



EKPC Transmission Zone: Baseline
Summer Shade-West Columbia 69 kV Rebuild

Process Stage: Recommended Solution

Criteria: EKPC 715 Criteria

Assumption Reference: EKPC Assumptions Presentation Slide 3-10

Model Used for Analysis: EKPC's internal models representing 2024/25 winter peak conditions that were used for EKPC's annual system screening analysis for 2021 planning cycle. Includes Cooper Units 1 and 2 off with replacement generation imported from south of EKPC system.

Proposal Window Exclusion: Below 200 kV Exclusion

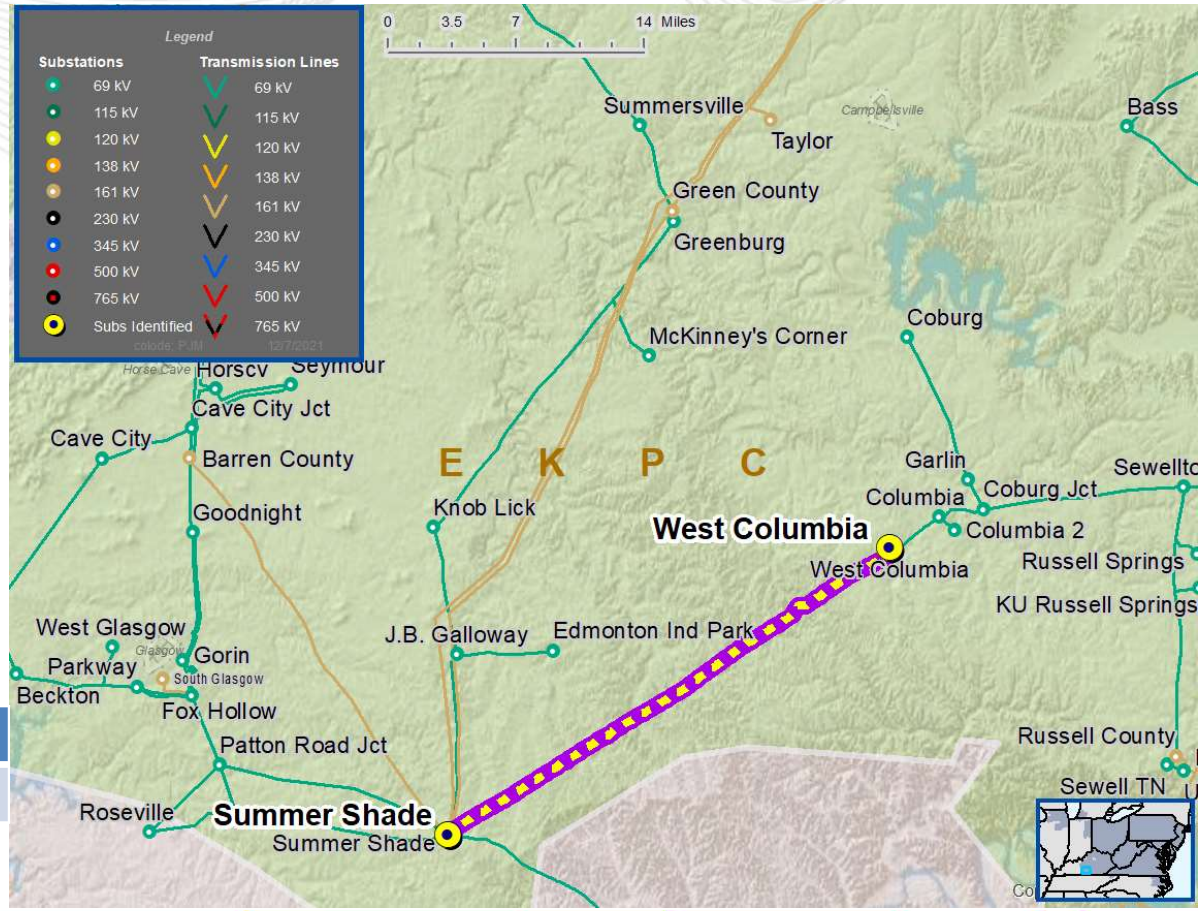
Problem Statement:

FG: EKPC-T1

The Summer Shade-West Columbia 69 kV line section is overloaded for a N-1 outage.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
2SUMM SHADE-2W COLUMBI T 69 kV	57/63/82/86



EKPC Transmission Zone: Baseline
Summer Shade-West Columbia 69 kV Rebuild

Recommended Solution:

Rebuild the Summer Shade-West Columbia 69 kV 0.19 miles of 266 conductor double circuit to 556 conductor. **(b3709)**

Total Estimated Cost: $0.191 M

Preliminary Facility Rating:

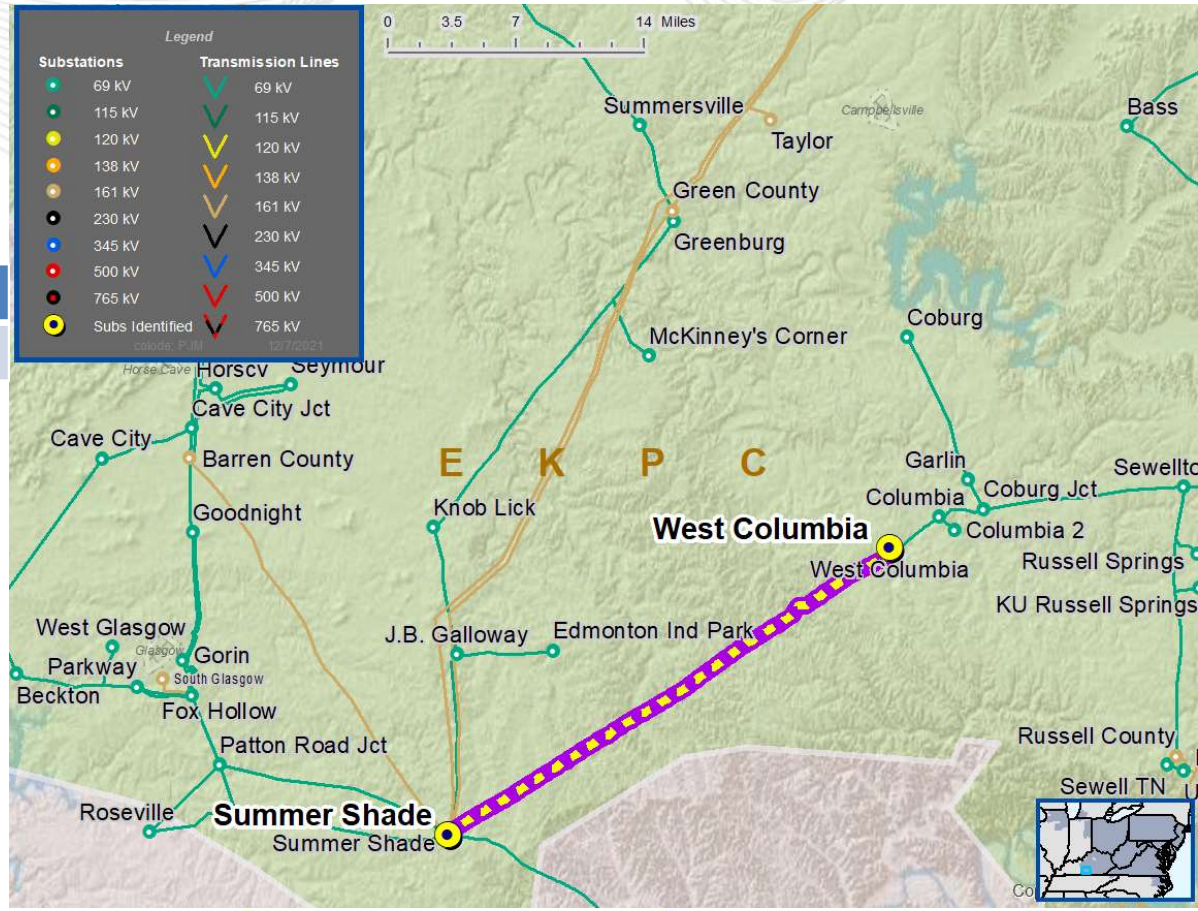
Branch	SN/SE/WN/WE (MVA)
2SUMM SHADE-2W COLUMBI T 69 kV	73/76/86/89

Ancillary Benefits:

Minimizes maintenance costs and increases operational flexibility over a MOT increase.

Required IS date: 12/1/2025

Projected IS date: 12/1/2025



APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2026 RTEP assumption

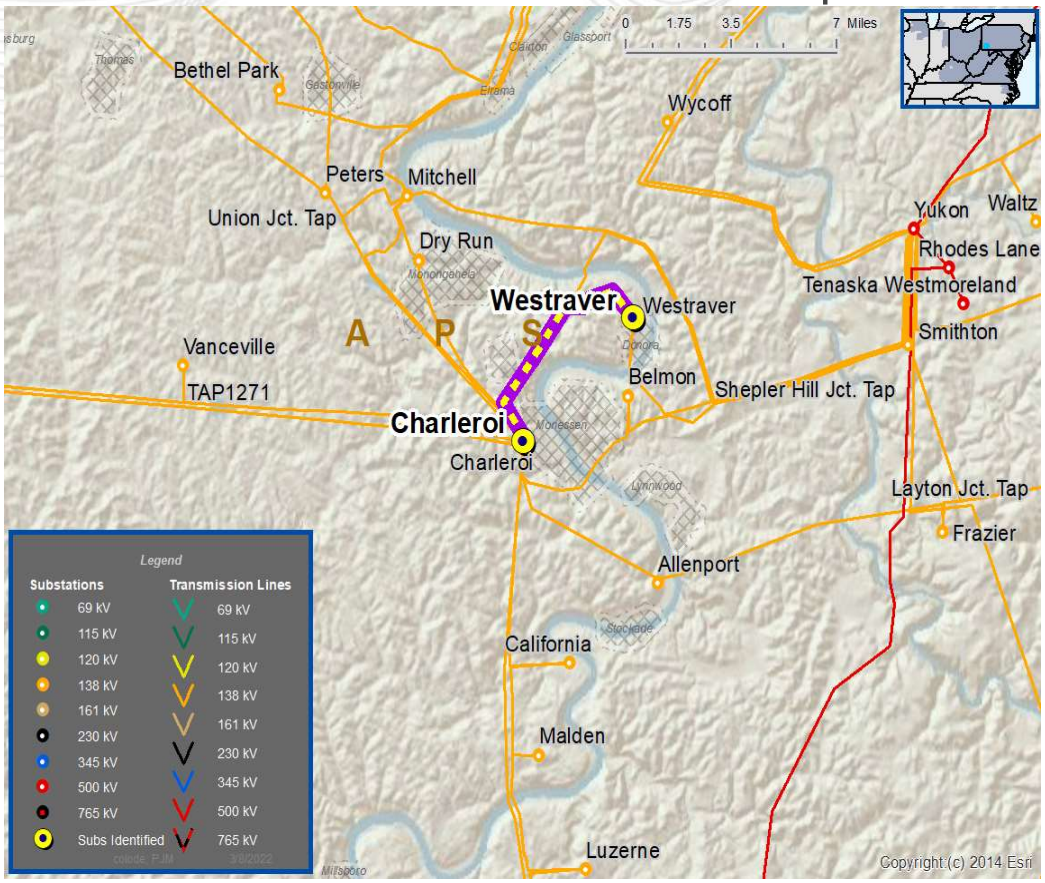
Model Used for Analysis: 2026 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: GD-S24 & GD-S29

In 2026 RTEP Summer case, Yukon to AA2-161 Tap 138 kV lines are overloaded due to single contingencies.

Branch	SN/SE/WN/WE (MVA)
Yukon to Westraver 138 kV	308/376/349/445
Westraver to Charleroi 138 kV	274/342/345/382



APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

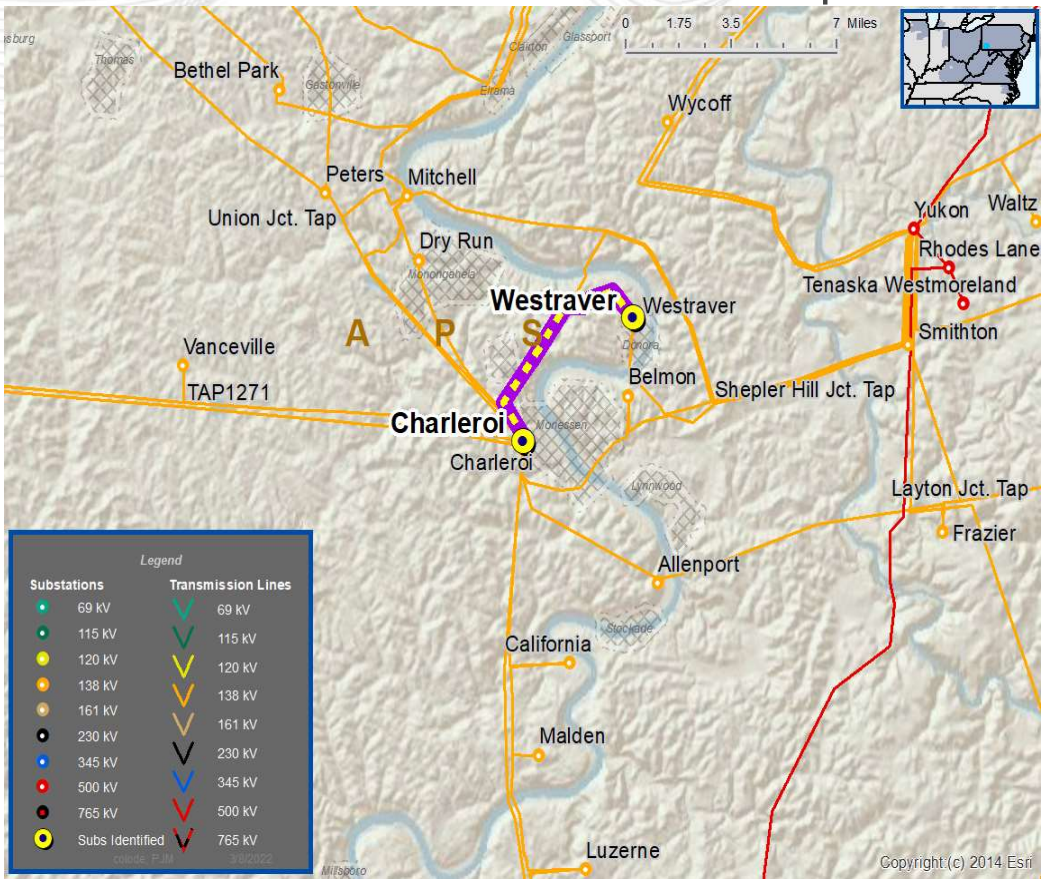
Recommended Solution:

Expand the future AA2-161 138 kV six (6) breaker ring bus into an eleven (11) breaker substation with a breaker-and-a-half layout by constructing five (5) additional breakers and expanding the bus. Loop the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation. Relocate terminals as necessary at AA2-161. Upgrade terminal equipment (wavetrap, substation conductor) and relays at Yukon, Huntingdon, Springdale, Charleroi, and the AA2-161 substation. (b3710)

Transmission Estimated Cost: $14.37M

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Yukon to Westraver 138 kV	308/376/349/445
Westraver to AA2-161 138 kV	308/376/349/445
AA2-161 to Charleroi 138 kV	297/365/345/441



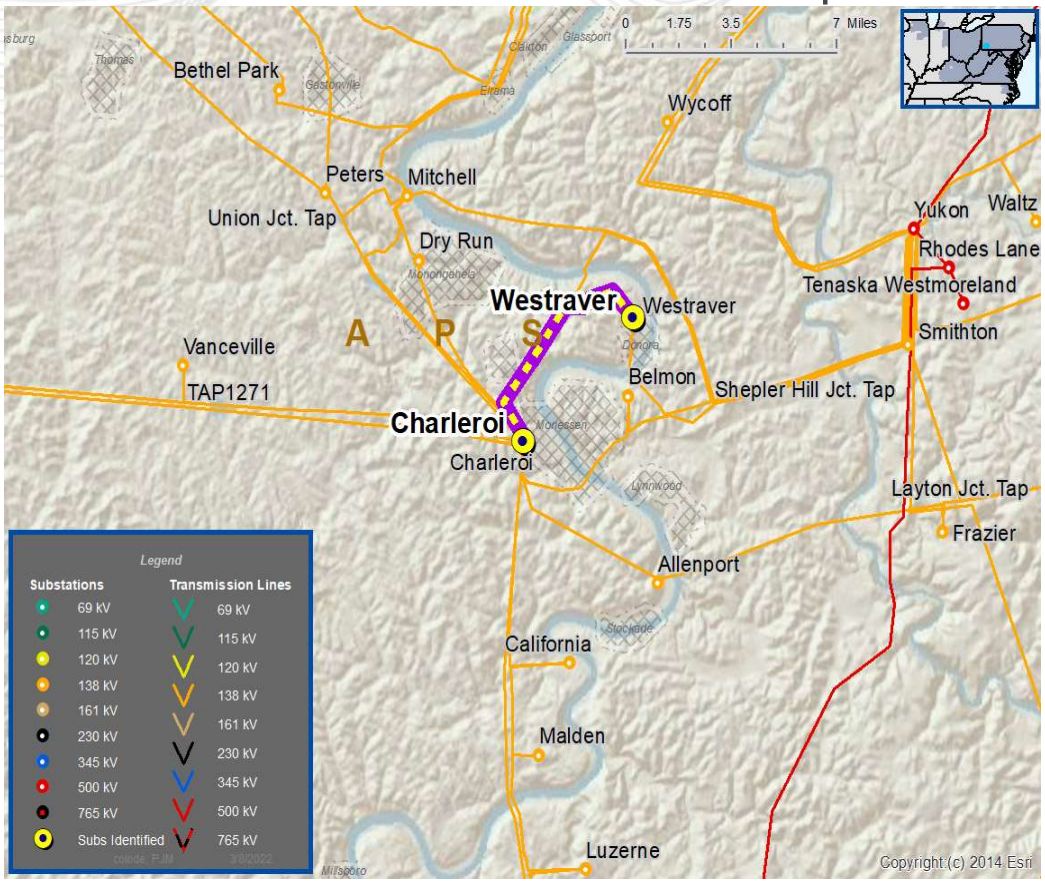
APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

Alternatives: Reconductor both Yukon - AA2-161 138 kV lines. This alternative would cost $15.1 million.

Ancillary Benefits: Looping the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation would alleviate the thermal overload violations. This project will also provide an additional network path from Yukon to Springdale, which is currently unavailable for multiple P4, P6, & P7 contingencies.

Required IS date: 6/1/2026

Projected IS date: 6/1/2026



EKPC Transmission Zone: Baseline
Liberty Junction Cap Bank

Process Stage: Recommended Solution

Criteria: EKPC 715 Criteria

Assumption Reference: EKPC Assumptions Presentation Slide 3-10

Model Used for Analysis: EKPC's internal models representing 2022/23 winter peak conditions that were used for EKPC's annual system screening analysis for 2021 planning cycle. Includes Cooper Units 1 and 2 off with replacement generation imported from north of EKPC system.

Proposal Window Exclusion: Immediate Need/Below 200 kV Exclusion

Problem Statement:

FG: EKPC-VM1, EKPC-VM3, EKPC-VM4

Low voltage at Broughtentown, Tommy Gooch and Highland 69 kV for a N-1 outage.

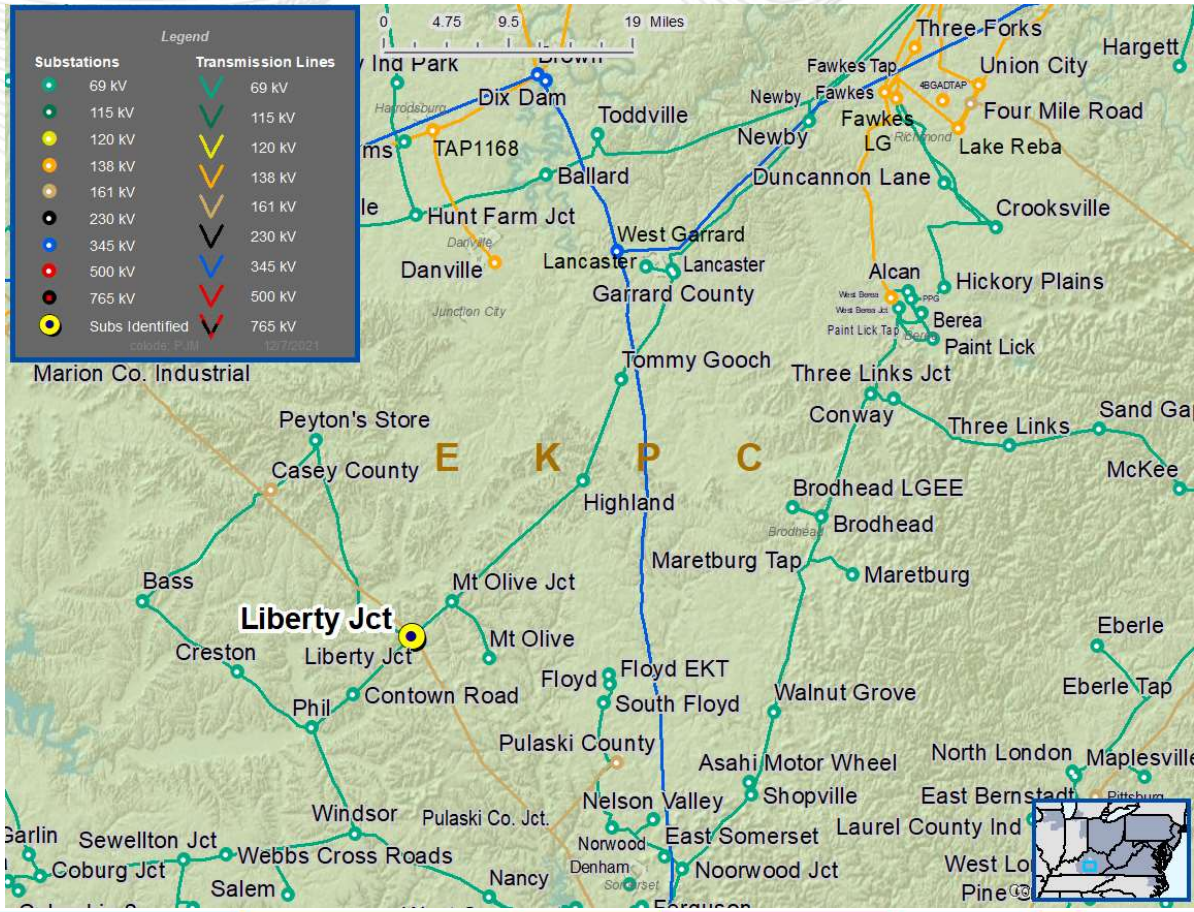
Existing Facility Rating: N/A

Proposed Solution:

Install a 28 MVAR cap bank at Liberty Junction 69 kV. **(b3712)**

Total Estimated Cost: $0.542 M

Preliminary Facility Rating: N/A



EKPC Transmission Zone: Baseline
Liberty Junction Cap Bank

Alternatives:

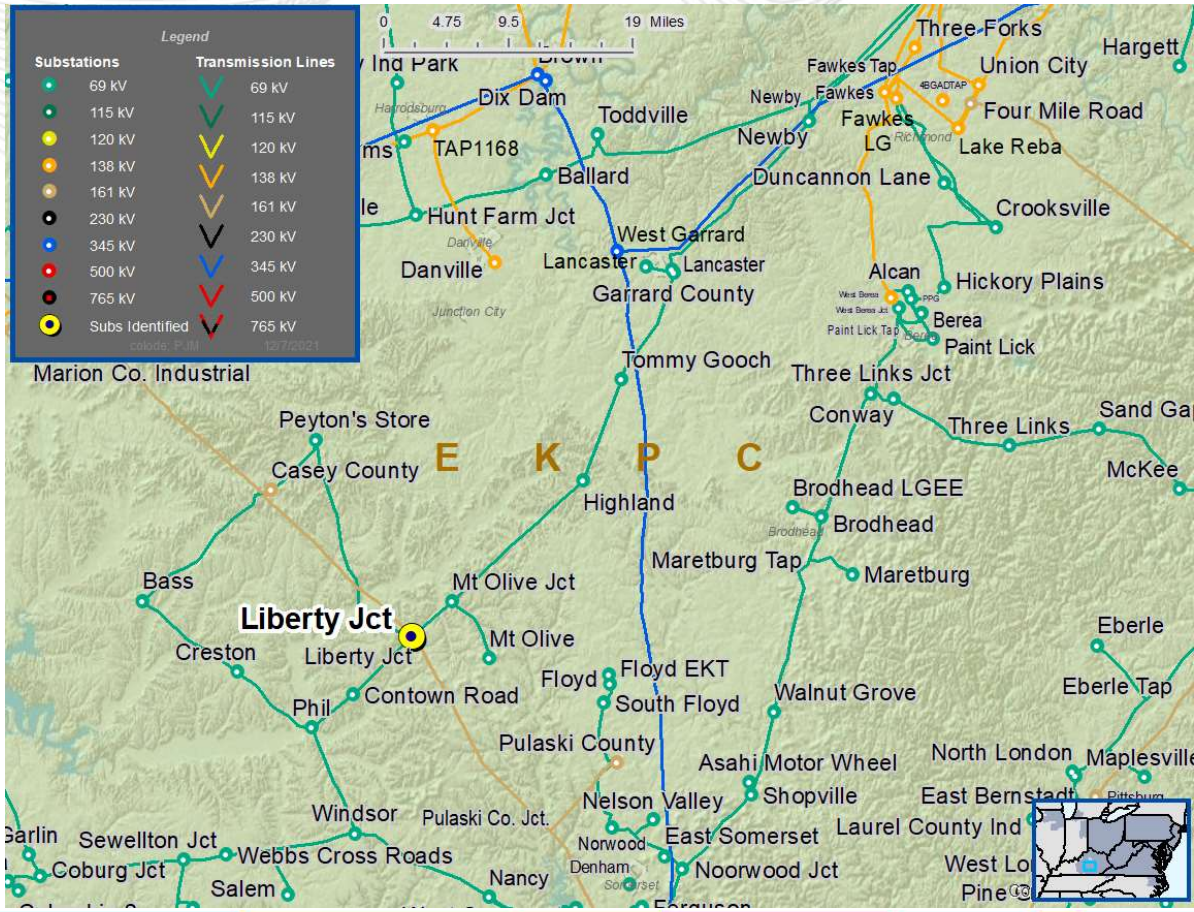
1. Build KU Stanford-Tommy Gooch normally-open connection using 556 ACSR (3.4 miles).
2. Build second line from Garrard Co-Tommy Gooch using 556 ACSR (7.3 miles) with Tommy Gooch served radially.
3. Build Brodhead-Broughtentown normally-open using 556 ACSR (8 miles).
4. Build Three Links Jct-Tommy Gooch normally-closed line using 556 ACSR (16.67 miles).

Ancillary Benefits:

Provides voltage support for the Oakhill area without need for future projects as compared to other alternatives.

Required IS date: 12/1/2022

Projected IS date: 12/1/2022



AEP Transmission Zone: Baseline Darrah – Barnett 69 kV Line Rebuild

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Winter RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-T1, 2022W1-AEP-T2

In 2027 RTEP winter case, the Darrah – Barnett 69 kV line is overloaded under a N-1-1 contingency scenario

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Darrah – Barnett 69 kV	50/50/63/63

AEP Transmission Zone: Baseline Darrah – Barnett 69 kV Line Rebuild

Recommened Solution:

- Rebuild the existing Darrah - Barnett 69 kV line, approximately 2.8 miles and replace a riser at Darrah Station. (**B3722**)

Transmission Estimated Cost: $6.98M

Ancillary Benefits: Supplemental needs on the Darrah – Barnett 69 kV line section: Darrah - Owens Illinois Circuit originally installed in 1954, currently has 213 conditions on 86 structures

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Darrah – Barnett 69 kV	93/114/118/134

Required IS Date: 12/1/2027

Projected IS Date: 12/1/2027

Previously Presented: 9/16/2022

AEP Transmission Zone: Baseline
George Washington-Kammer 138kV Line Rebuild

Process Stage: Recommended Solution

Criteria: Summer Generation Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 Summer RTEP case

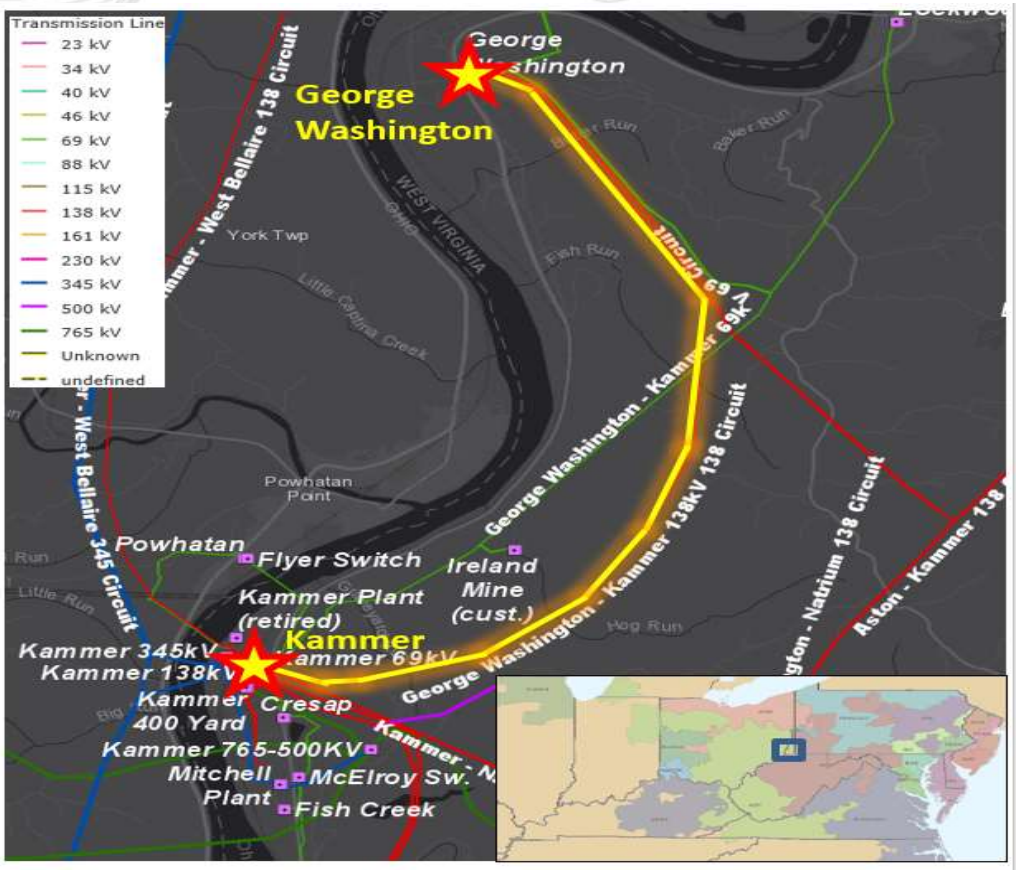
Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S1032

In 2027 RTEP Summer case, the George Washington-Kammer 138 kV line is overloaded under a contingency scenario in generation deliverability test.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
George Washington – Kammer 138kV	446/621/563/698



AEP Transmission Zone: Baseline
George Washington-Kammer 138kV Line Rebuild

Recommended Solution:

- Rebuild the George Washington – Kammer 138kV circuit, except for 0.1-mile of previously-upgraded T-line outside each terminal station (6.7 miles of total upgrade scope). Remove the existing 6-wired steel lattice towers and supplement the right-of-way as needed. (**B3723**)

Transmission Estimated Cost: $18.3M

Ancillary Benefits: Addresses M-3 facility condition needs (AEP-2021-OH013), as presented in 3/19/2021 and 5/19/2022 W-SRREP

Preliminary Facility Rating:

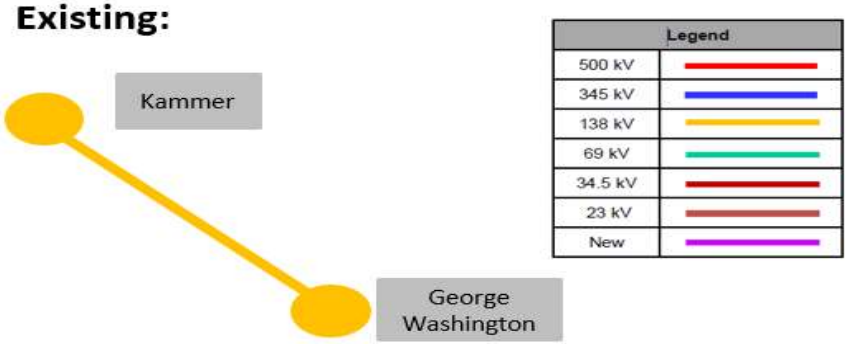
Branch	SN/SE/WN/WE (MVA)
George Washington – Kammer 138kV	730/747/791/791

Required IS Date: 6/1/2027

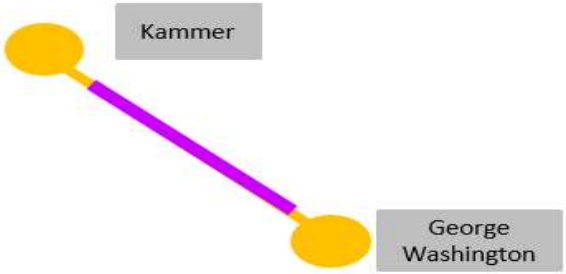
Projected IS Date: 6/1/2024

Previously Presented: 9/16/2022

Existing:



Proposed:



ATSI Transmission Zone: Baseline Avery – Hayes 138 kV line

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2027 RTEP assumption

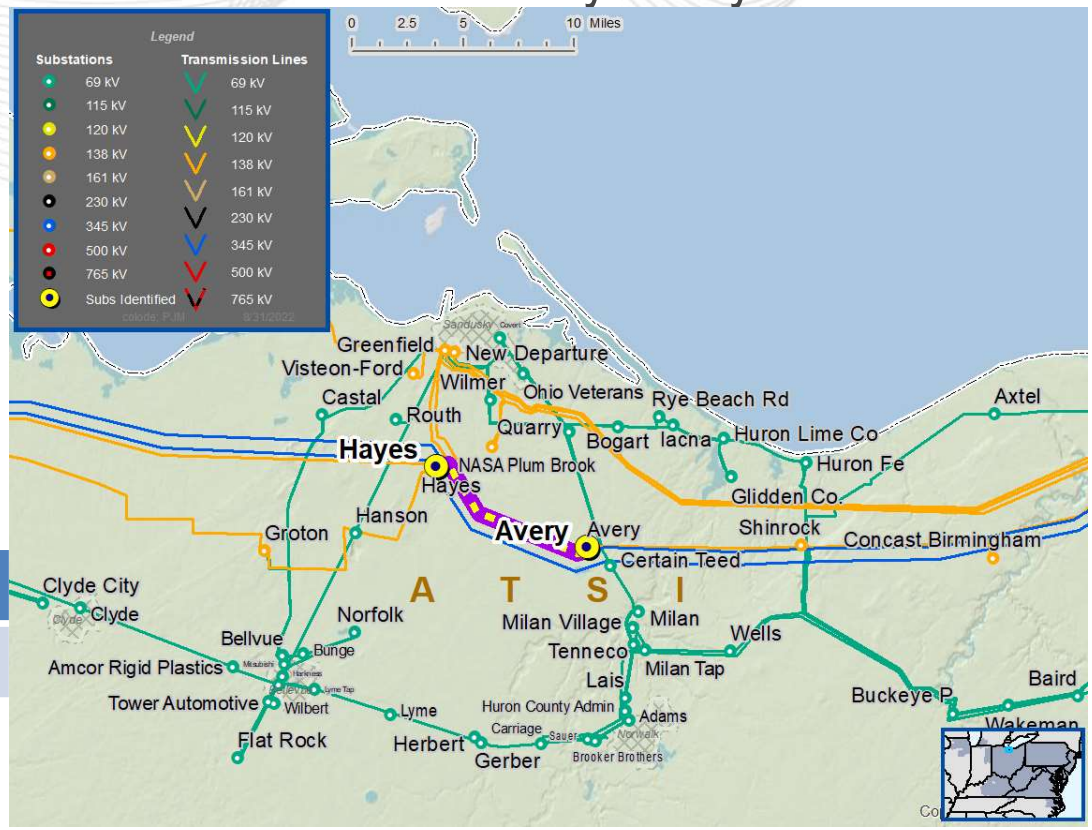
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-GD-S1030

In 2027 RTEP Summer case, Hayes to Avery 138 kV line is overloaded due to a tower contingency

Branch	SN/SE/WN/WE (MVA)
Hayes to Avery 138 kV	233/282/263/333



ATSI Transmission Zone: Baseline Avery – Hayes 138 kV line

Recommended Solution:

Rebuild and reconductor the Avery-Hayes 138 kV line (approx. 6.5 miles) with 795 KCMIL 26/7 ACSR (b3721)

Transmission Estimated Cost: $10.4M

Ancillary Benefits: Capacity increase for future growth

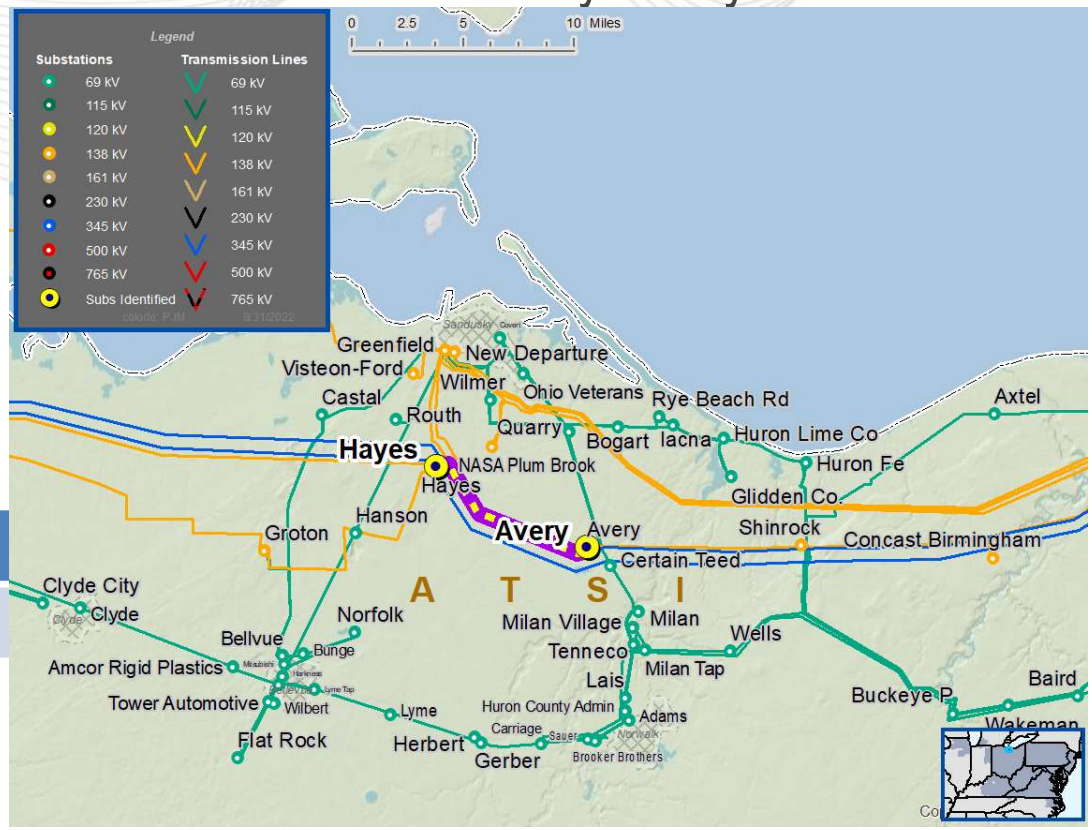
Alternatives: None

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Hayes to Avery 138 kV	278/339/315/401

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027



ATSI Transmission Zone: Baseline Abbe – Johnson 69 kV line

Process Stage: Recommended Solution

Criteria: First Energy 715 Criteria

Assumption Reference: 2027 RTEP assumption

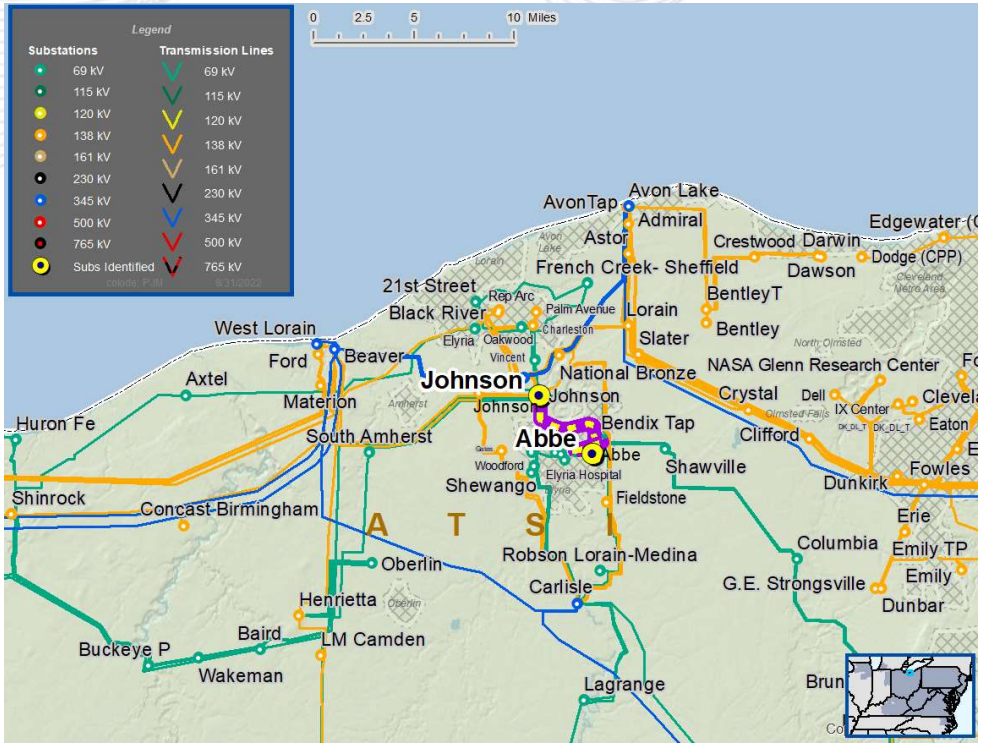
Model Used for Analysis: 2027 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-ATSI-T1

In 2027 RTEP Summer case, Johnson to Redman 138 kV line is overloaded due to a P2-1 contingency

Branch	SN/SE/WN/WE (MVA)
Abbe to Johnson 69 kV	76/92/87/111



ATSI Transmission Zone: Baseline Abbe – Johnson 69 kV line

Recommended Solution:

- Rebuild the Abbe-Johnson #2 69 kV Line (approx. 4.9 miles) with 556 kcmil ACSR conductor
- Replace (3) disconnect switches (A17, D15 & D16) and line drops and revise relay settings at Abbe.
- Replace (1) disconnect switch (A159) and line drops and revise relay settings at Johnson.
- Replace (2) MOAB disconnect switches (A4 & A5), (1) disconnect switch (D9), and line drops at Redman. (b3720)

Transmission Estimated Cost: $10.9M

Ancillary Benefits: Capacity increase for future growth

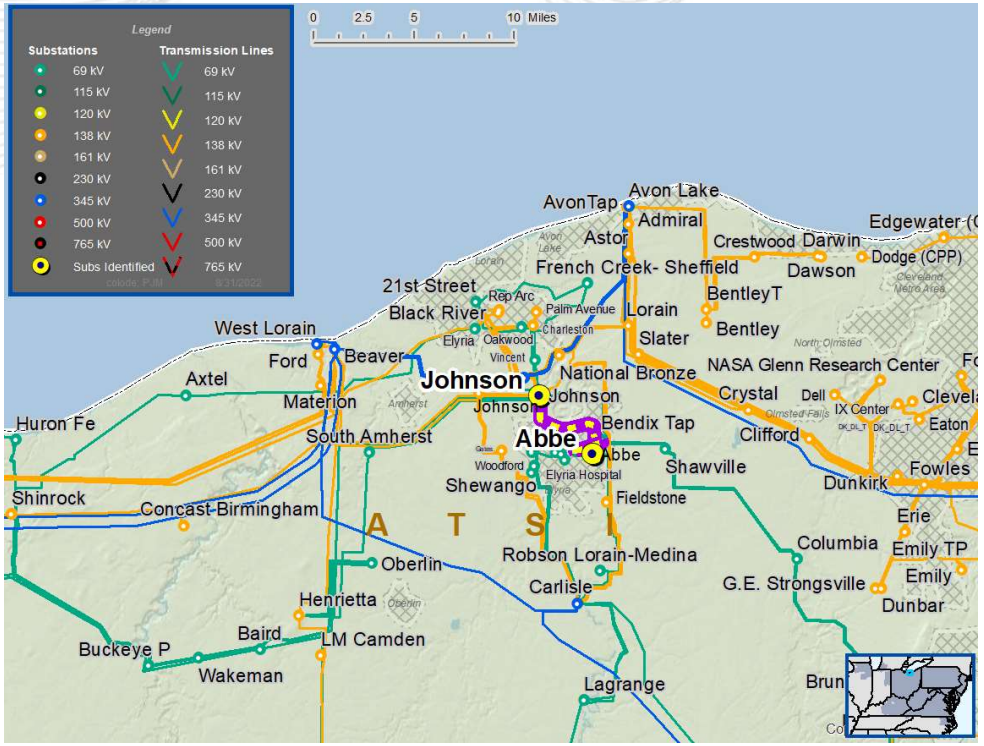
Alternatives: None

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Abbe to Johnson 69 kV	111/134/125/159

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2026



AEP Transmission Zone: Baseline Summerhill-Willow Grove 69kV Line Rebuild

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer case

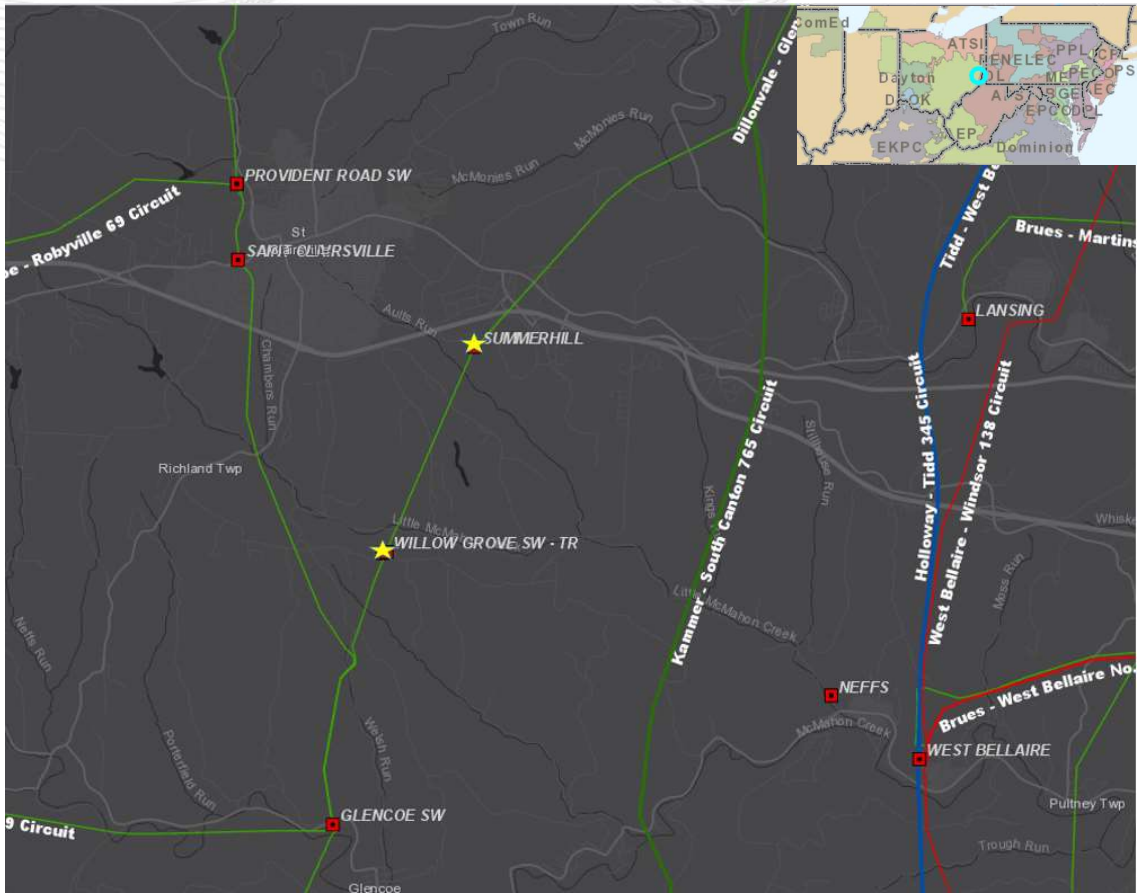
Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-T10

In 2027 RTEP summer case, The Summerhill-Willow Grove Switch 69kV line segment is overloaded for an N-1-1 contingency pair.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05SUMMERHI -05WILLGRSS 69kV	50/50/63/63



AEP Transmission Zone: Baseline Summerhill-Willow Grove 69kV Line Rebuild

Recommended Solution:

Rebuild the 1.8 mile 69kV T-line between Summerhill and Willow Grove Switch. Replace 4/0 ACSR conductor with 556 ACSR. (**B3733**)

Transmission Estimated Cost: $5.1M

Preliminary Facility Rating:

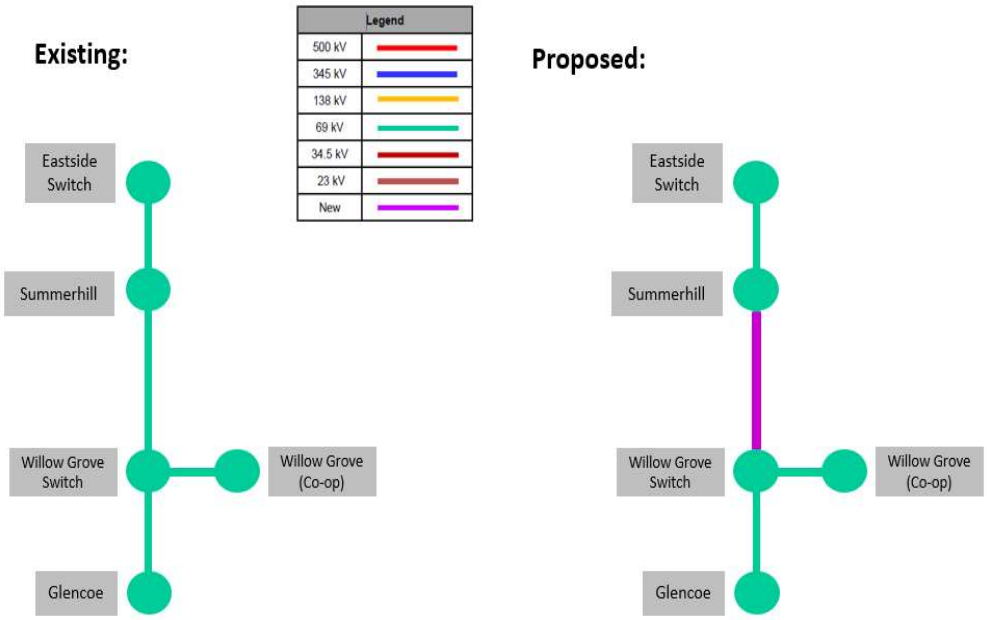
Branch	SN/SE/WN/WE (MVA)
05SUMMERHI -05WILLGRSS 69kV	82/90/107/113

Ancillary Benefits: Addresses potential M-3 facility condition needs, as documented by field personnel and AEP Asset Renewal groups. Existing structure conditions include broken down leads, broken molding, and cracked cross-bracing. This portion of line was originally constructed in 1946, primarily with wooden H-frame structures. The line has experienced over 680k CMI between 2015-2021 with 8 momentary and 2 permanent outages. There are 37 structures (46% of the line) with at least one open condition. There are 67 open conditions along the line.

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



AEP Transmission Zone: Baseline Rarden-Rosemount Cap Banks

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

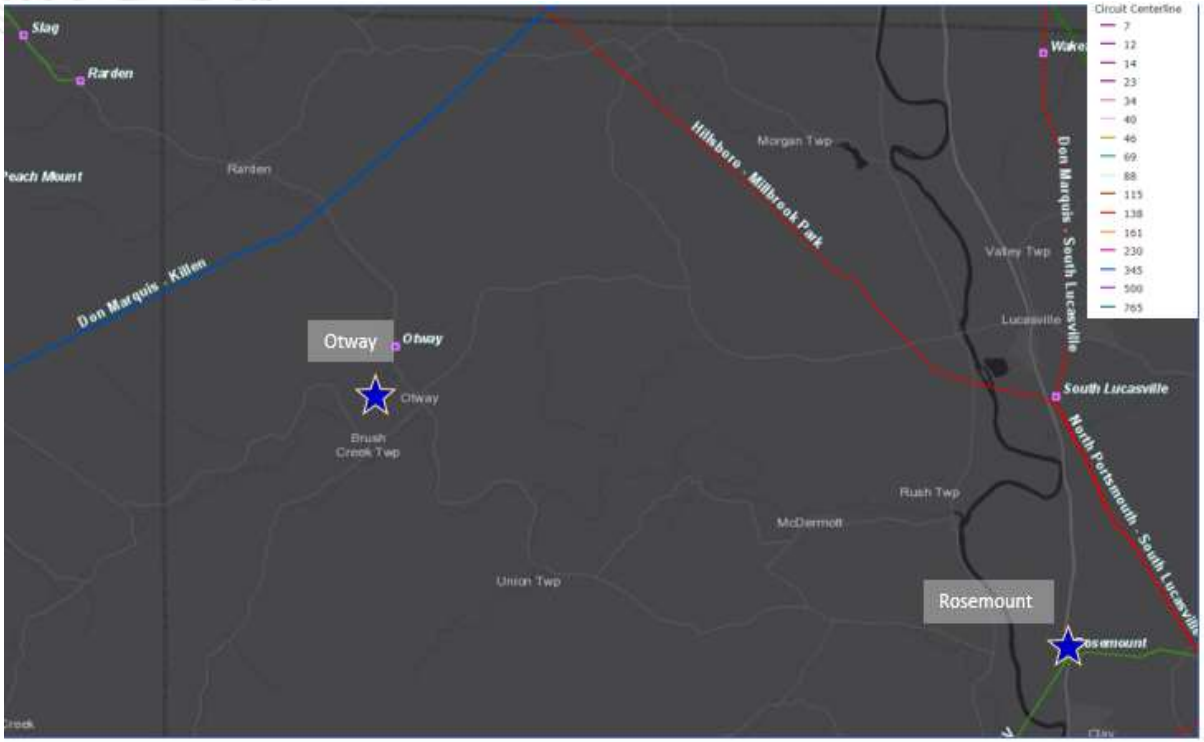
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-VD34 through 2022W1-AEP-VD37

In 2027 RTEP summer case, voltage-drop violations at Rarden switch, Otway station, Tick Ridge station, and Rarden station 69kV buses under a N-1-1 contingency scenario.



AEP Transmission Zone: Baseline Rarden-Rosemount Cap Banks

Recommended Solution:

Install a 7.7 MVAR, 69kV cap bank at both Otway station and Rosemount station to resolve N-1-1 voltage-drop violations (**B3734)**

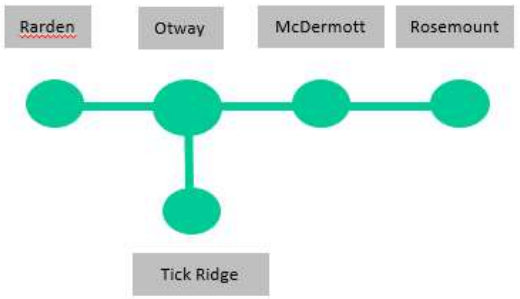
Transmission Estimated Cost: $1.73M

Required in-service date: 6/1/2027

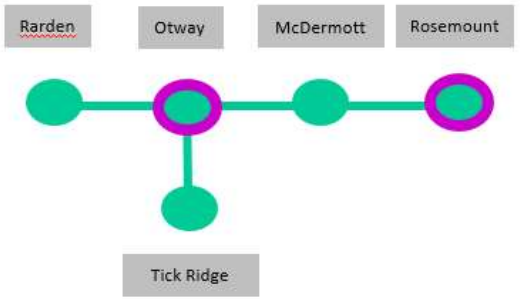
Projected in-service date: 6/15/2026

Previously Presented: 10/14/2022

Existing:



Proposed:



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

AEP Transmission Zone: Baseline Abingdon Station Upgrades

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

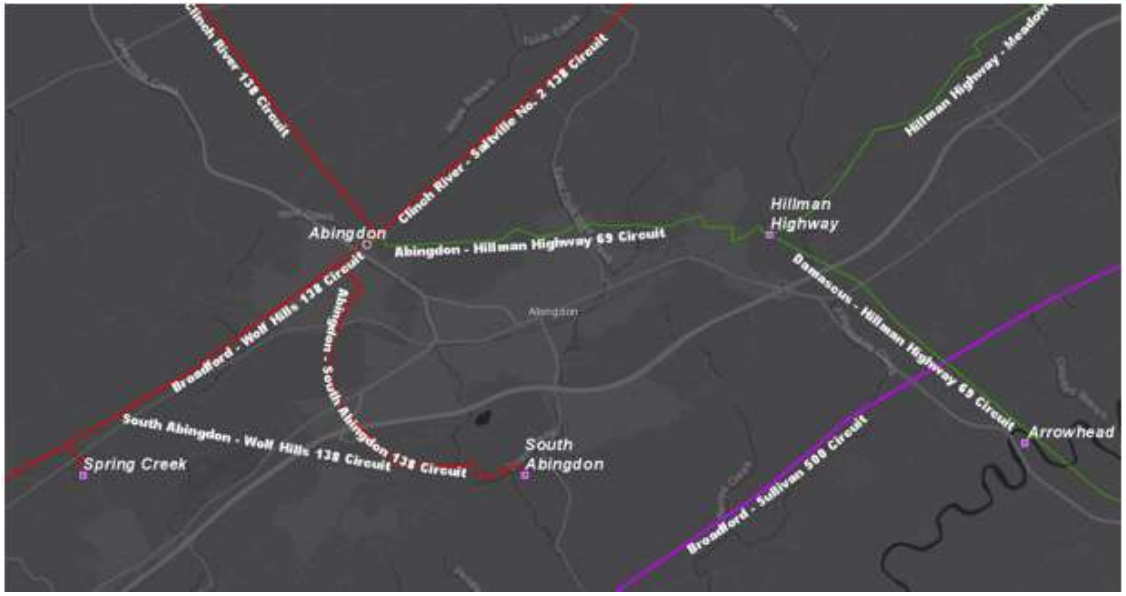
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP summer/winter cases

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-T3, 2022W1-AEP-T4, 2022W1-AEP-VM1 through 2022W1-AEP-VM3, 2022W1-AEP-VD1 through 2022W1-AEP-VD4

In 2027 RTEP summer/winter case, Thermal overload on the Arrowhead - Hillman Highway 69 kV line under multiple N-1-1 contingency pairs. In 2027 RTEP winter case, Voltage Mag. and Voltage Drop Violations at Arrowhead, Damascus, Hillman and South Abington 69kV buses under a N-1-1 contingency pair.



AEP Transmission Zone: Baseline Abingdon Station Upgrades

Recommended Solution:

- Terminate the existing Broadford – Wolf Hills #1 138 kV line into Abingdon 138 kV Station. This line currently bypasses the existing Abingdon 138 kV Station.
- Install two new 138 kV circuit breakers on each new line exit towards Broadford and towards Wolf Hills #1
- Install one new 138 kV circuit breaker on line exit towards South Abingdon for standard bus sectionalizing (**B3735**)

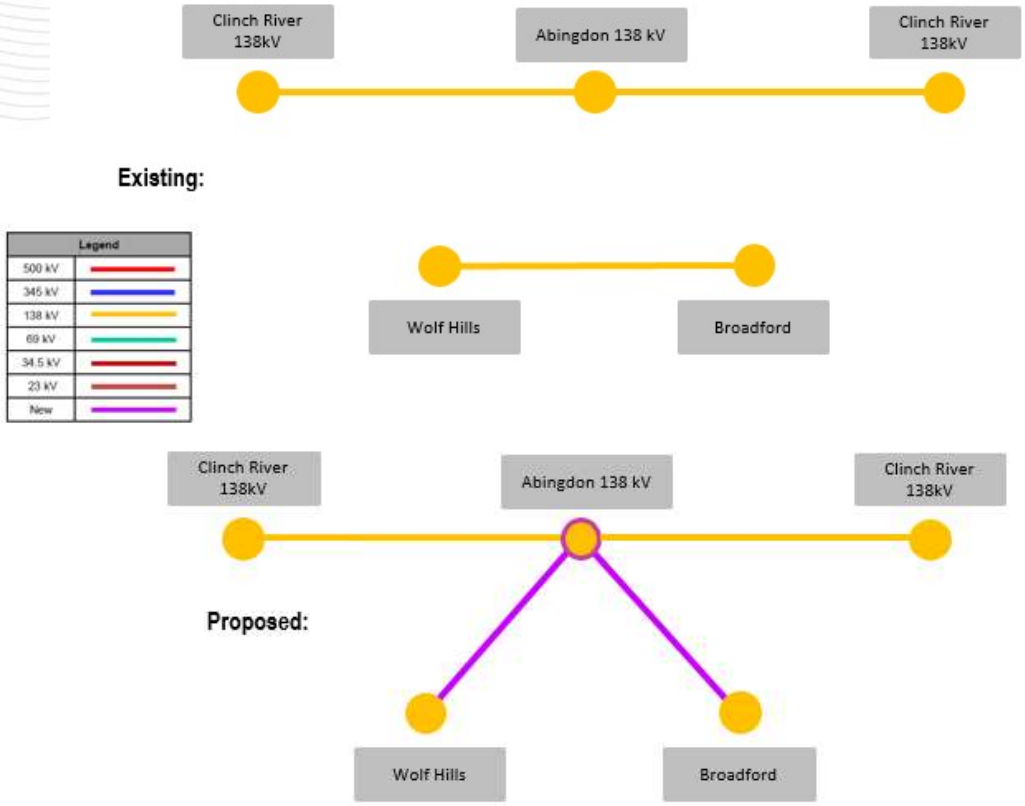
Transmission Estimated Cost: $8.48M

Ancillary Benefits: Operational flexibility is improved with the additional sources into Abingdon

Required in-service date: 6/1/2027

Projected in-service date: 6/1/2027

Previously Presented: 10/14/2022



AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

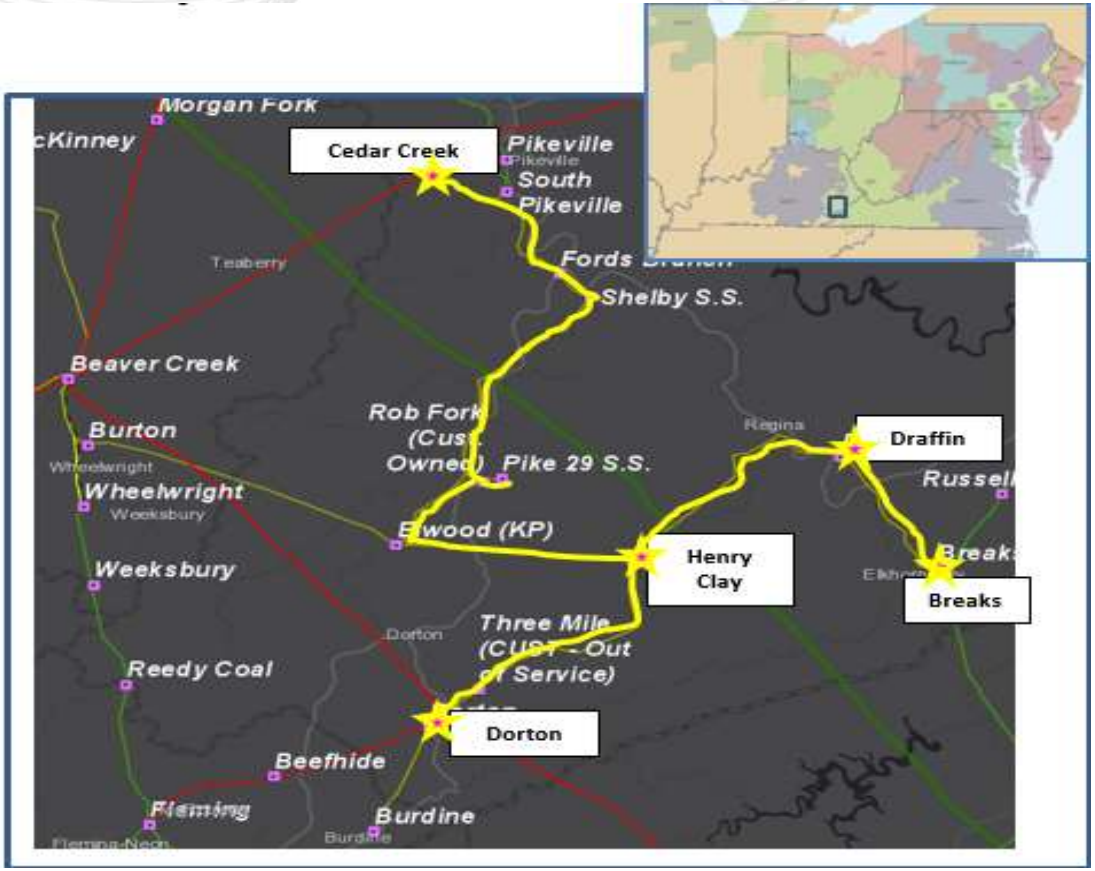
Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Winter case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: 2022W1-AEP-VM4 through 2022W1-AEP-VM21, 2022W1-AEP-VD5 through 2022W1-AEP-VD24

In 2027 Winter RTEP case, Dorton, Pike 29, Rob Fork, Burdine, Henry Clay, Draffin 46KV buses (along the Cedar Creek - Elwood and Breaks - Dorton – Elwood 46KV circuits) experience voltage magnitude and drop violations under multiple N-1-1 contingency scenarios.



AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

Recommended Solution:

Transmission Components:

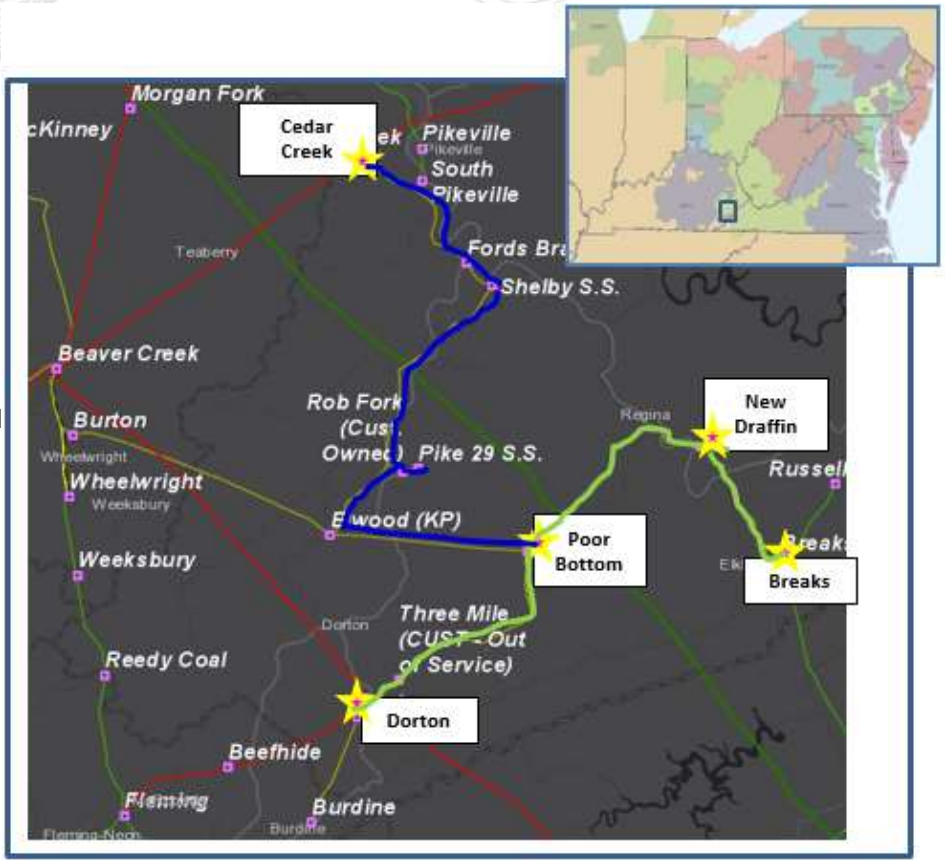
- Establish 69kV bus and new 69 kV line CB at Dorton substation. (**B3736.1**) $1.13 M
- At Breaks substation, reuse 72kV breaker A as the new 69kV line breaker. (**B3736.2**) $0.71 M
- Rebuild ~16.7 mi Dorton – Breaks 46kV line to 69kV. (**B3736.3**) $58.52
- Retire ~17.2 mi Cedar Creek – Elwood 46kV circuit. (**B3736.4**) $11.15 M
- Retire ~ 6.2 mi Henry Clay – Elwood 46kV line section. (**B3736.5**) $4.3 M
- Retire Henry Clay 46 kV substation and replace with Poor Bottom 69 kV station. Install a new 0.7 mi double circuit extension to Poor Bottom 69kV. (**B3736.6**) $3.42 M
- Retire Draffin substation and replace with a new substation. Install a new 0.25 mi double circuit extension to New Draffin substation. (**B3736.7**) $2.01M
- Remote End work at Jenkins substation. (**B3736.8**) $0.03 M
- Provide Transition fiber to Dorton, Breaks, Poor Bottom, Jenkins and New Draffin substations. (**B3736.9**) $0.41M
- Henry Clay S.S Retirement: . (**B3736.10**) $ 0.3 M
- Cedar Creek substation work: . (**B3736.11**) $0.44 M
- Breaks substation retire 46kV equipment: (**B3736.12**) $0.25 M
- Retire Pike 29 SS and Rob Fork SS: . (**B3736.13**) $0.42 M

Total Transmission Estimated Cost: $83M

Distribution Components:

- Serve Pike 29 and Rob Fork customers from nearby 34kV Distribution sources. . (**B3736.14**) $ 2.23 M (D cost)
- Poor Bottom substation install: . (**B3736.15**) $8.46 M (D cost)
- Henry Clay 46kV substation retirement: . (**B3736.16**) $0.82 M (D cost)
- New Draffin 69kV substation install: . (**B3736.17**) $6.66 M (D cost)
- Draffin 46kV substation retirement: . (**B3736.18**) $0.68 M (D cost)

Total Distribution Estimated Cost: $18.9M



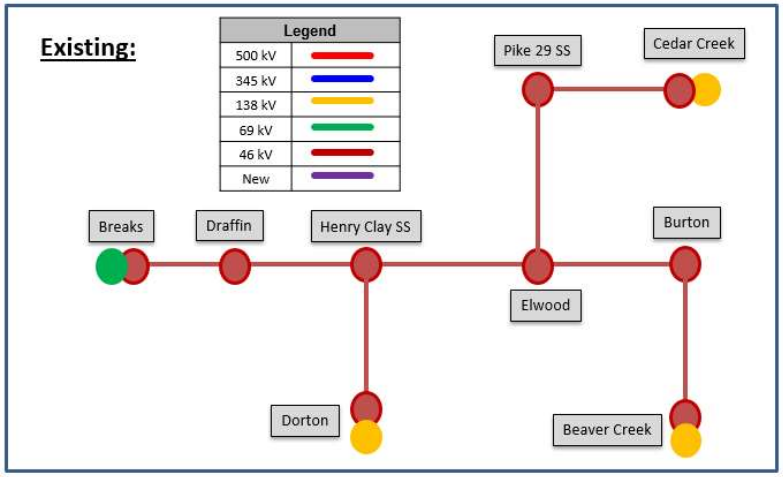
AEP Transmission Zone: Baseline Breaks - Dorton 69kV Conversion

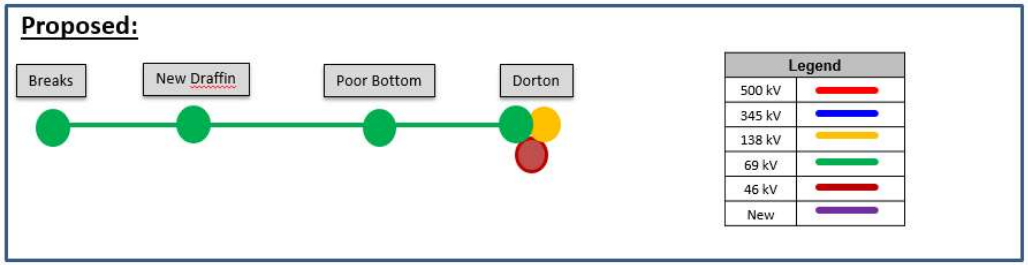
Ancillary Benefits: This proposal completely addresses identified supplemental needs on Cedar Creek – Elwood 46kV under Need AEP-2019-AP032 (presented 8/29/2019 W-SRRTEP), and Identified supplemental needs on Breaks – Dorton – Elwood 46kV circuit under AEP-2020-AP012 (presented 2/21/2020 W-SRRTEP). The proposal proposes retirement of roughly 23.4 mi of obsolete 46kV line.

Required in-service date: 12/1/2027

Projected in-service date: 7/31/2027

Previously Presented: 10/14/2022





AEP Transmission Zone: Baseline
Hyatt 138kV Breaker Replacements

Process Stage: Recommended Solution

Criteria: Short Circuit

Assumption Reference: 2027 RTEP Assumption

Model Used for Analysis: 2022 Series 2024 RTEP Short Circuit Model

Proposal Window Exclusion: Immediate Need, Below 200 kV

Problem Statement:

2022W1-SC-15 and 2022W1-SC-23

Hyatt 138kV breakers AB1 and AD1 are overdutied.

Existing Facility Rating: 50kA

Proposed Solution:

Replace the Hyatt 138kV breakers AB1 and AD1 with 63kA breakers **(B3764)**

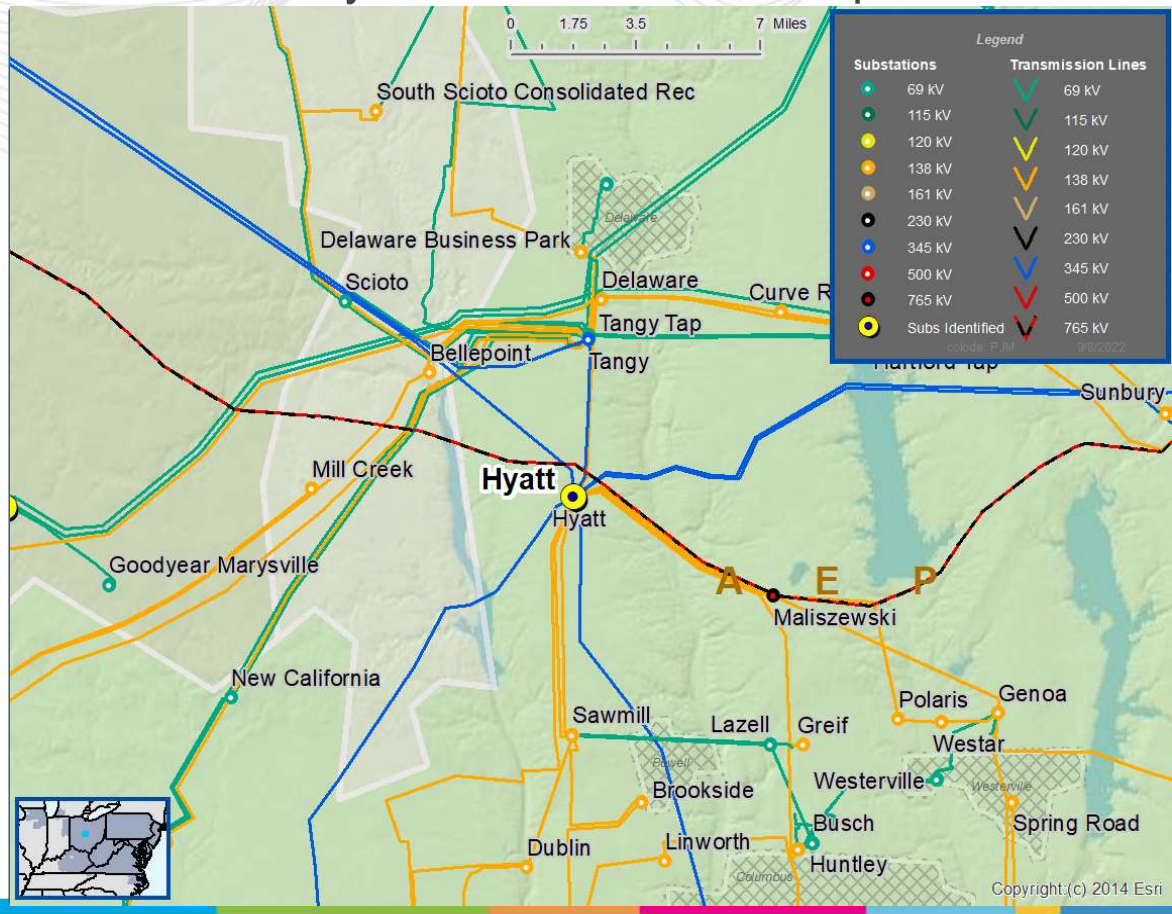
Existing Facility Rating: 63kA

Estimated Total Cost: $2M ($1M each)

Required In-Service: 06/01/2024

Projected In-Service: 06/01/2024

Previously Presented: 11/18/2022



EKPC Transmission Zone: Baseline
Fawkes-Duncannon Lane Tap 69 kV Rebuild

Process Stage: Recommended Solution

Criteria: EKPC 715 Criteria

Assumption Reference: EKPC Assumptions Presentation slides 3-10

Model Used for Analysis: EKPC's internal models representing 2026/27 winter peak conditions that were used for EKPC's annual system screening analysis for 2022 planning cycle. Includes Cooper Units 1 and 2 off with replacement generation imported from the north of EKPC system.

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement:

The Fawkes-Duncannon Lane Tap 69 kV line (LGEE-EKPC tie line) is overloaded for an N-1 outage.

Violation was posted as part of the 2022 Window 1: FG# 2022W1-EKPC-T1

Existing Facility Rating: 89SN/98SE, 128WN/134WE MVA

Proposed Facility Rating: 114SN/127SE, 166WN/174WE MVA

Proposed Solution:

Rebuild EKPC's Fawkes-Duncannon Lane Tap 556.5 ACSR 69 kV line section (7.2 miles) using 795 ACSR. **(b3762)**

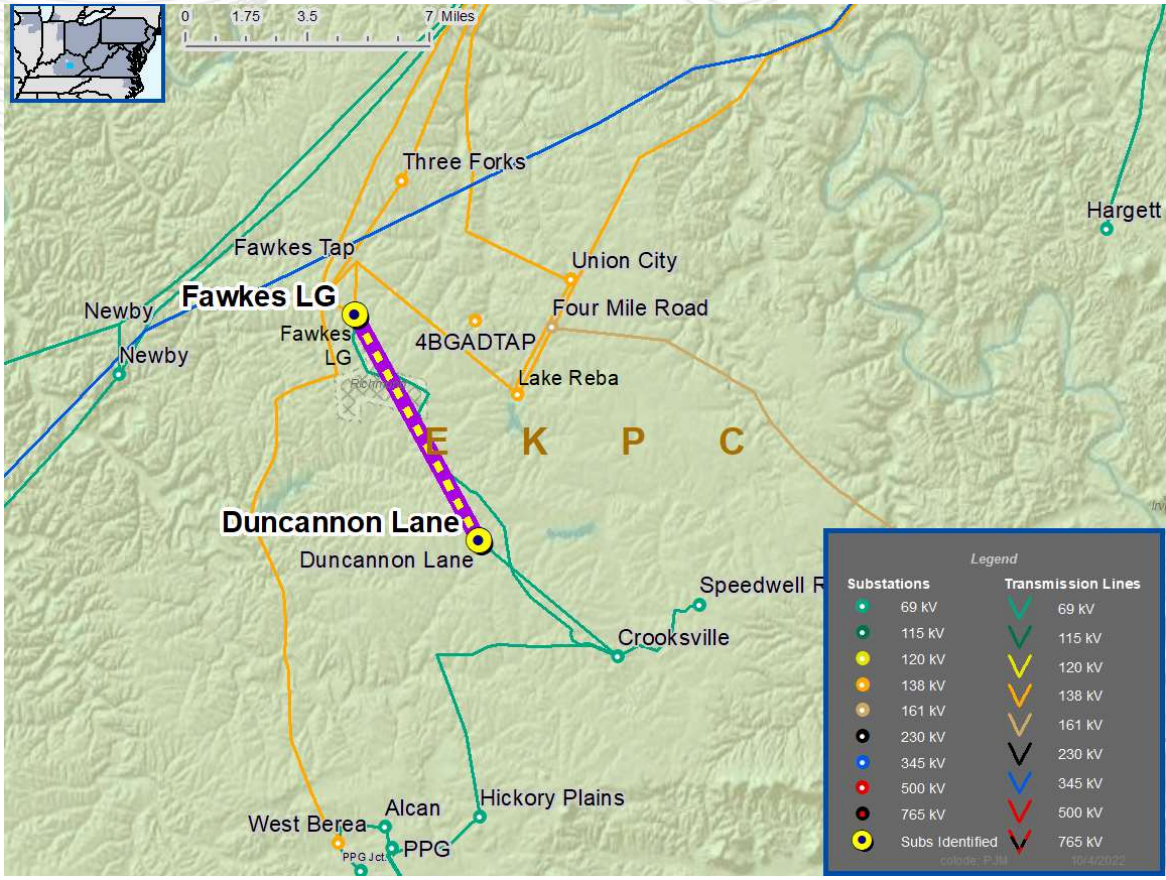
Estimated Cost: $8.5 M

Ancillary Benefits: Replacement of aging infrastructure associated with line section.

Required In-Service: 12/1/2026

Projected In-Service: 12/31/2024

Previously Presented: 10/14/2022



Planned Projects: Supplemental

Solutions of the M-3 Process

AEP Transmission Zone M-3 Process
Troutville, VA Area

Need Number: AEP-2021-AP001

Process Stage: Solutions Meeting 2/9/2022

Previously Presented: Needs Meeting 1/6/2021

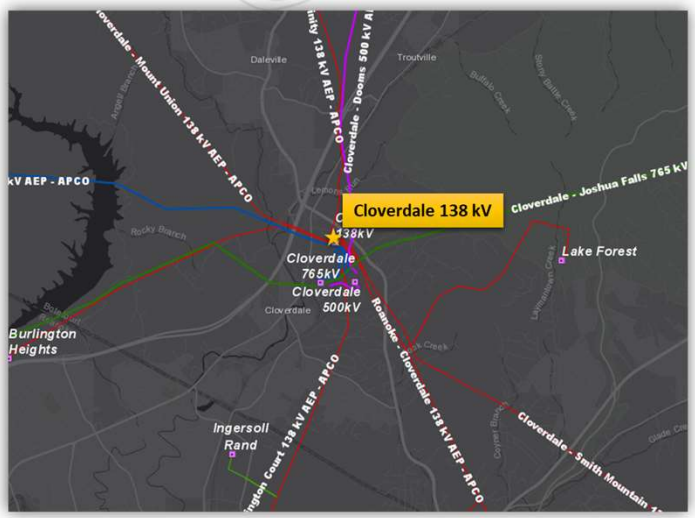
Supplemental Project Driver: Equipment Condition/Performance/Risk

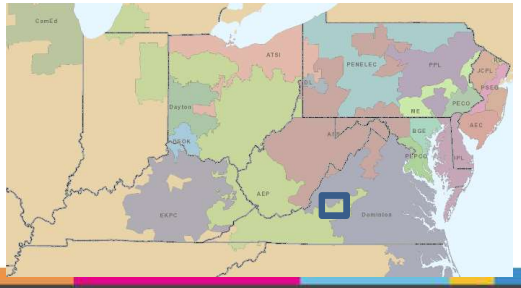
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Cloverdale Station:

- **345/138 kV Transformer #11A**
  - Transformer 11A was manufactured in 1972 with identified upward trending insulation power factor which indicates increased particles in the oil as well as elevated levels of ethylene indicating increased decomposition of the insulating paper materials, decreasing the units ability to withstand electrical faults
  - Unit leaks oil
  - Connected in parallel with transformer 11B; high-side connected directly to 345 kV bus #1 exposing it to faults and scheduled maintenance outages
- **345/138 kV Transformer #11B**
  - Transformer 11B was manufactured in 1997 with increased tertiary bushing power factor indicating capacitive layer deterioration. The change in bushing dielectric data indicates the tertiary bushings are at greater risk of failure or loss of service of the transformer. Also, observed elevated levels of carbon monoxide and carbon dioxide indicates decomposition of the paper insulation that impairs the units ability to withstand future short circuit or through fault events
  - Unit leaks oil
  - Connected in parallel with transformer 11A; high-side connected directly to 345 kV bus #1 exposing it to faults and scheduled maintenance outages
- **345/138 kV Transformer #3**
  - High-side connected to 345 kV bus #2 via Motor Operated Air-Break Switch (MOAB) exposing the bus to momentary transformer fault events
- 31 of the 94 microprocessor relays in the Cloverdale 138 kV Station were commissioned between 2003 and 2020 utilize obsolete firmware
- 69 kV hook-stick circuit breaker and switcher disconnect switches identified in need of replacement with Gang Operated Air-Breaker Switches





Need Number(s): AEP-2021-AP001

Process Stage: Solutions Meeting 2/9/2021

Proposed Solution:

Cloverdale Station

- Replace 345/138 kV Transformer 11A & 11B with new 345/138 kV, 675 MVA Transformer 11 and reconnect to the 138 kV structure via a new 138 kV tie-line with 3 custom single-pole structures outside of the station in order to keep storage/driving space within the station. Install two new 345 kV 5000A 63 kA breakers to connect the new transformer and existing transformer 3 into a string position in the 345 kV yard.
- Replace all 69 kV hook-stick switches new 2000 A GOAB switches.

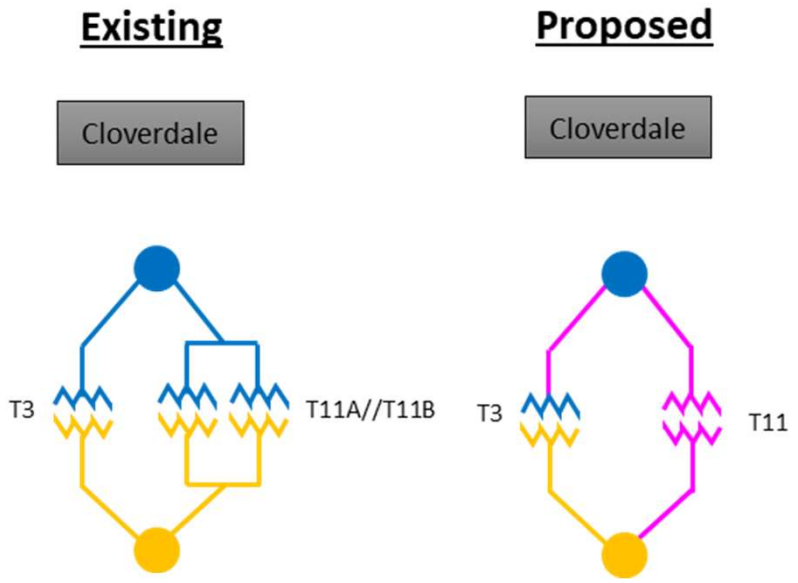
Total Estimated Transmission Cost: $12.33 M

Ancillary Benefits:
Installation of 2 new 345 kV circuit breakers will allow for the high-side of the new 345/138 kV transformer 11 and the existing 345/138 kV transformer 3 to be located in a breaker and a half position, preventing an outage of the 345 kV buses for loss of either transformer.

Alternatives Considered:
No cost effective alternatives were identified.

Projected In-Service: 10/31/2025

Project Status: Scoping



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

ATSI Transmission Zone M-3 Process
Delta/Wauseon Area

Need Number: ATSI-2021-027
Process Stage: Solution Meeting – 07/12/2022
Previously Presented: Need Meeting – 11/30/2021

Supplemental Project Driver(s):
Operational Flexibility and Efficiency
Infrastructure Resilience

Specific Assumption Reference(s)

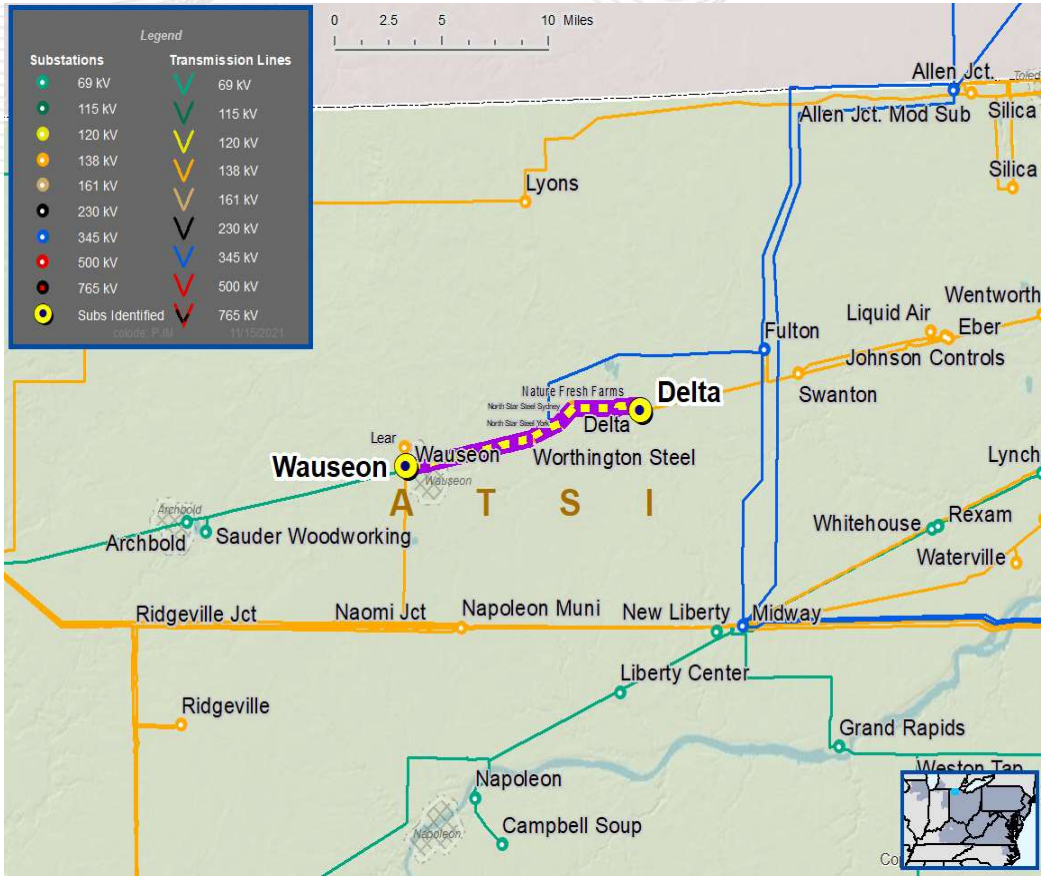
- System Reliability and Performance
- Load at risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Add/Expand Bus Configuration

- Loss of substation bus adversely affects transmission system performance
- Reduce amount of exposed potential local load loss during contingency conditions.
- Accommodate future transmission facilities

Add/Replace Transformers

- System concerns related to loss of an existing transformer or other contingency scenarios at a specific voltage level(s)



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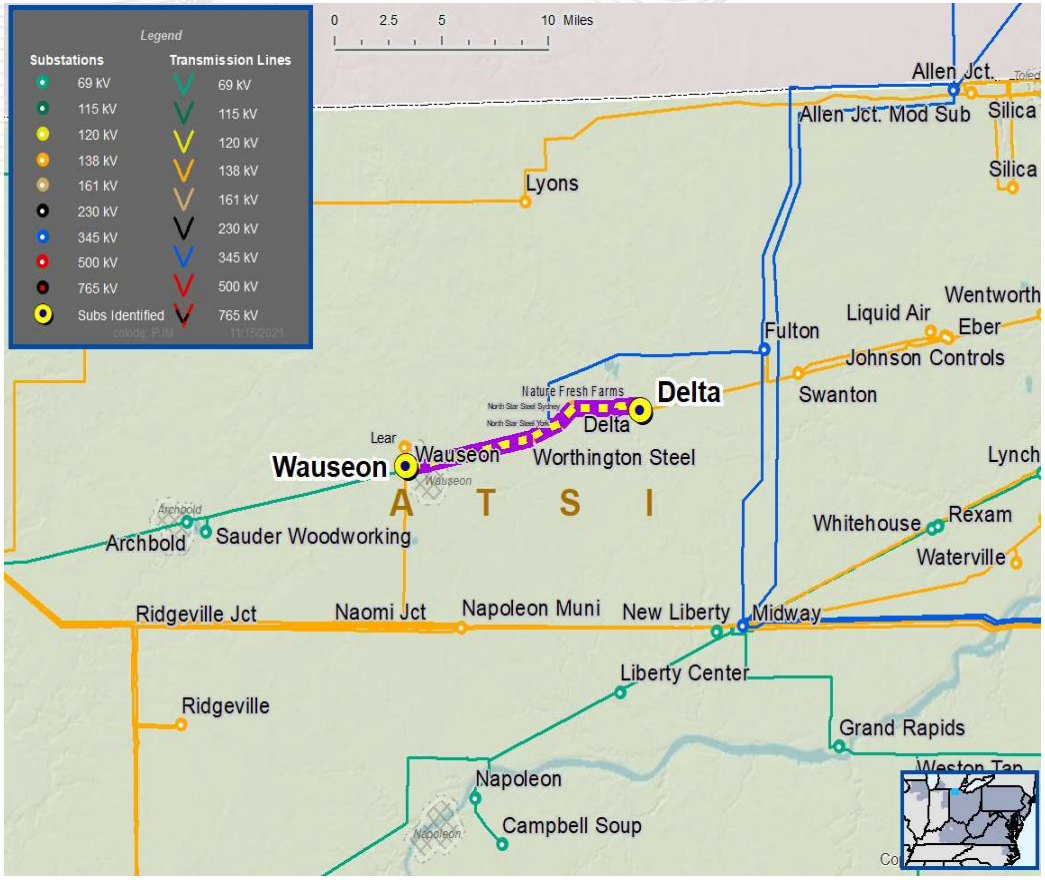
ATSI Transmission Zone M-3 Process
Delta/Wauseon Area

Need Number: ATSI-2021-027
Process Stage: Solution Meeting – 07/12/2022
Previously Presented: Need Meeting – 11/30/2021

Problem Statement

- The Delta/Wauseon area is a concentrated load pocket with future load growth expected. Existing customers planning for future load growth, and new transmission load connections in progress with load expected to grow to approximately 500 MVA and 9,000 customers in the near term.
- Under an N-1-1 contingency, post-contingency voltage on 138 kV busses is near emergency minimum of 0.92 p.u. with approximately 200 MVA and 9,000 customers at risk. Under same contingency set, and area capacitor bank off, low voltages with near voltage collapse on the 138 kV system in the area.
- Also, under an N-1-1 contingency results in voltage near criteria limits on a radial 345 kV line with approximately 300 MVA of load at risk.



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ATSI Transmission Zone M-3 Process
Delta/Wauseon Area

Need Number: ATSI-2021-027
Process Stage: Solution Meeting – 07/12/2022
Previously Presented: Need Meeting – 11/30/2021

Proposed Solution:

- Install two 345 kV circuit breakers at Melbourne 345 kV Substation
- Install two 345-138 kV transformers
- Construct a four breaker (future 6) 138 kV ring bus at Melbourne Substation
- Loop in the Delta-Wauseon 138 kV line into Melbourne 138 kV Substation
- Install two 138 kV line switches, one near Lear tap and one near Worthington tap
- Install one 138 kV circuit breaker at Delta 138 kV Substation

Line Ratings:

Wauseon-Melbourne 138 kV Line:

After proposed project: 278/343 MVA SN/SE

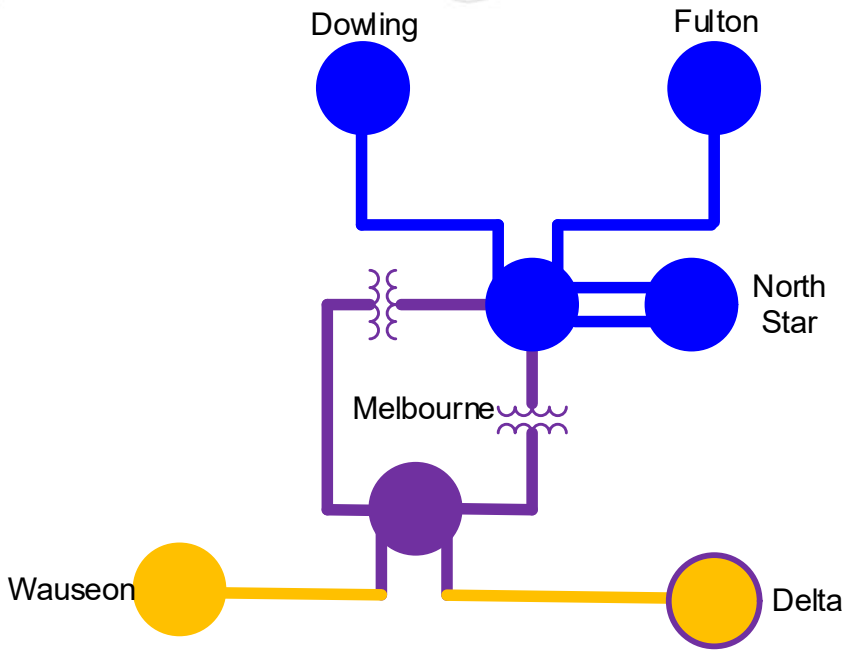
Delta-Melbourne 138 kV Line:

After proposed project: 278/343 MVA SN/SE

Alternatives Considered:

- Construct a new four breaker 345 kV ring bus. Construct a six breaker 138 kV ring bus and tie it to the 345 kV station with transformation. Re-terminate the Fulton-North Star Steel Sydney 345 kV line into the new 345 kV station. Expand Fulton substation to install a second 345/138 kV transformer. Expand Delta substation to install a second line from Fulton-Delta 138 kV. Rebuild the Delta Wauseon 138 kV line as double circuit and loop in the double circuit line into the new 138 kV Ring Bus. ($107.2M)

Estimated Project Cost: $25.1M
Projected In-Service: 12/01/2025
Status: Pre-Engineering
Model: 2021 Series 2026 Summer RTEP 50/50

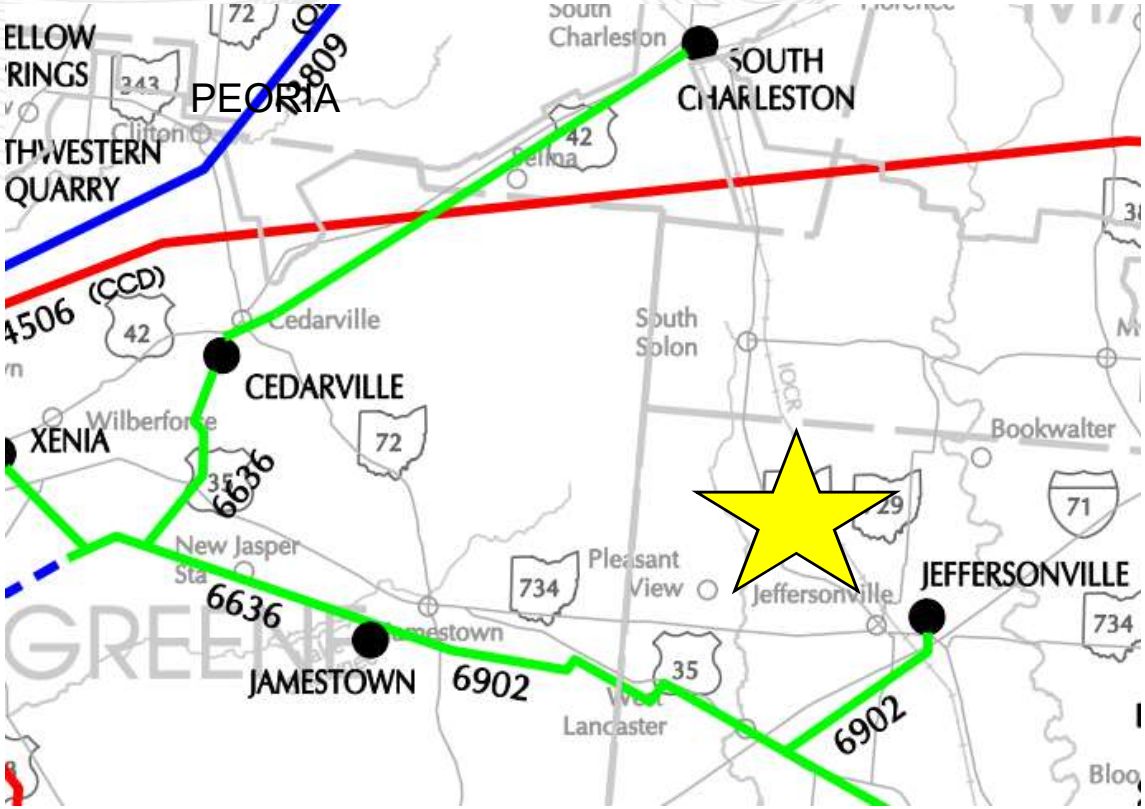


Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Need Number: Dayton-2022-004
Previously Presented: Need Presented, 8/19/2022
Process Stage: Solution Presentation, 12/6/2022
Project Driver: Customer Request
Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Problem Statement:

- AES has received multiple large industrial customer requests for service in the Jeffersonville area.
- Total load requests have ranged from 100MW to several hundred megawatts
- Presently, Jeffersonville has certified 2,000-acres for industrial development with over 250 acres currently under option by customers.
- AES projects the site will be capable of supporting over 1,000 MWs of new manufacturing related load based upon the total number and size of customer requests.
- AES currently has a supplemental project, S0323, that proposes to build a 69kV line from South Charleston – Jeffersonville. AES believes that the magnitude of the load requests in the area exceed the capabilities of the existing project.



= 765kV
= 345kV
= 138kV
= 69kV

Model: 2021 RTEP Series, 2026 Summer Case

Dayton Transmission Zone M-3 Process

Need Number: Dayton-2022-004
Previously Presented: Need Presented, 8/19/2022
Process Stage: Solution Presentation, 12/6/2022
Project Driver: Customer Request
Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Proposed Solution:

- **Fayette Substation:**
  - The newly established Fayette Substation will serve as the primary source for the Jeffersonville area and will step service down from 345kV to 138kV and 69kV. This substation is located central to the largest developing load center in the AES Ohio area supporting the electric vehicle manufacturing industry developing in the area. The new substation called Fayette will have a breaker and half 345kV design, two 345/138kV 450MVA transformers, a breaker and half 138kV design, a 138/69kV 200MVA transformer, 138kV capacitor, and 69kV feed to a new Panther Substation. A 0.25-mile 138kV extension will span from AES's Fayette Substation to a 138kV delivery point to serve the first 140MW development. **Estimated Transmission Cost: $33.9M, ISD 8/1/2024**
- **Madison-Fayette 1 & 2 345kV Lines*:**
  - AES will construct a 13-mile double circuit 345kV line from Madison to Fayette Substation utilizing bundled 1024.5 ACAR 30x7 conductor. The new 345kV transmission lines will provide the primary feed into the new Fayette Substation and Jeffersonville, Ohio region which will be the primary load center between Dayton, Cincinnati, and Columbus, Ohio.

  Estimated Transmission Cost: $51.2M, ISD 8/1/2024
- **Madison Substation*:**
  - AES will establish a new 3-bay breaker and half 345kV substation at Madison. Madison plays a critical role in sourcing the emerging load center while also improving reliability by looping present day radial loads at Cedarville, Jeffersonville, and South Charleston. The Madison Substation will have a single 345/69kV transformer and will have 4-345kV line exits. **Estimated Transmission Cost: $27M, ISD 8/1/2024**
- **Jeffersonville 69kV Substation Relocation & Retirement:**
  - Retire the existing radial Jeffersonville Substation that is located in floodplain and not conducive to further expansion for an additional 69kV source. The retired substation will be replaced with a new 69kV looped substation called Panther. The new Panther Substation will have three 69/12kV 30MVA distribution transformers. The new Panther sub will be designed as a 69kV breaker and a half station. **Estimated Transmission Cost: $15.5M, ISD 12/31/2025**
- **6946 69kV Reroute & Extension*:**
  - Establish a new ~1.5-mile 69kV transmission line from Fayette Substation to Panther Substation using 1351 AAC conductor. Reroute and upgrade to 1351 AAC conductor approximately 5.5 miles of line from Panther Substation to Octa Substation.

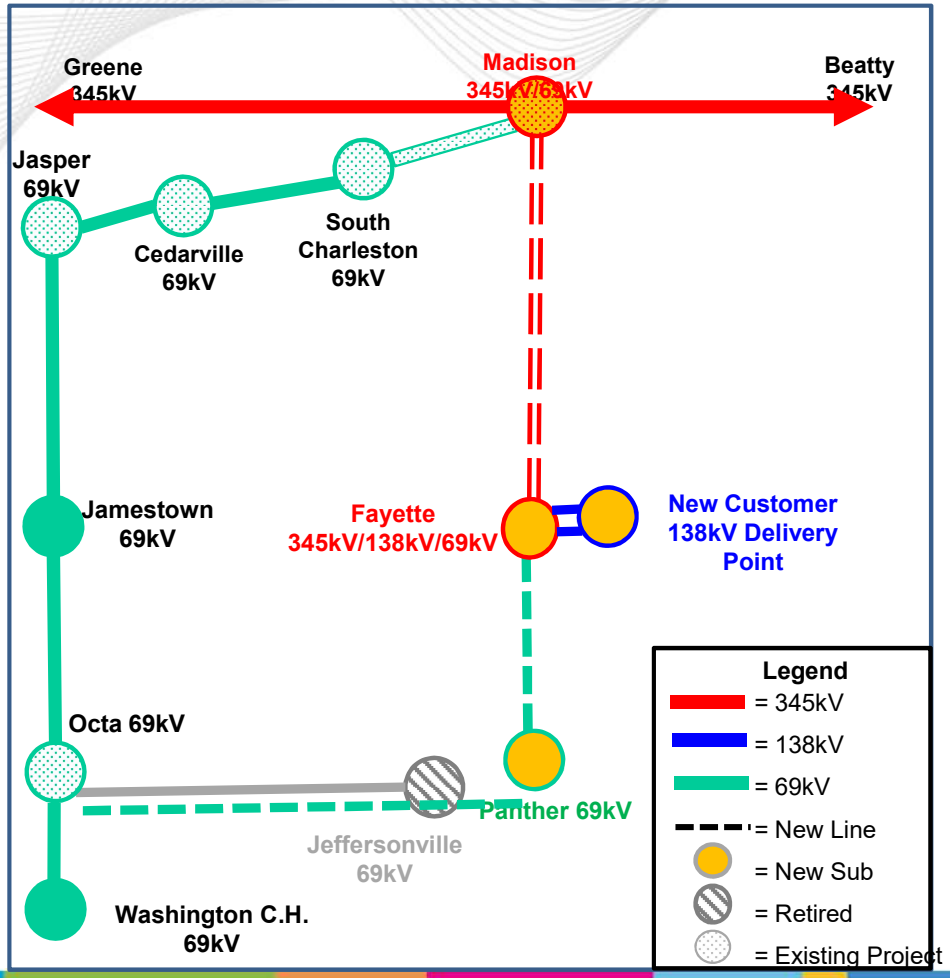
  Estimated Transmission Cost: $17.5M, ISD 12/31/2025

Total Cost : $145.10M

*Approximately $10M of this Solution will take the place of Supplemental Projects s0322 and s0323. The previous projects were scoped primarily to loop radial load and not serve major development.

Alternatives Considered:

- Madison 345/138kV Transformer & Madison-Fayette 1&2 138kV Lines
  Estimated Total Transmission Cost: $120.9M, ISD 8/1/2024
  Not selected due to putting primary transformation 12 miles from load center.
- Madison-Fayette 345kV Line & N. Wilmington 345kV line:
  Estimated Total Transmission Cost: $196.4M, ISD 8/1/2024
  Not selected due to higher cost.



AEP Transmission Zone: Supplemental Northern Melita Area Improvements

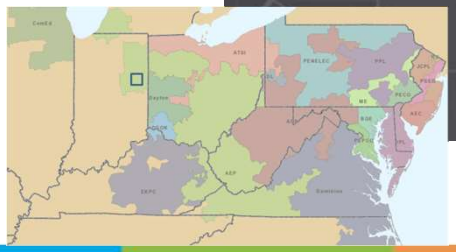
Need Number: AEP-2019-IM017
Process Stage: Solutions meeting 1/21/2022
Previously Presented: Needs Meeting 04/23/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

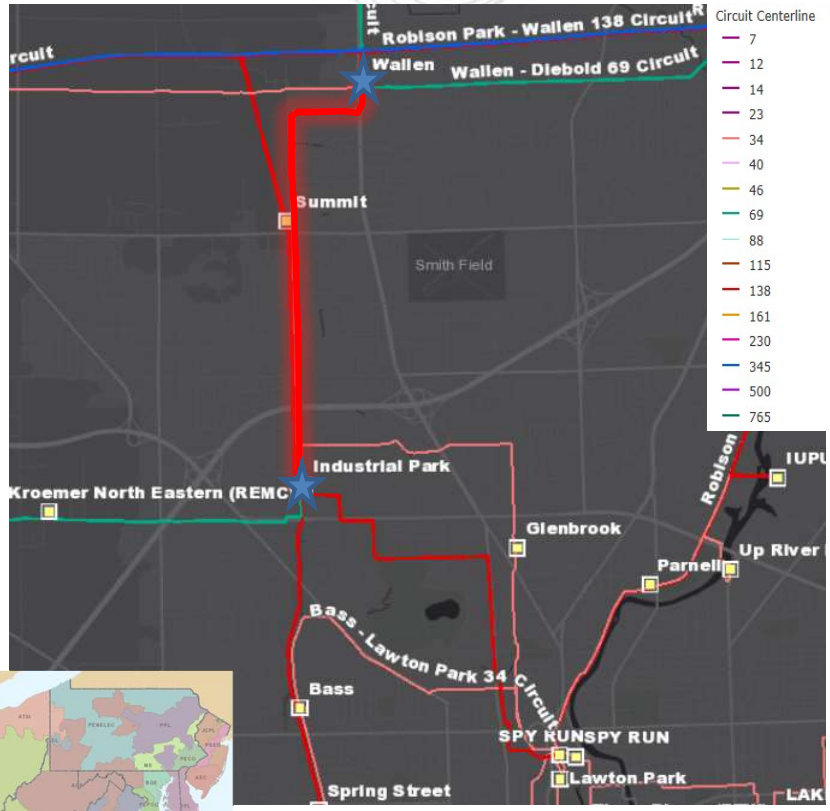
Industrial Park – Wallen 34kV (~3.3 Miles)

- 1925 vintage steel lattice construction
- There are currently 5 open conditions on this line with majority being structure issues. The O&M cost of the line is expected to increase as the age of the line increases.
- Six wired Copper conductor with copper weld shield wire. Copper conductors become brittle with age and Copper weld conductor has long been obsolete

Industrial Park 138kV

- Breakers F, D & E 34kV
  - 1967 vintage Oil breakers
  - Fault Operations: F(18), D(0) & E(14) – Recommended(10)
- Breakers G 69kV
  - 1967 vintage Oil breakers
  - Fault Operations: G(50) – Recommended(10)
- Oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require. Finding spare parts for these units is difficult or impossible, and these models are no longer vendor supported.
- Multiple wood pole 138kV transformer lead support structures inside Industrial Park Station



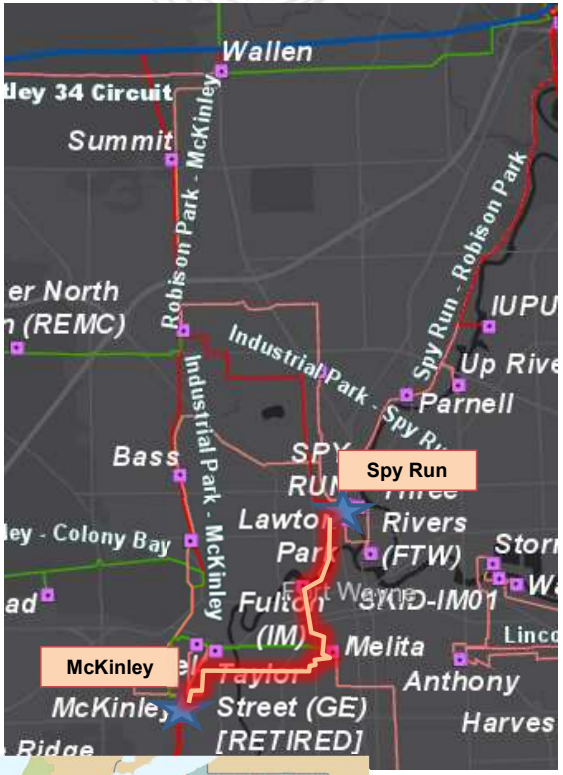


AEP Transmission Zone: Supplemental Northern Melita Area Improvements

Need Number: AEP-2020-IM006
Process Stage: Solutions meeting 1/21/2022
Previously Presented: Needs Meeting 2/21/2020
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

McKinley 138/69/34.5kV
- Breakers G 34kV
  - 1956 vintage Oil breakers
  - Fault Operations: G(10) – Recommended(10)
- Oil filled breakers have much more maintenance required due to oil handling that modern, vacuum counterparts do not require. Finding spare parts for these units is difficult or impossible, and these models are no longer vendor supported. Oil spills can result in significant costs associated with mitigation.

McKinley – Spy Run 34.5kV line asset (~5 miles)
- 1960 vintage wood crossarm construction
- There are currently 42 open conditions on this line across 37 unique structures (27% of the line) including, but not limited to, split crossarms, rot top, rot heart and broken grounds.
- Structures are in the river flood plains and in the flood control berm.



AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

Need Number: AEP-2020-IM025
Process Stage: Solutions meeting 1/21/2022
Previously Presented: Needs Meeting 11/20/2020
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Industrial Park 138/69/34.5kV Station:

138/69/34.5kV Transformer 1

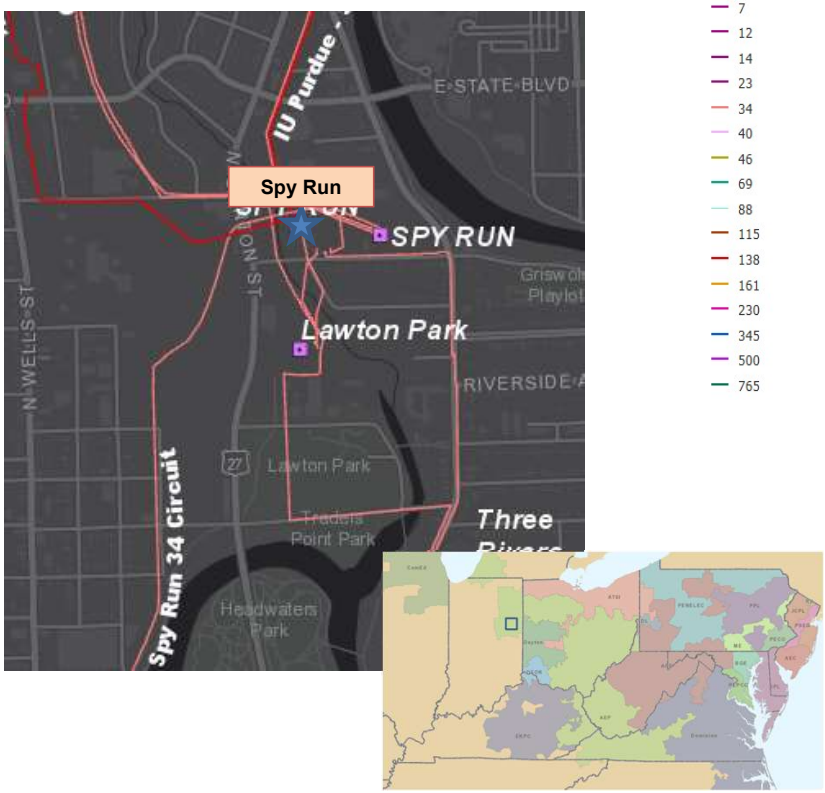
- Manufactured in 1967
- Transformer has increased levels of CO2 indicated in the dissolved gas analysis.
- Level of CO2 indicates decomposition of the paper insulating materials which impairs units ability to withstand faults.
- The downward Interfacial Tension trend paired with upward power factor trend indicate that there are increased particles within the oil, which decreases the dielectric strength of the transformer.
- Doble tests on the bushings indicate changes in the bushing power factor and capacitance. This change indicates these bushings are at a greater risk of failure.

AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

Need Number: AEP-2021-IM004
Process Stage: Solutions meeting 1/21/2022
Previously Presented: Needs Meeting 02/17/2021
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Spy Run 138/34.5kV Station

138/34.5kV Transformer 3
- Manufactured in 1975
- Per DGA analysis, this transformer has increased levels of gassing of Ethylene, Ethane, and CO2
- The low level of dielectric strength indicates acid coating insulation with sludge ready to deposit in the transformer, increasing the risk of failure.
- The levels of moisture and dielectric strength indicate the insulation system is in poor condition, reducing the ability of the unit to withstand through faults.



AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

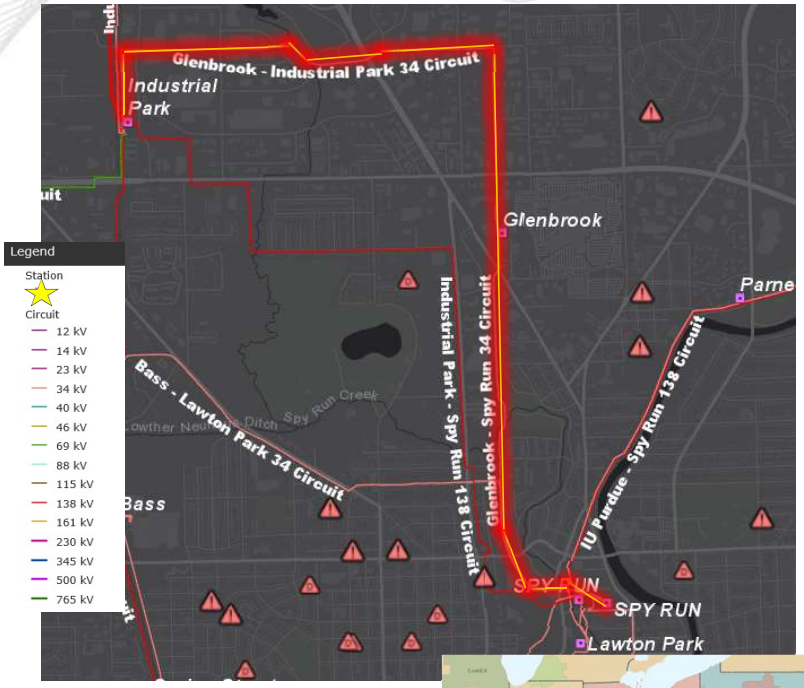
Need Number: AEP-2021-IM005
Process Stage: Solutions meeting 1/21/2022
Previously Presented: Needs Meeting 3/19/2021

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

- **Industrial Park – Spy Run 34.5kV ~4.2 Miles**
  - Wood pole line originally constructed in 1965
  - 45 structures have at least one open condition (37% of line) including Rot Top, Insect Damage and Woodpecker holes
  - 18 structures were assessed by an aerial drone and 12 assessed by ground crew. 6 structures had heart rot, 12 structures had insect/woodpecker damage.
  - 121,563 CMI over the past 5 years with 2 outages
  - Structures do not meet 2017 NESC Grade B loading criteria, do not meet current AEP structural strength requirements, and do not meet the current ASCE structural strength requirements.

Model: N/A

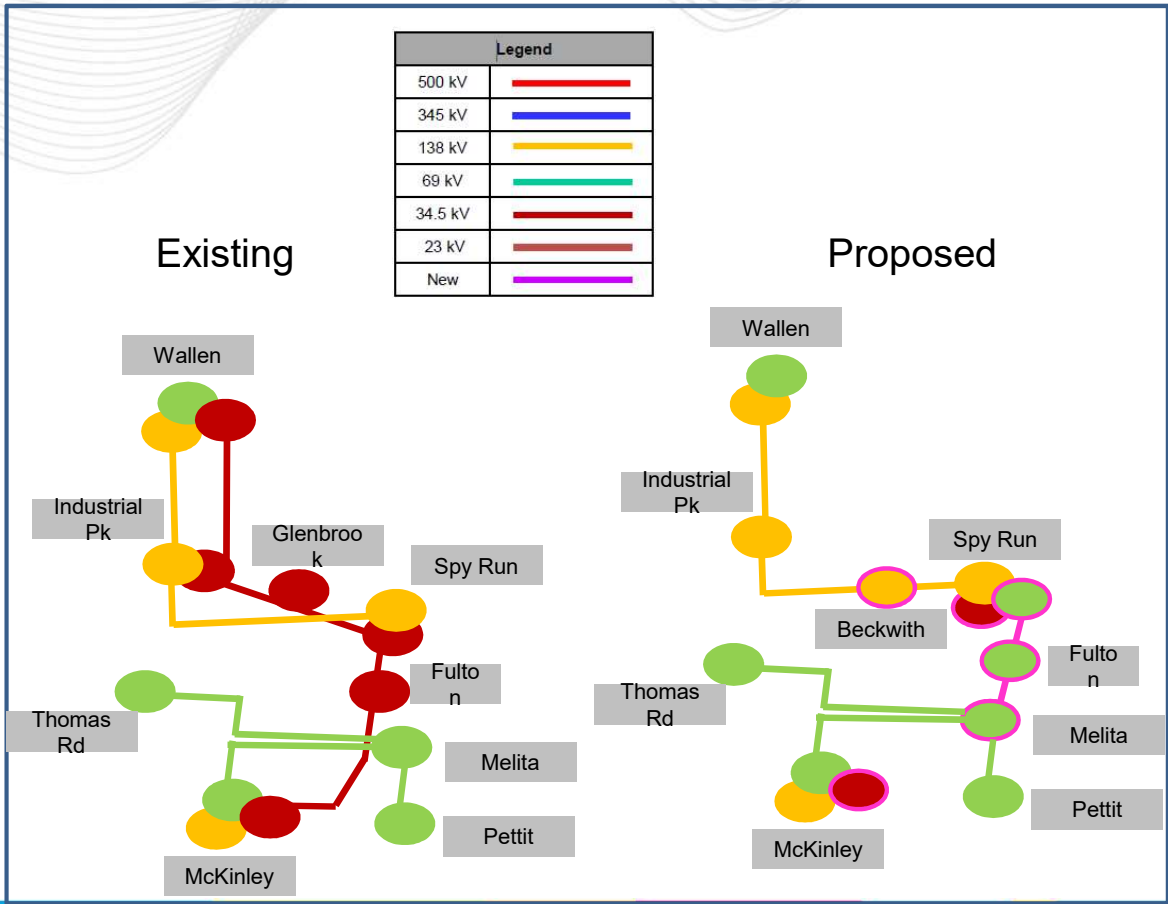


AEP Transmission Zone: Supplemental Northern Melita Area Improvements

Need Number: AEP-2019-IM017, AEP-2020-IM025, AEP-2021-IM004, AEP-2021-IM005 & AEP-2020-IM006
Process Stage: Solutions Meeting 1/21/2022
Proposed Solution:

General Solution Summary:

The Northern Ft Wayne 34.5kV network is comprised of 1920's steel and 1960's wood that have been identified as needs on the previous slides. By constructing a new distribution station to replace Glenbrook and transformer replacements at Industrial Park, Spy Run and Fulton, AEP is reducing the amount of urban line rebuild to less than 20% of the original mileage and retiring the rest. Not only will this save ratepayer investment, but will also reduce the impact to the urban city center and will remove the 34.5kV drop-and-pick operating procedures from this segment of Fort Wayne.



AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

Need Number: AEP-2019-IM017, AEP-2020-IM025, AEP-2021-IM004, AEP-2021-IM005 & AEP-2020-IM006
Process Stage: Solutions Meeting 1/21/2022
Proposed Solution:

Spy Run-Melita 69kV
- Rebuild the Spy Run – McKinley 34.5kV line as the ~2.2 mile Spy Run – Melita 69kV line and retire the remaining 2.8 miles.
  Estimated Cost: $12.15M – $24.8M depending on route considerations and underground construction through this heavily developed urban area.

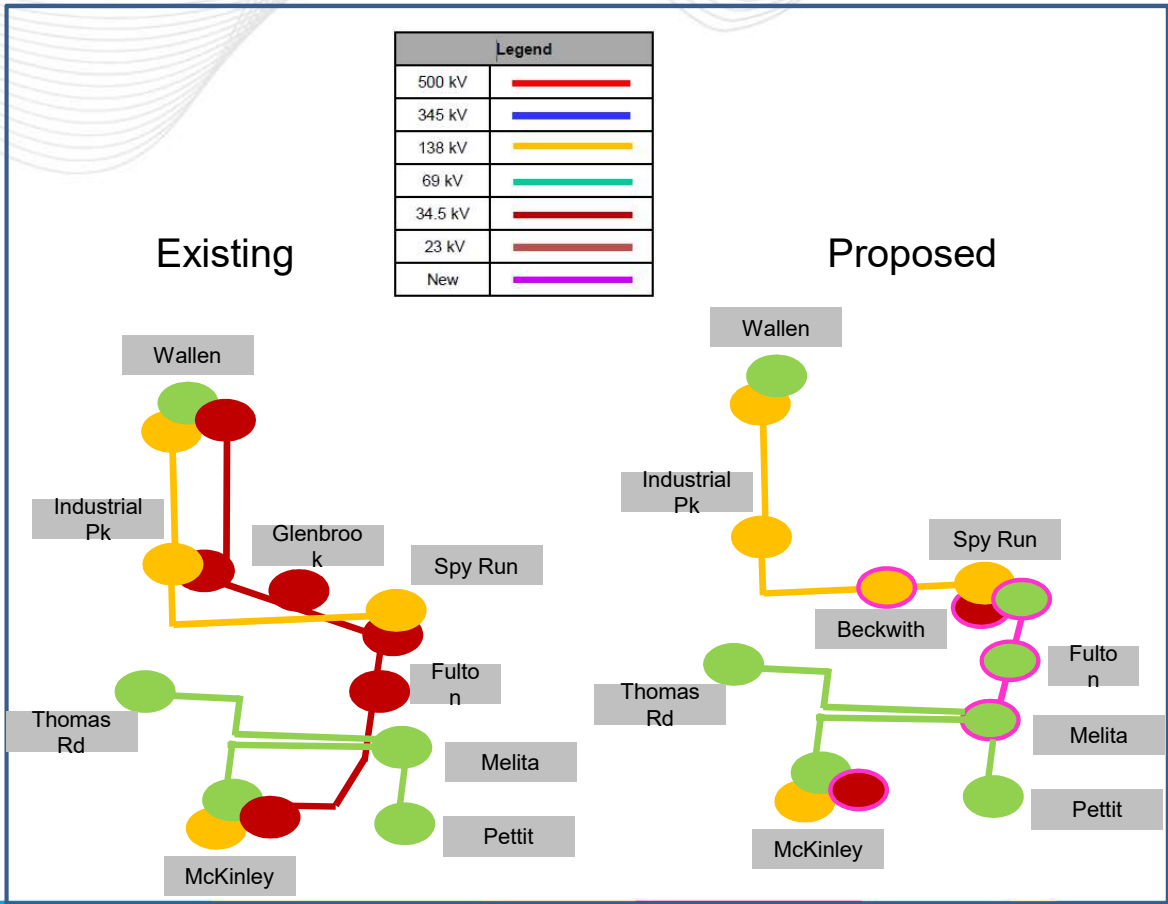
Melita Station
- Add a 69kV CB to Melita station.
  Estimated Cost: $1.2M

Fulton Station
- Rebuild the through-path of Fulton 34.5/12kV station at 69kV and replace the transformer with a 69/12kV unit.
  Estimated Cost: $0.6M

Spy Run Station
- At Spy Run station, replace transformer #3 with a 138/69/34.5kV unit. Move the Fulton exit from 34.5kV to 69kV.
  Estimated Cost: $2.6M

McKinley Station
- Retire CB "G" at McKinley station.
  Estimated Cost: $0.2M

Wallen Station
- Retire the 34.5kV voltage class equipment at Wallen station.
  Estimated Cost: $0.2M



AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

Need Number: AEP-2019-IM017, AEP-2020-IM025, AEP-2021-IM004, AEP-2021-IM005 & AEP-2020-IM006
Process Stage: Solutions Meeting 1/21/2022
Proposed Solution:

Industrial Park
- At Industrial Park station, retire the entire 34.5kV voltage class, install a new 138/12kV load delivery to replace the 34.5/12kV delivery. Replace 69kV CB "G", Replace the 138/69kV XFR 1 and add a high side switcher to XFR 1.
  Estimated Cost: $11.1M

Wallen-Industrial Park 34.5kV
- Retire the ~3.3 mile Wallen – Industrial Park 34.5kV line.
  Estimated Cost: $2.9M

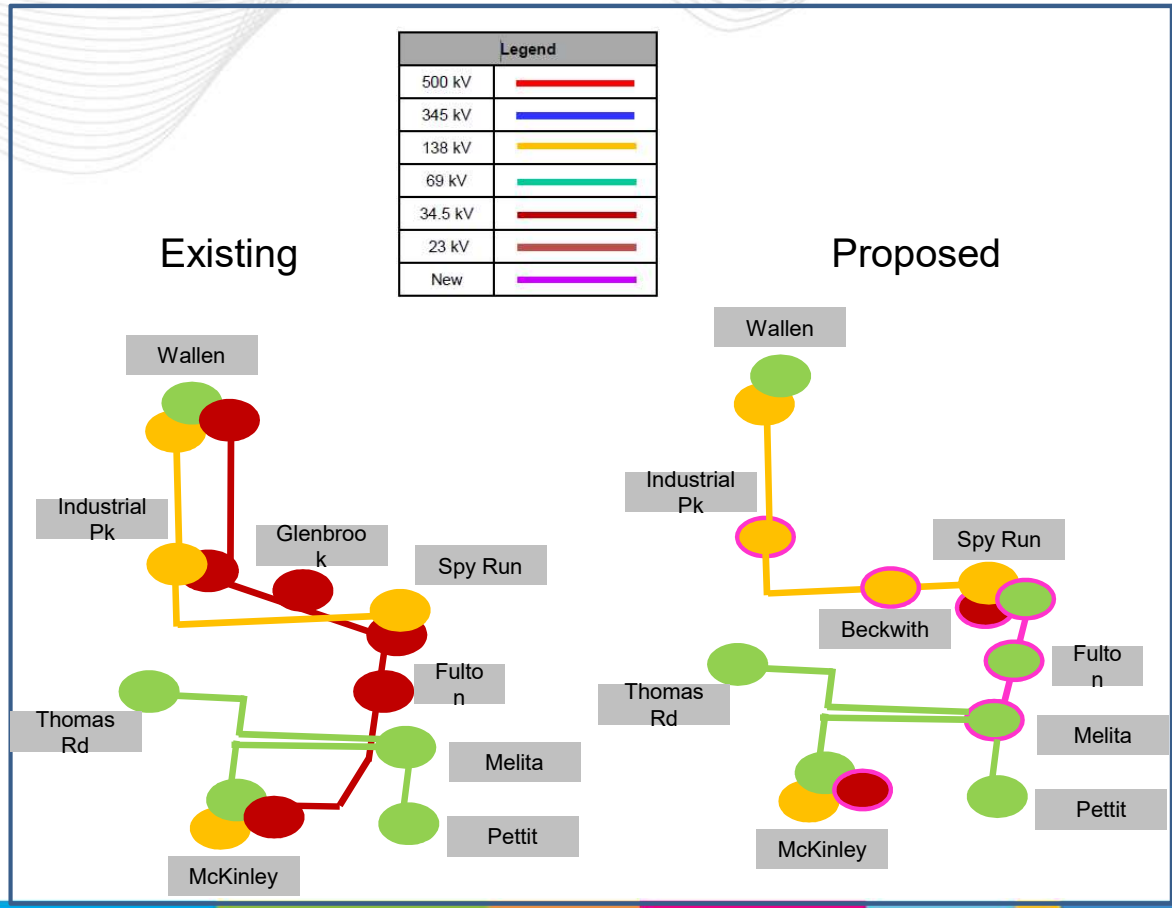
Glenbrook Station
- Retire Glenbrook 34.5/12kV substation
  Estimated Cost: $0M

Industrial Park-Spy Run 34.5kV
- Retire the ~4.2 mile 34.5kV Industrial Park – Spy Run line
  Estimated Cost: $2.2M

Beckwith Station
- Install a new 138/12kV Beckwith substation to take the place of Glenbrook with 2 25MVA XFR's and a 138kV bus tie CB.
  Estimated Cost: $1.5M

Industrial Park-Spy Run 138kV
- Cut in the Industrial Park – Spy Run 138kV to Beckwith station. **Estimated Cost: $0.6M**

Total Estimated Transmission Cost: $35.25M-$47.9M



AEP Transmission Zone: Supplemental
Northern Melita Area Improvements

Need Number: AEP-2019-IM017, AEP-2020-IM025, AEP-2021-IM004, AEP-2021-IM005 & AEP-2020-IM006
Process Stage: Solutions Meeting 1/21/2022

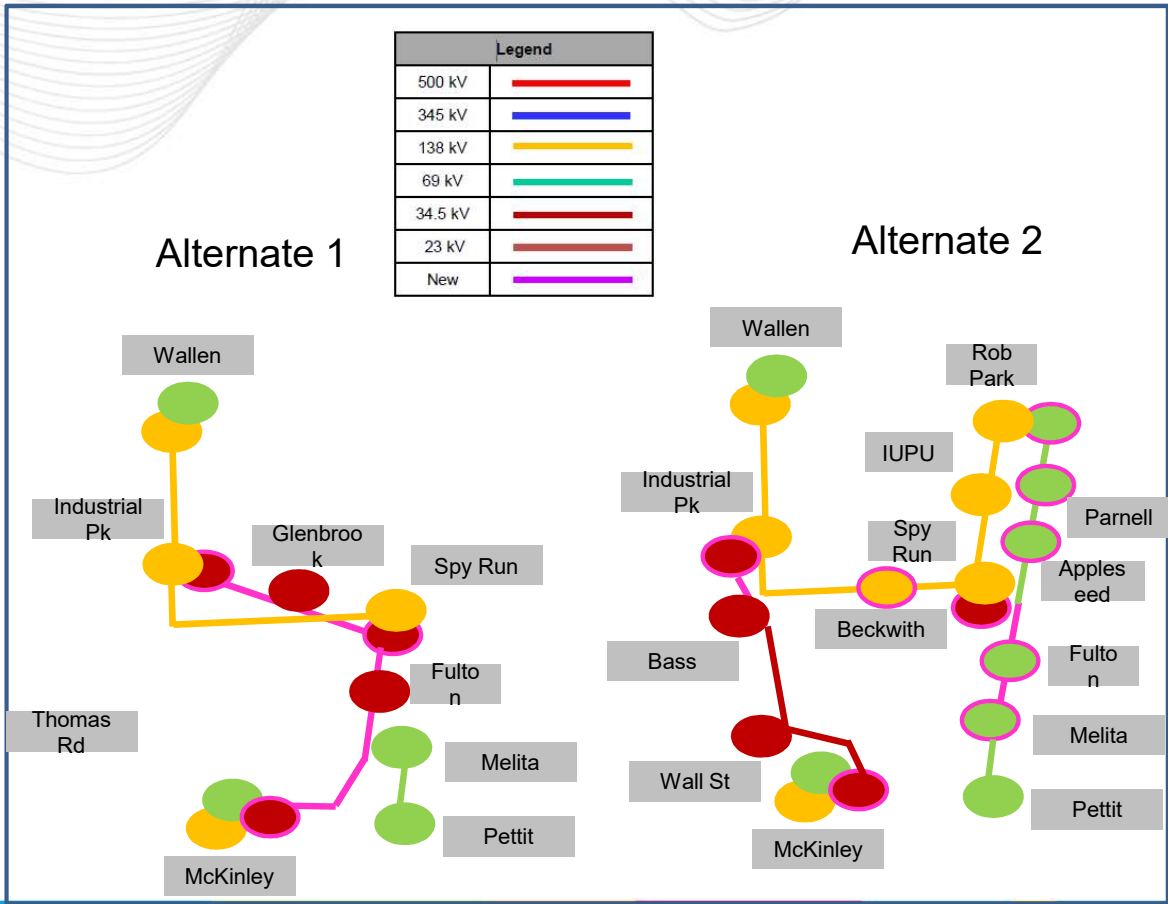
Alternatives Considered:
Alternate 1
Rebuild the McKinley – Spy Run and Industrial Park – Spy Run line as is and leave it at 34.5kV operation. This would cost more and would provide less benefit to the system and so wasn't chosen.
Estimated Cost: $38.1M-$50.75M

Alternate 2
Instead of terminating Melita into Spy Run, bypass the station and terminate into Rob Park, rebuild Parnell and Appleseed and re-energize the circuit to 69kV. This would also require McKinley – Spy Run 34.5kV to be reterminated into Industrial Park. This would cost more and would put 72.6MW of Fort Wayne load served from Industrial Park – Rob Park subject to N-1-1 outages.
Estimated Cost: $38.95M-$51.6M

Ancillary Benefits: Removes 7.5 miles of 34.5 kV line and converts 2.2 miles to 69 kV, moving the Glenbrook and Fulton delivery points to 138 kV and 69 kV respectively. The existing 34.5 kV feeds are out of phase with the surrounding 138 and 69 kV systems, requiring a drop-and-pick outage whenever the 34.5 kV source is out of service. This project simplifies the transferability of the existing load and removes 7.5 miles of line through urban Fort Wayne area.

Projected In-Service: 5/1/2023

Project Status: Scoping



AEP Transmission Zone M-3 Process
Montgomery County, VA

Need Number: AEP-2021-AP026

Process Stage: Solutions Meeting 01/21/2022
Previously Presented: Needs Meeting 06/15/2021

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

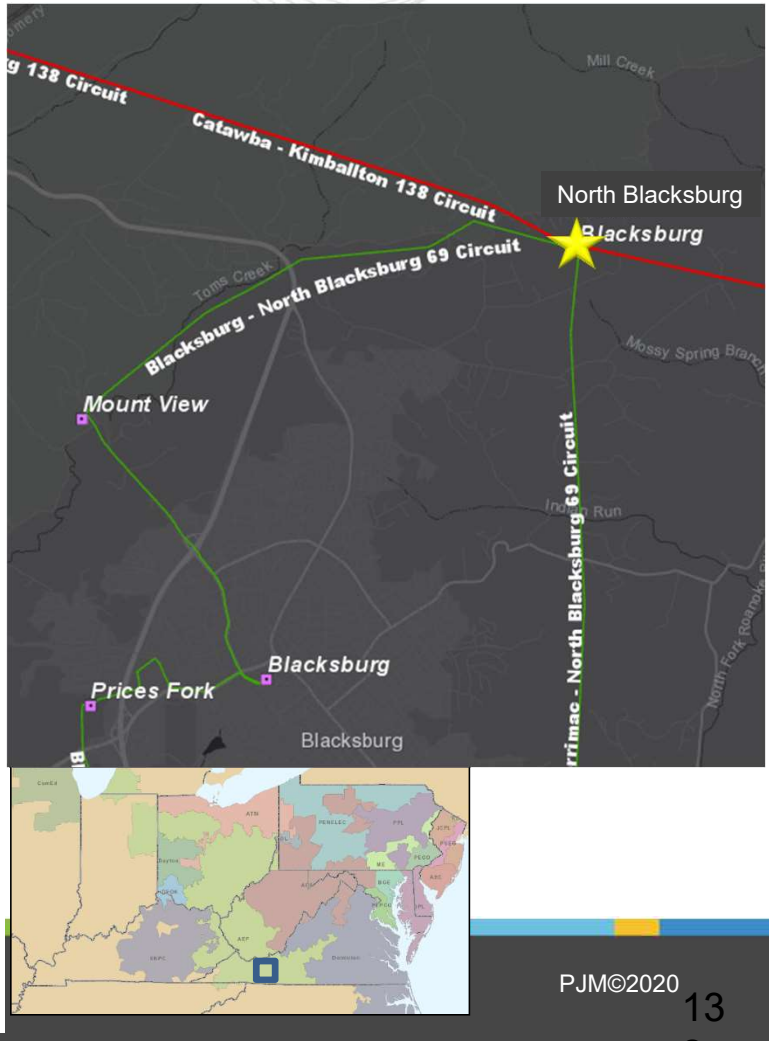
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

North Blacksburg Station:

- 138/69-12 kV Transformer #1
  - 1972 Vintage Transformer
  - The presence of Ethane, along with the indication of overheating faults, indicates decomposition of the paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
  - The dielectric is driven by the upward trend in insulation power factor, which indicates an increase in particles within the oil.
  - The transformer has had issues with proper oil flow.

- 138/12 kV Transformer #2
  - 1967 Vintage Transformer
  - The presence of Acetylene, confirms the insulation system (oil and paper) is in poor condition and also indicates electrical discharge faults of low energy have occurred within the main tank causing electrical breakdown of the unit.
  - The transformer has significant rust spots and weld leaks.
  - This is allowing voltage phase imbalances, specifically high voltage, to pass through to distribution customers served from North Blacksburg station.



AEP Transmission Zone M-3 Process
Montgomery County, VA

Need Number(s): AEP-2021-AP026

Process Stage: Solutions Meeting 01/21/2022

Proposed Solution:

North Blacksburg Station

- Replace existing Transformer #1 with a 130 MVA 138/69-12 kV transformer.
- Replace existing Transformer #2 with a 25 MVA 138/12 kV transformer and add bus regulators.
- Add a 69kV circuit breaker on the low side of Transformer #1

Estimated Total Transmission Cost: $4.06 M

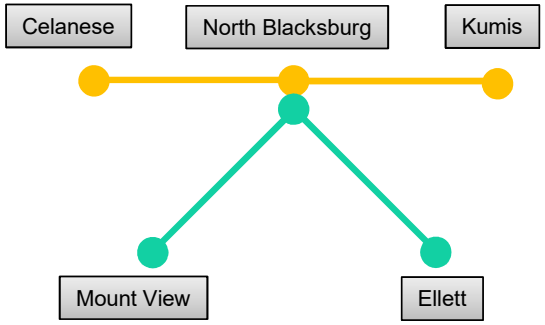
Ancillary Benefits: A 69kV breaker in between Transformer #1 and the 69kV bus would maintain two way service to Blacksburg Station which supplies a large load for Virginia Tech State University in the event of a high side fault.

Alternatives Considered: No viable transmission alternates were identified.

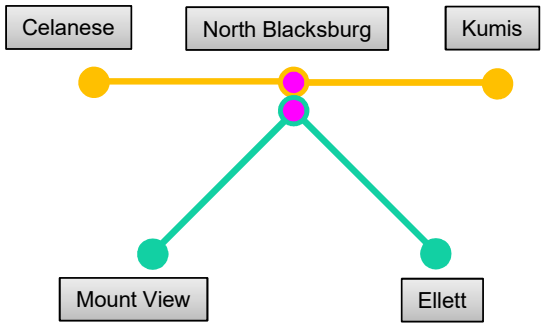
Projected In-Service: 11/01/2024

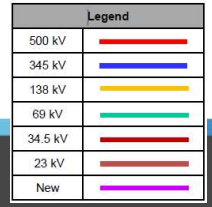
Project Status: Scoping

Existing



Proposed





AEP Transmission Zone M-3 Process
Robison Park – Sowers 138kV

Need Number: AEP-2021-IM022
Process Stage: Solution Meeting 01/21/2022
Previously Presented: Needs Meeting 7/16/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Robison Park – Sowers 138kV line:

- 13.6 miles of this 18 mile line is 1966 wood H Frame construction
- 4.3 miles of this 18 mile line is 1966 Steel lattice and isn't identified as a need at this time.
- 17.9 miles of this 18 mile line is 1966 636 Grosbeak ACSR conductor
- The wood structures fail AEP Strength requirements and ASCE structural strength standards and AEP Shielding requirements
- The 2015-2020 time period has seen 4 momentary and 3 permanent outages
- Line has been subject to 464,404 CMI to customers served out of Grabill station.
- 15 structures were inspected by drone with 16 assessed by ground crew
    - Moderate shell decay on most wood poles
    - Most Cross Arms have moderate decay on top side of arms
    - 40% of structures had broken/missing gounds.
- 11 structures with open conditions are on this line currently including disconnected X Braces/Crossarms, Rot Top and broken ground leads.

AEP Transmission Zone: Supplemental
Robison Park – Sowers 138kV

Need Number: AEP-2021-IM022
Process Stage: Solution Meeting 01/21/2022

Proposed Solution:

Robison Park – Sowers 138kV line:
Rebuild the 13.6 miles of wood construction with double circuit capable 138kV with one side strung.
Reconductor 4.3 miles of the steel lattice section with 795 Drake ACSR. This 4.3 mile section is already constructed as double circuit capable.
Estimated Cost: $42.3M

Replace switches and risers at Grabill switch to accommodate the line rebuild.

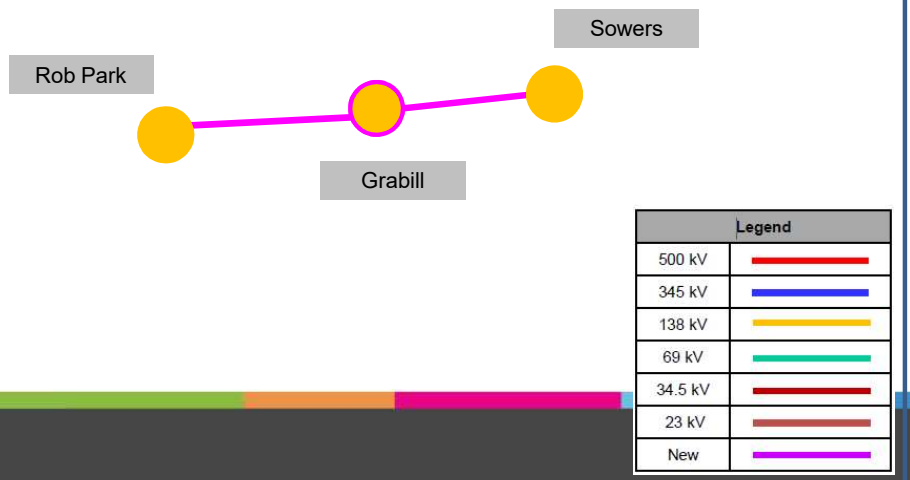
Estimated Cost: $1M

Total Estimated Transmission Cost: $43.3M

Alternates:

Rebuild line as single circuit. A load growth of 25MW near Varner would require another source brought into Sowers for N-1-1 outages of Auburn – Varner and Sowers – Rob Park due to low voltage issues. The load addition requested under AEP-2020-IM022 already accounts for 10MW. There have been other spec load requests for additional load growth in this area, including at Varner station, which would require this second circuit in the future. The first 4.3 miles of the line out of Rob Park station are already built to double circuit capability and wouldn't need rebuilt to allow this future connection.

Projected In-Service: 11/01/2025
Project Status: Scoping



AEP Transmission Zone M-3 Process
Cabin Creek – London 46 kV Rebuild

Need Number: AEP-2020-AP043

Process Stage: Solutions Meeting 2/18/2022

Previously Presented: Need Meeting 11/20/2020

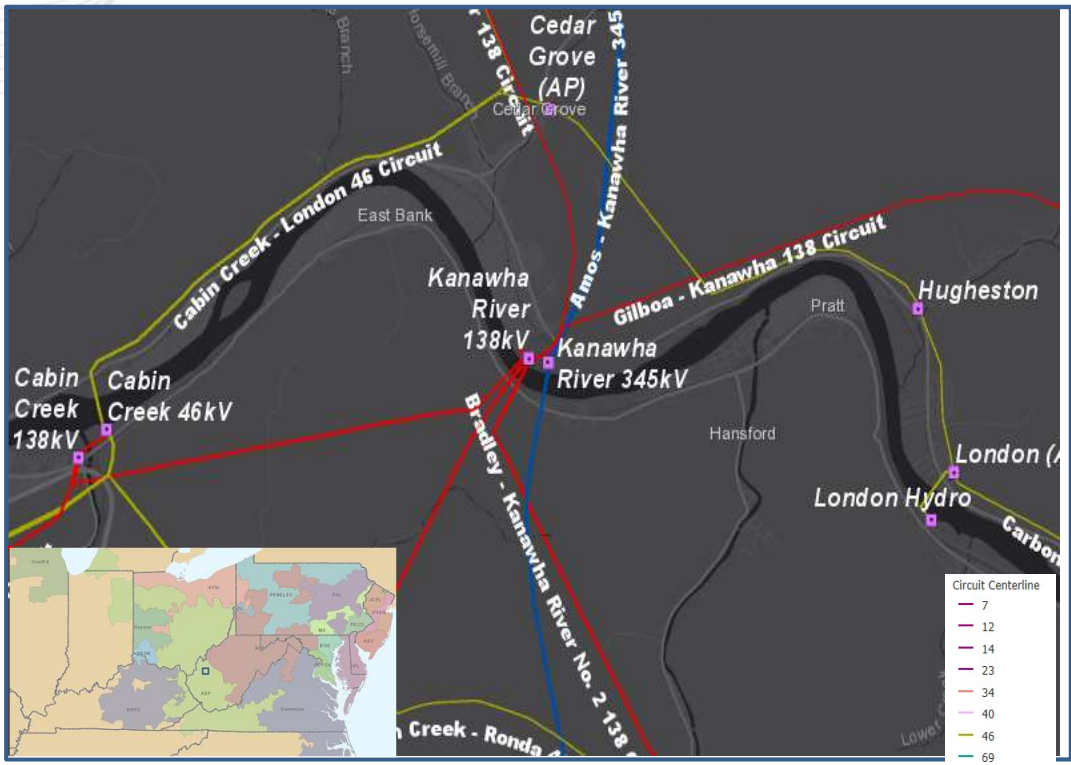
Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Tower Lines

Problem Statement:

Cabin Creek – London 46 kV (8.35 miles)

- Circuit is comprised primarily of 1913 vintage lattice steel (38%), 1999 vintage wood (27%) and 2011 vintage steel (29%)
  - Line was originally constructed in 1913
  - Circuit fails to meet 2017 NESC Grade B loading criteria, AEP structural strength requirements, and fails to meet current ASCE structural strength requirements
  - 4-bell porcelain insulators do not meet current AEP Standards
  - Conductor on the line is primarily 3/0 and 4/0 Copper
  - The circuit is located along the Kanawha River and has a history of landslides
- 9 Structures with at least one open condition (7% of the line)
  - 13 structural conditions include rot top, insect damage, woodpecker holes, bent/damaged steel lacing
- 58 hardware conditions related to rusted/corroded shielding and conductor hardware, broken insulators and guys, worn/cracked conductor hardware
- Since 2014, there have been 9 momentary and 1 permanent outages on the Cabin Creek – London 46 kV circuit
  - Majority of the momentary outages were due to weather including lightning/wind
  - Permanent outages were caused by vegetation fall-in from outside the ROW, flood/slides, lightning/ice/snow
  - Outages resulted in approximately 10k customer minutes of interruption
- There are a significant number of landslides along the length of this line. Known slides have occurred in the last 10 years. The terrain along the line is very rough and mountainous.



AEP Transmission Zone M-3 Process
Cabin Creek – London 46 kV Rebuild

Need Number: AEP-2020-AP045

Process Stage: Solutions Meeting 2/18/2022

Previously Presented: Need Meeting 11/20/2020

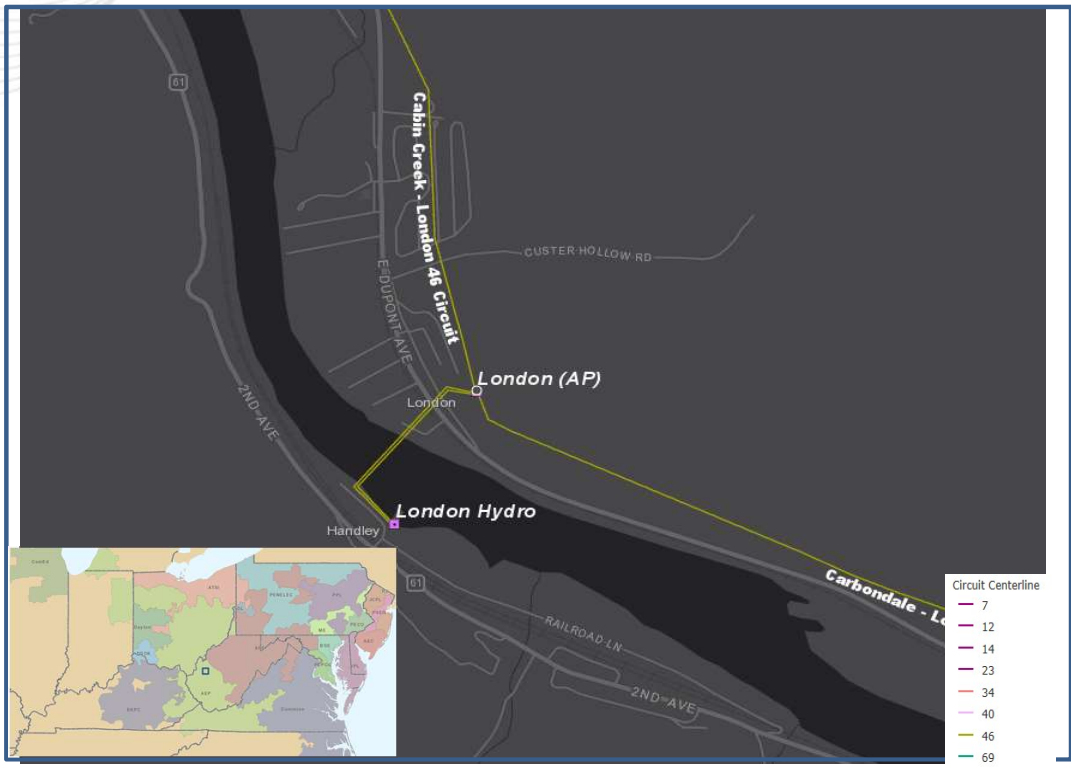
Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

London Station

- 46 kV CB-B
  - 1988 vintage
  - The breaker is oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling. Oil spills are common and can result in significant environmental mitigation costs.
  - 53 total fault operations
- 46 kV CB-F
  - 1968 vintage
  - The breaker is oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling. Oil spills are common and can result in significant environmental mitigation costs.
  - 15 total fault operations
- London station currently deploys 35 relays
  - 33 out of 35 relays are in need of replacement (94%)
  - 28 are electromechanical relays which have significant limitations with regards to fault data collection
  - 5 of the microprocessor relays utilize legacy firmware
- Control House
  - Asbestos/lead paint is present in the control house
- Access road to the station severely limits the ability to deliver large equipment to the station
- 46 kV bus shows significant signs of rust on lattice members and on bolts



AEP Transmission Zone M-3 Process
Cabin Creek – London 46 kV Rebuild

Need Number: AEP-2020-AP043, AEP-2020-AP045

Process Stage: Solutions Meeting 2/18/2022

Proposed Solution:

Rebuild approximately 4.5 miles of 46 kV line on the Cabin Creek – London 46 kV circuit (total length approximately 8 miles) in an area where there's larger than standard ROW requirements due to long spans from ridge-ridge and more angle/dead ends required to mitigate landslide risk in rugged terrain. Long access roads due to terrain. **Trans Cost: 17.7M**

Remove/retire existing Cabin Creek – London (4.5 miles). Helicopter removal will be utilized for existing line to avoid avoiding landslide prone areas. **Trans Cost: 2.3M**

Retire the existing Hugheston Station **Trans Cost: 0.0M**

Rebuild London Station in the clear due to space constraints and access concerns. Install four 46 kV circuit breakers in a single bus configuration, DICM and appropriate metering equipment for the adjacent Hydro Plant. **Trans Cost: 8.3M**

Rebuild approximately 1 mile of double circuit line from the existing London Hydro Station to the new London Station. Due to terrain dead-end structures will be used to construct this section of line. **Trans Cost: 5.4M**

Rebuild approximately 1 mile of single circuit line on the Carbondale – London 46 kV to accommodate the new London Station location. **Trans Cost: 3.5M**

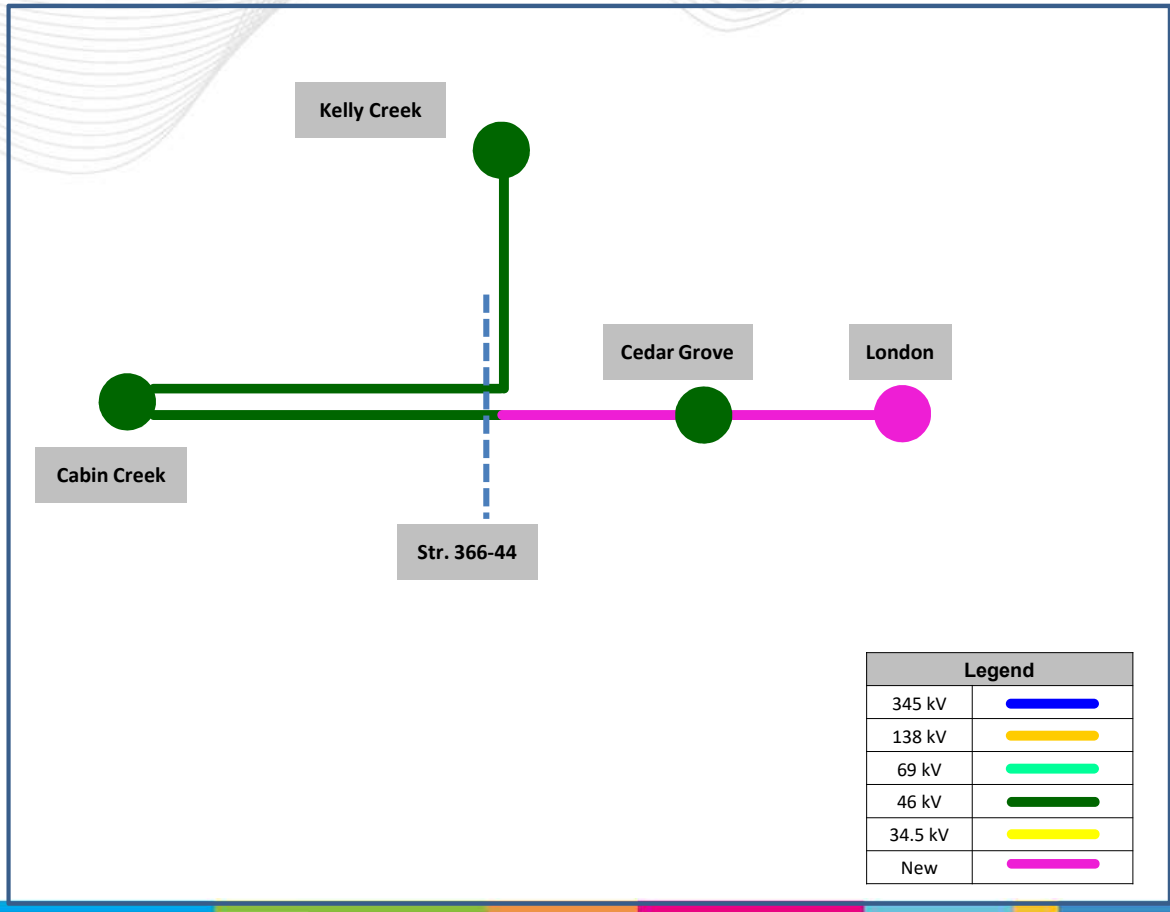
Total Estimated Transmission Cost: $37.2M

Ancillary Benefits: 4 miles of this line shares towers with the Cabin Creek – Kelly Creek 46 kV line and is already being rebuilt under baseline project B3280

Alternatives Considered:

1. Addressing the London Station needs on the existing footprint was investigated but ultimately not feasible due to constructability issues related to the small footprint the site is on, the location of the site between two ridges makes it challenging to get new lines into the station and access issues make it difficult to get larger vehicles to the site.

Projected In-Service: 5/1/2025
Project Status: Scoping
Model: 2025 RTEP



Dayton d/b/a AES Ohio Transmission Zone M-3 Process
Monroe Township, Ohio

Need Number: Dayton-2019-005

Process Stage: Solution Meeting 2/18/2022

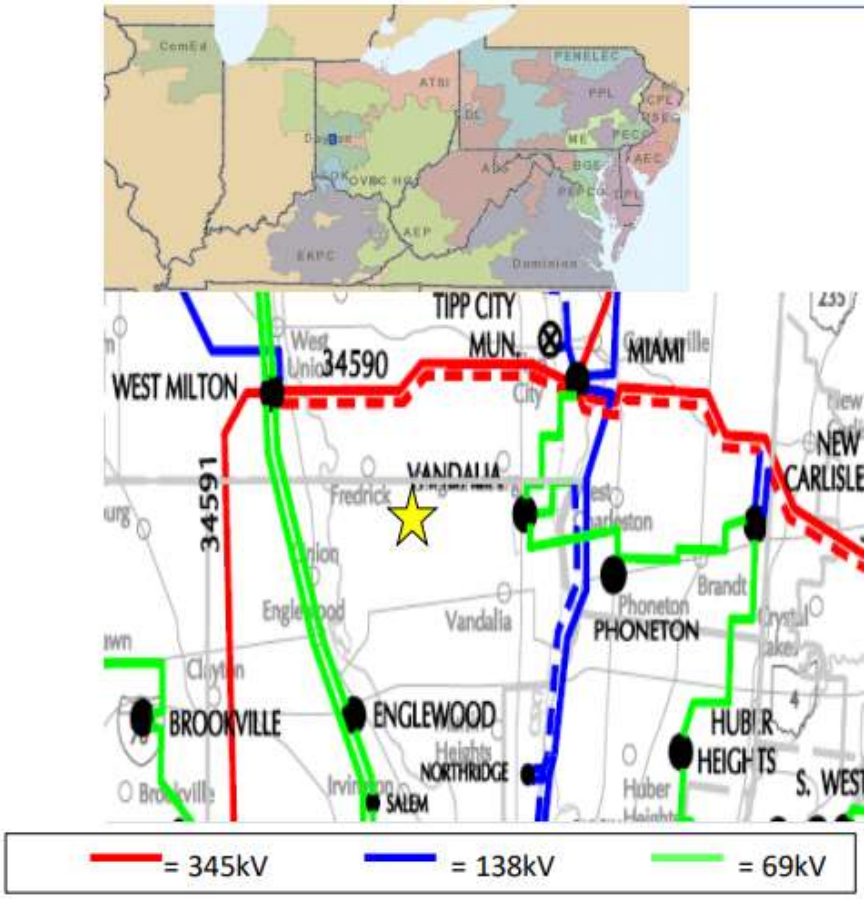
Previously Presented: Needs Meeting 2/20/2019, Solution Meeting 11/20/2020

Project Driver: Customer Service (Source for Underlying Distribution)

Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Problem Statement:

- Existing distribution circuits AZ1210 and AZ1205 from Vandalia Substation exceeded their thermal rating this past summer. There continues to be strong load growth in this area with multiple transmission and distribution customer requests.
- Distribution circuits that supply the growing load center emanate from distant substations and end-use customers are beginning to see voltage issues. Specifically this has been an issue on distribution circuit OC1204 from West Milton.
- There are critical customers served in this area and there is a need to supply sufficient capacity and diversity to ensure continued reliable operations amid the rapid load growth.



Dayton d/b/a AES Ohio Transmission Zone M-3 Process
Monroe Township, Ohio

Need Number: Dayton-2019-005

Process Stage: Solution Meeting 2/18/2022

Selected Solution: (originally presented on 11/20/2020, changes are redlined below)

This project will tap the existing West Milton to Miami 138kV line and build ~~a~~ two new ~~1.9-mile~~ 138kV circuits, each extending approximately ~1 mile from the tap point to the new substation. ~~to double circuit loop in and out of a new distribution substation~~. There will be a single 138/12kV 30 MVA distribution transformer, a 138kV delivery to Pioneer REC~~, installed at the new substation~~ and ~~three~~ four new 138kV breakers arranged in a ring bus configuration~~, expandable to four breakers~~. ~~OPGW will be installed between West Milton, the new substation, and Miami substation as part of this project.~~ The new substation will be in proximity to the growing load center near the Dayton airport and will provide critical distribution sources for ~~DP&L~~ AES Ohio's distribution load and Pioneer Electric distribution load in this area.

Estimated cost: ~~$8.7M~~ $12.9M

Reason for Revision:

- A fourth breaker and short line extension has been added to accommodate a new 138kV delivery to Pioneer who has recently finalized agreements to serve additional large new customer loads in the vicinity of the City of Union.

Alternatives Considered:

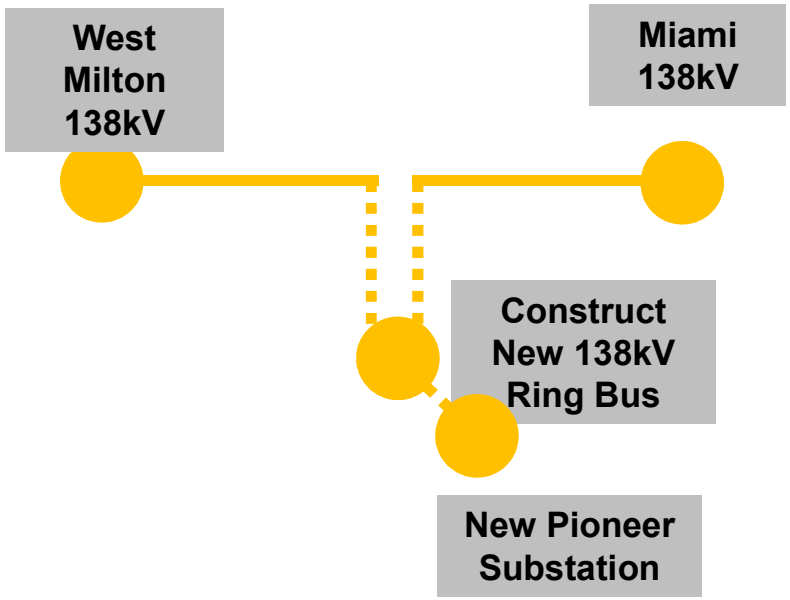
1. Route a ~4 mile double circuit 69kV line from the Salem-West Milton 69kV line to the new distribution substation. This solution would present significant routing issues including crossing a conservancy property, a flood plain, and heavy vegetation.

   Estimated cost: ~~$9.8M~~ $11.1M

Projected In-Service: 12/31/2022

Project Status: Engineering

Model: 2020 RTEP – 2025 Summer Case



DEOK Transmission Zone M-3 Process
Dicks Creek Gas Substation

Need Number: DEOK 2022-002

Process Stage: Solutions Meeting 02-18-2022

Previously Presented: Needs Meeting 01-21-2022

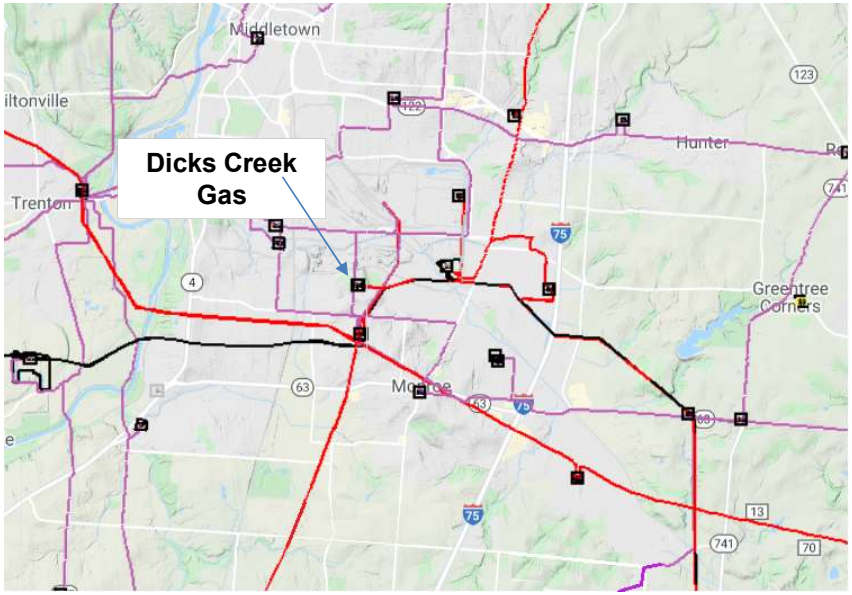
Project Driver: Customer Service

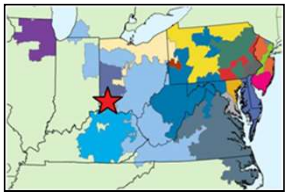
Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Problem Statement:

Duke Energy Distribution is retiring and demolishing Dicks Creek Gas substation. They have requested removal of the transmission system connection.





DEOK Transmission Zone M-3 Process
Dicks Creek Gas Substation

Need Number: DEOK 2022-002

Process Stage: Solutions Meeting 02-18-2022

Previously Presented: Needs Meeting 01-21-2022

Project Driver: Customer Service

Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Potential Solution:

Retire the one wood pole between the tap and substation. Retire 2 spans of conductor. Install post insulators for jumper support at the former tap.

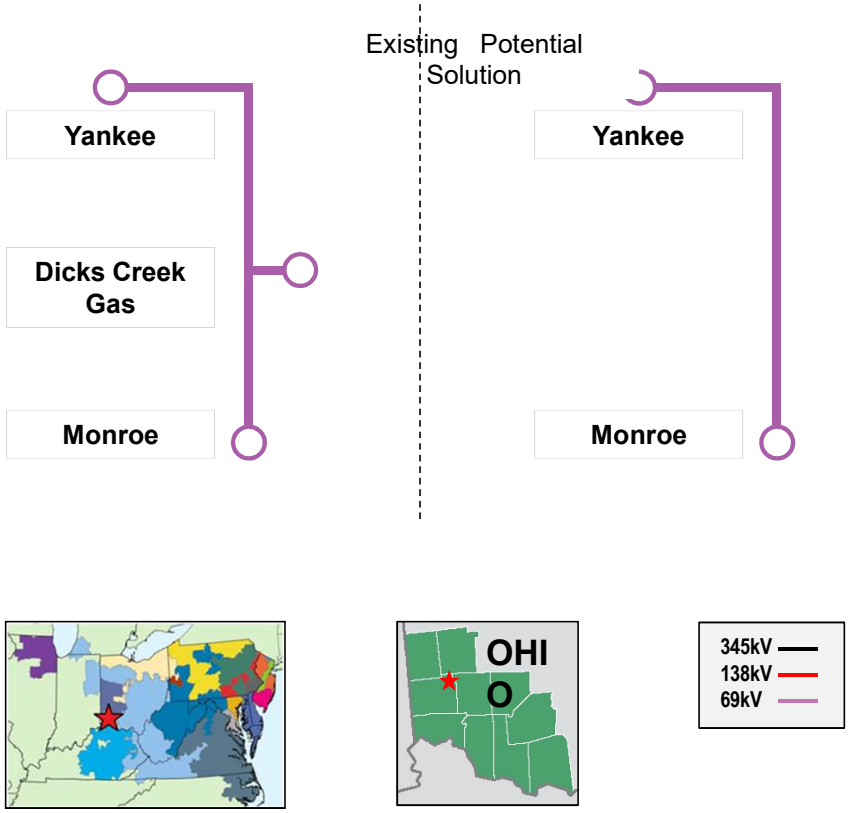
Alternatives: none

Estimated Transmission Cost: $80,419

Proposed In-Service Date: 07-01-2022

Project Status: Scoping

Model: 2021 RTEP



Need Number: DEOK-2022-003

Process Stage: Solutions Meeting 03-18-2022

Previously Presented: Needs Meeting 02-18-2022

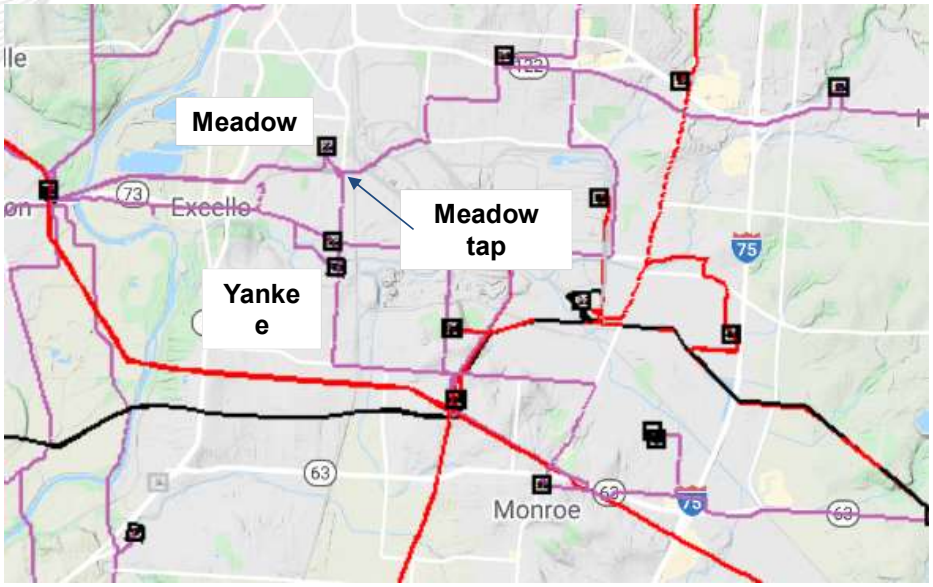
Project Driver: Equipment Condition, Performance and Risk

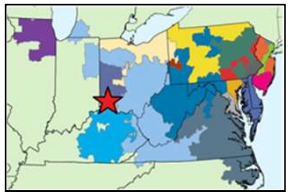
Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slides 5 & 6

Problem Statement:

A section of 69 kV feeder between Meadow substation and Meadow tap is in deteriorating condition. The 14 wooden structures in this section are 56 years old, have woodpecker damage, top rot, crossarm rot, crossarms with temporary repairs and buried down guy anchors.





345kV
138kV
69kV

Need Number: DEOK-2022-003

Process Stage: Solutions Meeting 03-18-2022

Previously Presented: Needs Meeting 02-18-2022

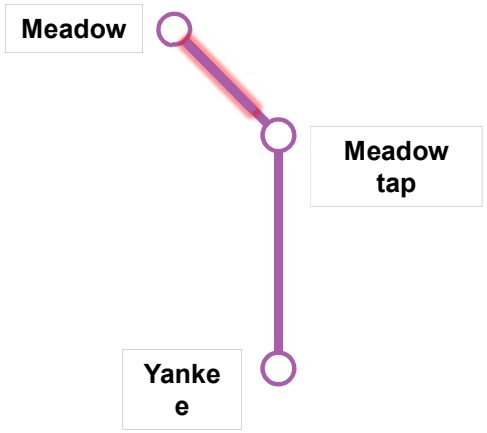
Project Driver: Equipment Condition, Performance and Risk

Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slides 5 & 6

Potential Solution:

Replace the wooden structure with embedded steel structures. Reconductor with 954ACSR. The summer rating will increase to 97/97 MVA SN/SE.



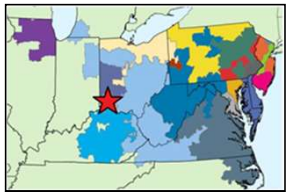
Alternatives: none

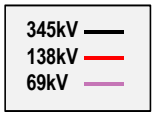
Estimated Transmission Cost: $1,628,642

Proposed In-Service Date: 07-01-2022

Project Status: Scoping

Model: 2021 RTEP





Need Number: DEOK-2022-004

Process Stage: Solutions Meeting 03-18-2022

Previously Presented: Needs Meeting 02-18-2022

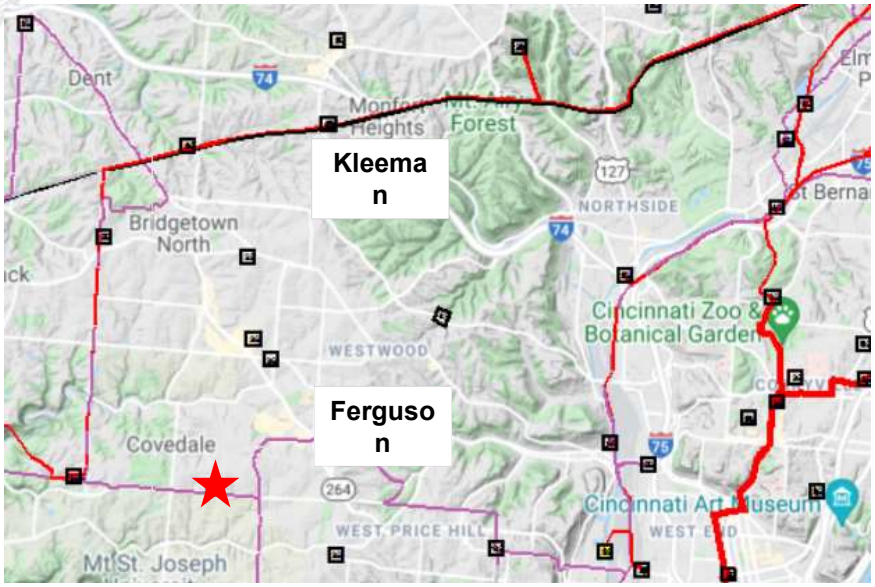
Project Driver: Costumer Service

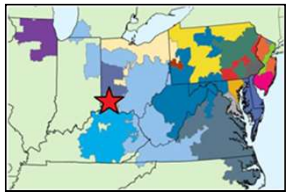
Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Problem Statement:

Duke Energy Distribution has asked for a new delivery point near Linneman Avenue in the Covedale area of Cincinnati. The distribution transformers that serve the Westwood and Covedale areas from Ferguson and Kleeman are peaking at 100% of rated capacity.





345kV
138kV
69kV

Need Number: DEOK-2022-004

Process Stage: Solutions Meeting 03-18-2022

Previously Presented: Needs Meeting 02-18-2022

Project Driver: Customer Service

Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Potential Solution:

Build a new substation named Linneman. Loop the nearby Ebenezer-Ferguson-Delhi 69 kV feeder through Linneman switch connecting the feeder to the bus. Install a 69 kV circuit switcher to connect a 69/13 kV 22 MVA distribution transformer. Install a control enclosure to house relaying and communications equipment.

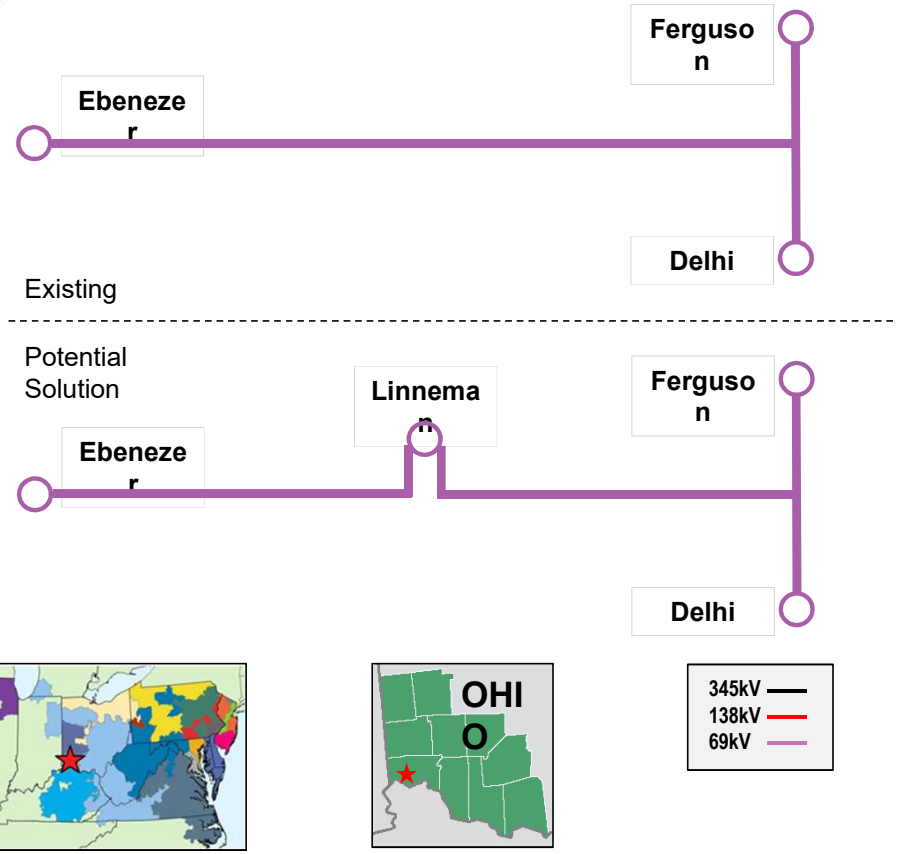
Alternatives: none

Estimated Transmission Cost: $2,863,197

Proposed In-Service Date: 12-31-2025

Project Status: Scoping

Model: 2021 RTEP



AEP Transmission Zone M-3 Process
Cowan 138 kV Customer Service

Need Number: AEP-2021-IM029

Process Stage: Solution Meeting 3/18/2022

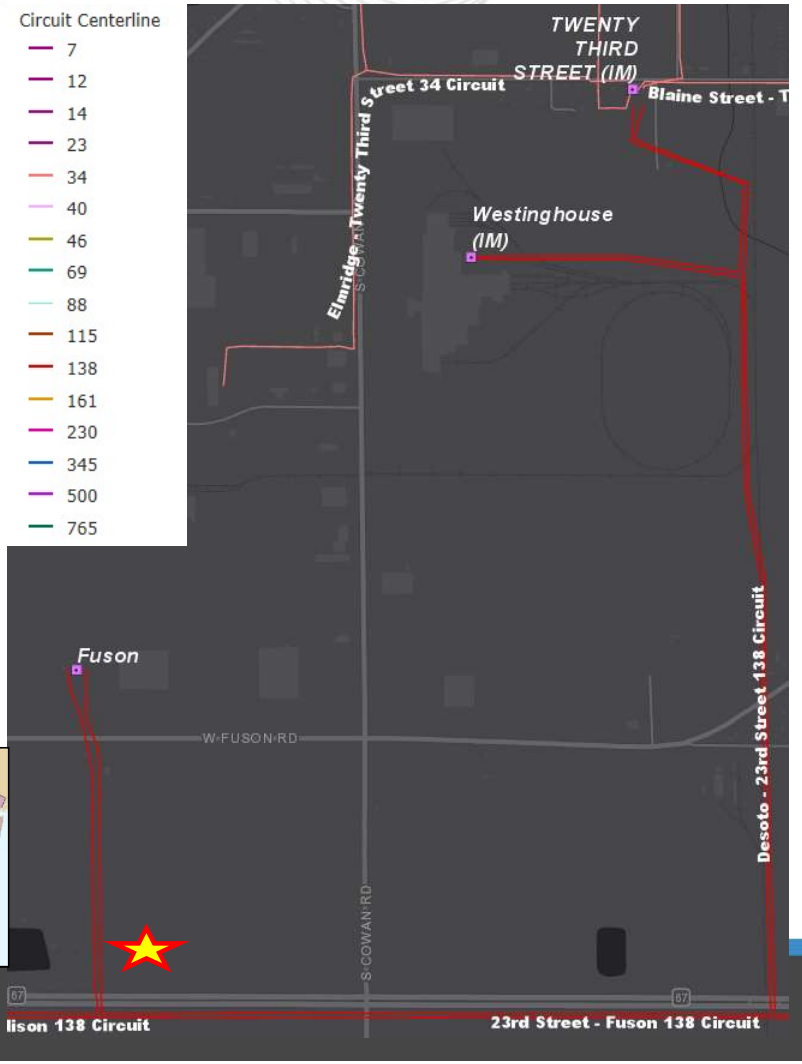
Previously Presented: Needs Meeting 08/16/2021

Project Driver: Customer Service

Specific Assumption Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

A customer has requested new transmission service in Muncie, Indiana by March 2022. Anticipated load is 16.16 MVA.



AEP Transmission Zone M-3 Process
Cowan 138 kV Customer Service

Need Number: AEP-2021-IM029

Process Stage: Solution Meeting 3/18/2022

Proposed Solution:

Cowan 138 kV: Install a new 138 kV four circuit breaker ring bus, 2-138 kV revenue metering, fiber and relaying. **Estimated Cost: $7 M**

Cowan 138 kV North Extension and Right of way: Install ~0.1 mi of 138 kV single circuit with the conductor size 795 ACSR 26/7 Drake. **Estimated Cost: $0.45 M**

Cowan 138 kV South Extension and Right of way: Install ~0.1 mi of 138 kV single circuit with the conductor size 795 ACSR 26/7 Drake. **Estimated Cost: $0.45 M**

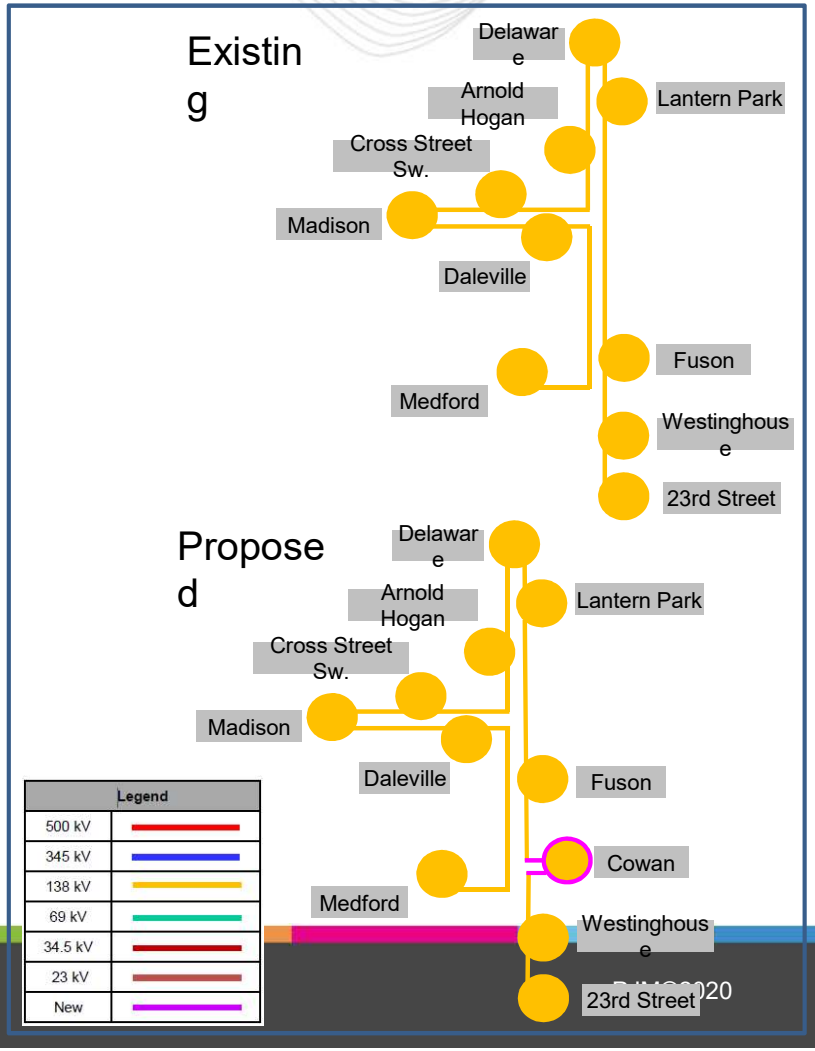
Fuson - 23rd Street 138 kV: Replace two structures with dead end structures on the Fuson – 23rd Street 138 kV circuit to connect the Cowan North Extension and Cowan South Extension. **Estimated Cost: $0.66 M**

23rd Street relay upgrades. **Estimated Cost: $0.3 M**

Fuson relay upgrades. **Estimated Cost: $0.21 M**

Total Estimated Transmission Cost: $9.07 M

Ancillary Benefits: A ring bus is proposed to serve the two required feeds for the customer. Breakers are also required here to eliminate having more than four automated switches on the circuit. Further, the load to be served (metal processing plant) at Cowan station is extremely sensitive to momentary outages where any momentary outage results in lost product and cleanup costs for any event. A ring bus will eliminate maintenance outages to the customer that would be needed in a straight bus arrangement.



AEP Transmission Zone M-3 Process
Cowan 138 kV Customer Service

Need Number: AEP-2021-IM029

Process Stage: Solution Meeting 3/18/2022

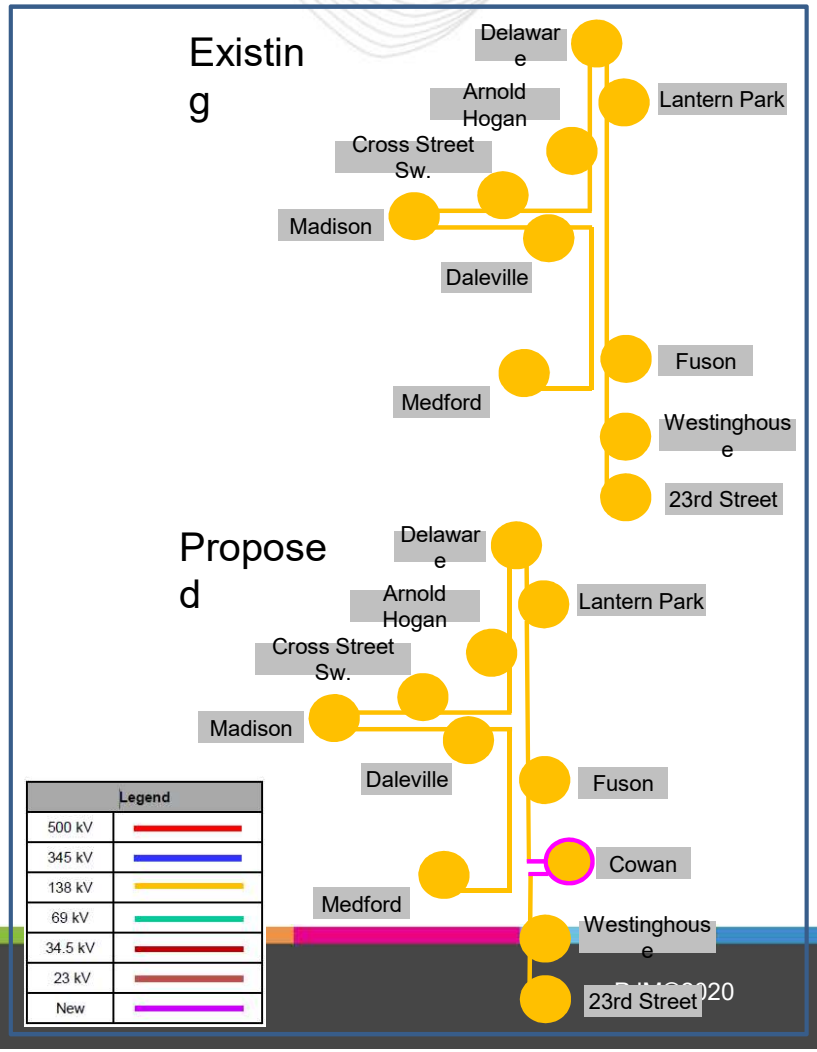
Alternative considered:

Connect the new Cowan station to the south circuit Medford – Madison 138 kV circuit via 2-138 kV single circuit lines ~0.19 mile and a 4- 138 kV ring bus. This option was not selected as it would require crossing the north circuit Fuson – 23rd Street 138 kV circuit and State Road 67. **Estimated Cost: $9.17 M**

Another alternative connecting to Fuson station, was not selected as it would require Fuson station to be rebuilt with six breakers in a ring, require multiple outages to customers already served from Fuson, and it would require longer 138 kV lines to connect to the customer station. **Estimated Cost: $10M**

Projected In-Service: 9/22/2022

Project Status: Scoping



AEP Transmission Zone M-3 Process
Huron County, Ohio

Need Number: AEP-2019-OH034

Process Stage: Solutions Meeting 3/18/2022

Previously Presented: Needs Meeting 6/17/2019

Supplemental Project Driver: Operational Flexibility, and Customer Service

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:

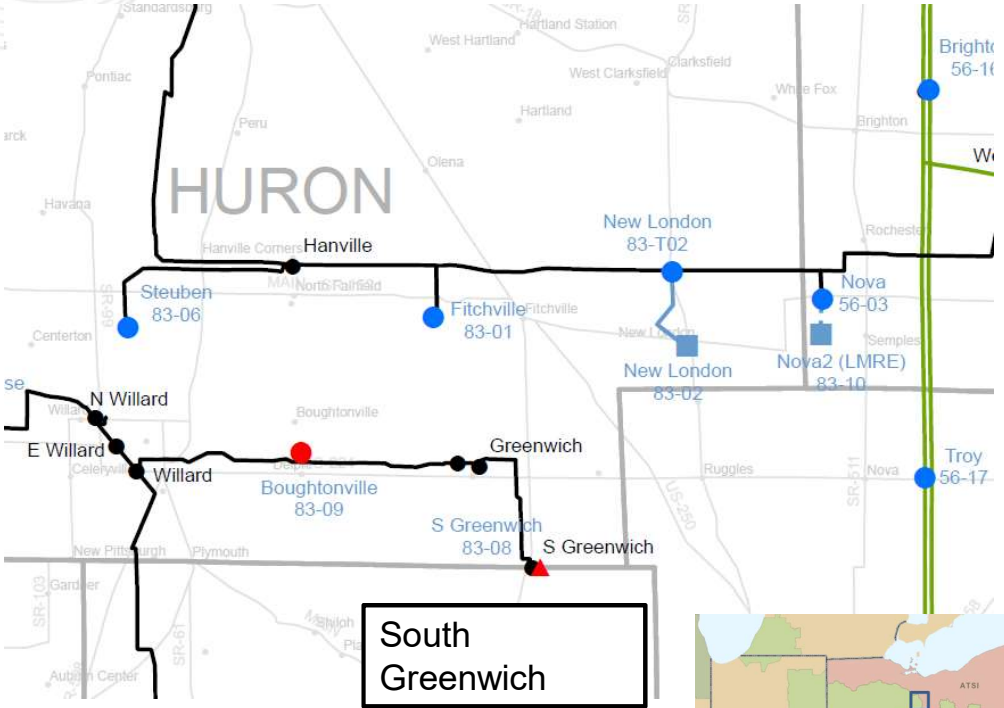
South Greenwich-Willard (vintage 1964)

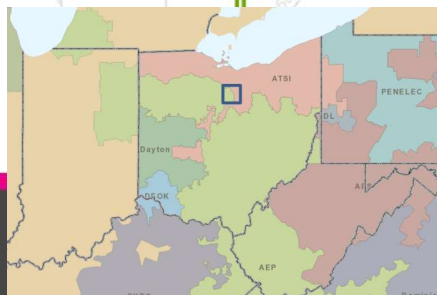
- • Length: 15.22 Miles
- • Original Construction Type: Wood
- • Original Conductor Type: 4/0 ACSR 6/1 (Penguin)
- • Momentary/Permanent Outages: 13 in the past 5 years
- • Number of open conditions: 77

Open conditions include: Damaged Insulator, Structure, Guy Wire, Ground

- Lead Wire, & Shield Wire

Radial service severely restricts the ability to perform routine maintenance and restoration activities. The maintenance of radial transmission lines often requires costly temporary facilities or other labor-intensive measures involving energized work because a maintenance outage to such radial loads is generally not feasible.





AEP Transmission Zone M-3 Process
Huron County, Ohio

Need Number: AEP-2019-OH034

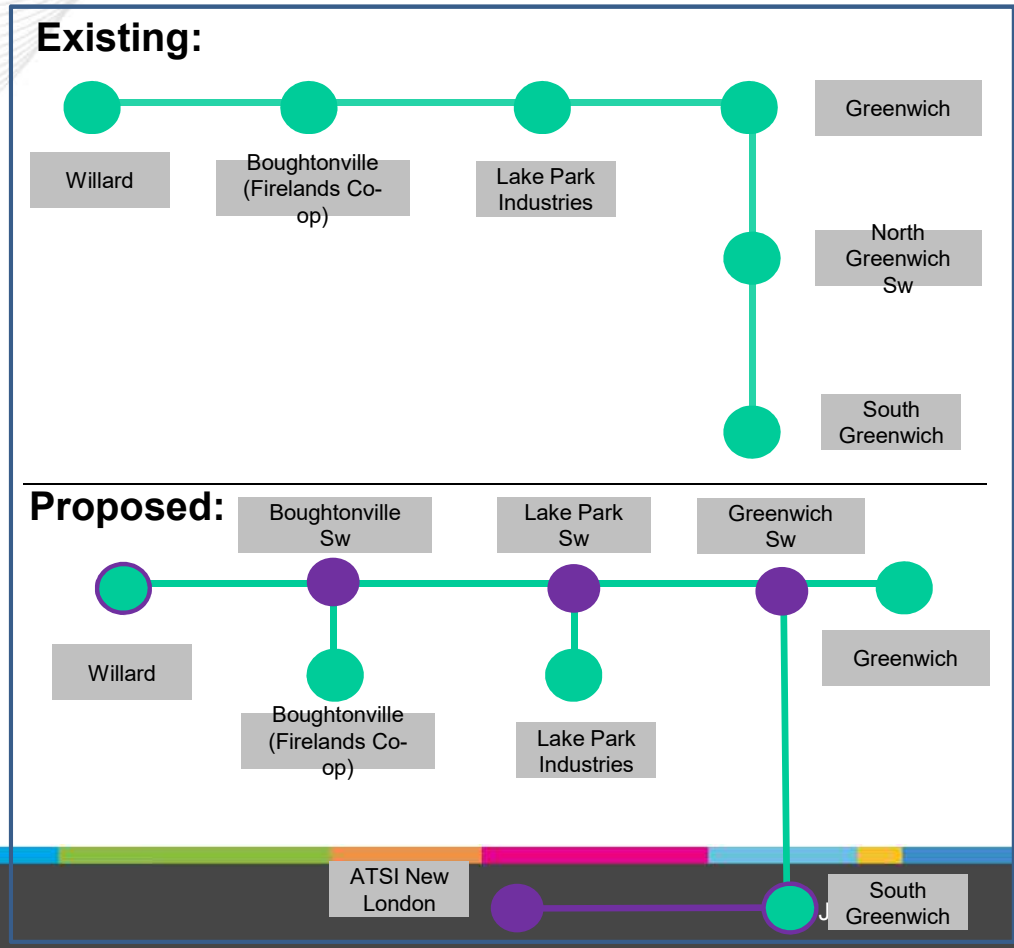
Process Stage: Solutions Meeting 3/18/2022

Proposed Solution:

AEP Scope:

- Install a new 3-way POP Switch (Boughtonville Sw) and 69 kV metering to address the hard tap to Firelands' Boughtonville station. **$0.75 M**
- Install a new 3-way POP Switch (Lake Park Sw) and 69 kV metering to address the hard tap to Lake Park Industries. **$0.76 M**
- Install a new 3-way POP Switch (Greenwich Sw) to address the hard tap to the Village of Greenwich's Greenwich station **$0.6 M**
- Remove North Greenwich Switch. **$0.07 M**
- Construct ~ 10.4 miles of new 69 kV line between South Greenwich and ATSI's New London delivery point using 556 ACSR conductor to give the existing radial line looped transmission service . **$18.0 M**
- Install a box bay and two new 69 kV 3000A 40kA breaker at South Greenwich to accommodate the new line to New London (ATSI) . **$3 M**
- Remove the existing 69kV bypass line at Willard station. **$0.32 M**

Cost estimate: $23.5 M



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

ATSI Transmission Zone M-3 Process
New London 69 kV Project

Need Number: AEP-2019-OH034

Process Stage: Solution Meeting 3/18/2022

Proposed Solution:

ATSI Scope:

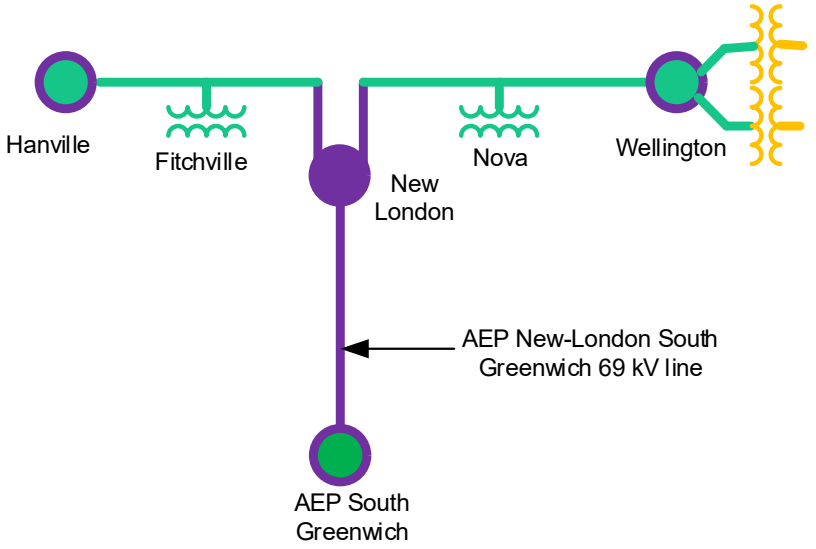
- Build a new four breaker 69 kV ring bus substation adjacent to the Fireland's New London distribution substation
- Acquire the Fireland 69 kV tap (~2 miles) and rebuild as a double circuit into the new ring bus and loop in/out the Hanville-Wellington 69 kV line.
- Serve the Firelands New London distribution substation from the new ring bus substation.
- Transfer the existing Firelands New London revenue metering from the existing location (line) into the Firelands New London distribution substation at the transformer high side within the zone of protection.
- Install new 69 kV tie line revenue metering equipment at the new ring bus substation exit to South Greenwich (AEP)
- Upgrade/adjust relaying at Hanville and Wellington
- Upgrade terminal equipment at Wellington

Transmission Line Ratings:

- Hanville-New London 69 kV Line
  - Before Proposed Solution: N/A
  - After Proposed Solution: 100 MVA SN / 121 MVA SE
- New London-Wellington 69 kV Line
  - Before Proposed Solution: N/A
  - After Proposed Solution: 100 MVA SN / 121 MVA SE
- New London-South Greenwich (AEP) 69 kV line
  - Before Proposed Solution: N/A
  - After Proposed Solution: (AEP) 102 MVA SN / (AEP) 142 MVA SE

Estimated ATSI Project Cost: $10.0M

Status: Conceptual



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

AEP Transmission Zone M-3 Process
Huron County, Ohio

Need Number: AEP-2019-OH034

Process Stage: Solutions Meeting 3/18/2022

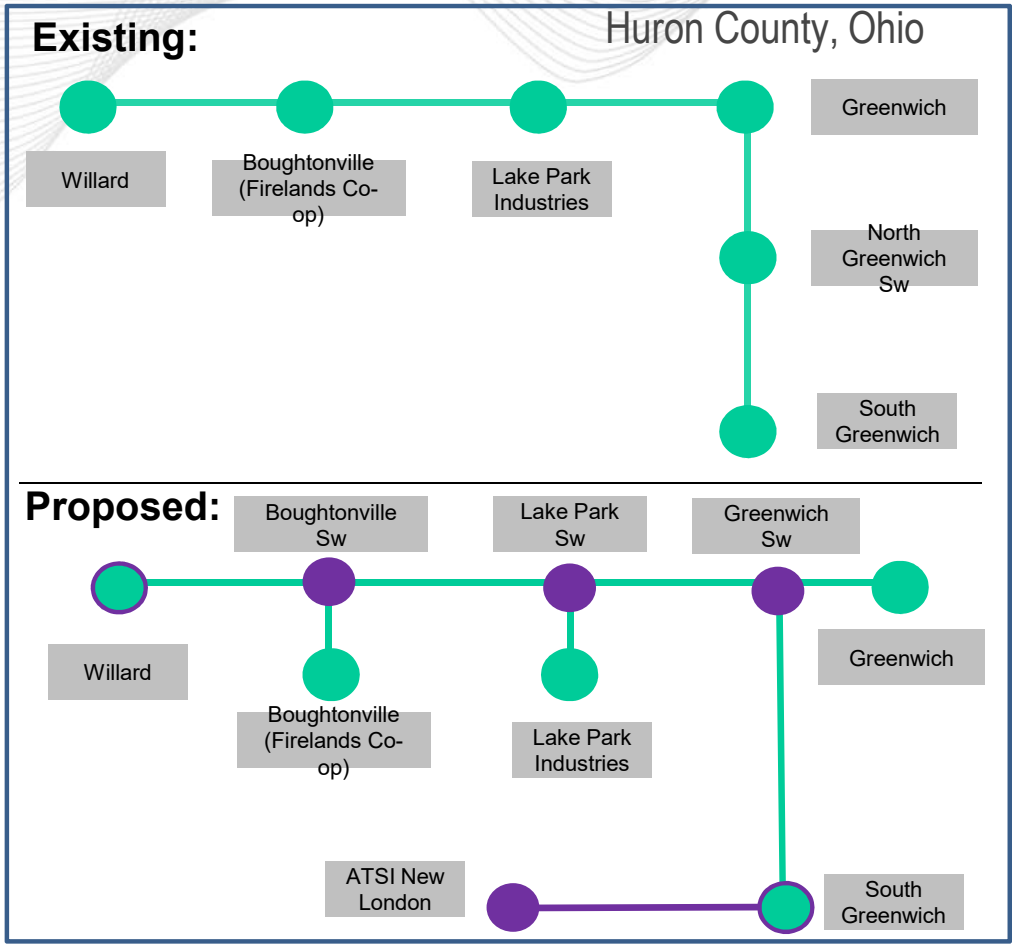
Proposed Solution:

Alternatives Considered:

- Construct a new 15 mile 69kV line connecting South Greenwich to Howard station and replace all customer hard taps with switches. This alternative was not chose due to the extra mileage of 69 kV line that would be required.
- Construct a new 12 mile 69kV line connecting South Greenwich to Willard station and replace all customer hard taps with switches. If Willard station has an outage, all of the customers along the original radial line will be out of service.

Projected In-Service: 9/3/2025

Project Status: Scoping



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

Need Number: ComEd-2022-002

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Need Meeting 3/18/2022

Project Driver:

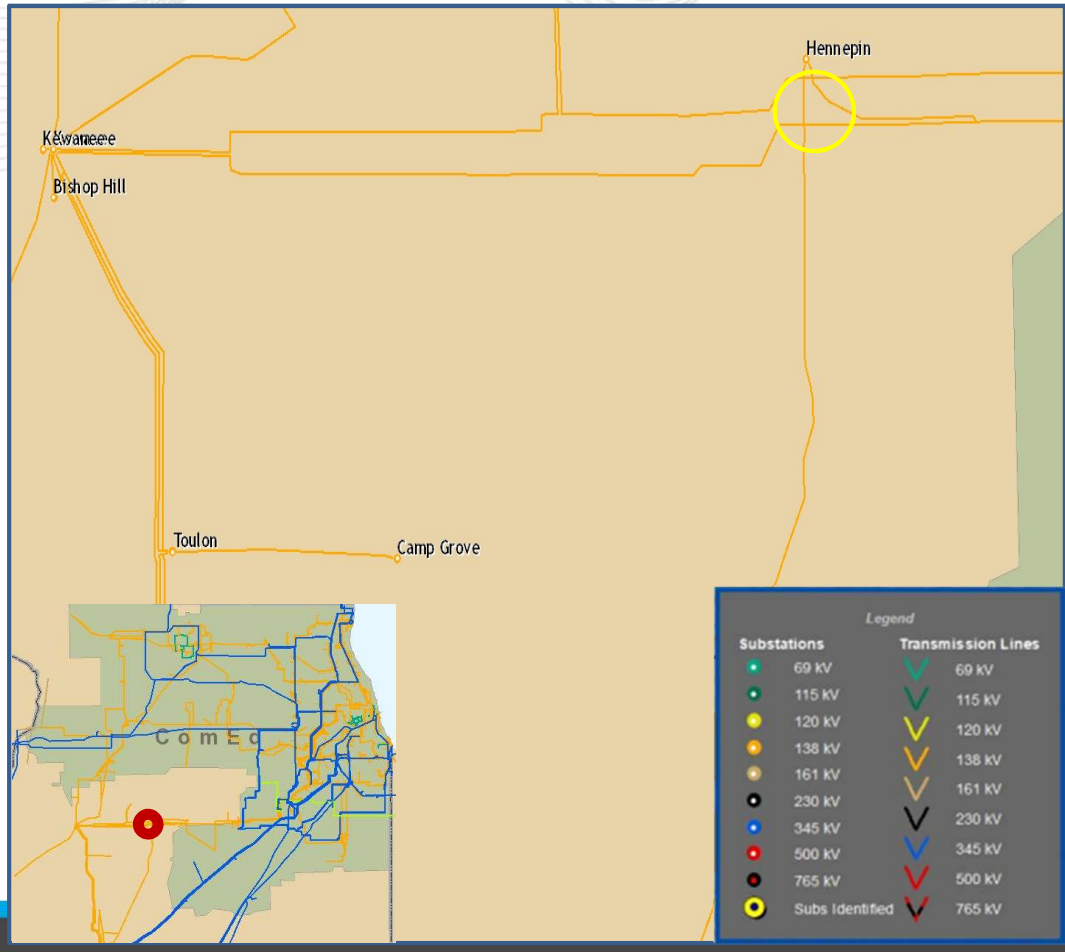
Operational Flexibility and Efficiency

Specific Assumption Reference:

- Enhancing system functionality, flexibility, visibility, or operability

Problem Statement:

Ameren is replacing its Hennepin substation with a new station named Putnam in 2023. Hennepin is currently tied to ComEd stations Kewanee and Streator with a three-terminal 138 kV line.



Need Number: ComEd-2022-002

Process Stage: Solutions Meeting 4/22/22

Proposed Solution:

New Ameren station Putnam will be a 138 kV breaker and a half design. The station will be cut into the ComEd Kewanee to Streator line. The existing ComEd connection to Ameren's Hennepin station will be removed, eliminating the three-terminal line.

Estimated Cost: $ 5.2 M

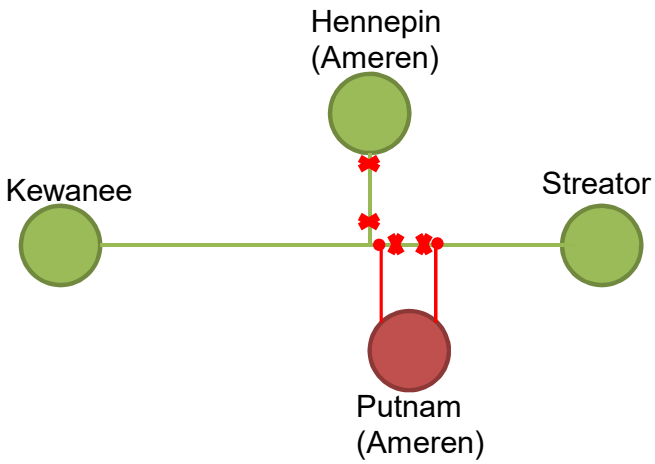
Alternatives Considered:

1. Single line tap was considered but does not address three-terminal line.

Projected In-Service: 12/1/2023

Project Status: Conceptual

Model: RTEP 2026



DEOK Transmission Zone M-3 Process
Kennel

Need Number: DEOK-2021-012

Process Stage: Solutions Meeting 04-22-2022

Previously Presented: Needs Meeting 11-19-2021

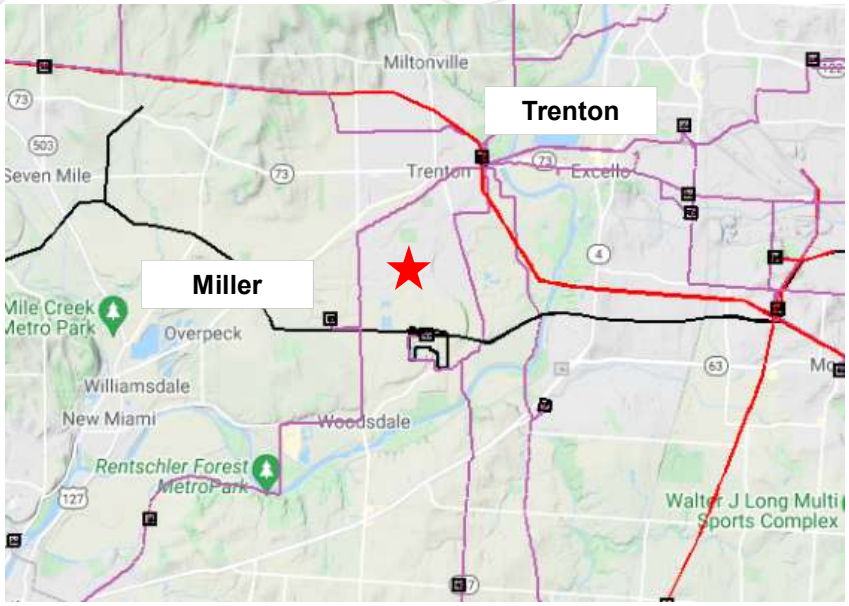
Project Driver: Customer Service

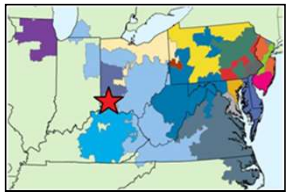
Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Problem Statement:

Duke Energy Distribution has requested a new delivery point near Kennel Road in Butler County Ohio. An existing customer is relocating to a new site for expansion. 10 MVA is required by Q1 2024 with a total 16 MVA required by Q1 2025.





345kV
138kV
69kV

DEOK Transmission Zone M-3 Process
Kennel

Need Number: DEOK-2021-012

Process Stage: Solutions Meeting 04-22-2022

Previously Presented: Needs Meeting 11-19-2021

Project Driver: Customer Service

Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Proposed Solution:

Construct a new 69 kV ring bus substation named Kennel. Install six circuit breakers and one 69/13 kV, 22 MVA transformer. Loop the 69 kV feeders currently feeding adjacent Miller substation through Kennel. Refeed Miller from Kennel. Distribution will feed the relocating customer from this new substation.

Ancillary Benefits: Operational flexibility, Infrastructure resilience

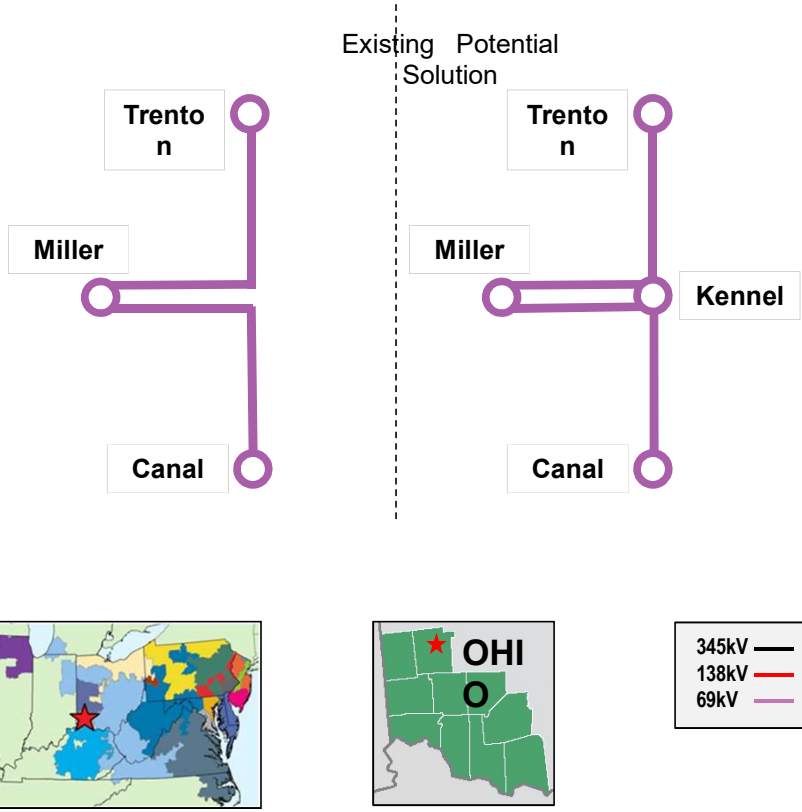
Alternatives: none

Estimated Transmission Cost: $6,671,179

Proposed In-Service Date: 12-31-2023

Project Status: Scoping

Model: 2021 RTEP



Need Number: DLC-2022-001

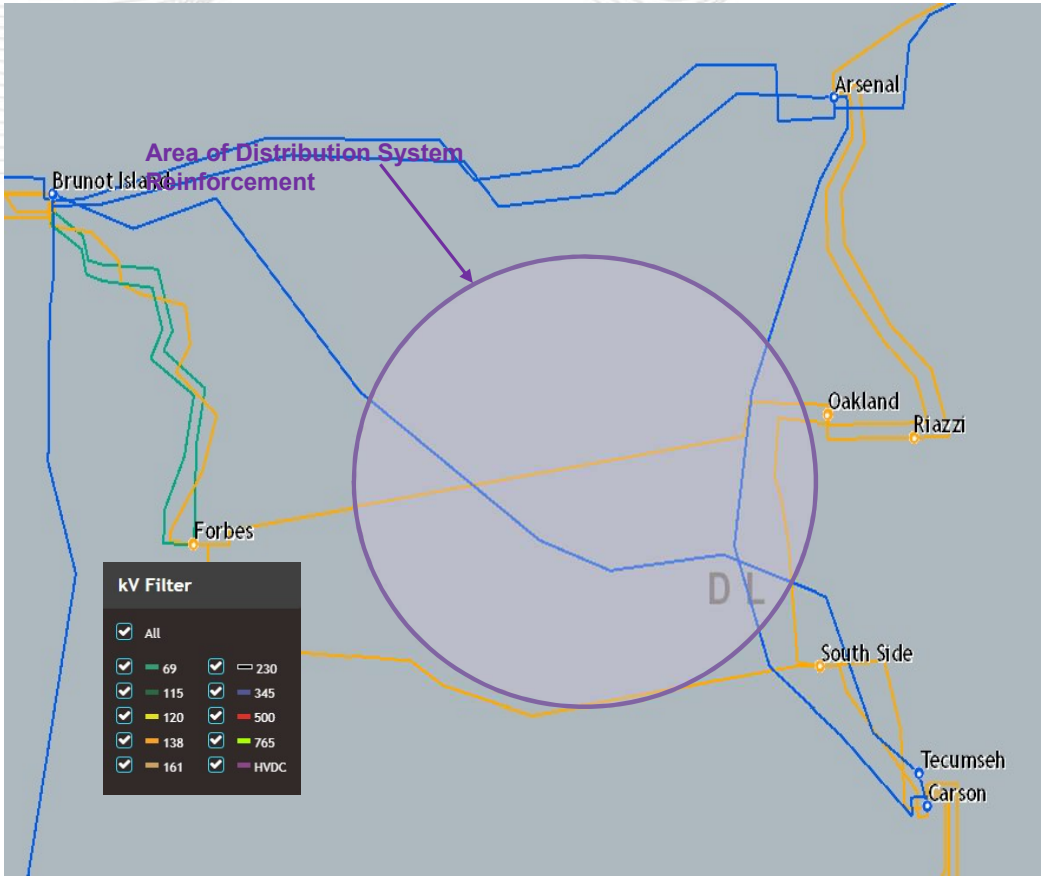
Process Stage: Needs Meeting (3/18/2022)

Project Driver: Infrastructure Resilience and Customer Service

Specific Assumptions Reference: Slide 9 and 10 of the DLC 2022 Local Planning Assumptions.

Problem Statement:

Load growth in Pittsburgh's downtown area, and in its adjacent communities, has presented concerns regarding DLC's existing distribution lines and its ability to serve its customers. As such, additional capacity and resiliency is needed to provide adequate distribution service to these areas.



Need Number: DLC-2022-001

Process Stage: Solutions Meeting (4/22/2022)

Potential Solution:
Establish a new 138-23 kV Watson substation with a 138 kV 3000A GIS ring bus. New substation will provide additional distribution feeds to DLC's downtown area which will increase capacity and provide increased resiliency. The existing Oakland–Forbes (Z-48) and Carson–Forbes (Z-86) 138 kV circuits will be looped through the new Watson 138 kV Substation to act as its transmission source. Four new 138 kV circuits will be created: Oakland–Watson (Z-48), Forbes–Watson (Z-85), Forbes–Watson (Z-86), and Carson–Watson (Z-89).

The Watson substation will provide load relief, increased service reliability, and resiliency to the distribution lines which provide service to Pittsburgh's downtown area and nearby communities.

Estimated Project Cost: $34M

Alternatives Considered:

1. **No Changes/ Do Nothing** – this is not a recommended alternative. Failing to address this issue would result in distribution system reliability and resiliency concerns with DLC's downtown area, including a number of critical customers.

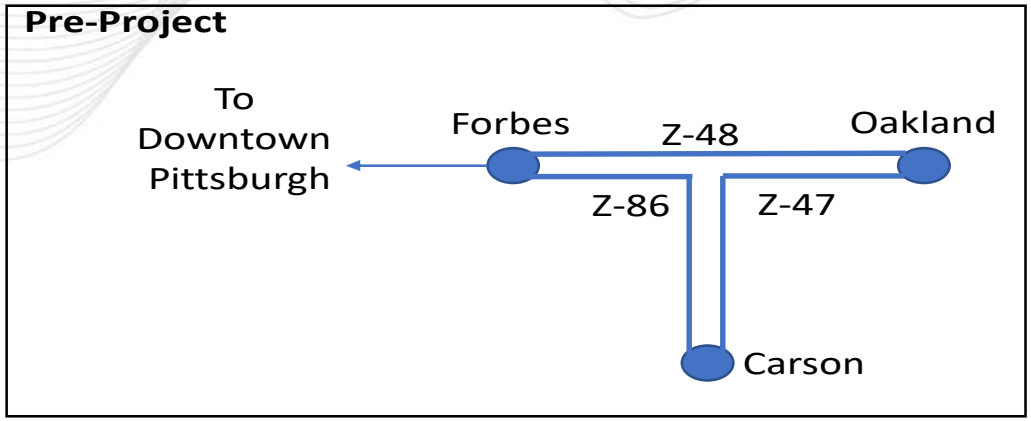
Estimated Alternative Solution #1 Cost: N/A

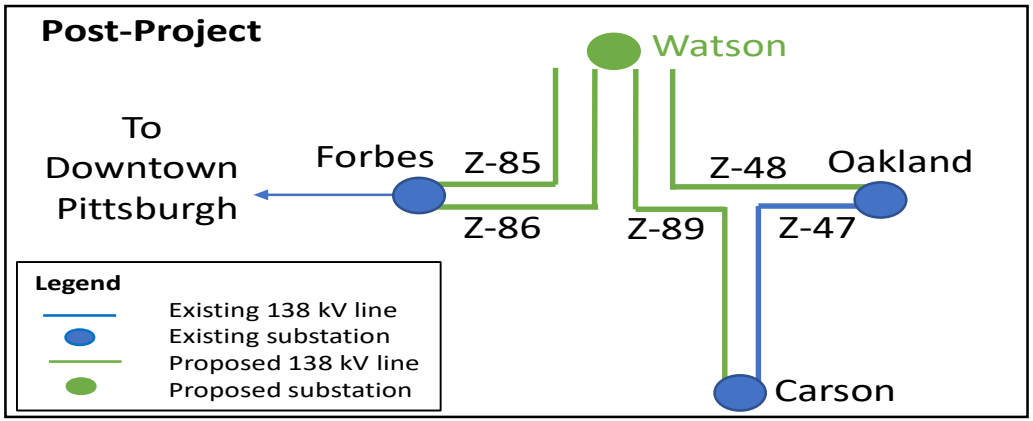
2. **Build breaker and a half bus configuration of Watson Substation** – this alternative is more costly as it would require more land, equipment, and involve complex relaying protection relaying and control.

Estimated Alternative Solution #2 Cost: $54M

Projected In-Service: 6/2025

Project Status: In Progress





AEP Transmission Zone M-3 Process
Bradley – Layland 69 kV Project

Need Number: AEP-2020-AP042

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Need Meeting 11/20/2020

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Bradley – Layland 69 kV (14.25 miles)

- Circuit is comprised mostly of wood pole structures
  - 1930s vintage structures (81%)
  - Circuit fails to meet 2017 NESC Grade B loading criteria, AEP structural strength requirements, and fails to meet current ASCE structural strength requirements
  - 4-bell porcelain insulators do not meet current AEP Standards
- 39 structures with at least one open condition (38% of the structures)
  - Structure conditions include rot top, insect damage, woodpecker holes
- Since 2014, there have been 30 momentary and 23 permanent outages on the Bradley - Layland 69 kV circuit
  - Majority of the momentary outages were due to weather including lightning/wind
  - Outages resulted in approximately 984k customer minutes of interruption

Bradley – Layland 69 kV Project

Need Number: AEP-2020-AP042

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

Retire the existing Bradley – Layland 69 kV line (approx. 14.3 miles) **Total Estimated Trans. Cost: $9.7M**

Construct a new double circuit 138 kV in/out line from the existing Bradley – Grandview 138 kV line (approx. 2.6 miles) **Total Estimated Trans. Cost: $8.3M**

Prince Station: Retire existing station **Total Estimated Trans. Cost: $0.0M**

Chessie Station: Install new 138 kV station including two 138 kV switches, circuit switcher and 138/12 kV 20 MVA XFR **Total Estimated Trans. Cost: $0.3M**

Grandview Station: Install a new 138/12 kV transformer to accommodate the retirement of Prince Station **Total Estimated Trans. Cost: $2.2M**

Bradley Station: Remove existing 69 kV breaker due to line retirement **Total Estimated Trans. Cost: $0.1M**

Layland Station: Remove existing 69 kV breaker due to line retirement **Total Estimated Trans. Cost: $0.1M**

Total Estimated Trans. Cost: $20.6M

Ancillary Benefits: The majority of the existing Bradley – Layland line is located within the Park Service Territory and will be retired and removed upon completion of the proposed project, this also includes a crossing on the New River. The station will also be re-located across the river and the work related to the new station and bank at Grandview will reduce exposure to the customers in the area.

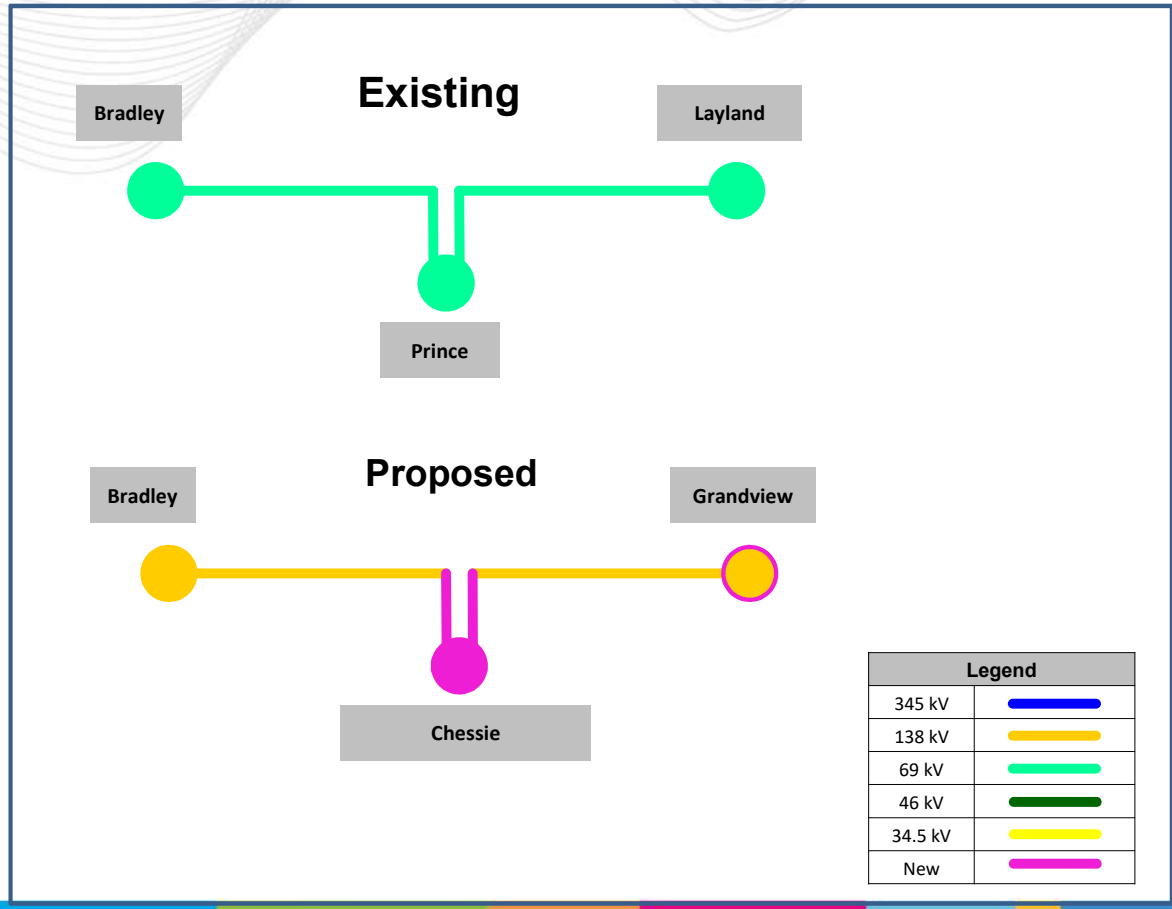
Alternatives Considered:

1. Rebuild the existing Bradley – Layland 69 kV line (approx. 14.3 miles) and replace the existing switches at Prince Station. **Total Estimated Cost: 37.3M**

Projected In-Service: 5/1/2025

Project Status: Scoping

Model: 2025 RTEP



AEP Transmission Zone: Supplemental
Pettit Ave – Melita 69kV

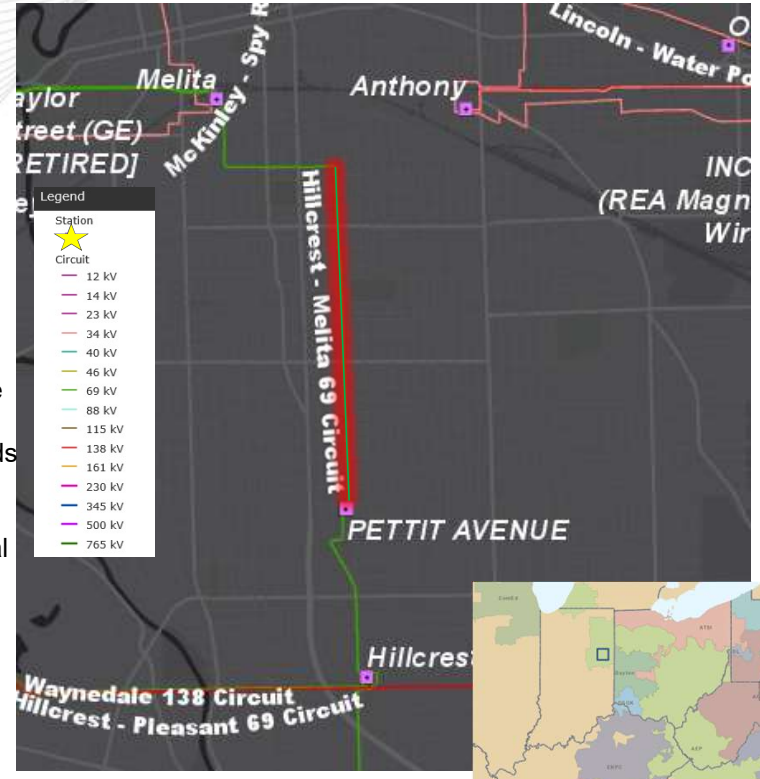
Need Number: AEP-2020-IM023
Process Stage: Solution Meeting 4/22/2022
Previously Presented: Needs Meeting 11/20/2020

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

- **Pettit Ave – Melita 69kV ~1.84 Miles**
  - Originally constructed in 1967
  - Wood pole construction with 61/62 structures original from 1967.
  - Recent field inspection identified 48 of the 62 structures on the line have moderate to advanced decay or shell damage.
    - Additional conditions include insect damage and stolen/missing ground leads along with the rot top and/or shell decay on the structures.
  - Structures do not meet 2017 NESC Grade B loading criteria, do not meet current AEP structural strength requirements, and do not meet the current ASCE structural strength requirements.

Model: N/A



AEP Transmission Zone: Supplemental
Pettit Ave – Melita 69kV

Need Number: AEP-2020-IM023

Process Stage: Solution 4/22/2022

Proposed Solution:

Rebuild the Pettit Ave – Melita 69kV 1.84 mile section on centerline utilizing 556.5 ACSR. Construction includes a high percentage of custom self-supporting running corners and dead ends due to line angles created by route adjustments. Constrained corridors are not suitable for guy wire installation. There are also an increased number of structures per mile due to configuration of existing underbuild and existing distribution service connections to residential and commercial customers along the existing line route. The line also passes through a heavily developed urban area of Fort Wayne, requiring new easements along the route and short span construction which all lead to higher than normal costs.

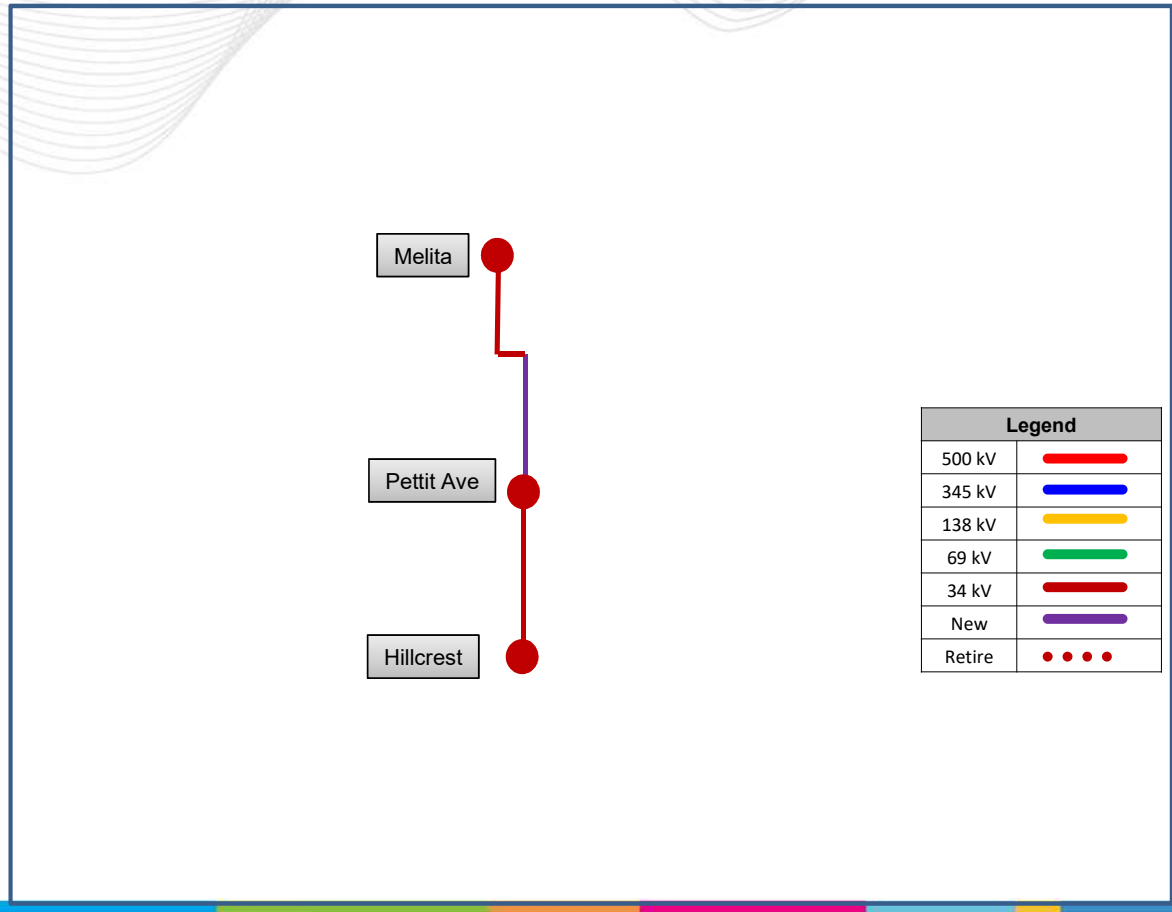
Total Estimated Transmission Cost: $7.4 to 12.0M

Alternatives Considered:

Rebuild this line as underground. This was not pursued as it would cost more and an overhead route was deemed achievable at this time.
Cost: $24.3M

Projected In-Service: 2/14/2025

Project Status: Scoping



AEP Transmission Zone M-3 Process
East Lima – Columbus Grove 69kV Line Rebuild

Need Number: AEP-2020-OH037

Process Stage: Solution Meeting 04/22/2022

Previously Presented: Need Meeting 10/16/2020

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

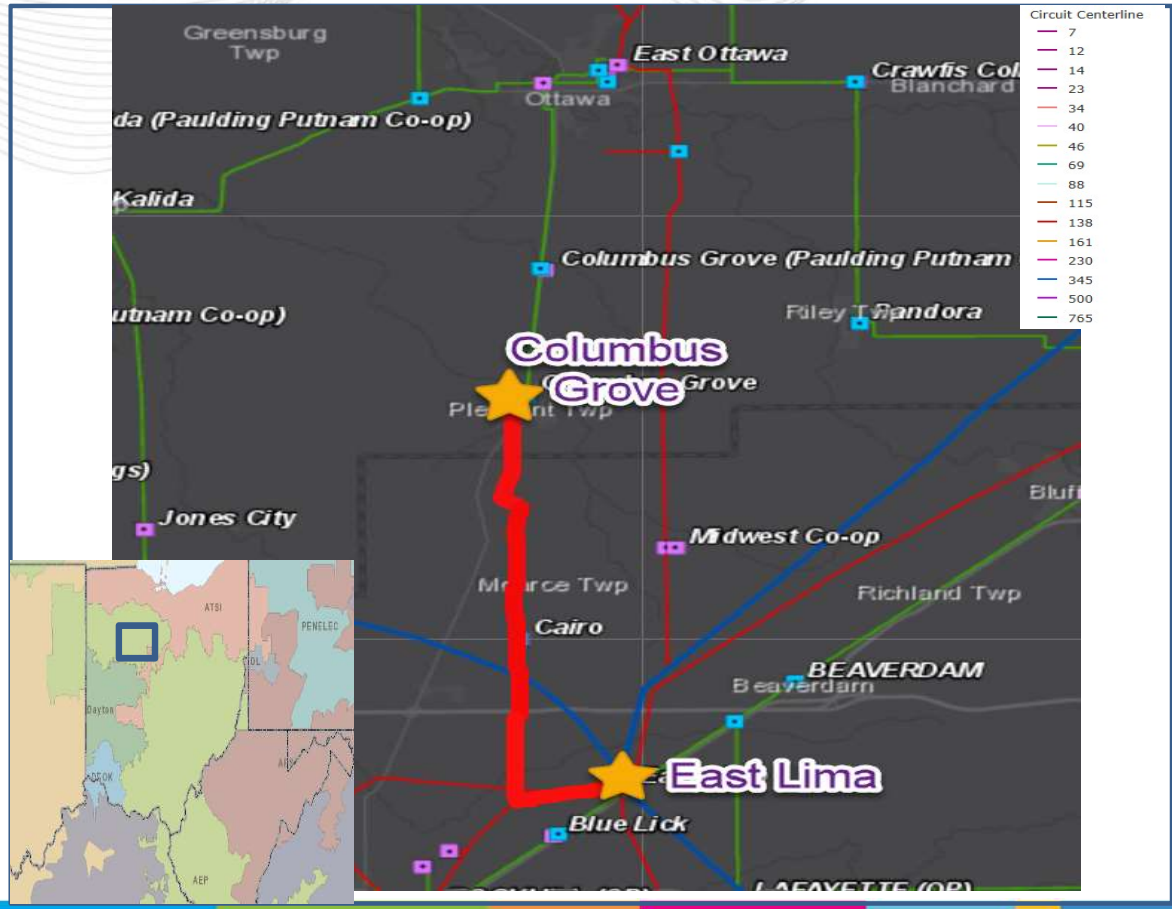
Problem Statement:

Line

East Lima – Columbus Grove 69kV (vintage 1953)

LINE CHARACTERISTICS

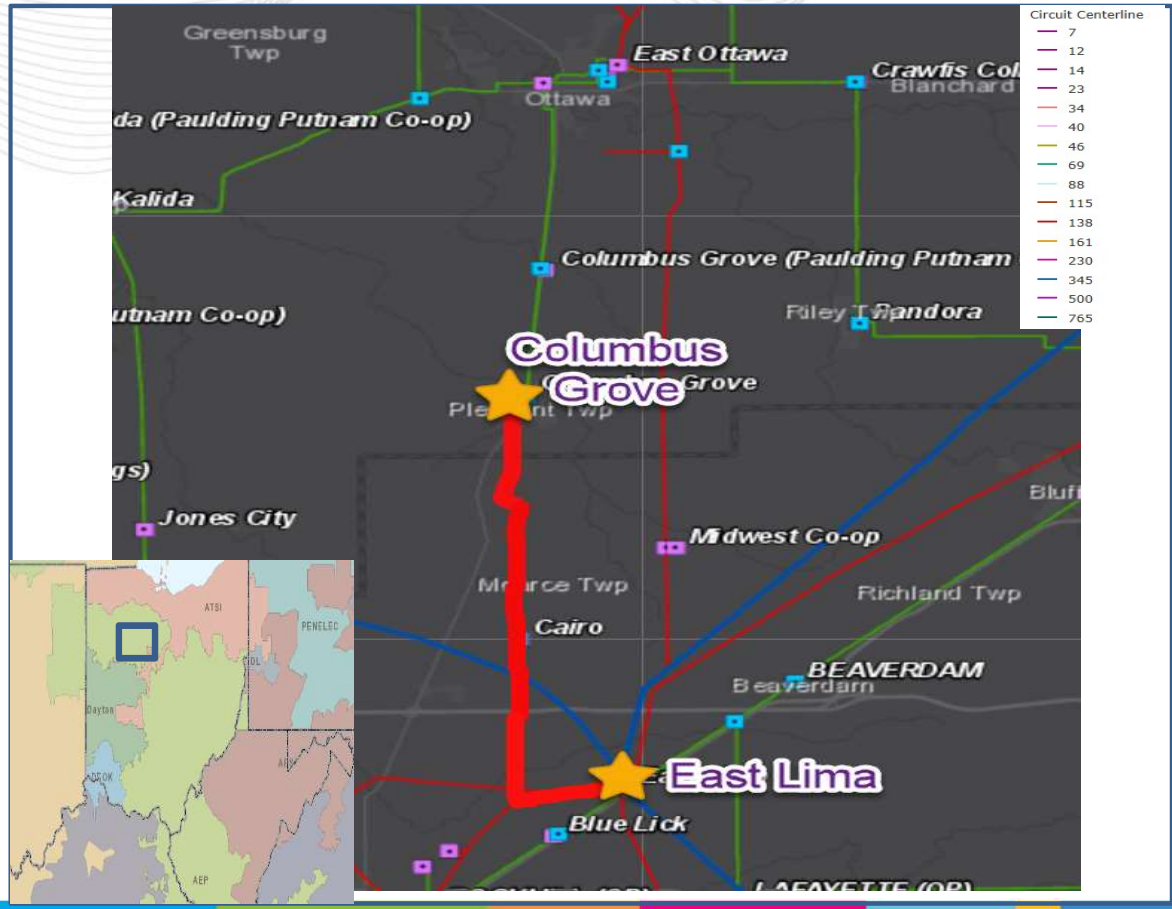
- Original install date: 1953
- Length of Line: 10.86 miles
- Total structure count: 255; 150 dating back to original installation.
- Original Line Construction Type: Wood monopoles
  - Cross Arm Material: Wood
  - The line has vertical and horizontal ceramic insulators and is butt wrap grounded
- Conductor: 4/0 ACSR 6/1 (Penguin) -72% and 556 kCM ACSR 26/7 (Dove) -28%



AEP Transmission Zone M-3 Process
East Lima – Columbus Grove 69kV Line Rebuild

CONDITION / PERFORMANCE / RISK ASSESSMENT:

- Momentary/Permanent Outages and Duration: 20 total outages: 17 (Momentary), 3 (Permanent)
- 5 Year CMI: 911,294
- Number of open conditions: 112 Open conditions on 94 unique structures
  - Open conditions include: rotten heart, woodpecker holes, insect damage, split crossarms, burnt insulators, broken ground lead wires etc.
- Risk
  - Number of Customers at Risk: 3,272
  - Load at Risk: 22.71 MVA
  - The grounding/shielding and the insulation of the line is inadequate according to the current AEP standards.



Need Number: AEP-2020-OH046

Process Stage: Solution Meeting 04/22/2022

Previously Presented: Need Meeting 12/18/2020

Project Driver:

Customer Service

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Customer Service:

- **Station/Area Name:** Bluelick Switch
- **Load:** 3.185MW Existing/3.7MW projected by 2029
- **Customer Request:** The customer has requested to upgrade their existing delivery point from 34.5kV to 69kV.
- **Requested In-service Date:** 6/1/2024

AEP Transmission Zone M-3 Process
East Lima- Columbus Grove 69kV

Need Number: AEP-2021-OHO37, AEP-2021-OH046
Process Stage: Solutions Meeting 04/22/2022

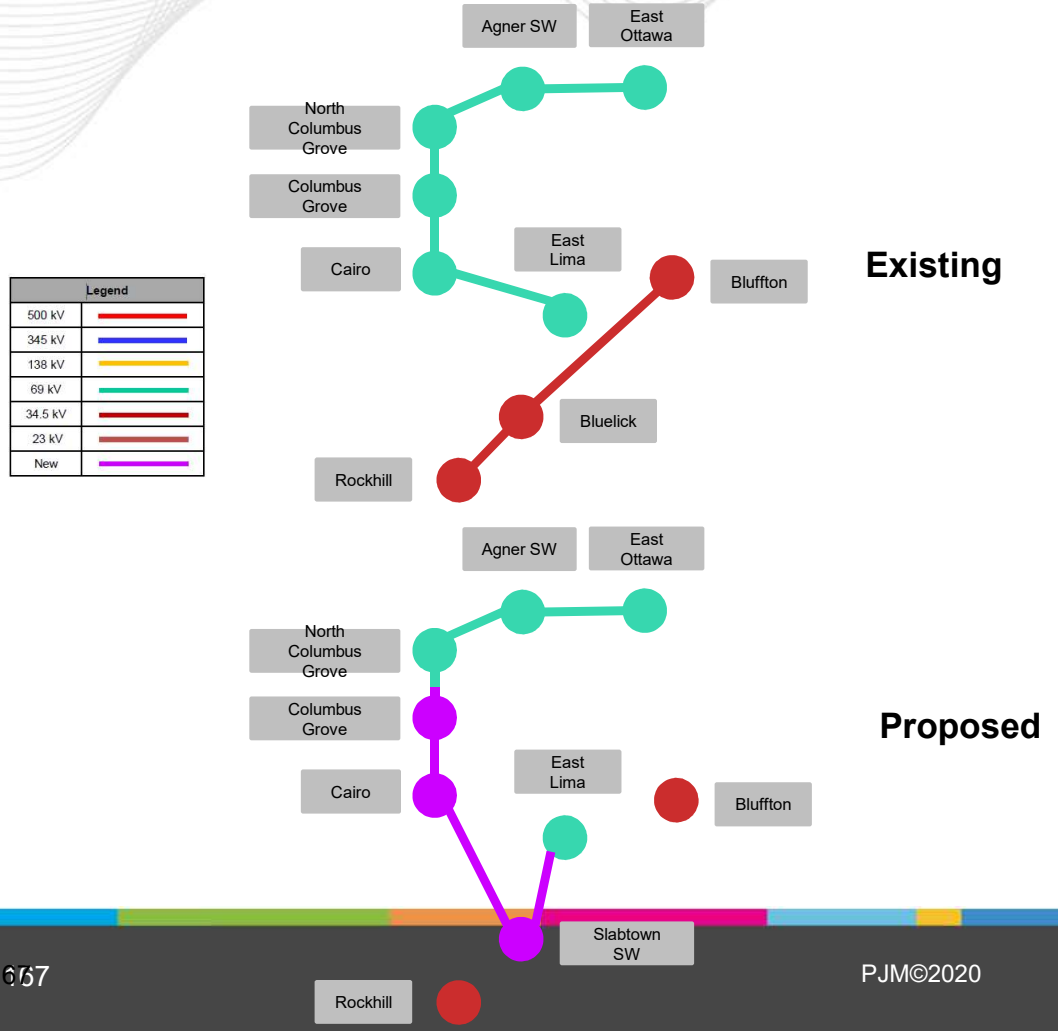
Proposed Solution:

- **East Lima – Columbus Grove Line:** Rebuild 9.3 miles of the East Lima - Columbus Grove line between Columbus Grove and structure 38. Construct ~1 mile of greenfield 69 kV line between structure 38 and the existing Bluelick Sw. Rebuild 1.65 miles of the 34.5 kV line section between Bluelick and East Lima to 69 kV to provide looped service to the new 69 kV delivery at Bluelick. Retire 1.7 miles of the Columbus Grove – East Lima line from structure 38 into East Lima. **Estimated Cost $25.547M**
- **Slabtown Switch:** Install Slabtown SW with 1200A POP switches. Install Auto-sectionalizing on the through path. Upgrade Bluelick delivery point metering. **Estimated Cost $0.885M**
- **Bluelick Switch:** Retire 34.5 kV Bluelick SW **Estimated Cost $0.054M**
- **Cairo Switch:** Replace Cairo switch with 1200A POP switches. Install SCADA control on the through-path. **Estimated Cost $0.706M**
- **East Lima Station:** Upgrade telecom equipment at East Lima station. **Estimated Cost $0.021M**
- **Columbus Grove Station:** In order to accommodate the line rebuild, work will be performed on the existing Columbus Grove switch. Install a box bay with two 69 kV, 1200A line witch automated MOABs, at Columbus Gove station. **Estimated Cost $1.141M**

Total Estimated Cost: $28.354M

Alternatives Considered:
The East Lima – East Ottawa 69kV circuit serves multiple customers as well as provides voltage and thermal reliability during contingency conditions. Rather than providing looped service to Bluelick, a radial could have been extended from East Lima. This option would have required greater station costs at East Lima in order to accommodate the additional 69 kV line position at the station and also reduces the reliability of service to Bluelick since they have looped service today. The proposed solution also allows for retiring 4 miles of 34.5 kV line by building one new mile of greenfield 69 kV.

Projected In-Service: 05/15/2024
Project Status: Scoping
Model: 2026 PJM RTEP Load-Flow and Short Circuit Models



AEP Transmission Zone M-3 Process
Belva – Clendenin Rebuild

Need Number: AEP-2021-AP021

Process Stage: Solutions Meeting 04/22/2022

Previously Presented: Need Meeting 06/15/2021

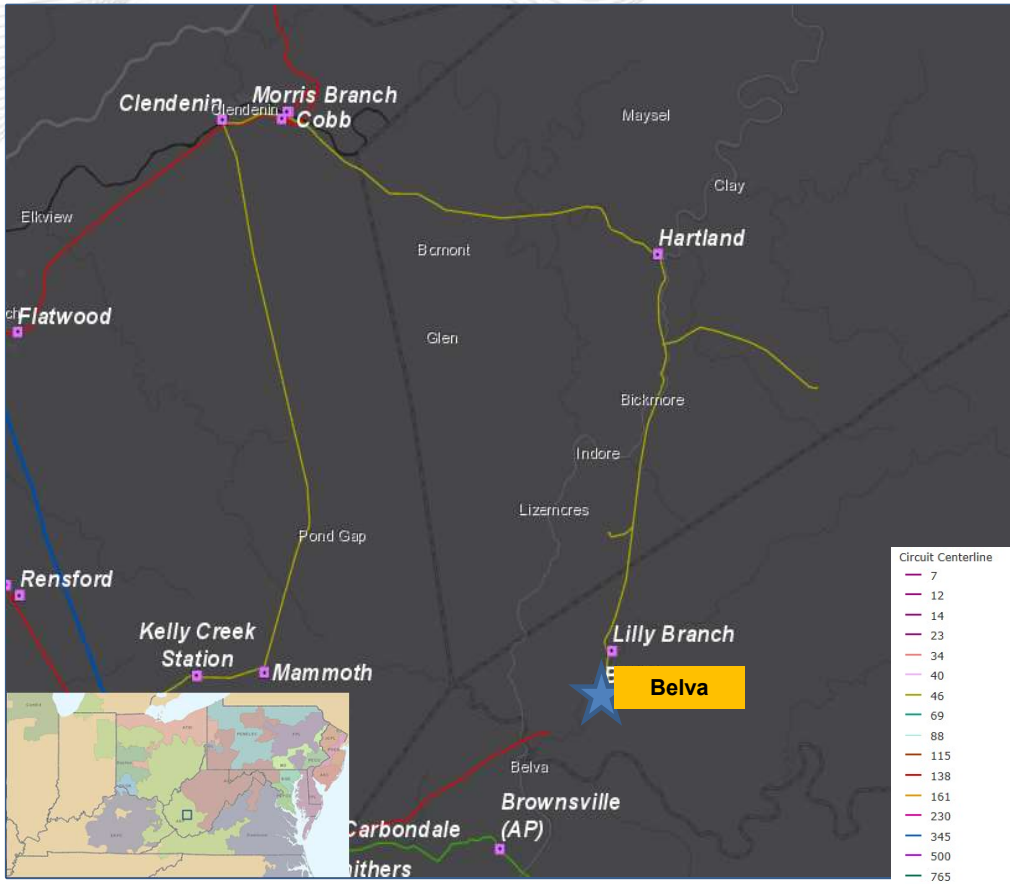
Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Belva 138/46 kV Station

- The transformer protection includes an obsolete MOAB-ground-switch system, which relies on remote station fault clearing.
- The lack of sectionalizing at the station creates dissimilar zones of protection (line, bus, and transformer) which can cause over tripping and mis-operations.
- Belva Station deploys 40 relays and currently 36 of the 40 (90%) are in need of replacement. 35 are electromechanical and 1 is static type, which have significant limitations with regards to part availability and fault data collection/retention.



AEP Transmission Zone M-3 Process
Clay County, WV

Need Number: AEP-2021-AP022

Process Stage: Solutions Meeting 04/22/2022

Previously Presented: Need Meeting 06/15/2021

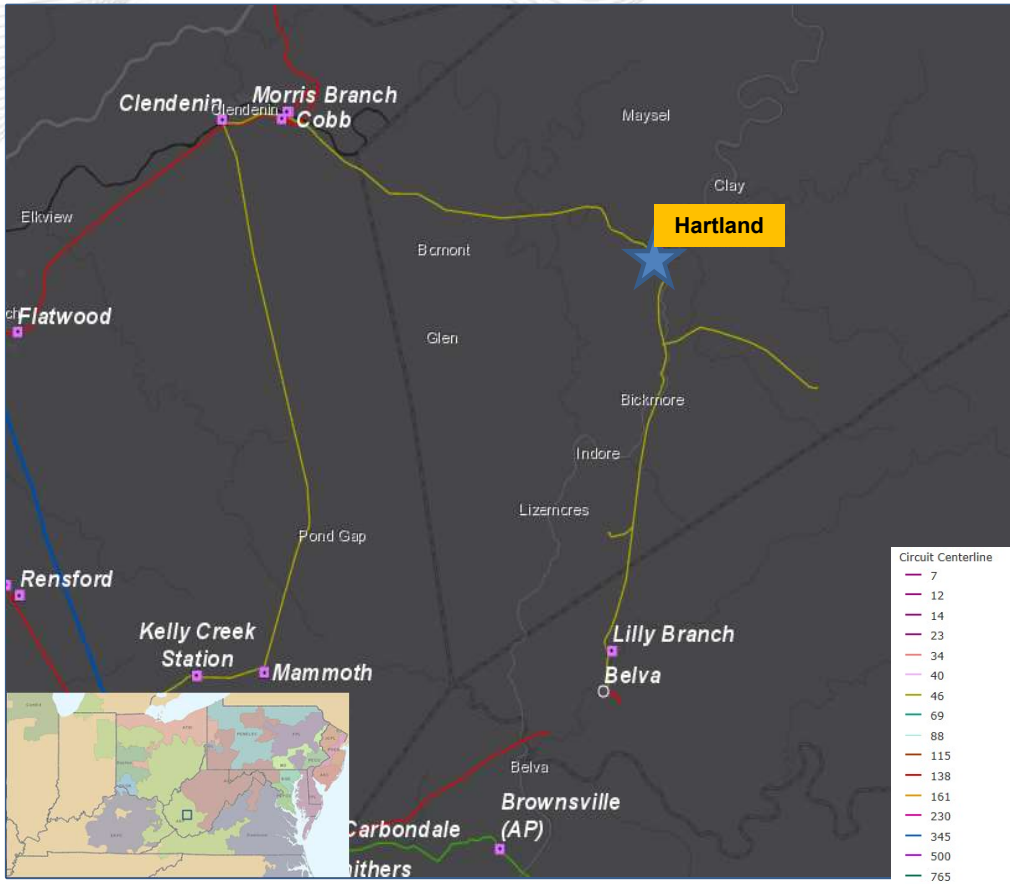
Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Hartland 46 kV Station

- Circuit switcher AA is a 2030-69 type SF6 filled switcher. The S&C 2030 family of circuit switchers have no gas monitor and currently in-service units on the AEP system have experienced 80 malfunctions from May 2002 to August 2019.
- Vacuum bottles on MOABs 'W' and 'Y' show signs of damage.



AEP Transmission Zone M-3 Process
Belva – Clendenin Rebuild

Need Number: AEP-2021-AP023

Process Stage: Solutions Meeting 04/22/2022

Previously Presented: Need Meeting 06/15/2021

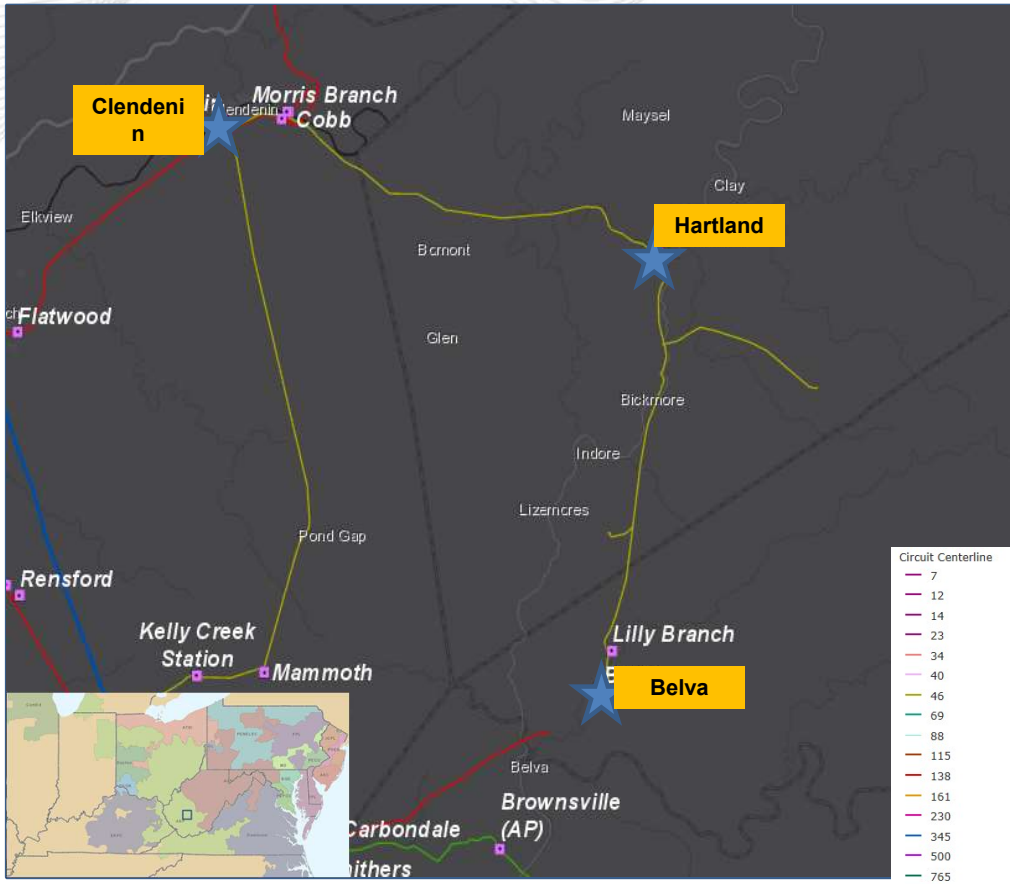
Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Belva – Clendenin 46 kV Circuit (~27 miles)

- Circuit is comprised mostly of vintage wood pole structures.
  - Original vintage wood structures from 1940
  - The Belva – Clendenin 46kV Line uses primarily original vintage conductor includeing 2/0 Copper, 4/0 ACSR and 336 ACSR.
  - The circuit fails to meet 2017 NESC Grade B loading criteria, AEP structural strength requirements, and ACSE structural strength requirements
- Since 2015, there have been 28 momentary and 30 permanent outages on the Belva – Clendenin 46kV Circuit.
  - The momentary outages were due to lightning (16), wind (3), misoperation (3), field error (1) causes.
  - The permanent outages were due to vegetation fall-in from outside of the AEP ROW (15), lightning (7), vegetation contacts from inside the AEP ROW (4), flood/slide (1), crossarm failure (1), ice/snow (1), and distribution (1) causes.
  - These outages caused 8.9M minutes of interruption for customers. The reported CMI is an estimated value due to the wholesale delivery point at Hartland Station.
- Currently, there are 114 structures with at least one open structural condition, which relates to 44% of the structures
  - 357 structural open conditions primarily related to rotten poles and crossarms. Other structural conditions include woodpecker damage, leaning in-line, or split poles, broken rusted, or corroded crossarms, and a split knee/vee brace.
  - 22 open forestry conditions related to brush clearances and dead trees
  - 21 open hardware conditions related to broken, loose, or damaged guys, broken insulators, and rusted or worn conductor hardware.
  - 1 open conductor related condition related to damaged conductor
  - 1 open grounding condition related to a broken ground lead wire



AEP Transmission Zone M-3 Process
Belva – Clendenin Rebuild

Need Number: AEP-2021-AP021, AEP-2021-AP022, AEP-2021-AP023

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

Rebuild the existing Belva – Clendenin 46 kV line to 138 kV standards (approximately 27 miles). **Estimated Trans. Cost: $85.6M**

Belva Station: Replace existing Gr. Sw. MOAB with a new 138 kV 3000 A 40 kA CB. Install a new 138 kV 3000 A 40 kA CB on the Belva – Gilboa 138 kV line at Belva Station. Install 9.6 MVAR cap bank. **Estimated Trans Cost: $2.9M**

Hartland Station: Replace existing MOABs W and Y with two new switches. Retire/Remove existing circuit switcher AA and cap bank. **Estimated Trans Cost: $0.7M**

Total Estimated Trans. Cost: $89.2M

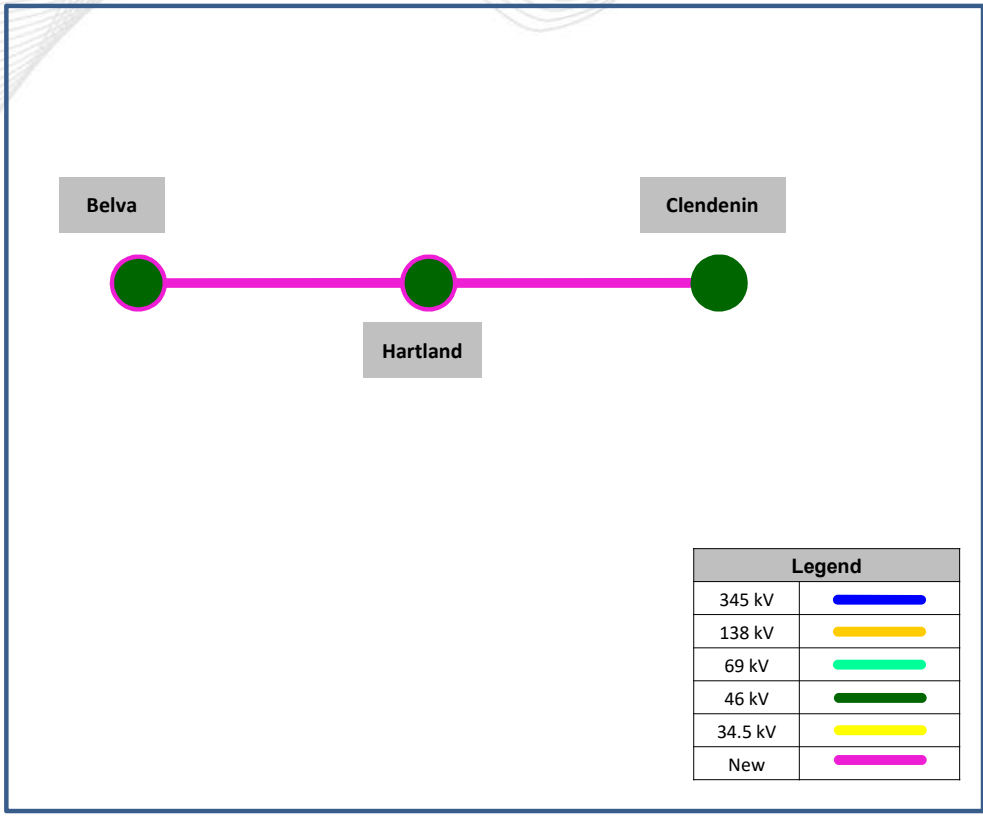
Alternatives Considered:

1. Due to the remote load that is being served at Hartland Station, retirement is not an option for this line.
2. Since there is no other 69 kV voltage in the area, rebuilding the line at 69 kV instead of 138 kV would leave this line as the only 69 kV line in the area if/when converted in the future. 138 kV construction is the prevalent voltage in the area.

Projected In-Service: 9/1/2026

Project Status: Scoping

Model: 2026 RTEP

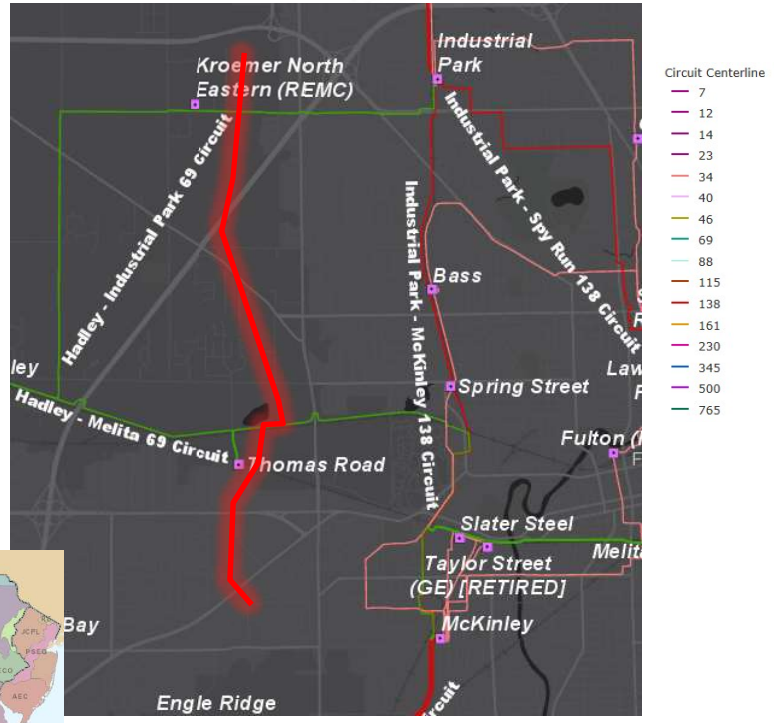


AEP Transmission Zone M-3 Process
Industrial Park – McKinley 138kV

Need Number: AEP-2021-IM019
Process Stage: Solution Meeting 4/22/2022
Previously Presented: Needs Meeting 07/16/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Industrial Park – McKinley 138kV line:

- 4.59 miles of 1968 795 ACSR. ~1 miles is double circuited with McKinley – Melita 69kV and ~.9 miles is double circuit with Melita – Hadley 69kV. The remainder is single circuit.
- All sections of this line is 1968 conductor, and 85/98 structures are original wood poles. There are 11 steel structures from 1968 and 2 steel structures from 2018 that are not identified as a need at this time.
- Structures fail NESC Grade B, AEP Strength requirements, and ASCE structural strength standards
- 18 structures were inspected by drone with 11 assessed by ground crew
    - 9 structures found to have moderate-heavy checking or insect/bird damage
    - Several instances of insulators tipping away from pole
    - 81% of poles inspected by ground crew had beyond normal decay.
- 12 open conditions are on this line including woodpecker damage, damaged guy wires, damaged insulators



AEP Transmission Zone M-3 Process
Industrial Park – McKinley 138kV

Need Number: AEP-2021-IM019
Process Stage: Solution Meeting 4/22/2022

Proposed Solution:

Industrial Park – McKinley 138kV line:
Rebuild the ~1 mile section that is double circuit with McKinley – Melita 69kV and rebuild the ~0.9 mile section that is double circuit with Melita – Hadley 69kV in place. The remaining ~1.3 miles will be rebuilt as single circuit. All new line conductor will be 795 Drake ACSR. The total rebuild length is 1.9 miles double circuit and 1.3 miles single circuit for a total of 3.2 miles.

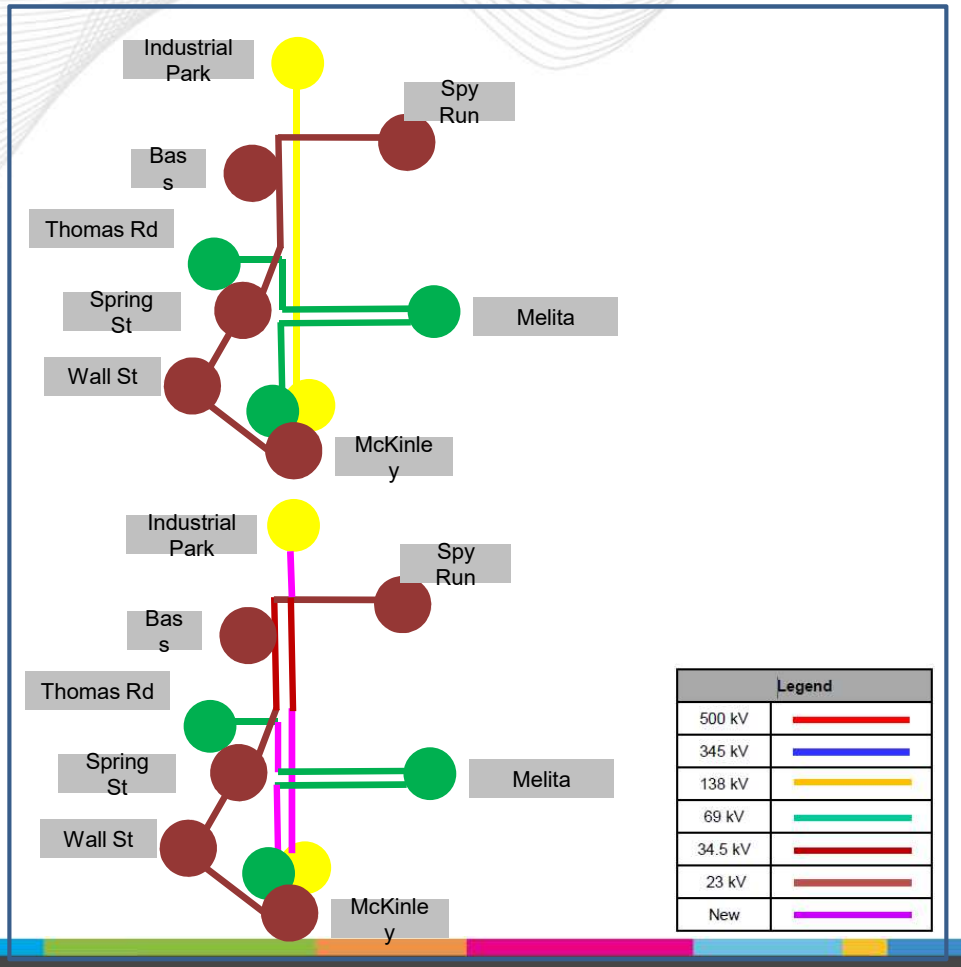
The remaining ~1.4 miles is rebuilt under S2152
Estimated Cost: $ 9.3M

Alternates:

Rebuild the line as-is instead of consolidating the Spy Run – McKinley 34 line and the Industrial Park – McKinley 138 line into a double circuit section. This would lower the cost of S2152, but would overall cost more to the ratepayers.

Alternate Cost: $13.3M

Projected In-Service: 11/01/2026
Project Status: Scoping



AEP Transmission Zone M-3 Process
Robison Park – Wallen 69kV

Need Number: AEP-2021-IM027
Process Stage: Solution Meeting 4/22/2022
Previously Presented: Needs Meeting 08/16/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Robison Park – Wallen 69kV line (3.24 miles):

- 14 of the 44 structures are original 1930 Steel Lattice
- There are 7 wood poles with significant insect and wood pecker damage, with insulators that are pulling away and flashed insulators.
- Remainder of structures are steel monopole and are in acceptable condition at this time.
- 2.96 miles of line is original 1930s vintage 300,000 CM CU conductor
- Since 2015 there have been 5 momentary and 1 permanent outages
- 7 wood structures fail NESC Grade B, AEP Strength requirements and ASCE structural strength standards

AEP Transmission Zone: Supplemental
Robison Park – Wallen 69kV

Need Number: AEP-2021-IM027
Process Stage: Solution Meeting 4/22/2022

Proposed Solution:

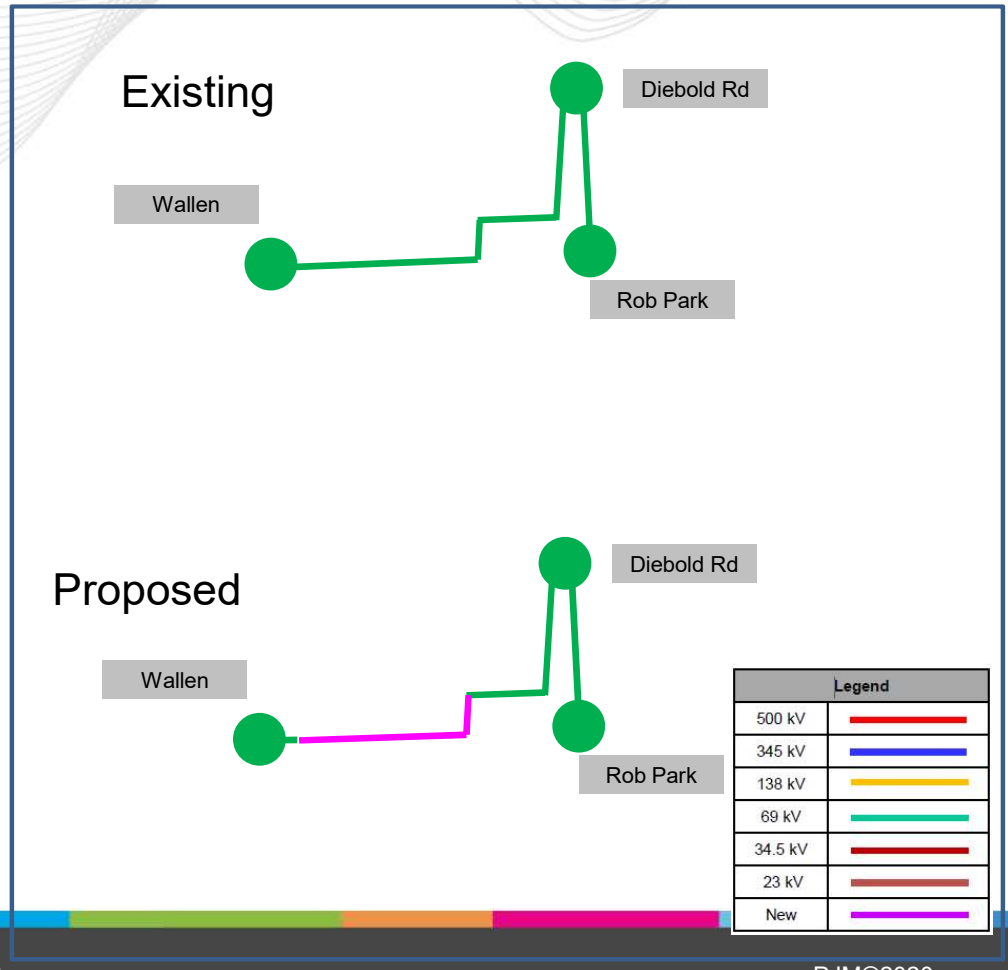
Robison Park – Wallen 69kV line:
Reconductor the ~2.96 miles of 300,000 CU with 556.5 ACSR and replace 21 structures outlined in the need with steel monopole structures.
Estimated Cost: $6.3M

Alternates:

In lieu of rebuilding the line, turn Diebold Rd into an in and out from Robison Park. Since this was just a partial rehab and not a full rebuild this solution wasn't considered. In addition, this solution would have required a second 138/69kV XFR at Robison Park to maintain two sources to the load, making it more expensive.

Cost: $8M

Projected In-Service: 11/01/2025
Project Status: Scoping



AEP Transmission Zone M-3 Process
Richland, Ohio

Need Number: AEP-2021-OH006

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Needs Meeting 2/17/2021

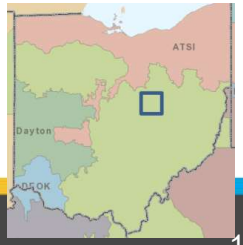
Supplemental Project Driver: Operational Flexibility, and Customer Service

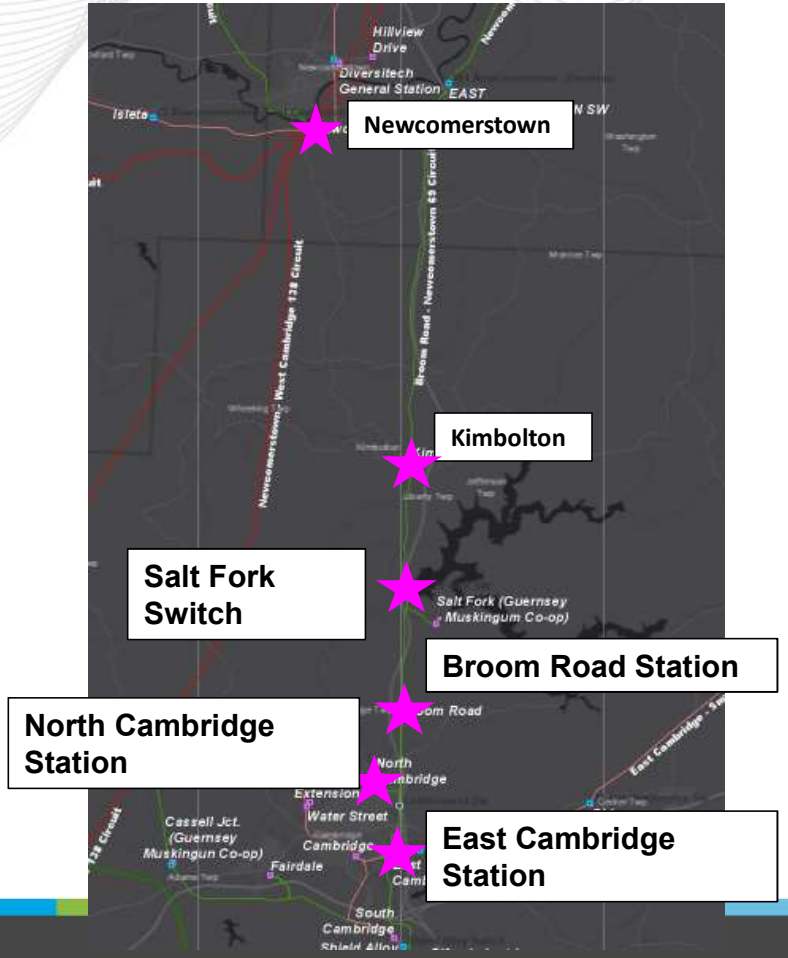
Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:

- The Newcomerstown- Cambridge and Leatherwood- North Cambridge 69kV lines were originally constructed in 1926 with wood structures and copper conductor (3/0 CU). 79% of the lines still utilizes the original 1926 copper conductor. The remaining sections have been replaced over the years with 336 ACSR conductor.
- The circuits have had 23 forced operations in the last 5 years of which 5 have been permanent and resulted in 33.4 hours of down time and a CMI of 453,409.
- There are currently 88 open conditions along the Newcomerstown- Cambridge 69kV line and 13 open conditions along the Leatherwood- North Cambridge 69kV mile long line.
- The Leatherwood- North Cambridge 69kV line is served via a radial switch with old 1963 wood pole structures. Radial service severely restricts the ability to perform routine maintenance and restoration activities leading to longer customer outages.
- The FOI limit is surpassed for Salt Fork Switch to Newcomerstown requiring a MOAB to be added to Salt Fork. The existing structure is unable to accommodate this MOAB and a new switch pole will be required. Building this switch at Str 212 will also not require rebuilding the 0.4 mile double circuit spans thus increasing customer reliability as well

Model: PJM 2026 RTEP Series Cases





AEP Transmission Zone M-3 Process
Seneca County, Ohio

Need Number: AEP-2021-OH006

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

- Rebuild approximately 4.6 mile of the Newcomerstown- Cambridge 69kV line that wasn't addressed under b3274 and b3345 utilizing 556 ACSR conductor **$8.97 M**
- Rebuild the 0.6 mile Leatherwood Sw- North Cambridge with double circuit 556 ACSR conductor to provide loop service to North Cambridge station. **$1.45 M**
- Add line MOABs for each of the double circuit lines coming into North Cambridge station. **$0.28 M**
- Remove the Leatherwood Switch that currently radially serves North Cambridge station. **$0.08 M**
- Replace Salt Fork Switch with a new 1200A POP Switch. **$1.13 M**

Cost estimate: $11.91 M

Alternatives Considered:

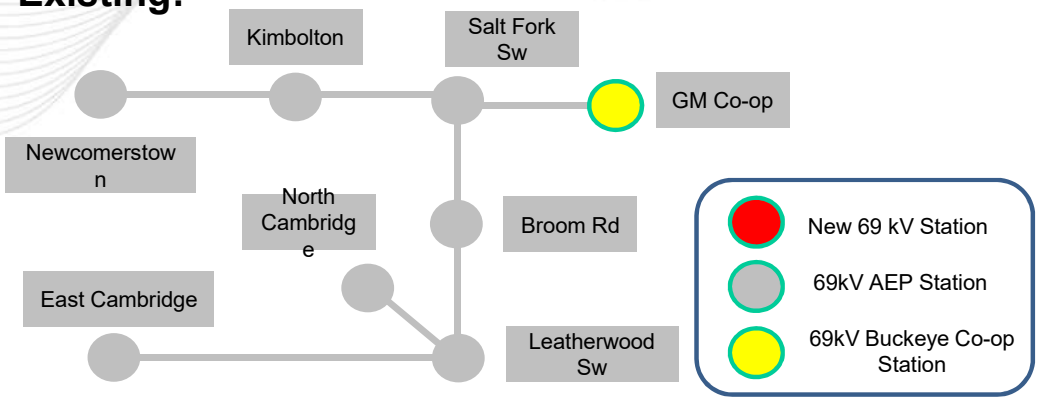
A portion of this line is already approved to be rebuilt as a baseline project. Considering the number of customers served from the line and the already approved work to rebuild, no other alternatives were identified.

Projected In-Service: 6/1/2025

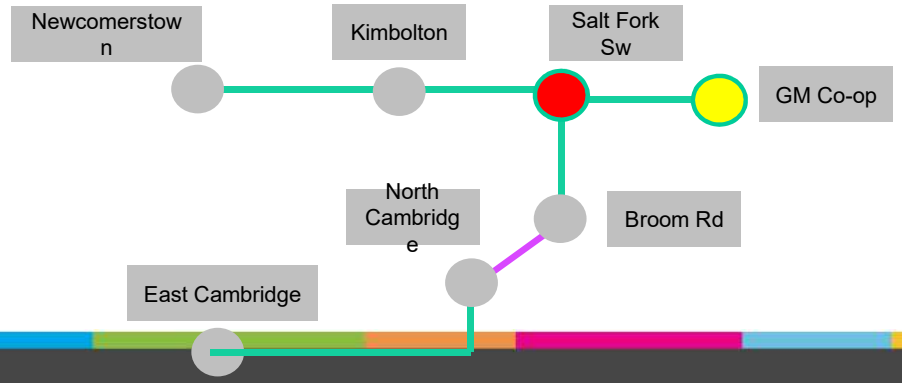
Project Status: Scoping

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

Existing:



Proposed:



AEP Transmission Zone M-3 Process
Fremont, Ohio

Need Number: AEP-2021-OH007

Process Stage: Solutions Meeting 4/22/2022

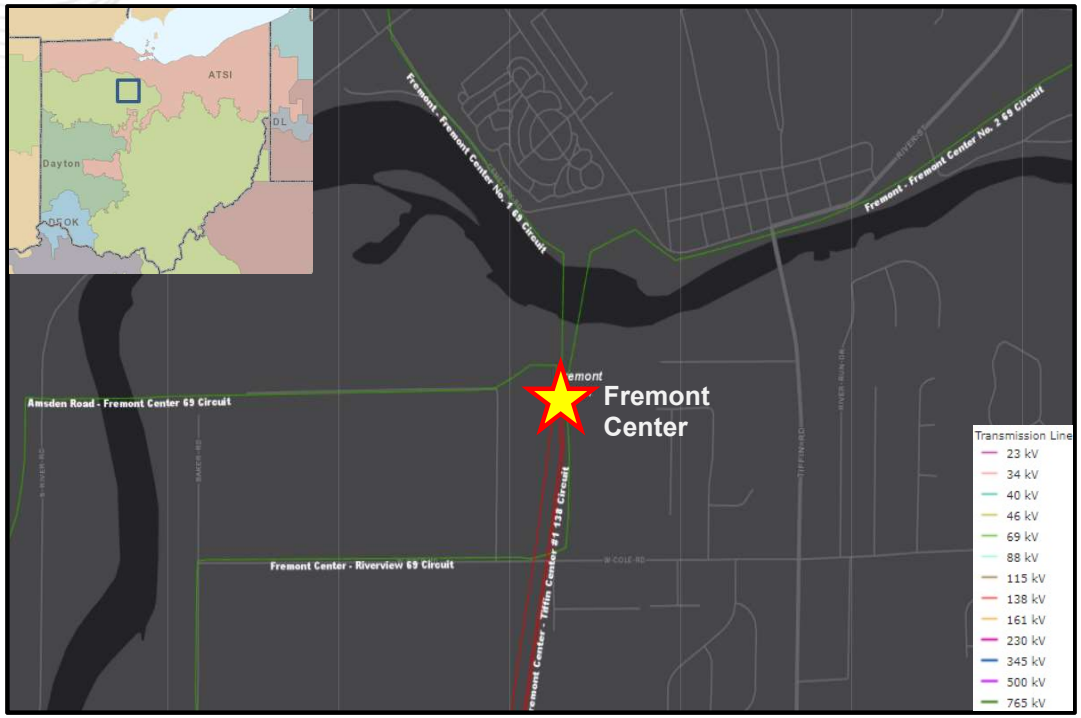
Previously Presented: Needs Meeting 2/17/2021

Supplemental Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:

- Circuit Breakers F, G, H, J, K, & L
- Breaker Age: F 1971, G 1971, H 1971, J 1971, K 1971, & L 1988
- Interrupting Medium: (Oil)
- Fault Operations:
- Number of Fault Operations: F 15, G 51, H 26, J 20, K 19, & L 69
- Manufacturer recommended Number of Operations: 10
- Additional Breaker Information: These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require.
- Relays: Currently, 40 of the 76 relays (53% of all station relays) are in need of replacement or upgrades. 39 of these are of the electromechanical type and 1 of the static type which have significant limitations with regards to fault data collection and retention.
- RTU: The existing Data Concentrator – DOS type RTU installed at Fremont Center is a non-standard RTU with no vendor support, no active warranty, no available training and no Ethernet compatibility. In addition, this unit has high a malfunction rate.



Model: PJM 2025 RTEP Series Cases

Need Number: AEP-2021-OH007

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

- Rebuild the existing 69 kV yard to a breaker and a half arrangement. Install 11 new 3000A 40kA 69kV breakers and relocate one existing breaker into the new strings. **$10.35 M**

Cost estimate: $10.35 M

Ancillary Benefits:

Currently, the 69 kV bus at Fremont Center is a single bus design with five 69 kV transmission lines and three transformers served from it. In order to improve operational flexibility and address the 69 kV breakers identified at the station the 69 kV bus will be reconfigured to a breaker and a half arrangement.

Alternatives Considered:

Replace the identified breakers in place and keep the current straight bus configuration. This alternative was not advised as the breaker and a half configuration produces a superior protection scheme than the straight bus configuration that exists today. The breaker and a half configuration will now allow for a 69kV breaker fault to occur and avoid taking the entire 69kV side of the station out of service. Considering the number of transmission elements served at 69 kV, the breaker and a half arrangement provides the most reliable service to all elements for outages and maintenance considerations.

Projected In-Service: 12/15/2026

Project Status: Scoping

No bubble diagram needed. Station work only.

Need Number: AEP-2021-OH023

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Needs Meeting 4/16/2021

Supplemental Project Driver: Operational Flexibility, and Customer Service

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:
Line Name: Howard- Fostoria 138kV

LINE CHARACTERISTICS

- Original Install Date (Age): 1928
- Length of Line: 45.34 miles
- Total structure count: 264
- Original Line Construction Type: Steel Lattice
- Conductor Type: 397 CM ACSR 30/7

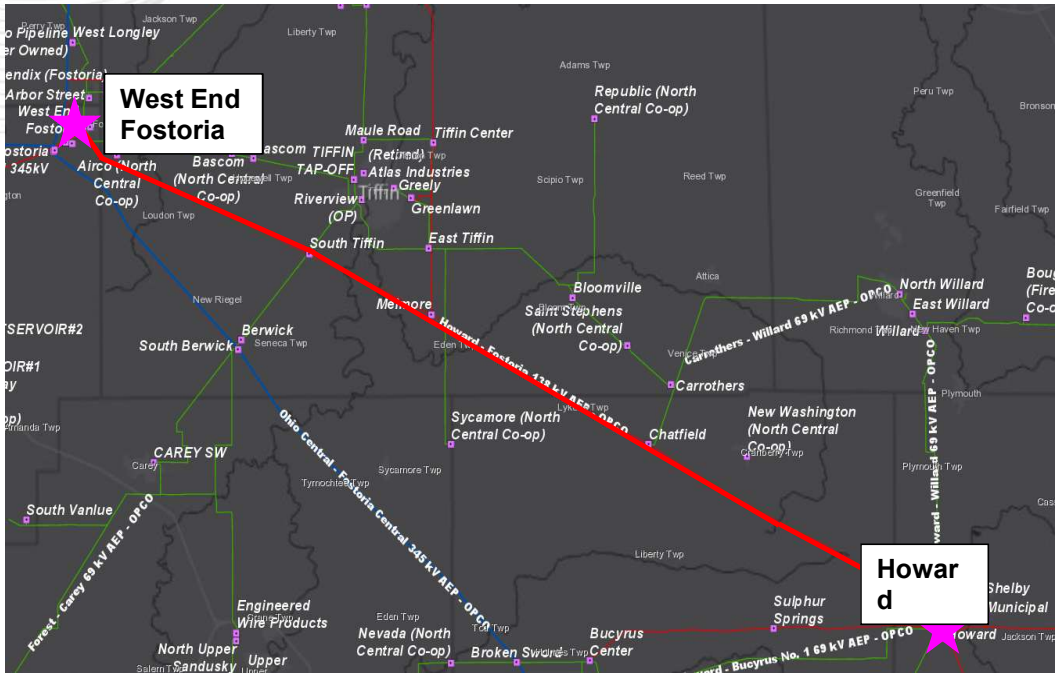
CONDITION / PERFORMANCE / RISK ASSESSMENT:

- Outage History
- 11 momentary and 2 permanent outages with an average duration of 28.53 hours
- Condition Summary
- Number of open conditions by type / defects / inspection failures: 126
- 37 structure based open conditions consisting of bent lacing, rust on the leg of a structure, vines on the leg of a structure and tower base, and tower base debris. There are currently 195 hardware based open conditions consisting of a broken/loose/missing conductors, bird droppings on insulators, broken/burnt/chipped/rusty insulators, bent/broken/burnt insulator assembly hardware and broken/loose/worn shield wire hardware.

Risk

- 410MW of planned generation on this line in the IPP queue.

Model: PJM 2026 RTEP Series Cases



AEP Transmission Zone M-3 Process
Seneca County, Ohio

Need Number: AEP-2021-OH023

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

- Rebuild the 15.7 mile 138kV line between Howard and Chatfield stations with new 1033 ACSR conductor **$36.96 M**
- Rebuild the 6.1 mile 138kV line between Melmore and South Tiffin stations with new 1033 ACSR conductor **$14.97 M**
- Rebuild the 11.7 mile 138kV line between South Tiffin and West End Fostoria stations with new 1033 ACSR conductor **$30.19 M**

Cost estimate: $82.12 M

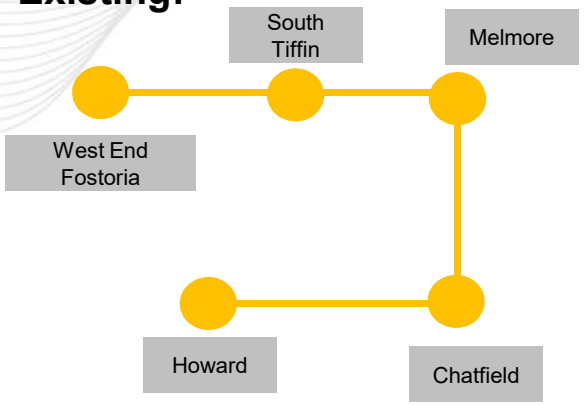
Alternatives Considered:

Considering the customers and 69 kV sources served from this line, retirement of the line is not a viable alternative. The section of line between Melmore and Chatfield has already been approved as baseline project b3249.

Projected In-Service: 5/1/2025

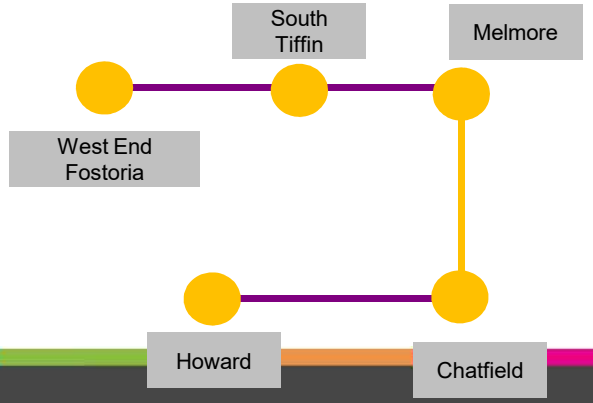
Project Status: Engineering

Existing:



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

Proposed:



Need Number: AEP-2021-OH031

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Needs Meeting 5/21/2021

Project Driver:

Customer Service

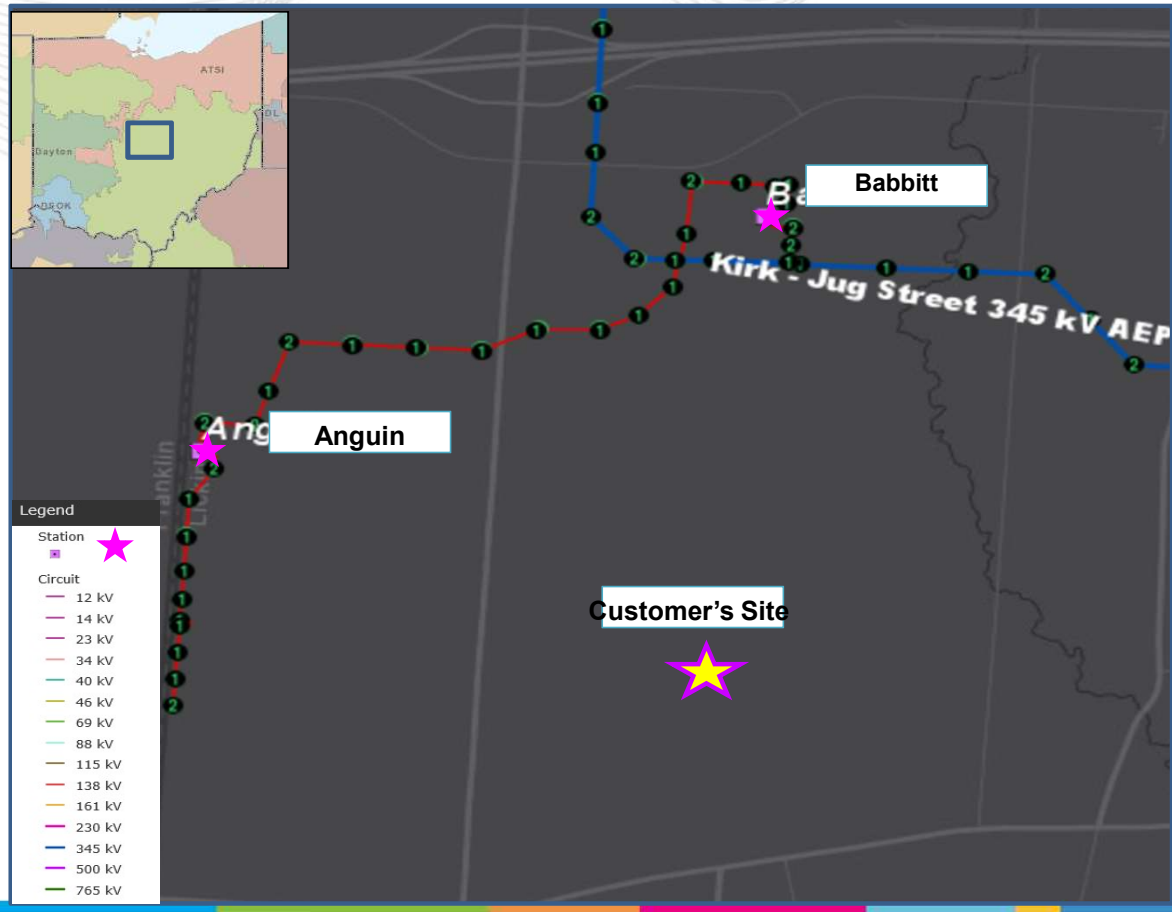
Specific Assumption Reference:

AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- A customer has requested transmission service at a site in New Albany, OH.
- The customer has indicated an initial peak demand of 84 MVA with an ultimate capacity of up to 240 MVA at the site.



AEP Transmission Zone M-3 Process
New Albany, Ohio

Need Number: AEP-2021-OH031

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

- **Anguin 138 kV Station:** Relocate the Anguin extension No. 4 into strings C & D at Anguin station installing two circuit breakers in each string to complete the strings. The new double circuit line to Brie station will be installed in strings A & B. Expand DICM to accommodate additional relays. **Estimated Cost: $1.33M**
- **Anguin – Penguin DP1 138kV:** Re-terminate the existing 138 kV Anguin Extension lines into strings C & D at Anguin Station. **Estimated Cost: $0.78M**
- **Brie 138kV Station:** Establish the greenfield 138kV Brie station. Two full breaker and a half strings and 2 partial strings will be initially installed; total of ten (10) 138 kV breakers. **Estimated Cost: $11.04M**
- **Anguin – Brie 138 kV:** Build ~1.5 miles of greenfield 138kV double circuit line between Anguin and Brie station with 2 Bundle ACSS 1033.5 Curlew. Extend the telecom fiber into Brie station for relaying/communication. Short span construction and larger than normal foundations are required in this area to maintain clearances and paths for future development from the customers in the area, leading to higher than normal costs for this line. **Estimated Cost: $7.83M**
- **Brie – Customer Why 1 138kV:** Tie lines #1-4 to the customer's facility. **Estimated Cost: $0.11M**

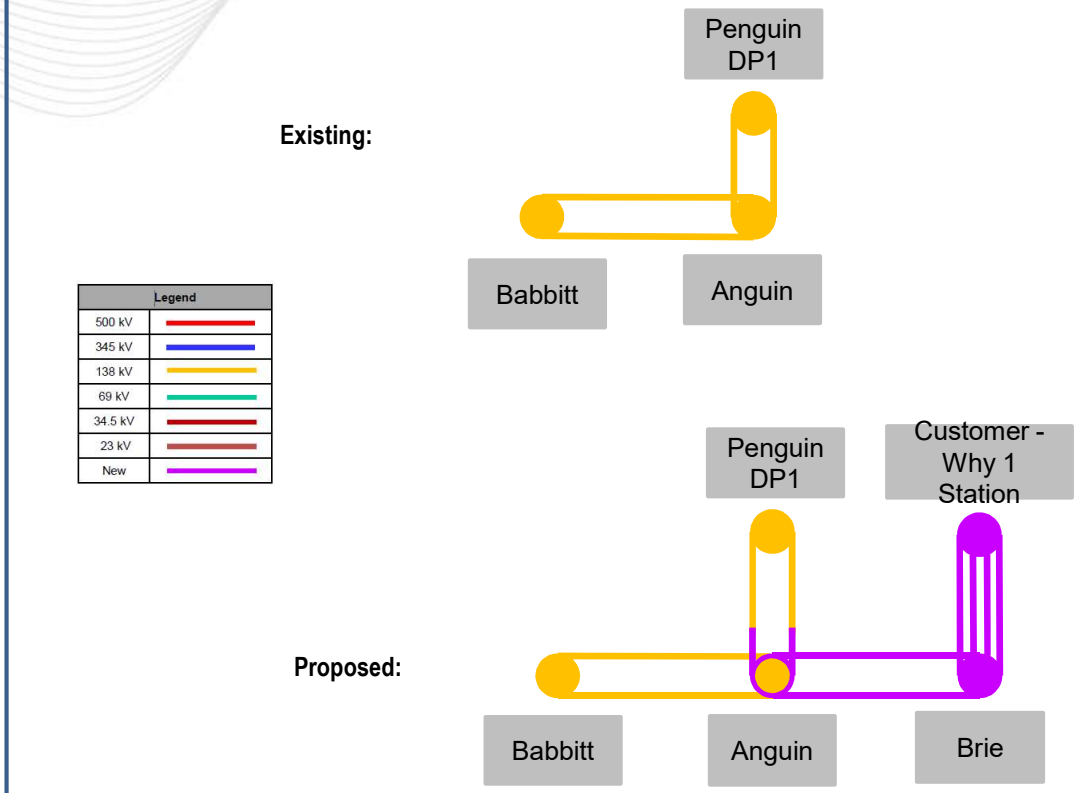
Total Estimated Transmission Cost: $21.08M

Alternatives Considered: No cost effective alternate was determined.

Projected In-Service: 6/1/2023

Project Status: Scoping

Model: 2026 RTEP



AEP Transmission Zone M-3 Process
Fostoria, Ohio

Need Number: AEP-2021-OH054

Process Stage: Solution Meeting 4/22/2022

Previously Presented: Need Meeting 10/15/2021

Supplemental Project Driver:

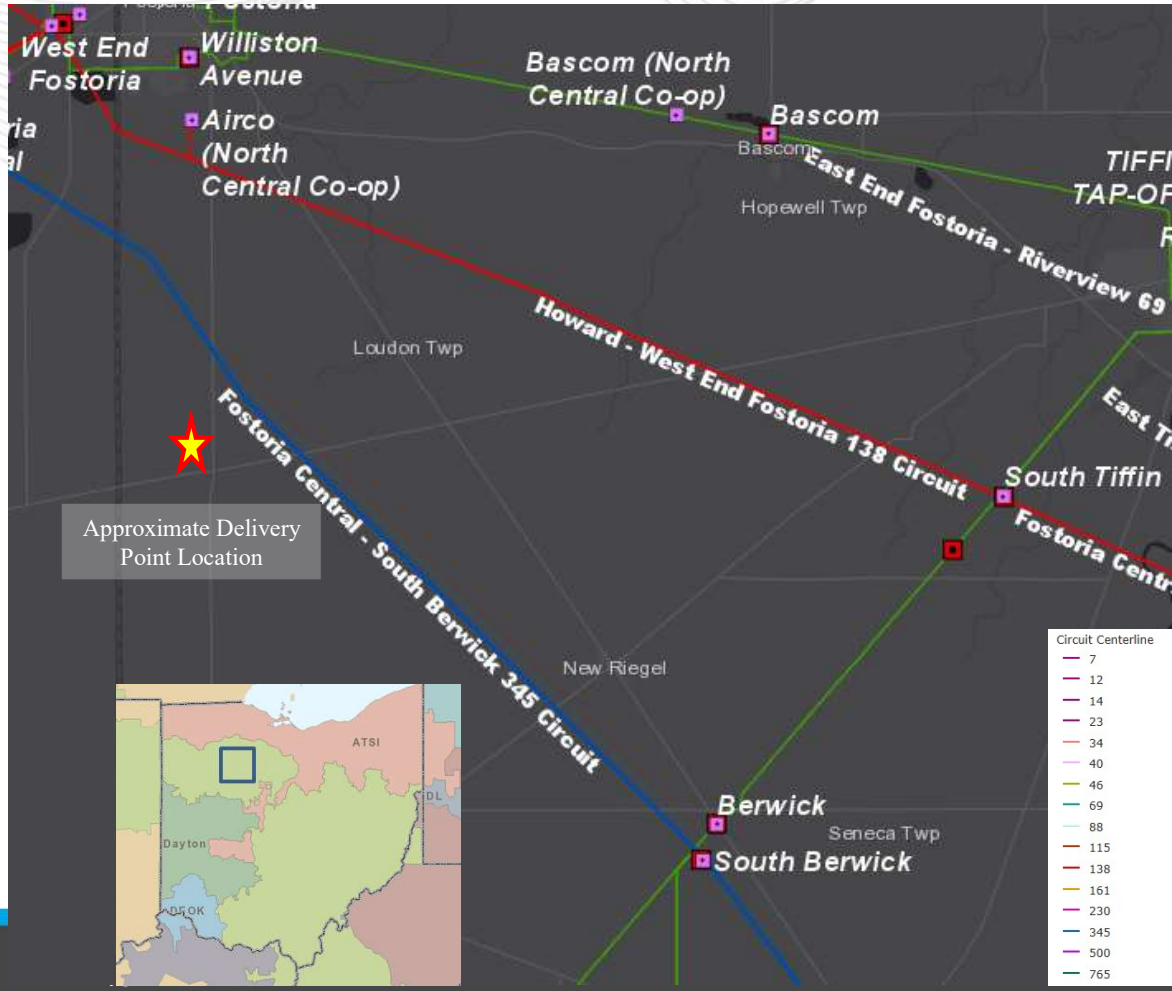
Customer Service

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 12)

Problem Statement:

- Buckeye is requesting on behalf of North Central Electric Co-op a new 138kV delivery point tapped off of the Fostoria Central – Melmore 138kV Circuit by August 2022. Anticipated load is about 6.2 MVA.



AEP Transmission Zone M-3 Process
Iron Triangle 138kV Project

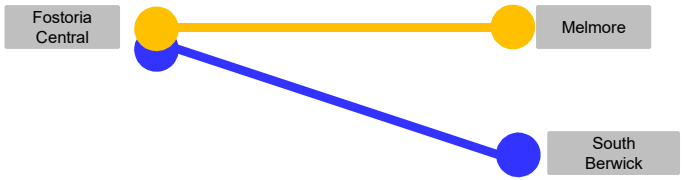
Need Number: AEP-2021-OH054
Process Stage: Solutions Meeting 04/22/2022

Proposed Solution:

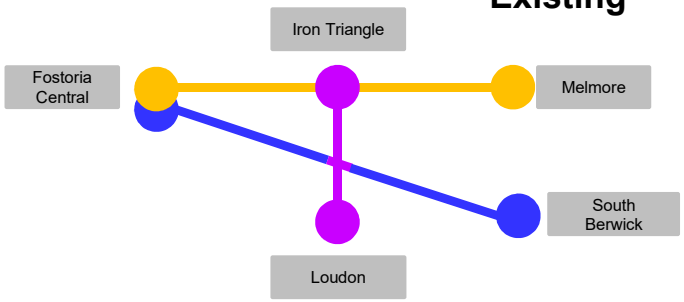
- **Iron Triangle Switch 138kV:** Establish a new three way POP switch on the Fostoria Central – Melmore circuit to serve new North Central delivery point. The through-path will include auto-sectionalizing switches. **Estimated Cost $0.866M**
- **Iron Triangle – Loudon 138kV**. Construct ~3.85 miles of single circuit 138 kV line utilizing 795 ACSR conductor between the proposed Iron Triangle Switch and the new NCEC Loudon delivery point **Estimated Cost $8.586M**
- **West End Fostoria – Melmore 138kV:** Cut in work will be required on the Fostoria – Melmore Circuit for the Iron Triangle Switch. **Estimated Cost $0.627M**
- **Ohio Central – Fostoria Central 345kV.** Modify Fostoria Central – South Berwick 345kV for the Iron Triangle – Loudon 138kV line crossing. **Estimated Cost $1.338M**

Total Estimated Cost: $11.432M

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



Existing



Proposed

Alternatives:
Considering the location and timing of the customer request, no other viable alternatives were considered.

Projected In-Service: 7/1/2023
Project Status: Scoping
Model: 2026 RTEP

Need Number: AEP-2022-OH001

Process Stage: Solutions Meeting 4/22/2022

Previously Presented: Needs Meeting 1/21/2022

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

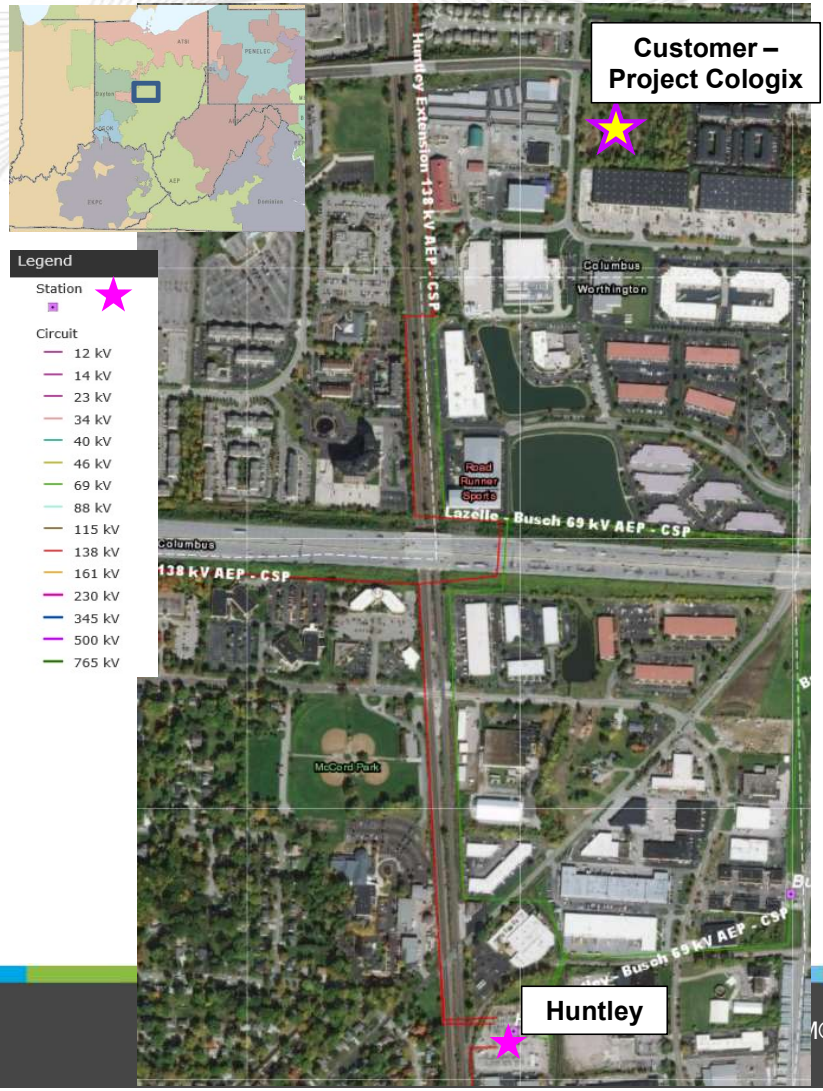
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- A customer has requested transmission service at a site North of AEP's existing Huntley station in Worthington, OH.
- The customer has indicated a demand of 40 MW at the site.

Model: 2026 RTEP



Need Number: AEP-2022-OH001

Process Stage: Solutions Meeting 4/22/2022

Proposed Solution:

- **Scherers Switch 138kV:** Install a new 2000 A three-way Phase Over Phase switch with SCADA automation on the Huntley – Greif through path and install a bypass for maintenance. **Estimated Cost: $0.800M**
- **Greif – Huntley 138kV line:** Tap the existing Greif-Huntley 138kV circuit by installing structures to carry the 69 kV underbuild Lazelle-Busch circuit and maintain separation from the new Scherers Switch as well as install dead end poles and centerline poles on each direction of the new switch. **Estimated Cost: $1.113M**
- **Cologix Extension 138kV:** Construct ~0.24 miles of single circuit 138kV radial transmission line from Scherers Switch to the new Cologix Customer Station. **Estimated Cost: $0.795M**

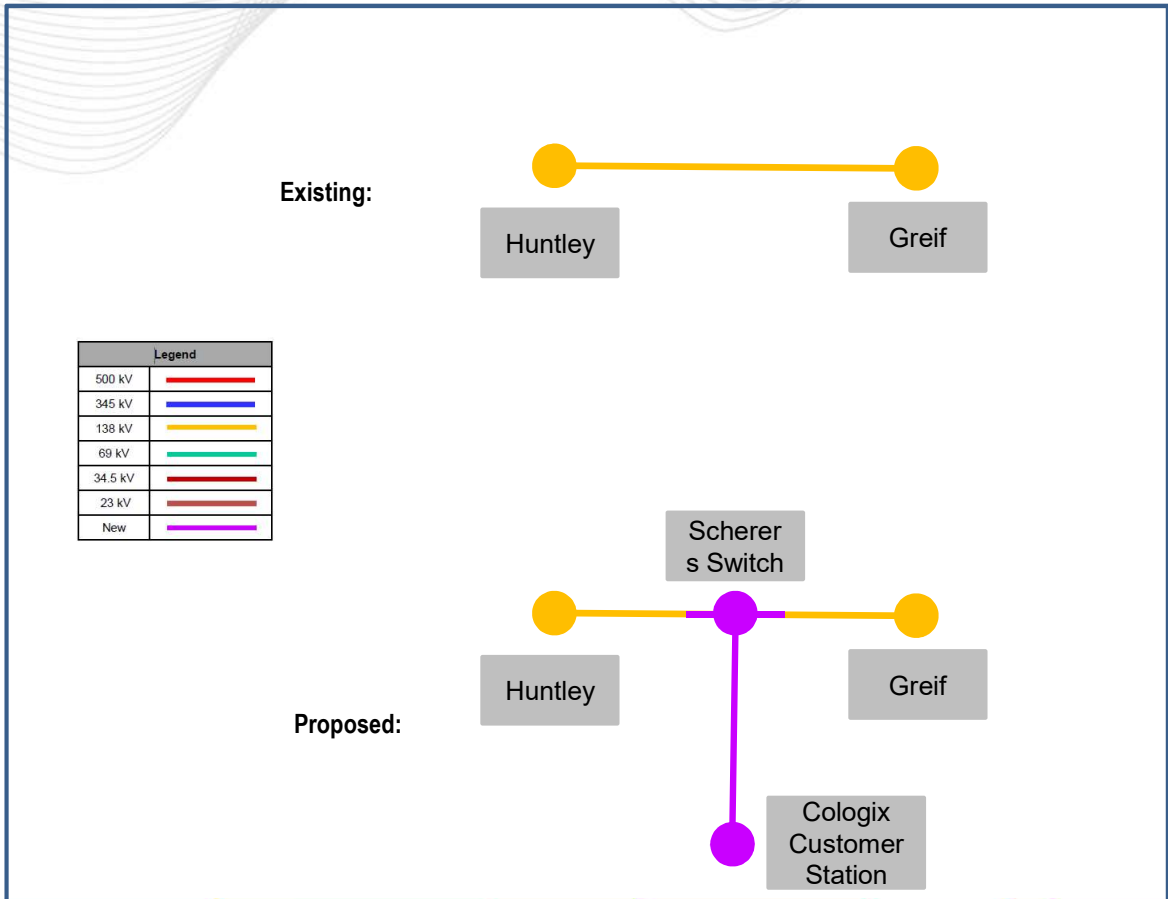
Total Estimated Transmission Cost: $2.708M

Alternatives Considered: Considering the location of the customer request and proximity of the line to serve them, no other viable alternates were identified.

Projected In-Service: 4/1/2024

Project Status: Scoping

Model: 2026 RTEP



AEP Transmission Zone: Supplemental Danville, VA

Need Number: AEP-2021-AP033

Process Stage: Solutions Meeting 5/19/2021

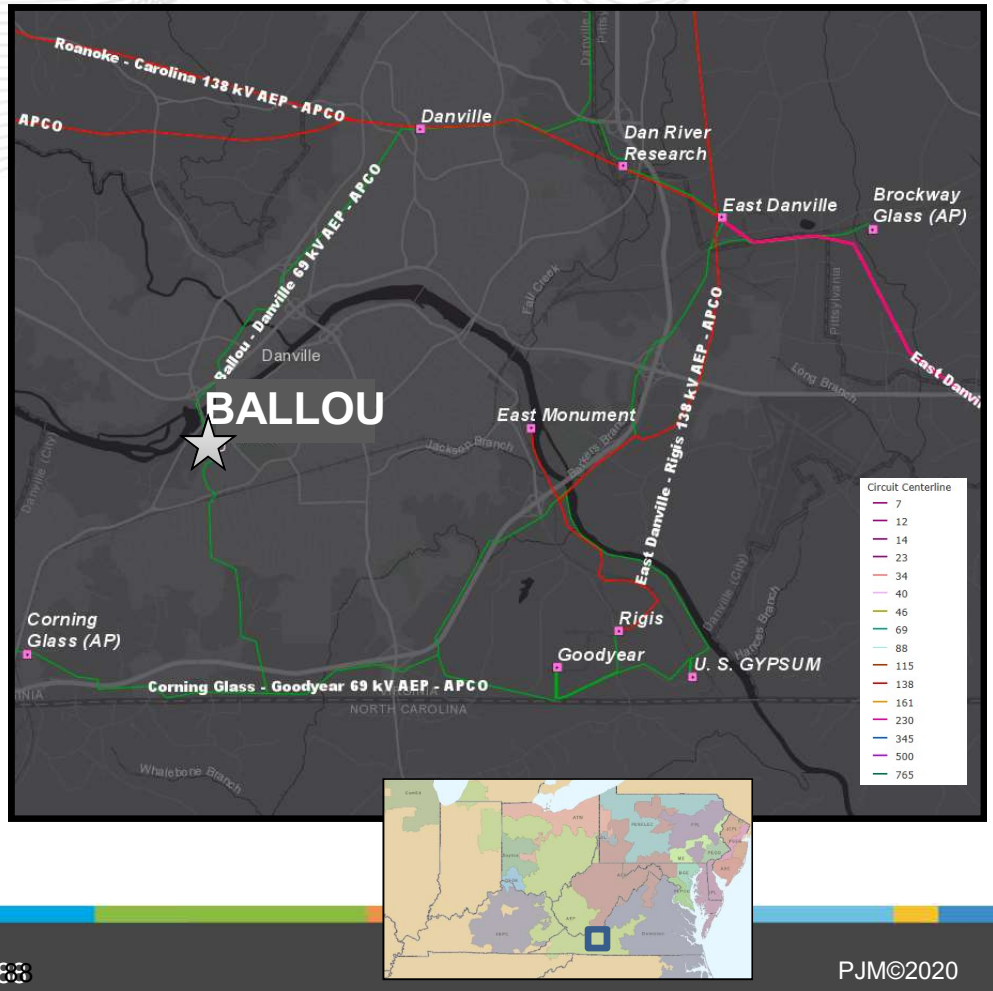
Previously Presented: Needs Meeting 11/19/2021

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

- The City of Danville requested a new 69 kV delivery point located at Ballou Station in Danville, VA to provide up to 25 MW of peak load (with an average load of 7-10 MW).



Need Number(s): AEP-2021-AP033

Process Stage: Solutions Meeting 5/19/2021

Proposed Solution:

- Ballou Station
  - This station was recently abandoned due to a previous customer no longer being served there. This project will remove all steel and cut all foundations down to 6" below grade. The only existing equipment that will be reused are two H-frames and the control house (AEP will not have any relaying equipment inside this building).
  - Two 138 kV Motor Operated Air-Break Switches (MOABs) and high-side 69 kV, 3-element metering and associated CT's and PT's will be installed
  - **Estimated Cost: $0 (Distribution)**

- Ballou-State Line 69 kV Line Asset
  - Remove the temporary span between structure 290-58 and 289-1C, replace structure 289-1C, and then reinstall the span into Ballou Station using 795 kcmil 26/7 Drake ACSR with a 7#10 Alumoweld Shield Wire
  - **Estimated Cost: $0.46 M**

- Ballou-Danville 69 kV Line Asset
  - Remove the temporary span between structure 290-58 and 289-1C, replace structure 290-58, and then reinstall the span into Ballou Station using 795 kcmil 26/7 Drake ACSR with a 7#10 Alumoweld Shield Wire
  - **Estimated Cost: $0.42 M**

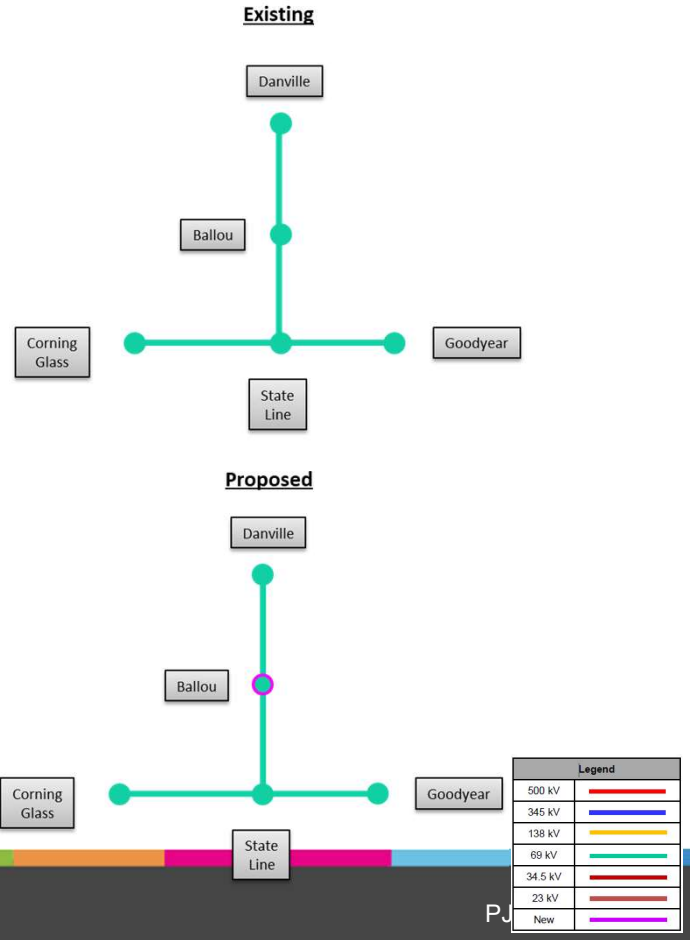
Total Estimated Transmission Cost: $0.88 M

Ancillary Benefits:
Establishing a new delivery point for the City of Danville will provide additional automatic sectionalizing on the existing Corning Glass-Danville-Goodyear 69 kV Circuit, decreasing the amount of exposure to permanent faults.

Alternatives Considered:
Circuit breakers were considered for in-line sectionalizing

Projected In-Service: 11/1/2023

Project Status: Scoping



AEP Transmission Zone M-3 Process
East Dover – Atwood Upgrade

Need Number: AEP-2020-OH029

Process Stage: Solution Meeting 05/19/2022

Previously Presented: Need Meeting 06/19/2020

Project Driver: Equipment Condition/Performance/Risk

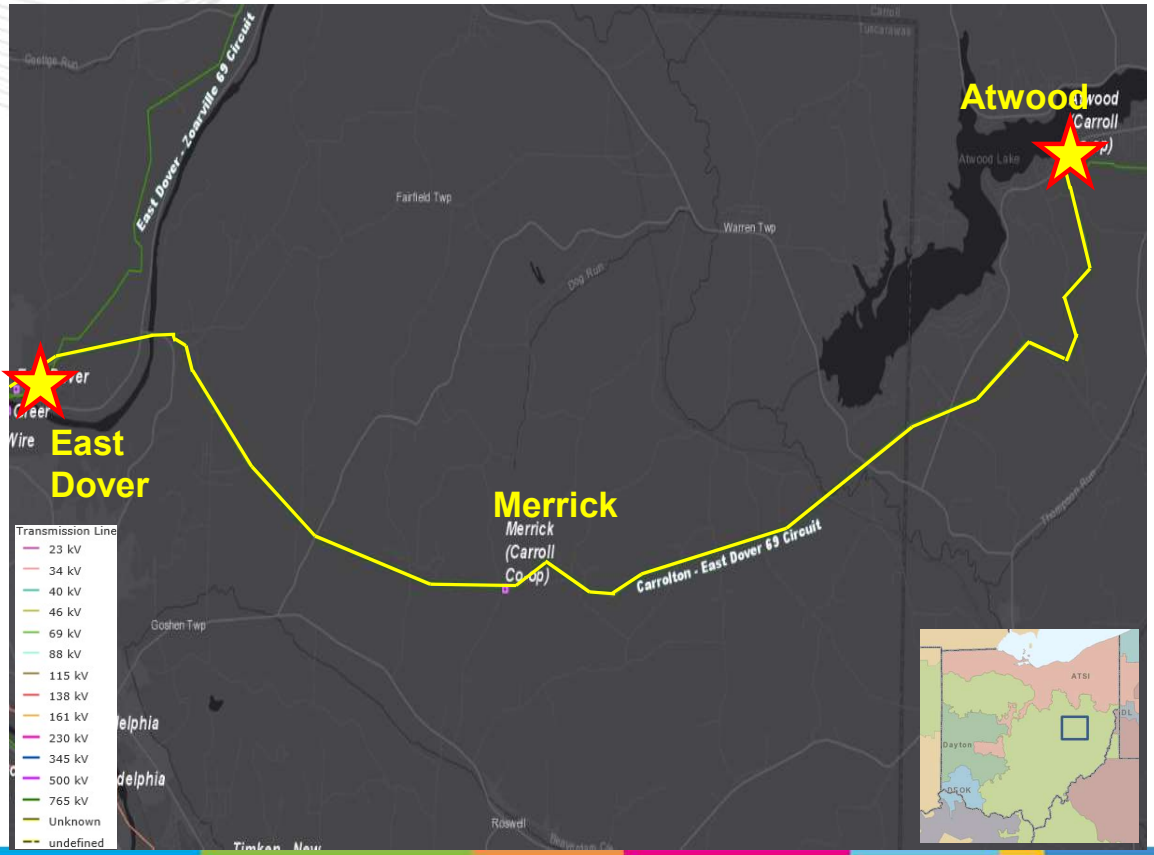
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

East Dover Carroll Co-op 69kV (15.30 miles)

- The line consists of wooden monopoles, H-frames and 3 pole structures.
- The line was originally built in 1958 with 4/0 ACSR conductor.
- There are currently 95 structures (55.5% of the line) with at least one open condition.
  - 69 structures with open conditions consisting of insect damage, rot top, rot heart, split crossarms, broken knee braces, rot shell, split poles and woodpecker holes.
  - 7 conductor-based open conditions consisting of damaged conductors and malfunctioning splices.
  - 28 hardware-based open conditions consisting of loose/broken insulators, burnt insulators, insulators missing bolts and broken/damaged/missing molding.
- For the 2015-2020 time period there have been 13 outage events on the Carrolton – East Dover Circuit. The permanent outages resulted in 2,344,426 minutes of interruption to the 2,643 customers served from the circuit (all Carroll Electric Co-op).



Need Number: AEP-2020-OH029

Process Stage: Solution Meeting 05/19/2022

Proposed Solution:

Merrick Switch – Atwood Switch: Rebuild the existing 8.8 mile 69kV line section between Merrick Switch and Atwood Switch, using 477 ACSR conductor. $19.92 Million

Zoarville – Merrick Switch: Build 7.0 mile greenfield 69kV line between Merrick Switch and Zoarville, using 477 ACSR conductor. $16.47 Million

Merrick Switch – East Dover: Retire 6.5 miles of 69 kV line between Merrick Switch and East Dover. $1.84 Million

East Dover: Remove 69kV breaker K and associated equipment. Connect the modified Carrollton 69kV circuit to breaker H; upgrade a small amount of risers at East Dover. $0.34 Million.

Zoarville: Install 69kV switch and conductor to connect to new T-line entrance. Relay settings updates at Carrollton. $0.14 Million.

Total Transmission Cost: $38.71 Million

Ancillary Benefits: Addresses the 6.8-mile radial 69kV line to Zoarville station, by looping it into the Carrollton circuit. The existing radial system puts Zoarville area customers at risk of outages, due to the inability to take station or transmission line facilities out of service for maintenance or repairs.

Alternatives Considered: Consideration was given to a rebuild of the East Dover-Merrick-Atwood 69kV line on the existing route. This would have resulted in slightly less line miles being constructed (~0.5 mi), but still would of required additional ROW acquisitions to bring the existing 1950's line easement up to current standards. It also would have left the customer's at Zoarville radially fed from East Dover. Given the nominal difference in overall line mileage, the decision was made to move forward with the proposed solution as it would not only improve operational flexibility for customers served from Zoarville today, but it would also provide the benefit of allowing the existing line to Zoarville to be maintained in a manner that should extend it's life.

Projected In-Service: 05/01/2025

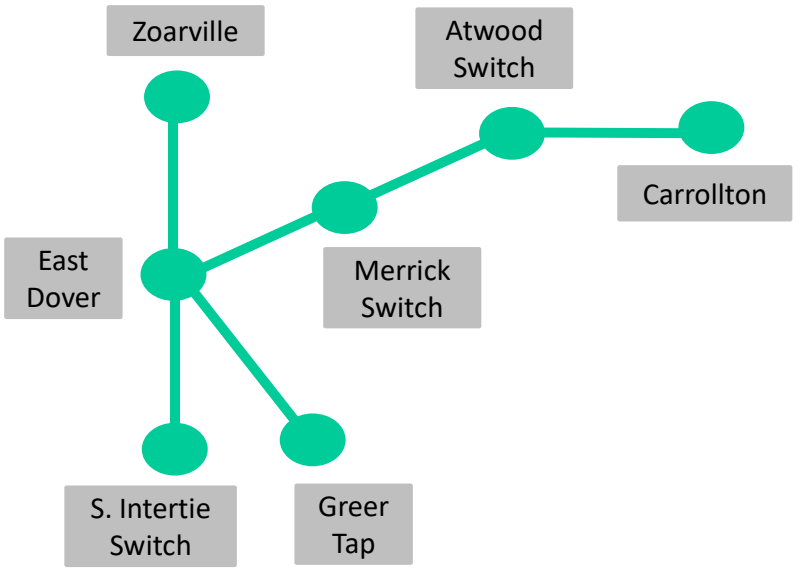
Project Status: Scoping

Model: 2026 PJM RTEP Load-Flow and Short Circuit Models

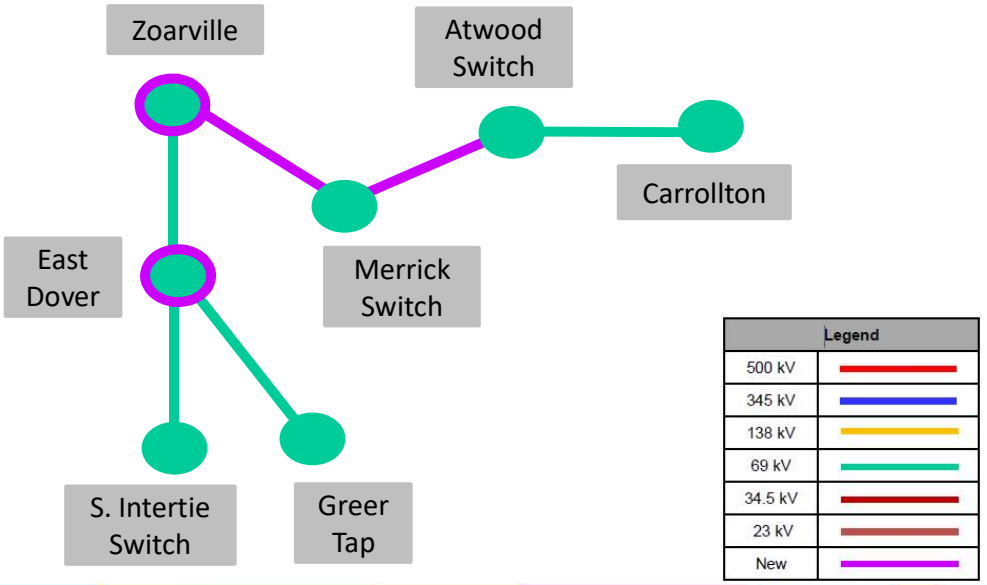
Need Number: AEP-2020-OH029

Process Stage: Solution Meeting 05/19/2022

Existing:



Proposed:



AEP Transmission Zone M-3 Process
Hancock, Ohio

Need Number: AEP-2021-OH003

Process Stage: Solutions Meeting 05/19/2022

Previously Presented: Need Meeting 02/17/2021

Supplemental Project Driver:

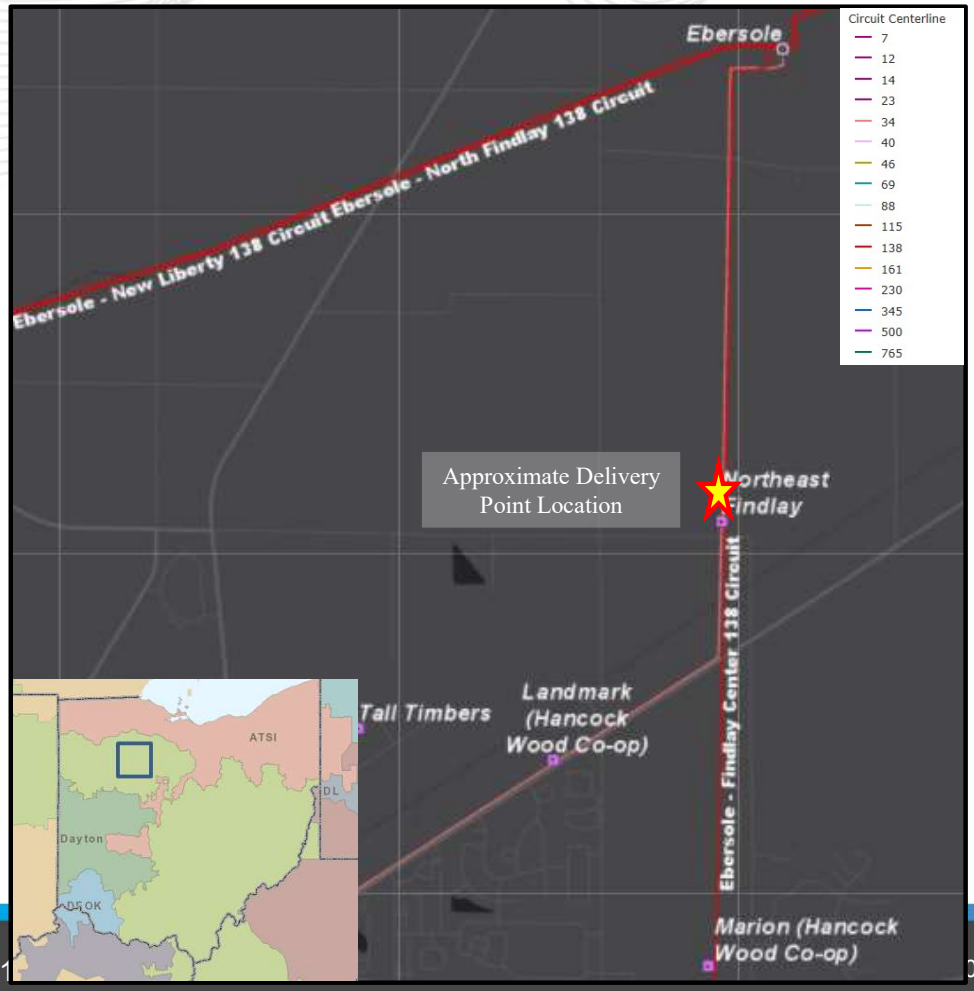
Customer Service

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 7)

Problem Statement:

- Buckeye is requesting on behalf of Hancock-Wood Electric co-op for a new 138kV delivery point on the Ebersole – Findlay Center 138kV Circuit by August 2023. Anticipated load is about 3 MVA.



Need Number: AEP-2021-OH003

Process Stage: Solutions Meeting Solutions Meeting 05/19/2022

Proposed Solution:

- Invision Switch: Install a new switch on the Ebersole – Findlay center 138 kV line to serve the new Buckeye Co-Op Cass Substation. Estimated Cost: $1.49 M
- Invision – Cass: Install approximately 0.1 miles of new 138 kV line from Invision Switch to the Buckeye Co-op Cass Substation. Estimated cost: $595 k

Total Estimated Transmission Cost: $2.085 M

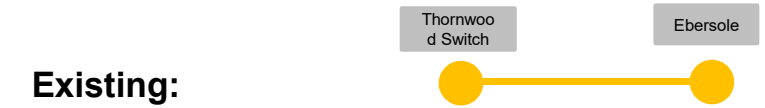
Alternatives Considered:

- Considering the location and timing of the customer request, no other viable alternatives were considered.

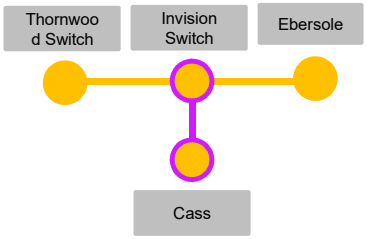
Projected In-Service: 8/15/2023

Project Status: Engineering

Existing:



Proposed:



AEP Transmission Zone M-3 Process
George Washington-Kammer (Marshall County, WV)

Need Number: AEP-2021-OH013

Process Stage: Solution Meeting 05/19/2022

Previously Presented: Need Meeting 03/19/2021

Project Driver: Equipment Condition/Performance/Risk

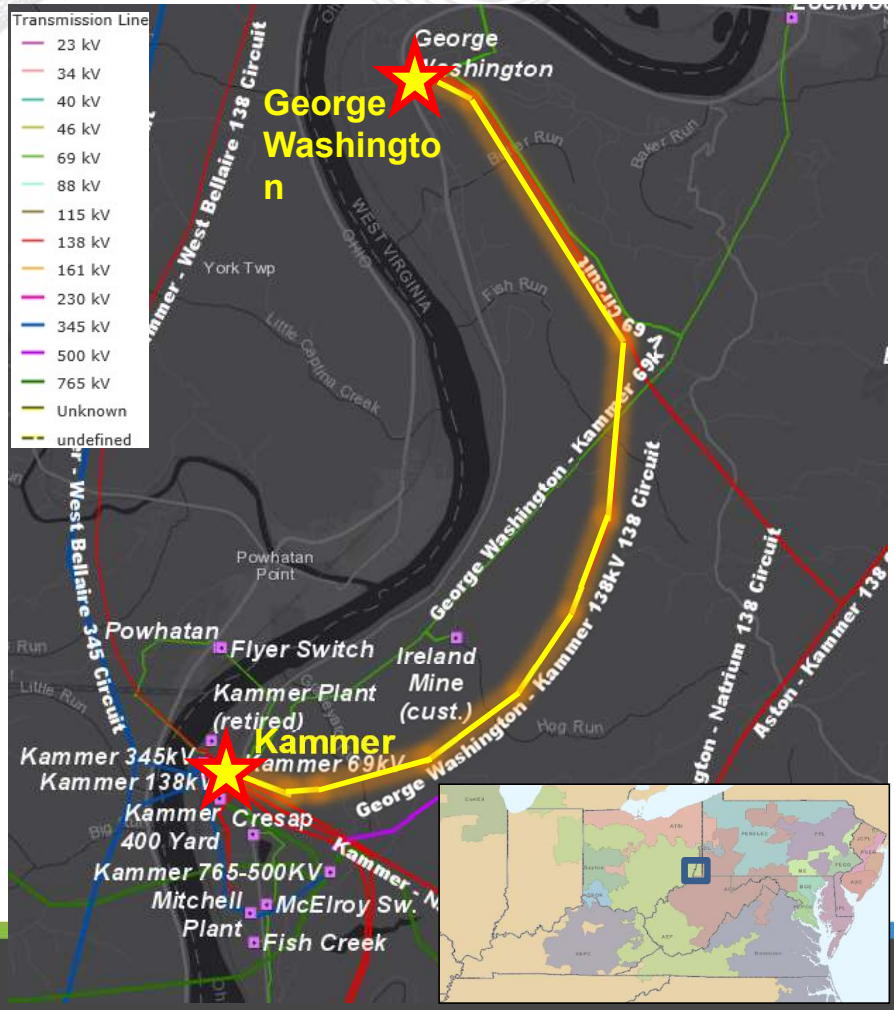
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

George Washington-Kammer 138kV circuit (6.9 miles)

- The line consist of 6.7 miles of original (1956) lattice towers and conductor (6-wired 636 ACSR). There is 0.2 miles of newer construction that is in adequate condition (outside the substation at each end).
- The shield wire design does not meet current shielding angle requirements.
- There are currently 14 hardware-based open conditions on the line (primarily insulator damage), 1 conductor condition (broken strands), and 1 structure condition.
- Some of the steel lattice towers show heavy rusting and corrosion. The original insulator strings show significant residue/contamination, leading to risk of flashovers and circuit outages.
    - Hook attachments freely move and wear through the hangers. This wear results in the loss of steel section over time. That section loss reduces the strength of the connection which can result in premature failure. There is evidence of hole elongation and the amount of steel left in the hanger holding up the suspension insulators is thin.



AEP Transmission Zone M-3 Process
George Washington-Kammer 138kV Line Rebuild

Need Number: AEP-2021-OH013

Process Stage: Solution Meeting 05/19/2022

Proposed Solution: Rebuild the George Washington – Kammer 138kV circuit, except for 0.1-mile of previously-upgraded T-line outside each terminal station (6.7 miles of total upgrade scope). Remove the existing 6-wired steel lattice towers and supplement the right-of-way as needed.

Total Cost = $18.3 Million

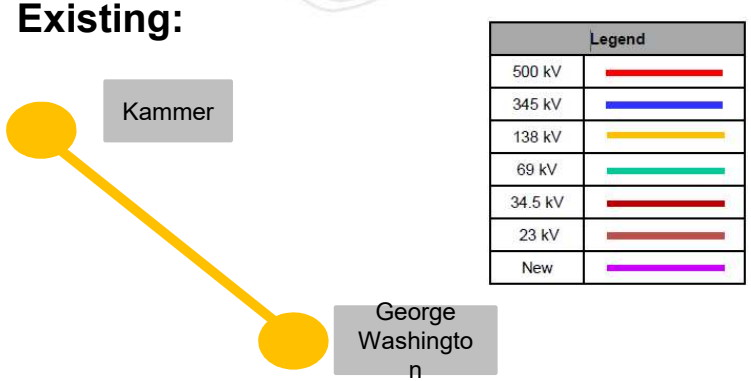
Alternatives Considered: No viable alternatives identified for this equipment condition issue. Retirement or re-routing of the 138kV circuit was not an option, as this is a heavily-loaded circuit in an area with much generation, large industrial customers, and tie-lines from West Virginia to Ohio. Rebuilding this 66-year-old transmission facility ensures a high level of system reliability for decades to come.

Projected In-Service: 06/01/2024

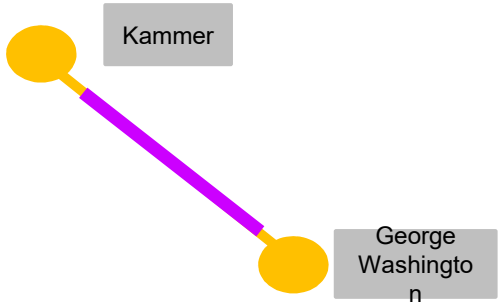
Project Status: Scoping

Model: 2026 PJM RTEP Load-Flow and Short Circuit Models

Existing:



Proposed:



AEP Transmission Zone M-3 Process
RV Capital Customer Request

Need Number: AEP-2021-IM035

Process Stage: Solution Meeting 05/19/2022

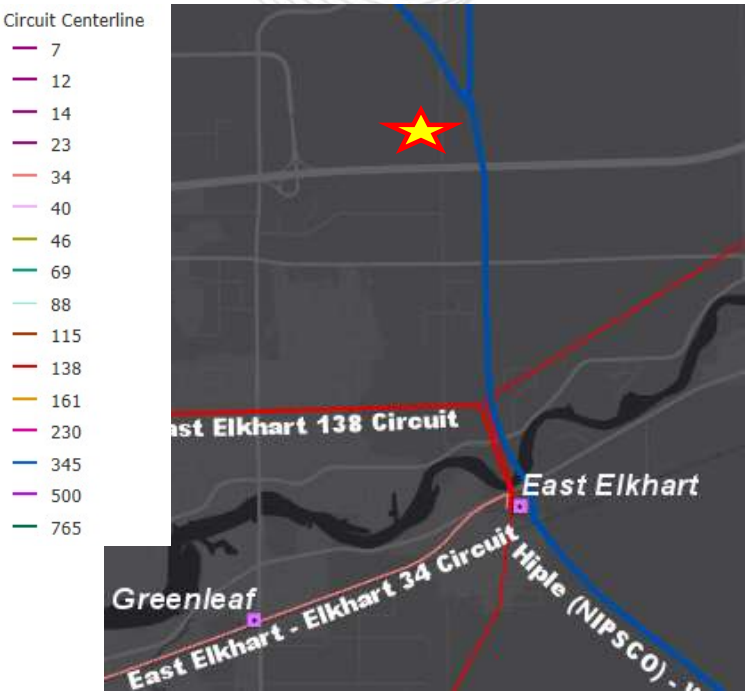
Previously Presented: Needs Meeting 11/19/2021

Project Driver: Customer Service

Specific Assumption Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

AMZ Propco, LLC has requested new transmission service in Elkhart, Indiana by January 2023. Anticipated load is approximately 8.5 MW.



AEP Transmission Zone M-3 Process
RV Capital Customer Request

Need Number: AEP-2021-IM035

Process Stage: Solution Meeting 05/19/2022

Proposed Solution:

RV Capital 138 kV - Install a new 138kV straight bus with a (2) 138kV MOAB switches, fiber and relaying.

Estimated Cost: $1.96M

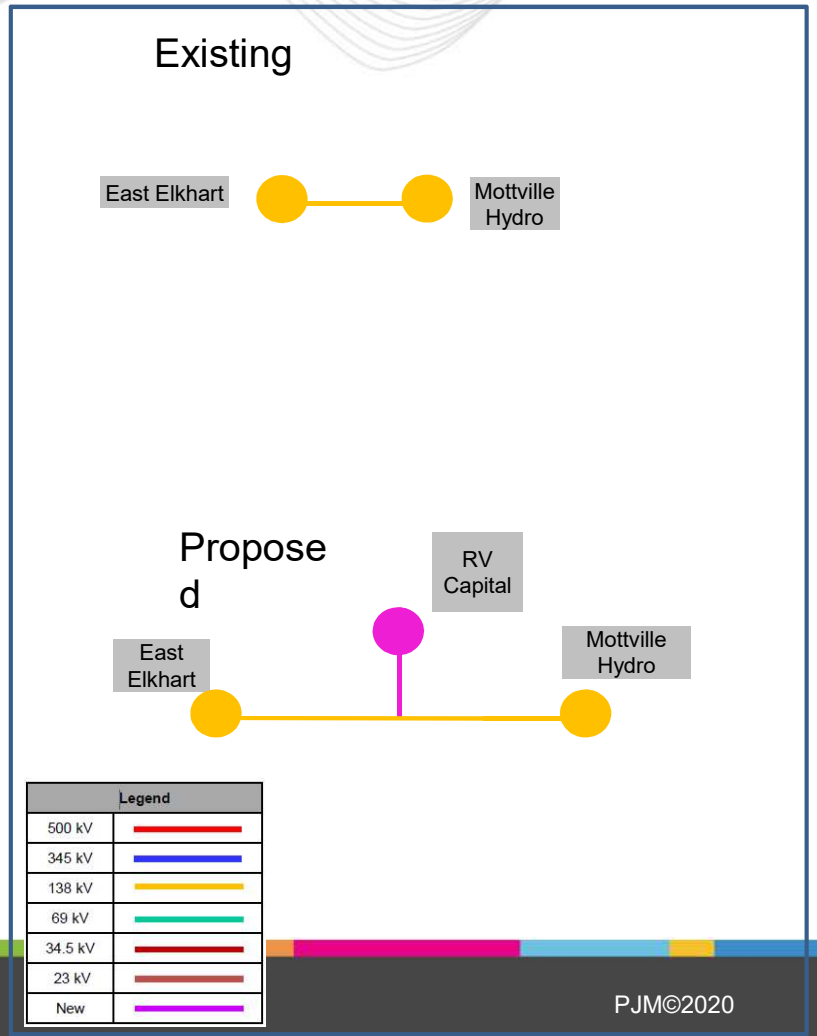
East Elkhart – RV Capital 138kV - Install ~1.44 mi of 138 kV single circuit from structure 1 to RV Capital on the East Elkhart – Mottville Hydro 138kV circuit with the conductor size 795 ACSR 26/7 Drake.

Estimated Cost: $3.34M

East Elkhart Stateline Metering - Relocate to Mottville Hydro.

Estimated Cost: $0.47M

Total Estimated Transmission Cost: $5.77M



AEP Transmission Zone M-3 Process
RV Capital Customer Request

Need Number: AEP-2021-IM035

Process Stage: Solution Meeting 05/19/2022

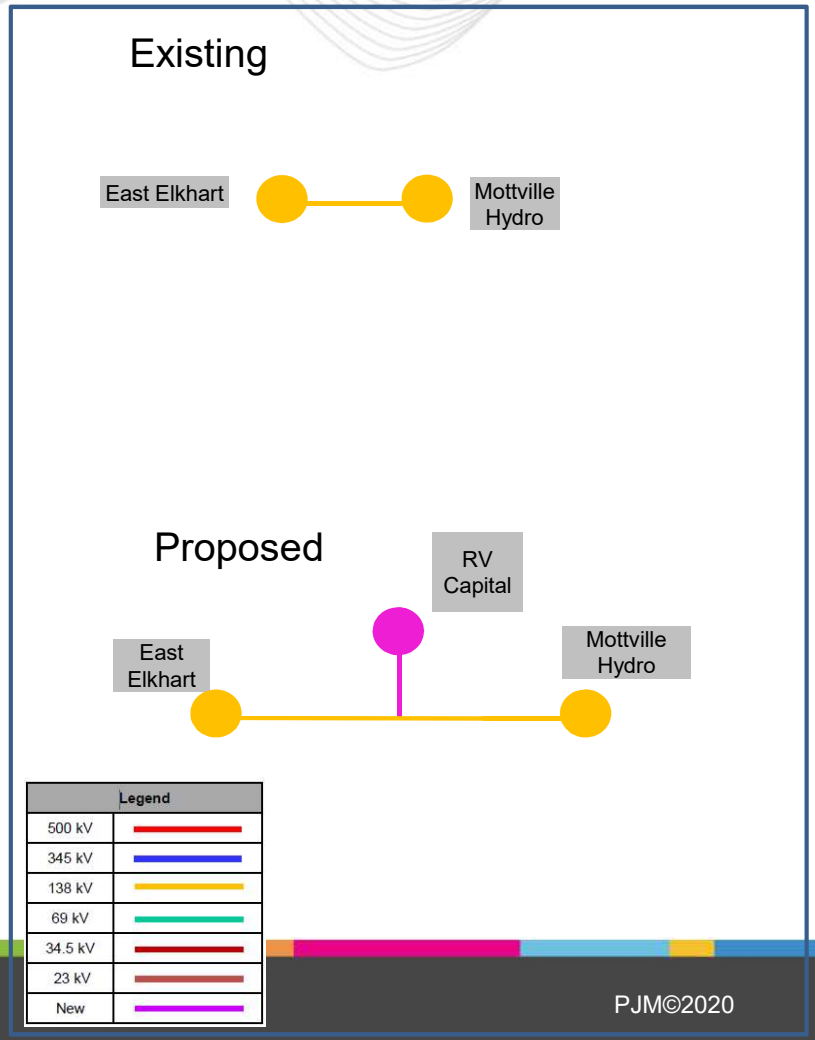
Alternates Considered:

Construct ~1.44 miles of double circuit 138kV line from structure 1 to the new RV Capital station to provide increased reliability. This alternative was not chosen as we can take advantage of the opportunity to re-route the existing rebuild of East Elkhart to Mottville Hydro 138kV (s2584) through RV Capital station to loop in the radial and provide increased reliability.

Estimated Cost: $6.27M

Projected In-Service: 3/28/2023

Project Status: Scoping



AEP Transmission Zone M-3 Process
Washington & Morgan Counties Ohio

Need Number: AEP-2019-OH045

Process Stage: Solutions Meeting 06/15/2022

Previously Presented: Need Meeting 07/24/2019

Project Driver:

Equipment Condition, Operational Flexibility, and Customer Service

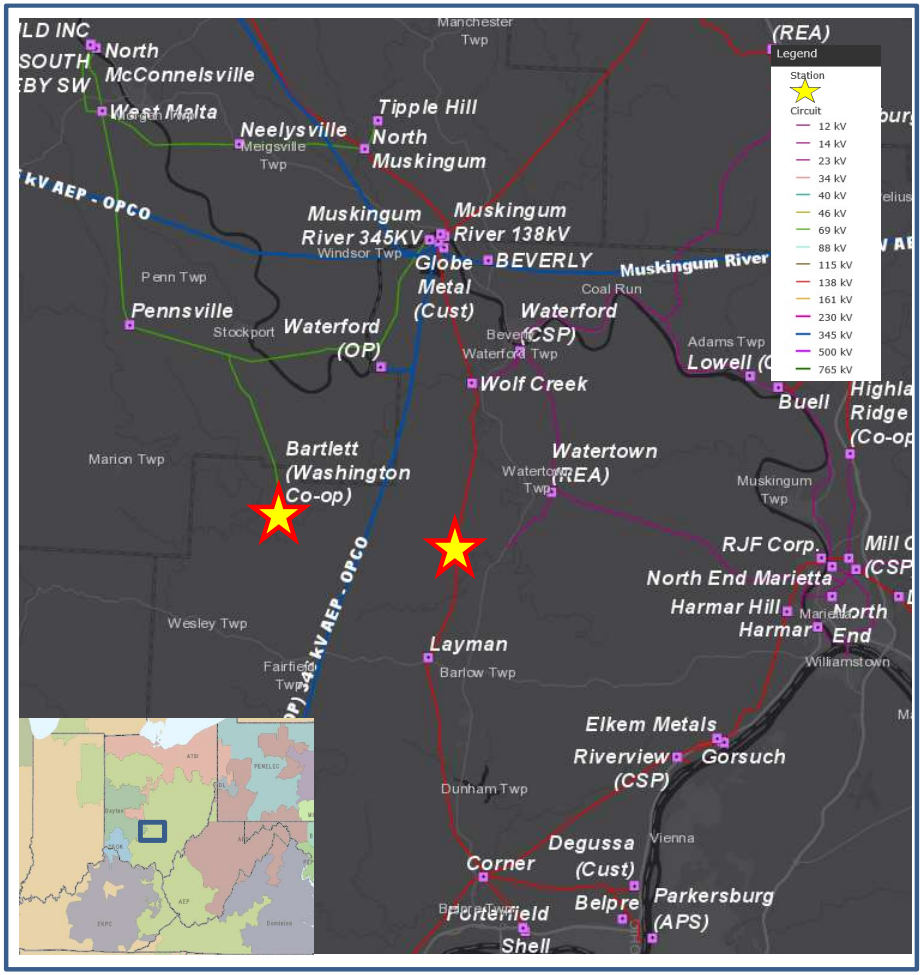
Specific Assumption Reference:

AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12) & AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Customer Service:

- Buckeye Power, on behalf of Washington Electric Cooperative, has requested transmission service in western Washington County, Ohio.
- Washington Electric Cooperative customers are currently connected to radial 23 kV and 12 kV AEP Ohio distribution lines in the area.
- The delivery points connected to the 23 kV system have consistently been identified as having poor reliability by Buckeye.
- Washington Electric Cooperative (WEC) has reported approximately 3,780,000 customer-outage minutes (CMI) over a ten year period (2012-2021).
- WEC's Bartlett delivery, which reported a 1,893,000 CMI between 2012-2021, is currently served via a 5 mile radial extension from a manual switch on the Muskingum River – South Rokeby 69 kV circuit.



AEP Transmission Zone M-3 Process
Washington & Morgan Counties Ohio

Need Number: AEP-2021-OH011

Process Stage: Solutions Meeting 06/15/2022

Previously Presented: Need Meeting 03/19/2021

Problem Statement

Equipment Condition:

Line Name: Muskingum – South Rokeby 69kV

Original Install Date (Age): 1965

Length of Line: ~21.3 mi

Total structure count: 164

Original Line Construction Type: Wood

Conductor Type: 4/0 ACSR 6/1, 336,400 CM ACSR 18/1, and 336,400 CM ACSR 30/7
Momentary/Permanent Outages and Duration:10 Momentary and 2 Permanent Outages

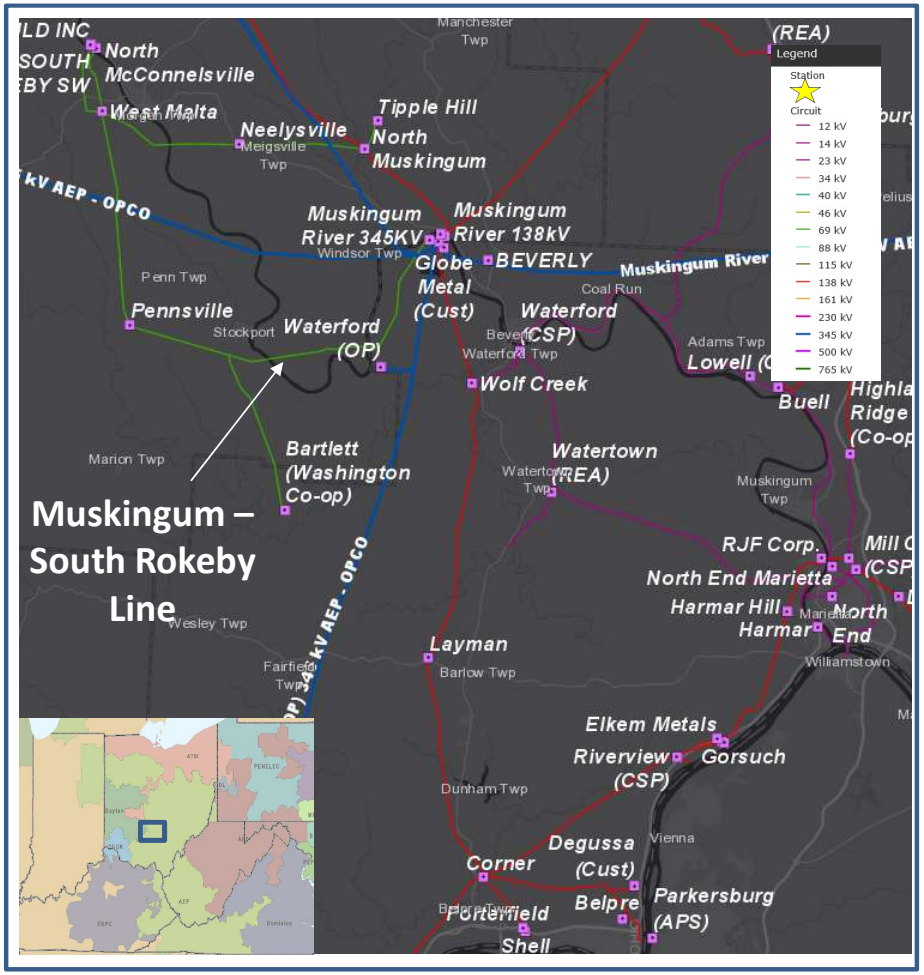
CMI: 756,000 (past five years)

Line conditions: 48 structures with at least one open condition, 29% of the structures on this circuit. 45 structure related open conditions impacting wooden poles, crossarms, braces, and filler blocks including rot, bowing, woodpecker holes, insect damage, cracked, split, and rot top. 12 open conditions related to conductor issues including broken strands. 12 hardware/shielding issues including open conditions related to burnt, broken, or chipped insulators.

Structure Age: 72% 1960's, 15% 1970, 13% 1980's or newer

Other: The line shielding angle does not meet AEP's current shielding angle requirements. Line does not meet current NESC Grade B loading criteria or AEP's current structural strength requirements.

Washington Co-op's Bartlett Station is served radially from this line (~ 5.09 miles) with limited sectionalizing ability.



AEP Transmission Zone M-3 Process
Washington & Morgan Counties Ohio

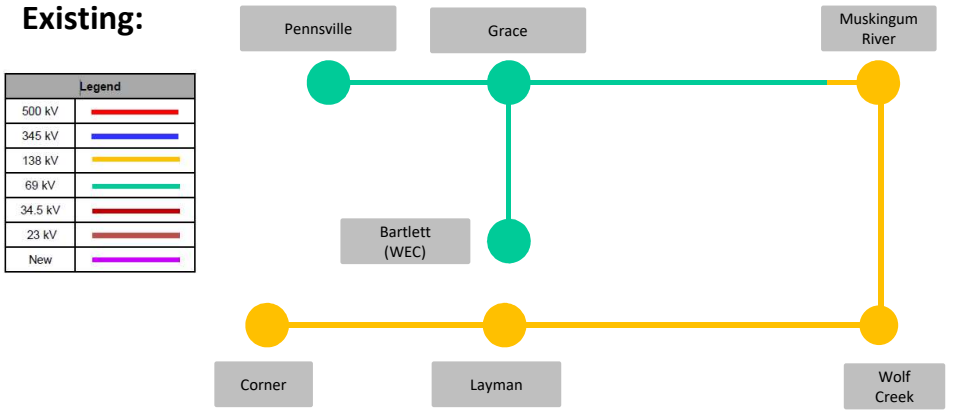
Need Number: AEP-2019-OH045 & AEP-2021-OH011

Process Stage: Solutions Meeting 06/15/2022

Proposed Solution:

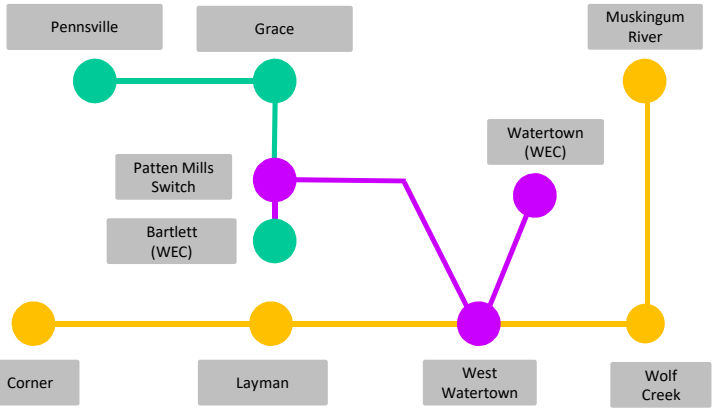
- **West Watertown Station, 138 kV**: Construct a greenfield 138/69 kV West Watertown station off the existing Corner – Wolf Creek 138 kV circuit. Install four-138 kV 3000 A 40 kA breakers configured in a ring arrangement. Install 90 MVA 138/69/13.09 kV transformer along with a 3000A 40 kA 69 kV low side breaker towards WEC's Bartlett delivery. **Estimated Cost: $8.8M**
- **Wolf Creek – Corner 138 kV Line cut-in**: Cut-in on the line to install the new West Watertown station. **Estimated Cost: $0.55M**
- **West Watertown – Watertown (WEC) 138 kV circuit:** Construct approximately 4.3 miles of single circuit 138 kV line between the newly proposed West Watertown station and WEC's new 138 kV delivery at Watertown. **Estimated Cost: $9.32M**
- **West Watertown – Patten Mills 69 kV circuit**: Construct approximately 5.8 miles of single circuit 69 kV line between the newly proposed West Watertown station and a proposed phase over phase switch (Patten Mills Switch) near WEC's delivery at Bartlett. **Estimated Cost: $11.81M**
- **Patten Mills Switch, 69 kV**: Install a new 69 kV 2000A phase over phase (Patten Mills switch) to serve the Bartlett delivery point. **Estimated Cost: $0.9M**
- **South Stockport - Washington Co-op 69 kV Line cut-in**: Cut-in on the line to install the new Patten Mills Switch. **Estimated Cost: $0.65M.**
- **Muskingum River - South Rokeby 69 kV Line Removal**: Retire ~9 miles of existing 69 kV line between Grace and Muskingum River stations. **Estimated Cost: $4.1M**
- **Muskingum River Removals**: At Muskingum River 138 kV yard, retire the 138/69 kV XF #C, CB-HM & HW. **Estimated Cost: $0.63M**
- **Grace Station, 69 kV**: Retire Grace - Muskingum River circuit, upgrade protection and fiber work at Grace Station. **Estimated Cost: $0.91M**

Existing:



Bubble Diagram

Proposed:



AEP Transmission Zone M-3 Process
Washington & Morgan Counties Ohio

Need Number: AEP-2019-OH045 & AEP-2021-OH011

Process Stage: Solutions Meeting 06/15/2022

- **Grace – Watertown Fiber**: Install fiber between Grace and Watertown stations. **Estimated Cost: $0.55M**
- **Wolf Creek & Corner Stations Protection upgrades**: Remote end protection upgrade. **Estimated Cost: $0.65M**
- **Watertown (WEC) Metering**: Install 12 kV revenue metering at WEC's new Watertown station. **Estimated Cost: $0.026M**

Total Estimated Transmission Cost: $38.9M

Alternatives Considered:

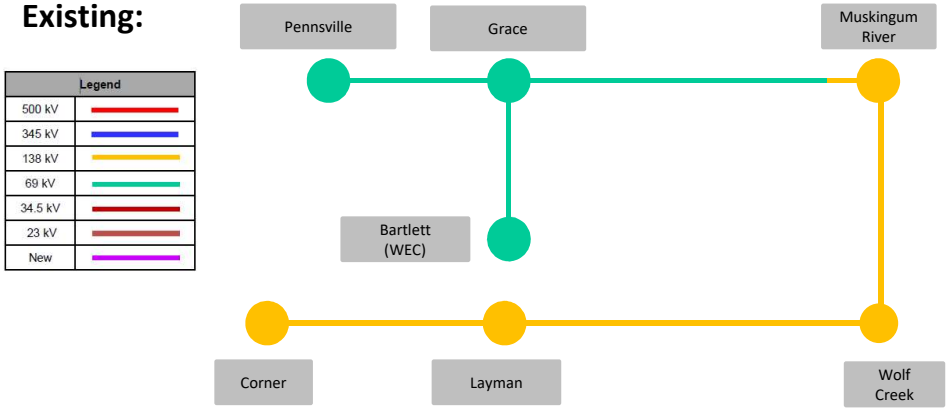
Consideration was given to locating the 138/69 kV transformer at Wolf Creek station and rebuilding a portion of the Corner – Wolf Creek line as double circuit to address emerging needs associated with it. Initial engineering feedback identified risk of a significant amount of grading possibly being required to accommodate the transformer at Wolf Creek. The civil work would at very least have put the alternative solution on par from a cost perspective with the proposed solution. From an electrical perspective the alternative solution have resulted in a significant increase in line exposure to WEC's customers at Watertown and Bartlett in comparisons with the proposed project. Because of this, the decision was made to move forward with the proposed plan of a new West Watertown station.

Projected In-Service: 9/1/2024

Project Status: Scoping

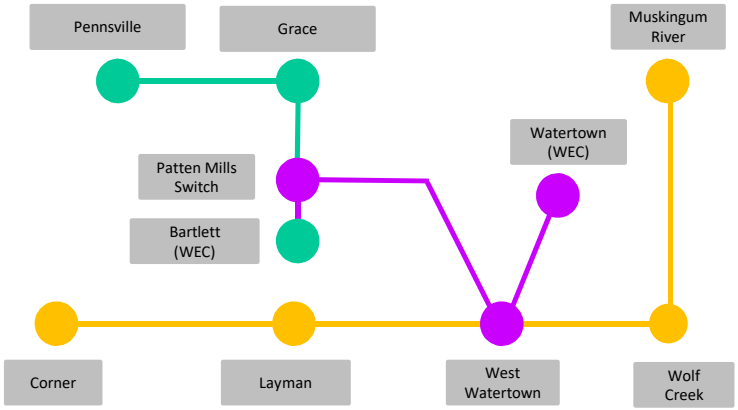
Model: 2025 RTEP

Existing:



Bubble Diagram

Proposed:



AEP Transmission Zone M-3 Process
Van Wert County, Ohio

Need Number: AEP-2020-OH044

Process Stage: Solution 6/15/2022

Previously Presented: Need Meeting 10/16/2020

Project Driver:

Equipment Material/Condition/Performance/Risk, Operational Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

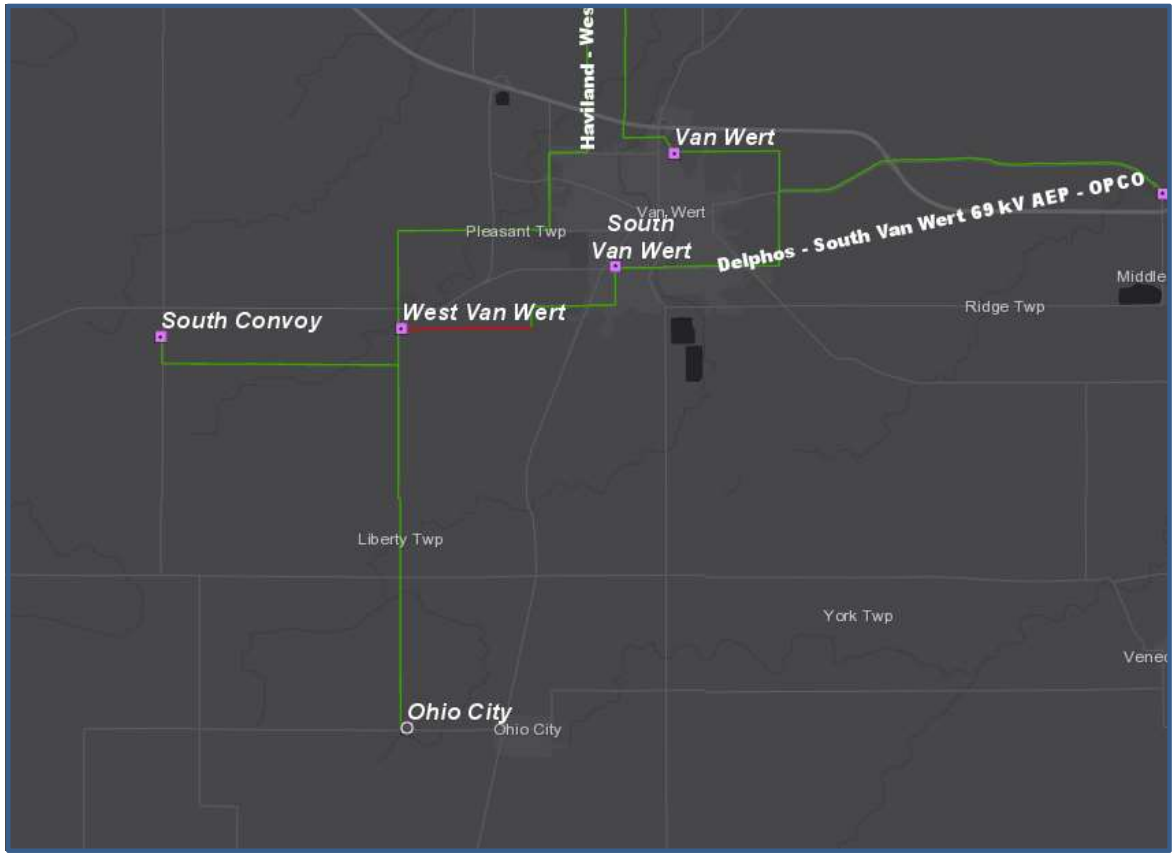
Line Name: Ohio City – West Van Wert 34.5kV Circuit

LINE CHARACTERISTICS

- **Original Install Date (Age):** 1963 (57 years)
- **Length of Line:** 8.90 miles
- **Total structure count:** 173
- **Original Line Construction Type:** Wood
  - 62% of structures replaced in 1994.
- **Conductor Type:** 1/0 Copper 7 (1939 Install), 4/0 ACSR 6/1 Penguin (1966 Install)

CONDITION / PERFORMANCE / RISK ASSESSMENT:

- **Condition Summary**
  - Open conditions / defects / inspection failures include: missing/broken ground wires, woodpecker damage, broken guy wires
  - Number of structures with defects/inspection failures: 24
- **Load at Risk:** 3.997 MVA
- **CMI:** 127,978 Customer Minutes of Interruption



AEP Transmission Zone M-3 Process
Van Wert County, Ohio

Problem Statement *(cont.)*:

CONDITION / PERFORMANCE / RISK ASSESSMENT:

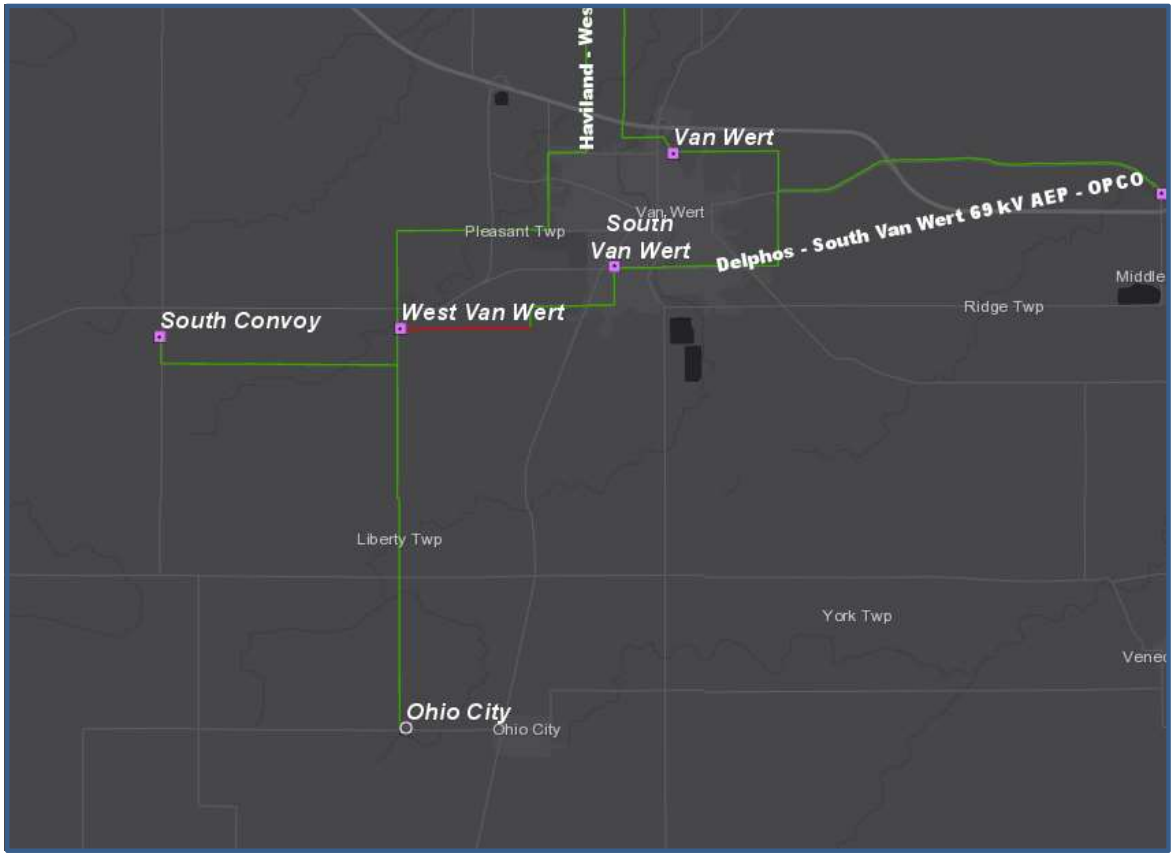
Station Name: Ohio City

Transformers Concerns:

- 1951 vintage and shows significant signs of dielectric breakdown (paper insulation), accessory damage (likely sludge in radiators, core, and coil), and short circuit breakdown.

OPERATIONAL EFFICIENCY:

- AEP has a normally open 34.5 kV tie with Dayton at Dayton's Rockford Substation that is built to 69kV standards. This is an out of phase interconnection point and can only be closed if the 12kV Dayton Rockford bus is de-energized first and the line is energized from AEP. AEP's Ohio City station is a radially served load out of West Van Wert. Since this is a normally open point, the Rockford load is radial under most operating conditions since a manual process must take place to switch the load to AEP's source if there is an issue with the Celina-Coldwater-Rockford 6688 69kV line. Dayton has limited switching options from Rockford substation so, the normally open point has needed to be used multiple times in recent years to transfer customers to the Ohio City source due to outages on the Dayton system.



AEP Transmission Zone M-3 Process
West Van Wert-Ohio City Conversion Project

Need Number: AEP-2020-OHO44

Process Stage: Solution 6/15/2022

Proposed Solution:

This solution will be coordinated with the previously proposed DP&L solution s2521

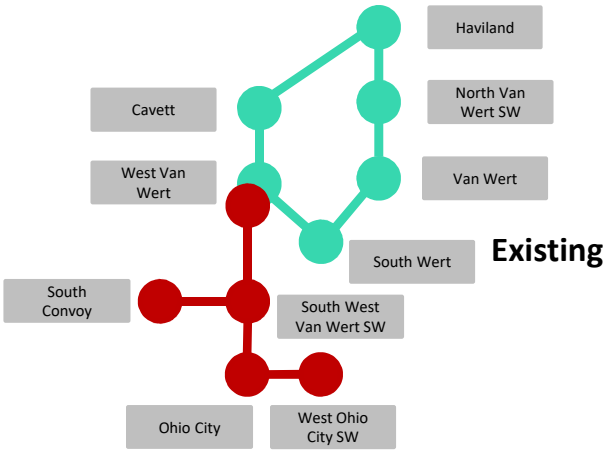
- **West Van Wert – Ohio City:** Rebuild the 8.9 mile West Van Wert – Ohio City 34.5 kV circuit to operate at 69 kV utilizing 556 ACSR conductor. **Estimated Cost $12.271M**
- **West Van Wert 69kV:** In order to address the three terminal point created by closing in the interconnection at Rockford and address existing dissimilar zones of protection, 4 new 3000A, 40kA breakers will be installed at West Van Wert station in a ring configuration. **Estimated Cost $5.503M**
- **Haviland – West Van Wert:** Relocate Haviland – West Van Wert 69kV to accommodate work at West Van Wert station. **Estimated Cost $1.035M**
- **West Van Wert – South Van Wert:** Relocate West Van Wert –South Van Wert to accommodate work at West Van Wert station. **Estimated Cost $1.174.M**
- **Roller Creek 69kV:** Install new 69/12 kV Roller Creek station to replace Ohio City 34.5/12 kV station. Install a box bay with a 1200A 69kV auto-sectionalizing MOAB and a 3000A,40kA 69kV breaker on the West Van Wert- Rockford through path. Install 69kV metering. **Estimated Cost $1.641M**
- **West Ohio City Switch 34kV:** Retire Switch **Estimated Cost $0.039M**
- **Southwest Van Wert Switch 34kV:** Retire Switch **Estimated Cost $.088M**

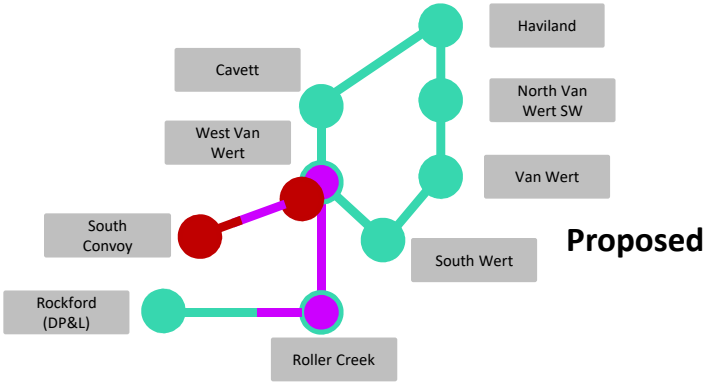
Total Estimated Cost: $21.751M

Alternatives Considered: Consideration was given to utilizing some of the wood poles that were installed in 1994 on the Ohio City – West Van Wert 34.5 kV circuit initially. Further engineering investigation revealed though that the poles installed were class 3 sixty-five foot poles. The wooden poles would not be able to support the proposed 556 ACSR conductor required to meet the thermal capacity requirements of the new interconnection. In addition, there were concerns raised over the existing structures meeting current AEP clearance and strength requirements due to distribution underbuilds that now exist on the line along with the proposed conversion to 69 kV to match the interconnection with DP&L's system.

Projected In-Service: 06/01/2025

Project Status: Scoping





AEP Transmission Zone M-3 Process
Layland – Mollys Creek

Need Number: AEP-2021-AP012

Process Stage: Solution Meeting 6/15/2022

Previously Presented: Need Meeting 3/19/2021

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Layland – Molly's Creek 69 kV, Molly's Creek – Brooklyn Switch (~8 miles)

- Circuit is comprised mostly of wood pole structures
  - 1913 vintage structures (98%)
  - Circuit fails to meet 2017 NESC Grade B loading criteria and AEP structural strength requirements
  - 4-bell porcelain insulators do not meet current AEP Standards
- 32 structures with at least one open condition (38% of the structures)
  - There are 58 structural open conditions affecting poles and crossarms including rot, woodpecker holes and insect damage
  - There are 2 shield wire open conditions related to broken strands, 5 hardware open conditions affecting guys and 2 forestry open conditions related to brush clearance
- Since 2014, there have been 6 momentary and 5 permanent outages on the Bradley - Layland No. 2A 69 kV circuit
  - Majority of the momentary outages were due to weather including lightning
  - Permanent outages due to vegetation from outside the ROW and lightning
  - Lack of shielding on 28% of the circuit likely contributed to poor lightning performance
  - Outages resulted in approximately 114k customer minutes of interruption

Thurmond SS – Claremont 69 kV (~2 miles)

- Circuit is comprised of wood pole structures
  - 1972 vintage structures (100%)
  - Circuit fails to meet 2017 NESC Grade B loading criteria and AEP structural strength requirements, and fails to meet ASCE structural strength requirements
  - 4-bell porcelain insulators do not meet current AEP Standards
- 5 structures with at least one open structural condition (17% of the structures)
  - There are 5 structural open conditions related to woodpecker damage and rot and 3 hardware conditions related to cracked insulator assembly and broken guys
  - Outage statistics included in the data above

AEP Transmission Zone M-3 Process
Layland – Mollys Creek

Need Number: AEP-2021-AP012

Process Stage: Solution Meeting 6/15/2022

Proposed Solution:

Rebuild approximately 4 miles of line from Layland – Mollys Creek (Str. 1183-229) **Estimated Trans. Cost: $13.8M**

Install a new 138 kV PoP switch on the Bradley – Mollys Creek 138 kV line and associated line work on the existing Bradley – Mollys Creek 138 kV line to accommodate switch. **Estimated Trans. Cost: $1.9M**

Construct a new 138 kV extension from the new 138 kV PoP Switch to the existing Claremont Station (to be renamed Dun Glen) approximately 0.6 mi **Estimated Trans. Cost: $2.0M**

Convert existing Claremont Station from 69 kV to 138 kV. Station to be renamed Dun Glen. **Estimated Trans. Cost: $0.0M**

Retire existing Claremont – Mollys Creek 69 kV line (approximately 3.1 miles) Retire existing Thurmond S.S. – Brooklyn S.S. 69 kV line (approx. 3.2 miles) **Estimated Trans. Cost: 7.6M**

Install two new 138 kV breakers at Mollys Creek Station **Estimated Trans. Cost: $1.5M**

Total Estimated Transmission Cost: $26.8M

Ancillary Benefits: Approximately 3.8 miles of the retired line is currently located in the National Park, along with a crossing on the New River.

Alternatives Considered:

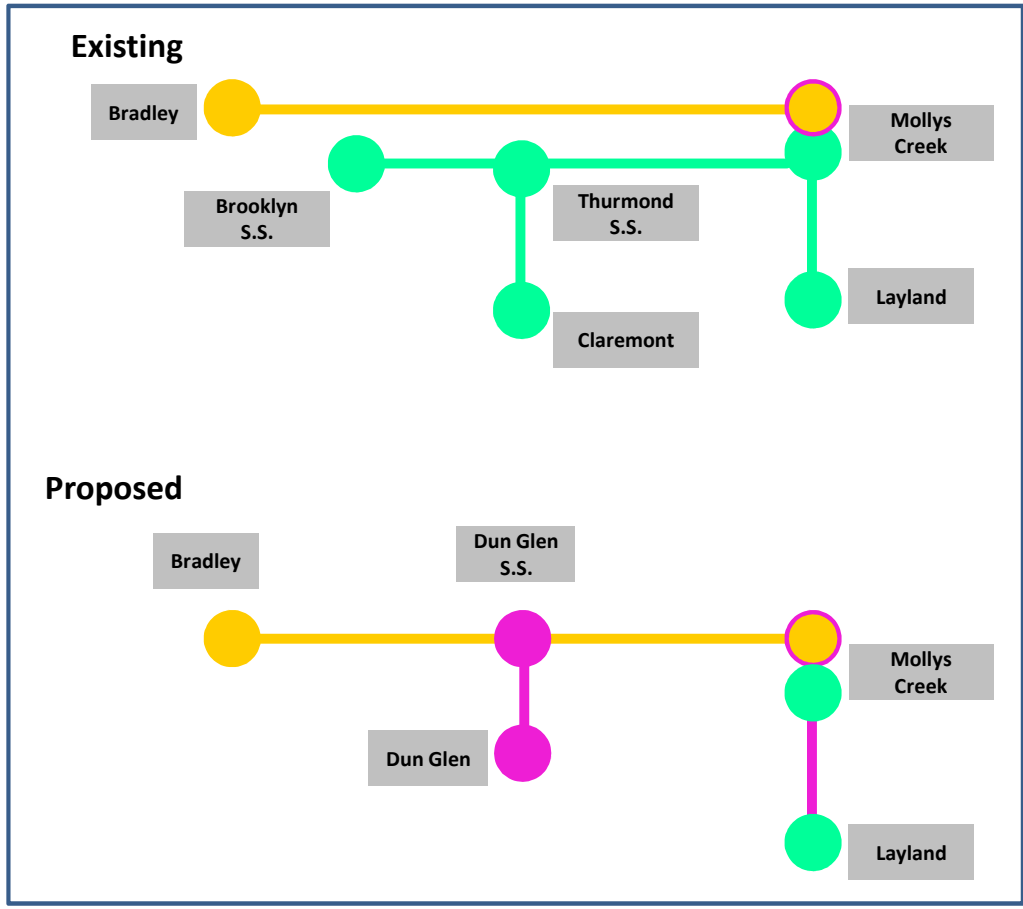
1. Rebuild existing Layland – Mollys Creek 69 kV line (approximately 4 miles). Rebuild existing Mollys Creek – Claremont 69 kV line (approximately 4 miles). Retire Thurmond S.S. – Brooklyn S.S. Total Estimated Trans. Cost: $30.2M

Projected In-Service: 9/1/2025

Project Status: Scoping

Model: 2026 RTEP

Legend	
345 kV	
138 kV	
69 kV	
46 kV	
34.5 kV	
New	

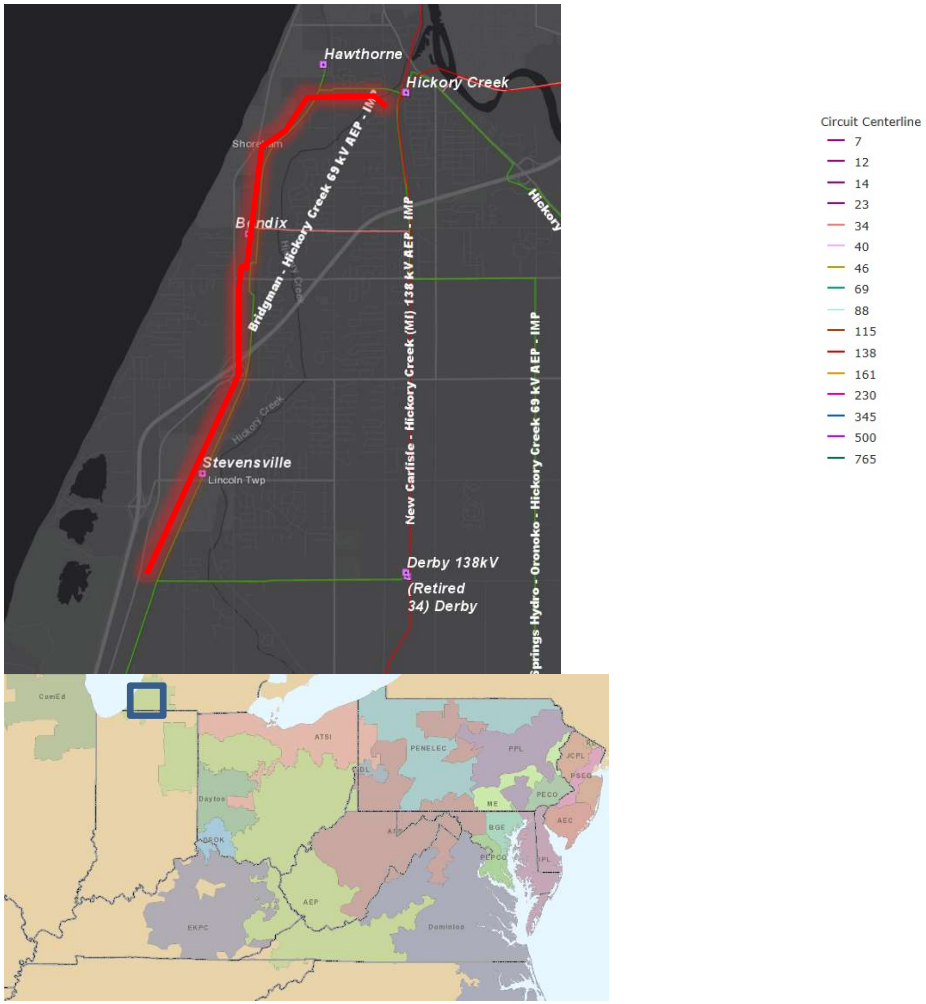


AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

Need Number: AEP-2021-IM017
Process Stage: Solutions meeting 6/15/2022
Previously Presented: Needs Meeting 7/16/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Derby – Hickory Creek 69kV line:

- ~6.2 miles of 1965 336.4 ACSR wood line exist on this line.
- Structures fail NESC Grade B, AEP Strength requirements, and ASCE structural strength standards
- Since 2015 there have been 13 momentary outages and 1 permanent outage on this circuit
- 13 structures were inspected by drone with 10 assessed by ground crew
    - 8 have flashed insulators
    - 7 had wood decay
    - 54% of poles inspected by ground crew had beyond normal decay.
- 24 structures have open conditions on this line including burnt insulators, broken/rust guys and corroded shield wires



AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

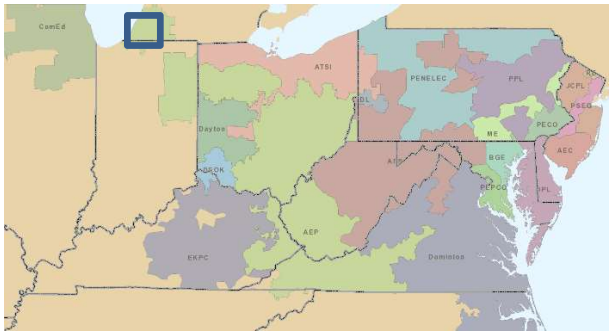
Need Number: AEP-2021-IM018
Process Stage: Solutions meeting 6/15/2022
Previously Presented: Needs Meeting 7/16/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Derby – Hickory Creek 34.5kV line (6.16 miles):

- Majority structures are 1957 wood pole crossarm style.
- Conductor is original 1957 4/0 Copper conductor
- Insulation is legacy cap and pin style insulation
- Structures fail NESC Grade B, AEP Strength requirements, ASCE structural strength standards, Insulation standards minimum leakage distance and shielding angle.
- 24 were assessed by drone with 18 assessed by ground crew.
    - 50% of crossarms had ground or shell decay
    - 15/24 drone inspected poles had moderate decay or splitting arms
    - Most insulators and attachment hardware was corroded
- Currently there are 82 structures with open conditions on this segment including rot, corrosion, splitting, twisting and bowing on the poles and corssarms.

Bendix Lakeshore 34.5kV Tap (1.73 miles):

- Majority structures are 1952 wood pole crossarm style.
- Conductor is original 1952 4/0 ACSR
- Structures fail NESC Grade B, AEP Strength requirements, ASCE structural strength standards, Insulation standards minimum leakage distance and shielding angle.
- All structures were assessed by drone with 10 assessed by ground crew.
    - 25% of crossarms had decay
    - All structures had moderate levels of decay
    - Several crossarms had insect damage
- Currently there are 11 structures with open conditions on this segment including rot, cracked wood, and woodpecker damage.
- Line is a radial line which is difficult to maintain due to outage constraints.

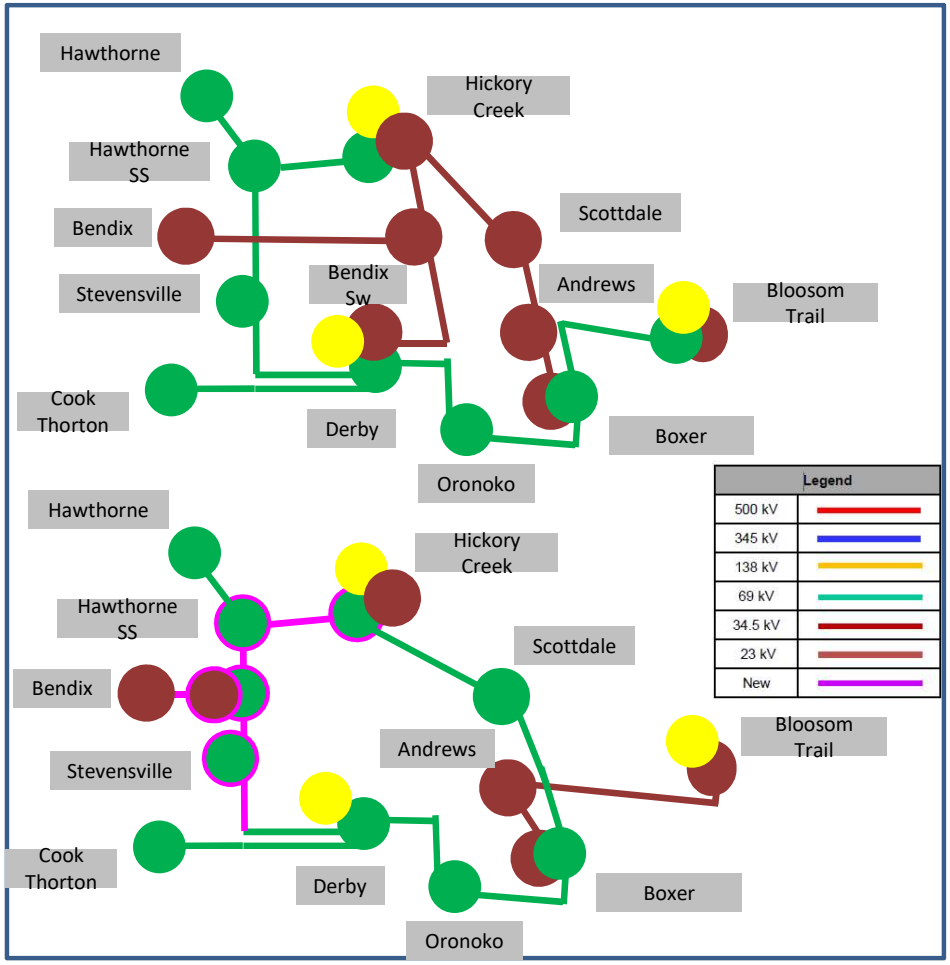


AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

Need Number: AEP-2021-IM018 & AEP-2021-IM017
Process Stage: Solution Meeting 6/15/2022

General Solution Summary:

The remaining western Michigan 34.5kV network is comprised of 1950's and 60's wood that have been identified as needs on the previous slides. In addition to the asset health needs, the 34.5kV network is out of phase with other sub-transmission and BES delivery points and is subject to the operational drop and pick procedure that is problematic. By moving the Bendix load to the new "Trafalgar" station, AEP is able to retire ~7.89 miles of 34.5kV line, remove 34.5kV operation from Derby and with the conversion of Scottdale the drop and pick operation is fully removed from this area.



AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

Need Number: AEP-2021-IM018 & AEP-2021-IM017
Process Stage: Solution Meeting 6/15/2022

Proposed Solution:

Derby – Hickory Creek 69kV Line:
Rebuild the remaining ~6.2 miles of the Derby – Hickory Creek 69kV line utilizing 795 ACSR which will match the ~2.5 miles built in 2013
Estimated Cost: $14.7M

Derby – Hickory Creek 34.5kV Line:
Retire the ~6.16 mile Derby – Hickory Creek 34.5kV line
Estimated Cost: $1.2M

Bendix Lakeshore 34.5kV Tap:
Retire the ~1.73 mile Bendix Lakeshore 34.5kV Tap
Estimated Cost: $ 0.6M

Hawthorne SS 69kV /Bendix Sw 34.5kV:
Remove the switch from Bendix Sw and re-use it at Hawthorne SS.

Estimated Cost: $ .7M

Stevensville 69kV:
Rework the through-path to accommodate the new line entrances.

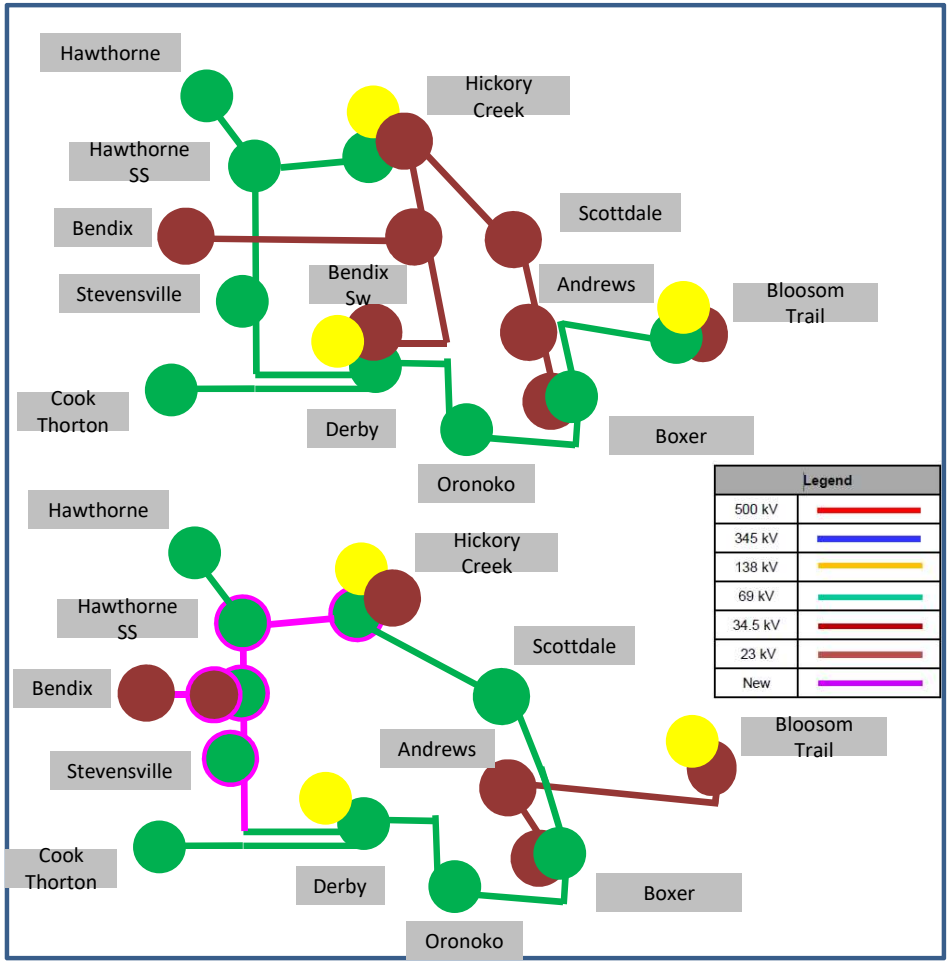
Estimated Cost: $0.6M

Trafalgar 69/34kV:
Install Trafalgar station to serve the Bendix 34.5kV customer. This station will include a new 69kV switcher and a new 69/34.5kV XFR. Two CB's will be reused from Derby and Hickory Creek.

Estimated Cost: $ 4.7M

Scottdale 69kV:
Re-energize to 69kV

Estimated Cost: $ 0M



AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

Need Number: AEP-2021-IM018 & AEP-2021-IM017
Process Stage: Solution Meeting 6/15/2022

Proposed Solution:

Derby 138/69/34.5kV:
Retire the 34.5kV voltage class
Estimated Cost: $0.1M

Boxer – Blossom Trail 34.5:
Re-energize at 34.5kV
Estimated Cost: $0.2M

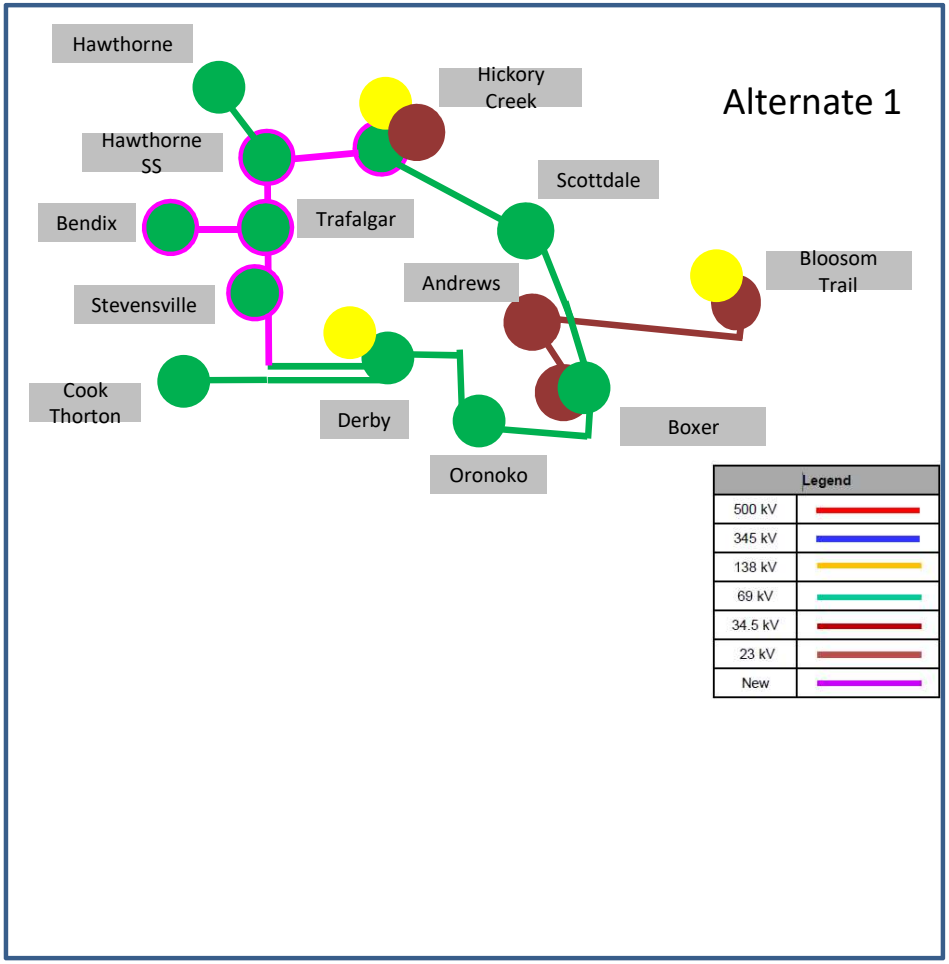
Boxer – Hickory Cr 69kV:
Re-energize at 69kV
Estimated Cost: $0.8M

Trafalgar – Bendix 34.5kV:
Build a 0.15 mile radial line from Trafalgar to Bendix Lakeshore

Estimated Cost: $ .5M

Total Estimated Transmission Cost: $24.1M

Alternatives Considered:
Alternate 1
Instead of installing a 69/34.5kV XFR at Trafalgar and relocating a breaker there for the 34.5kV, upgrade Bendix Lakeshore to 69kV operation. This would cost roughly the same but would require additional work from the retail customer. AEP will continue to pursue this option based on the customer needs.
Estimated Cost: $24.1M



AEP Transmission Zone M-3 Process
Western Michigan Area Improvements

Need Number: AEP-2021-IM018 & AEP-2021-IM017
Process Stage: Solution Meeting 6/15/2022

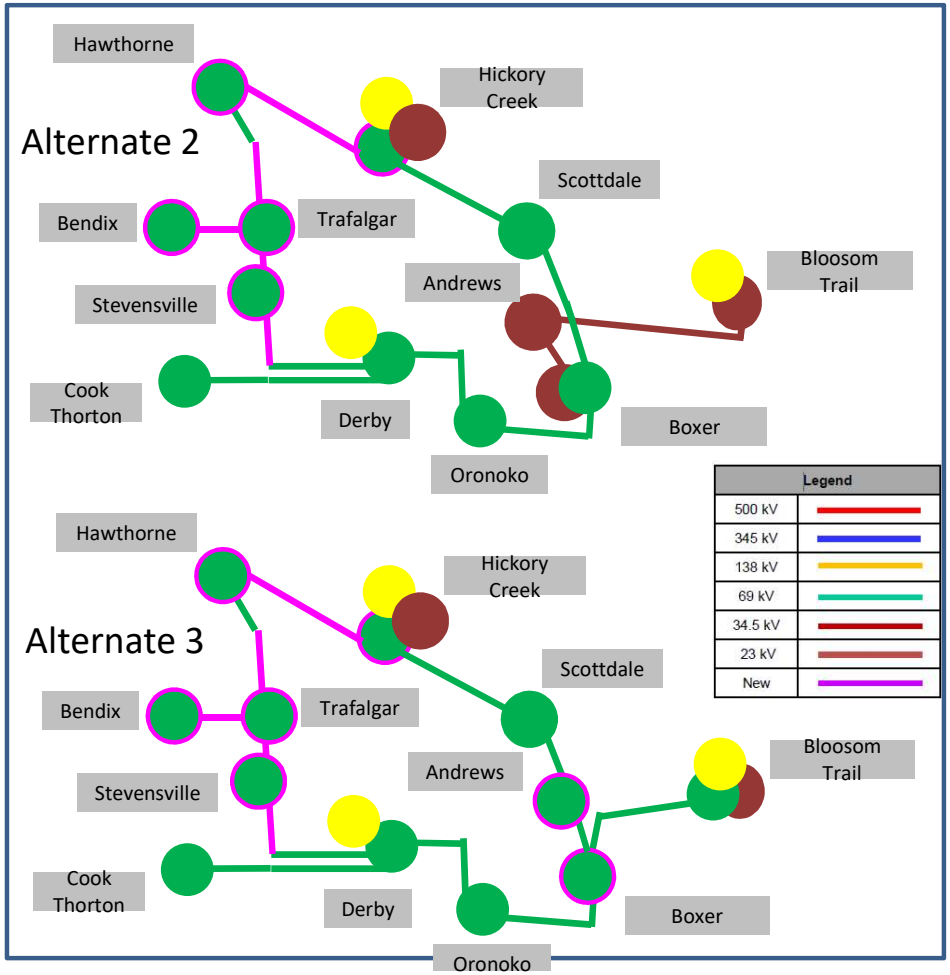
Alternatives Considered (Cont):

Alternate 2
Instead of re-using the Bendix Sw as the replacement for Hawthorne Sw, loop in Hawthorn with the line rebuild. While this would improve reliability to the customers, the area is fairly urban so even though the radial is only ~0.3 miles, a new line route would be costly and impactful to build. Because of this, the decision was to keep the station served from a radial line.
Estimated Cost: $25.6M

Alternate 3
Instead of re-energizing Blossom Trail – Boxer to 34.5kV, bring Andrews University to 69kV operation. Andrews University is a non-recoverable delivery point which means it is not subject to the problematic "drop and pick" procedure inherent in 34.5kV operation. As such this investment wouldn't help out our customers and wasn't chosen.
Estimated Cost: $26.1M

Ancillary Benefits
With the re-energization of Scottdale, the larger network will have successfully eliminated the "drop and pick" procedure inherent in 34.5kV operation thereby increasing the operational reliability of the network.

Projected In-Service: 11/1/2025
Project Status: Scoping



AEP Transmission Zone M-3 Process
Pendleton – Makahoy 138 kV line rebuild

Need Number: AEP-2021-IM036

Process Stage: Solution Meeting 6/15/2022

Previously Presented: 11/19/2021

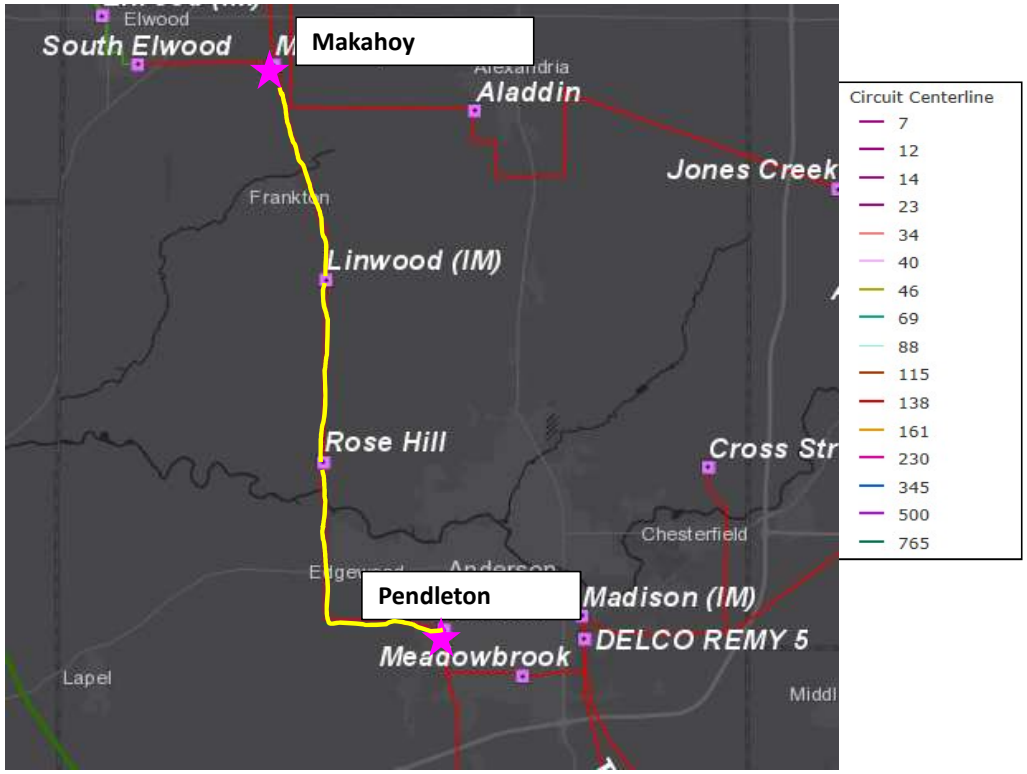
Project Driver: Equipment Material Condition, Performance and Risk

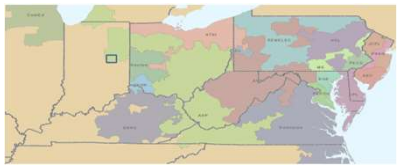
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:

Pendleton - Makahoy 138 kV (Vintage 1954)

- Length of Line: 14.93 miles
- Total structure count: 106 with 92 dating back to original installation.
- Original Line Construction Type: Predominantly wood poles
  - Wood cross arm
  - Horizontal insulators: Porcelain
  - Grounding method utilizes butt wraps on every other structure, providing reduced lightening protection for the line.
- Conductor Type: 556,500 CM ACSR 26/7 Dove
- Condition Summary
  - Number of open conditions: 21 structure open conditions with 8 structure related open conditions.
    - Open conditions include cross arm or pole with rot top, disconnected X-brace, disconnected conductor strands, shield wire broken strands, broken ground lead wire, burnt or broken insulators and shield wire hardware that is loose, broken or missing a cotter key.
    - Based on the aerial drone and ground crew assessment done on 56 structures, the following was noted.
      - Overall, a high percentage of the cross arms have moderate to advanced wood decay.
      - 40% of structures assessed at ground line have heart rot decay.
      - Structure hardware with moderate corrosion.
  - Structures fail NESC Grade B, AEP structural strength requirements, and ASCE structural strength requirements





AEP Transmission Zone M-3 Process
Pendleton – Makahoy 138 kV line rebuild

Need Number: AEP-2021-IM036

Process Stage: Solution Meeting 6/15/2022

Previously Presented: 11/19/2022

Project Driver: Equipment Material Condition, Performance and Risk

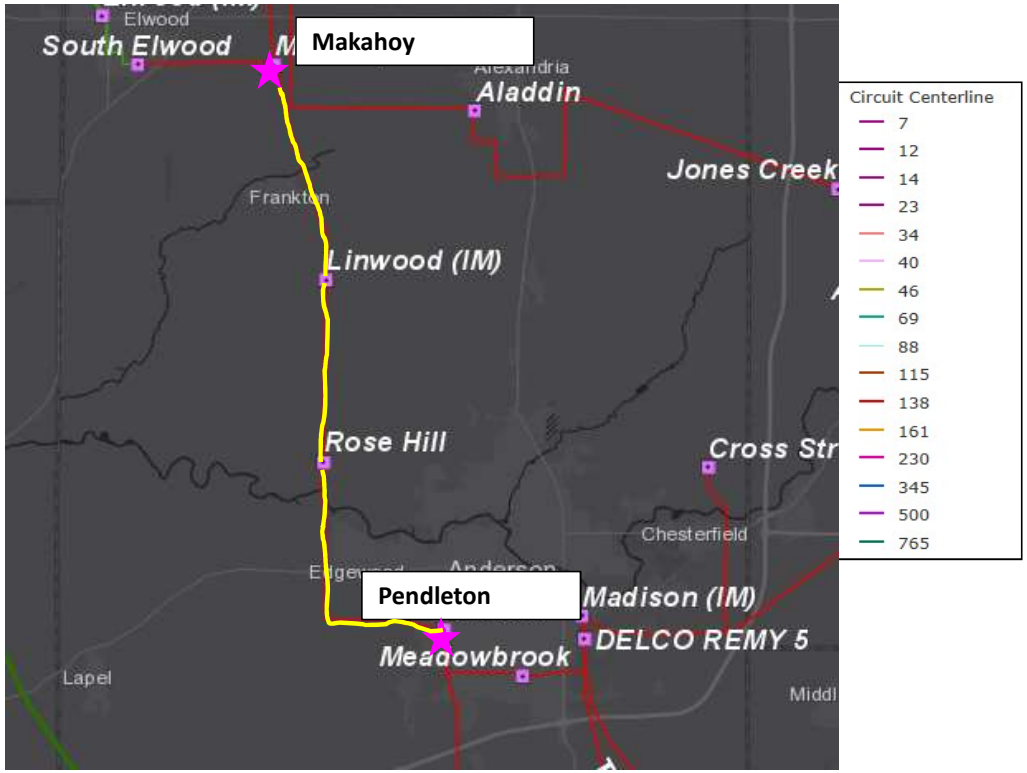
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 13)

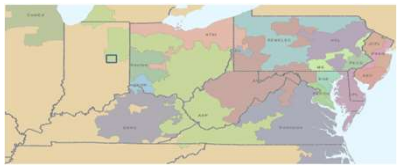
Problem Statement:

Pendleton 138/34.5 kV transformer #2

Transformers Concerns:

- Install date: 1967
- Oil concerns:
  - Dielectric strength breakdown: The elevated moisture levels and interfacial tension indicate the dielectric strength of the insulation system are in poor condition, which impairs the unit's ability to withstand electrical faults.
  - No oil containment
  - Oil / Gasket leaks
- Elevated moisture levels
- Interfacial Tension downward trend





AEP Transmission Zone M-3 Process
Pendleton – Makahoy 138 kV line rebuild

Need Number: AEP-2021-IM036

Process Stage: Solution Meeting 6/15/2022

Previously Presented: 11/19/2021

Proposed Solution:

Pendleton – Makahoy 138 kV: Rebuild ~15 miles of 138 kV line with the conductor size 795 ACSR. The following cost includes the line rebuild, line removal and ROW.
Cost: $27.2 M

Pendelton: Replace the Pendleton 138/34.5 kV transformer with a 138/34.5 kV 75 MVA transformer. The following cost includes the transformer install and removal.

Cost: $1.2 M

Total Estimated Transmission Cost: $28.4 M

Alternative considered:

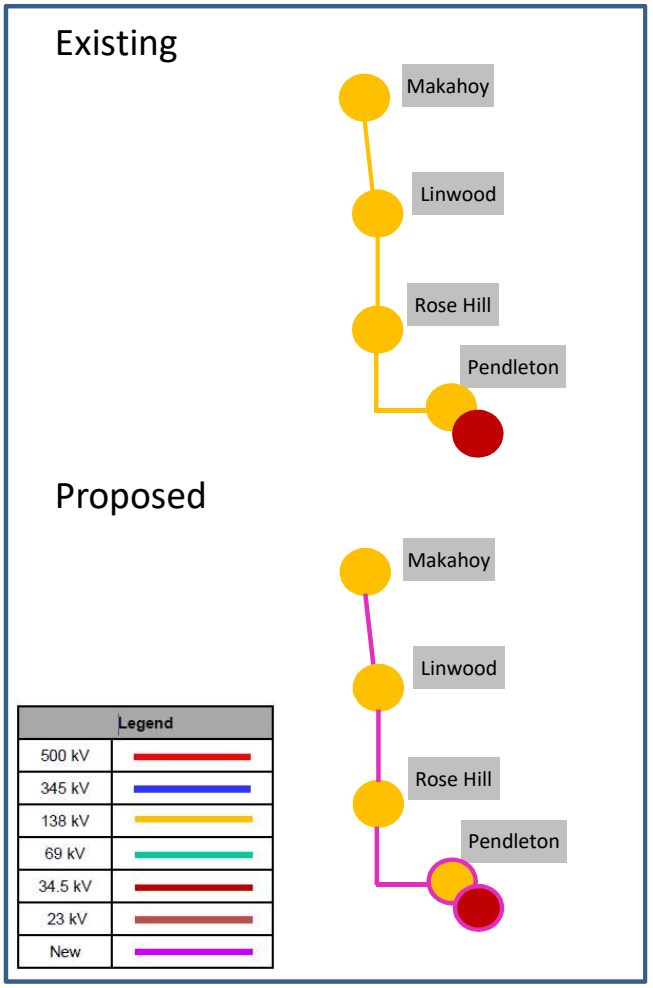
Remove 15 miles between Makahoy and Pendleton, install a 5 mile 138 kV loop between Makahoy and Linwood, install a 6 mile 138 kV loop between Rose Hill – Pendleton, install a 138 kV circuit breaker at Makahoy , install a 138 kV circuit breaker at Pendleton 138 kV bus #2, replace the Pendleton 138/34.5 kV transformer #2. Retire the section of line between Linwood and Rose Hill.

This option was not chosen as a tower outage on either 138 kV loops (Makahoy – Linwood and Rosehill – Pendleton) will drop the Rose Hill load or the Linwood load. Considering the loads served along the existing line, retirement of the asset is also not a consideration.

Total Cost: $38.5 M

Projected In-Service: 9/2026

Project Status: Scoping



EKPC Transmission Zone M-3 Process
Fall Rock - Manchester 69 KV

Need Number: EKPC-2022-001

Process Stage: Solutions Meeting – June 15, 2022

Previously Presented:

Needs Meeting –March 18, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

EKPC Assumptions Presentation Slide 13

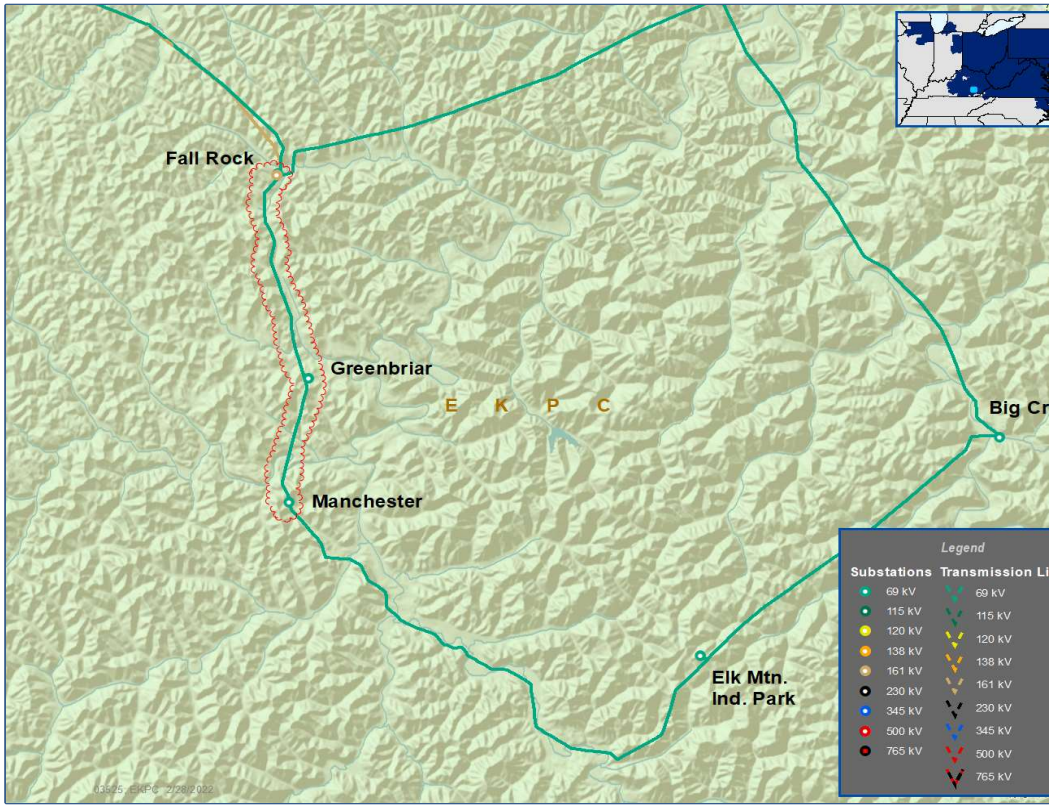
Problem Statement:

The 5.83 mile, Fall Rock-Manchester 69 KV transmission line section is 65 years old.

This line section has condition issues such as rusting, pitting, and broken strands. Based on this information, the EKPC Reliability team has concluded that this line is at or near end of life and should be addressed due to the condition assessment.

There are currently 33 open work orders for the line section with 30 being structure issues such as degraded poles, cross arm, or guy wire issues.

Model: N/A



EKPC Transmission Zone M-3 Process
Fall Rock - Manchester 69 KV

Need Number: EKPC-2022-001

Process Stage: Solutions Meeting – June 15, 2022

Proposed Solution:
Rebuild the Fall Rock-Manchester 5.83 mile 69 KV transmission line using 556.5 ACSR conductor.

Transmission Cost: $4.4M

Ancillary Benefits:

- None

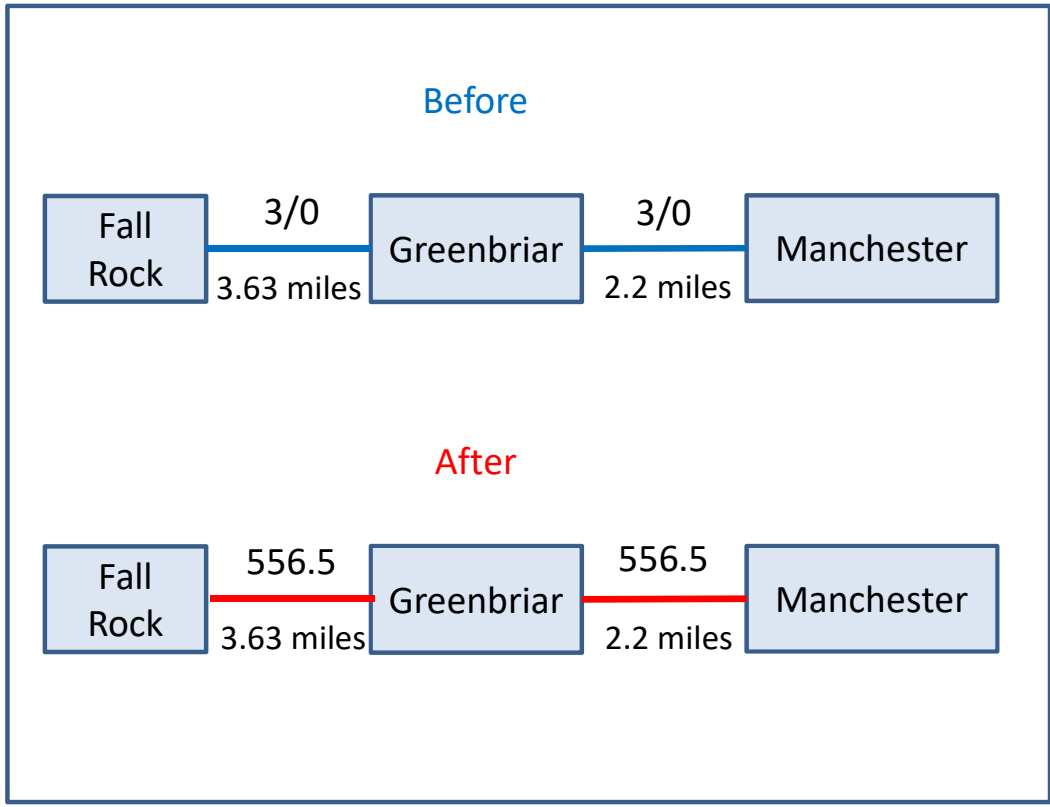
Alternatives Considered:

Alternative 1 - Rebuild the Manchester-Greenbriar 69 KV line section as double-circuit, build a new breaker station at Manchester, convert the normally open interconnection with KU at Manchester to normally closed, convert the normally open switch at Elk Mountain to normally closed and retire the Fall Rock-Greenbriar 69 KV line section.
Transmission Cost: $7.5M

Projected In-Service: 12/31/2024

Project Status: Engineering

Model: N/A



EKPC Transmission Zone M-3 Process
Headquarters – Millersburg Tap 69 KV

Need Number: EKPC-2022-002

Process Stage: Solutions Meeting – June 15, 2022

Previously Presented:

Needs Meeting –March 18, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

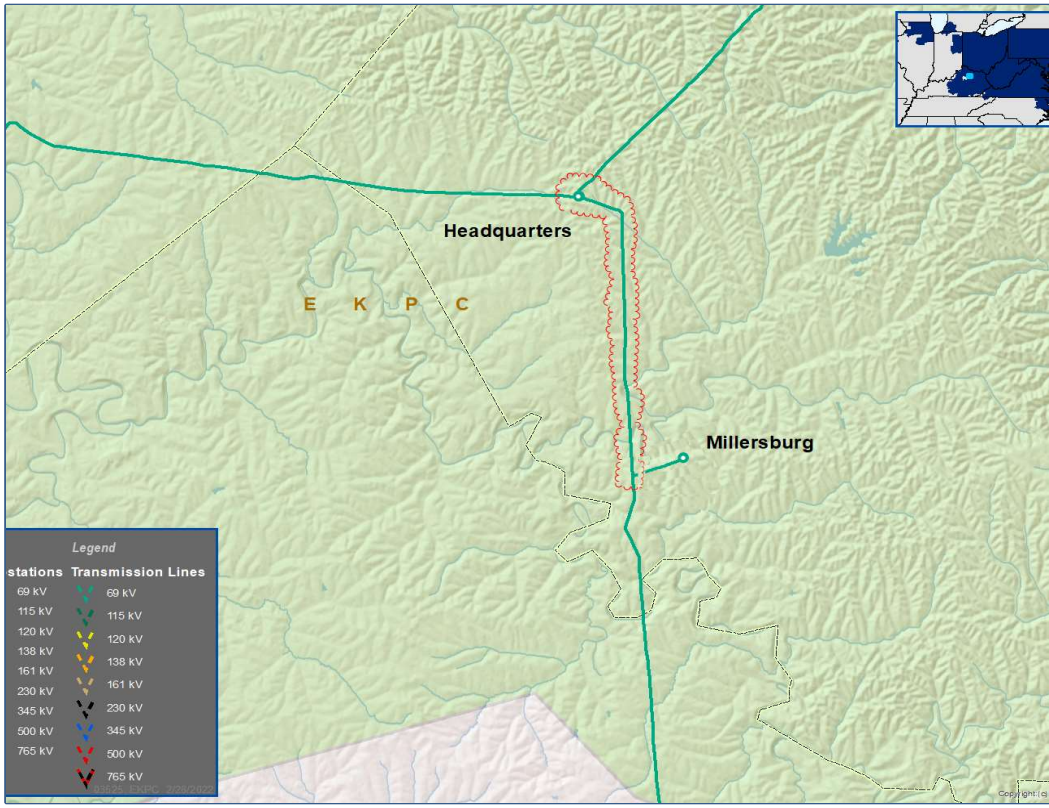
EKPC Assumptions Presentation Slide 13

Problem Statement:

The 5.12 mile, Headquarters-Millersburg Tap 69 KV transmission line section is 71 years old.

This line section has condition issues such as rusting, pitting, and broken strands. Based on this information, the EKPC Reliability team has concluded that this line is at or near end of life and should be addressed due to the condition assessment.

There are currently 42 open work orders for the line section with 9 being structure issues such as rotten poles and woodpecker holes.



Model: N/A

EKPC Transmission Zone M-3 Process
Headquarters – Millersburg Tap 69 KV

Need Number: EKPC-2022-002

Process Stage: Solutions Meeting – June 15, 2022

Proposed Solution:
Rebuild the 5.12 mile Headquarters-Millersburg Tap 69 KV line section using 556.5 ACSR conductor.

Transmission Cost: $3.8M

Ancillary Benefits:

- None

Alternatives Considered:

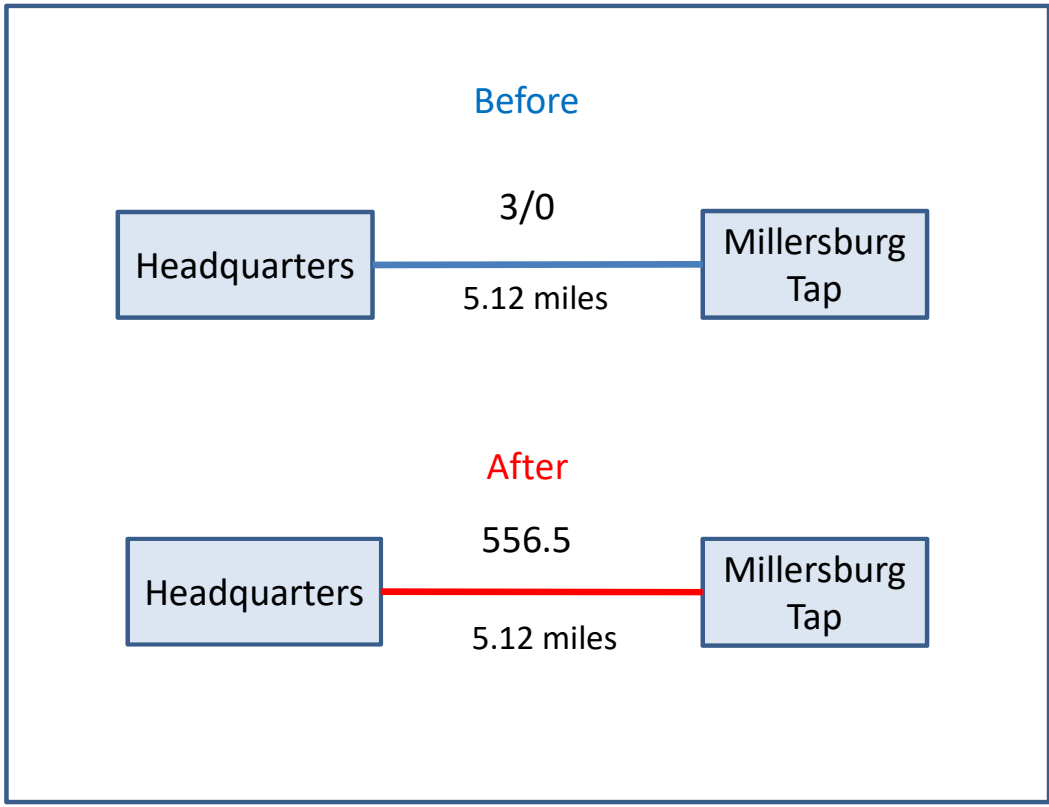
Alternative 1 - Retire the 5.12 mile Headquarters-Millersburg Tap 69 KV line section.
Transmission Cost: $0.28M

Alternative 2 - Build a new 3.3 mile EKPC Millersburg-KU Millersburg 69 KV line section using 556.5 ACSR conductor. Retire the existing 5.12 mile Headquarter-Millersburg Tap 69 KV line section.
Transmission Cost: $5.6M

Projected In-Service: 12/31/2025

Project Status: Engineering

Model: N/A



EKPC Transmission Zone M-3 Process
Griffin Junction – Griffin 69 KV

Need Number: EKPC-2022-003

Process Stage: Solutions Meeting – June 15, 2022

Previously Presented:

Needs Meeting –March 18, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Customer Service

Specific Assumption Reference:

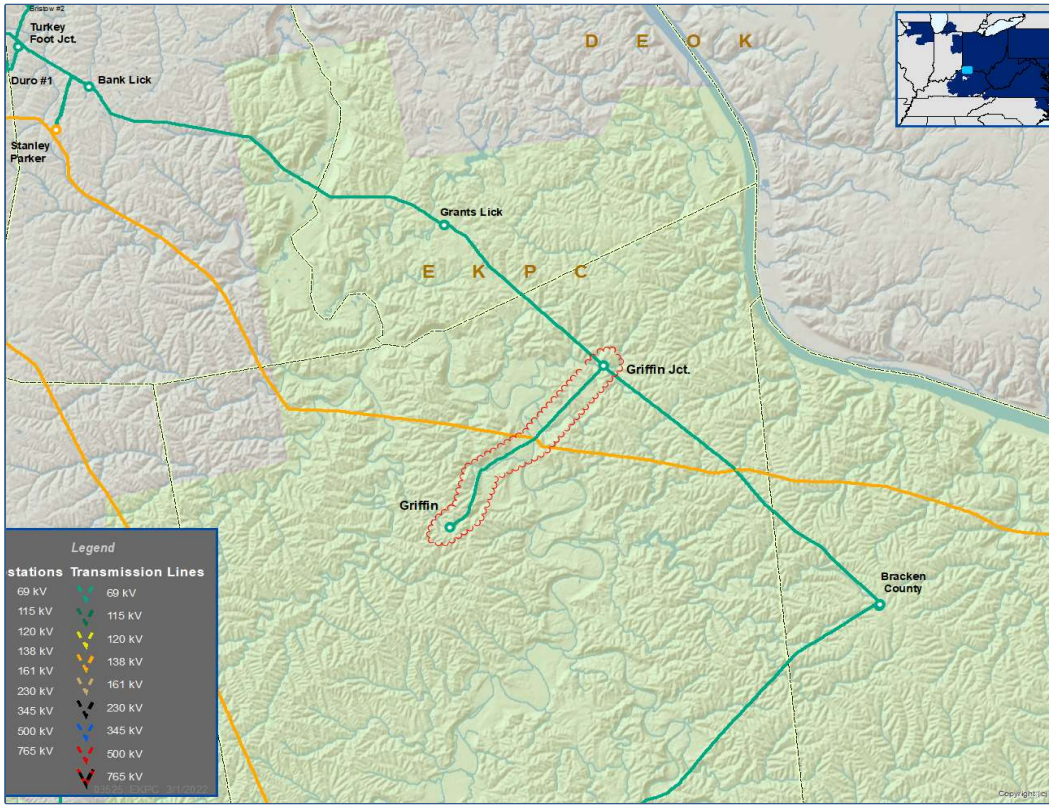
EKPC Assumptions Presentation Slides 13 & 15

Problem Statement:

The 6.4 mile, Griffin Junction-Griffin 69 KV transmission line section is 56 years old.

This line section has condition issues such as severe static wire condition and wood pole deterioration. Due to safety concerns and potential for forced long-term outages related to the static wire condition, line maintenance cannot be performed while energized and the Griffin substation cannot be back fed during a line outage. The EKPC Reliability team has concluded that this line section is at or near end of life and should be addressed due to this condition assessment.

There are currently 33 open work orders for this line section.



Model: N/A

EKPC Transmission Zone M-3 Process
Griffin Junction – Griffin 69 KV

Need Number: EKPC-2022-003

Process Stage: Solutions Meeting – June 15, 2022

Proposed Solution:
Build a new 6.4 mile Griffin Junction-Griffin 69 KV line section using 266.8 ACSR conductor parallel to the existing line section. Retire the existing 6.4 mile line section upon completion of new line.

Distribution Cost: $4.3M
Transmission Cost: $0.0M

Ancillary Benefits:

- None

Alternatives Considered:

Alternative 1 - Build a new 6.4 mile double circuit Griffin Junction-Griffin 69 KV line section using 556.5 ACSR conductor parallel to the existing line section. Retire the existing 6.4 mile line section upon completion of new line.

Distribution Cost: $0.35M

Transmission Cost: $5.25M

Alternative 2 –Convert the distribution substation to 138 KV, loop in the EKPC 138 KV transmission via a new 3.5 mile 138 KV double circuit line. Retire the existing Griffin Junction-Griffin 6.4 mile line section upon completion of new line.

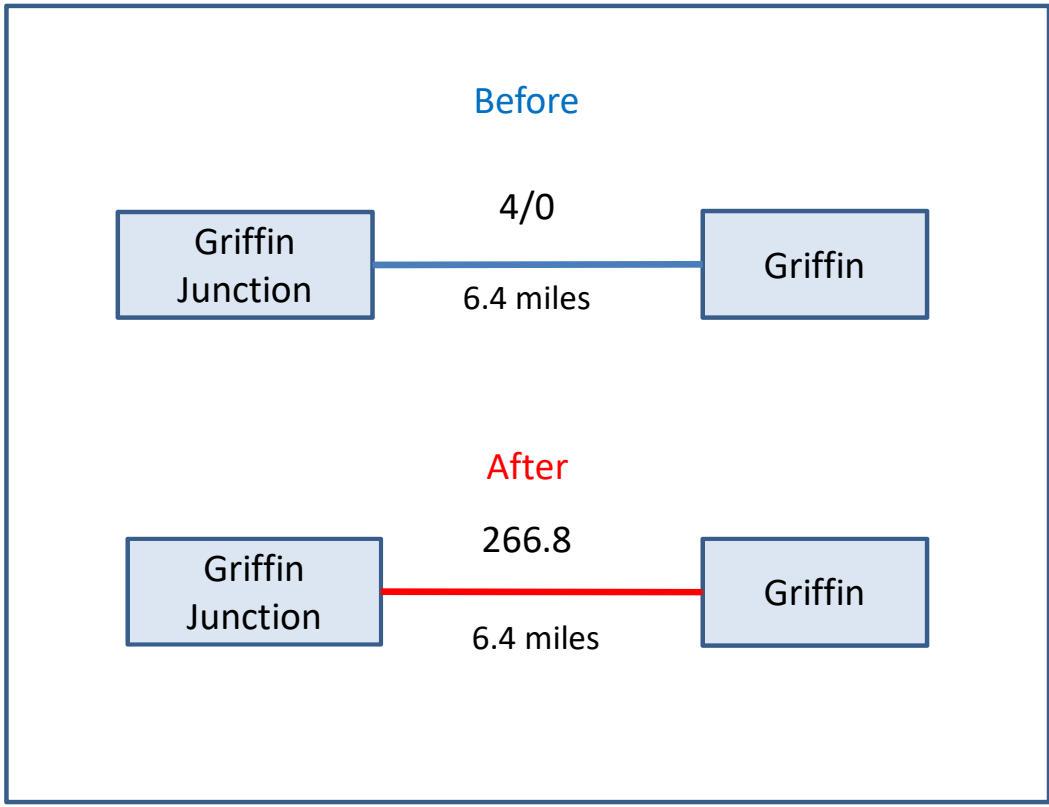
Distribution Cost: $2.35M

Transmission Cost: $4.45M

Projected In-Service: 12/31/2023

Project Status: Engineering

Model: N/A



AEP Transmission Zone M-3 Process
Muskingum & Perry Counties, OH

Need Number: AEP-2022-OH008

Process Stage: Solutions Meeting 07/22/2022

Previously Presented: Need Meeting 01/21/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

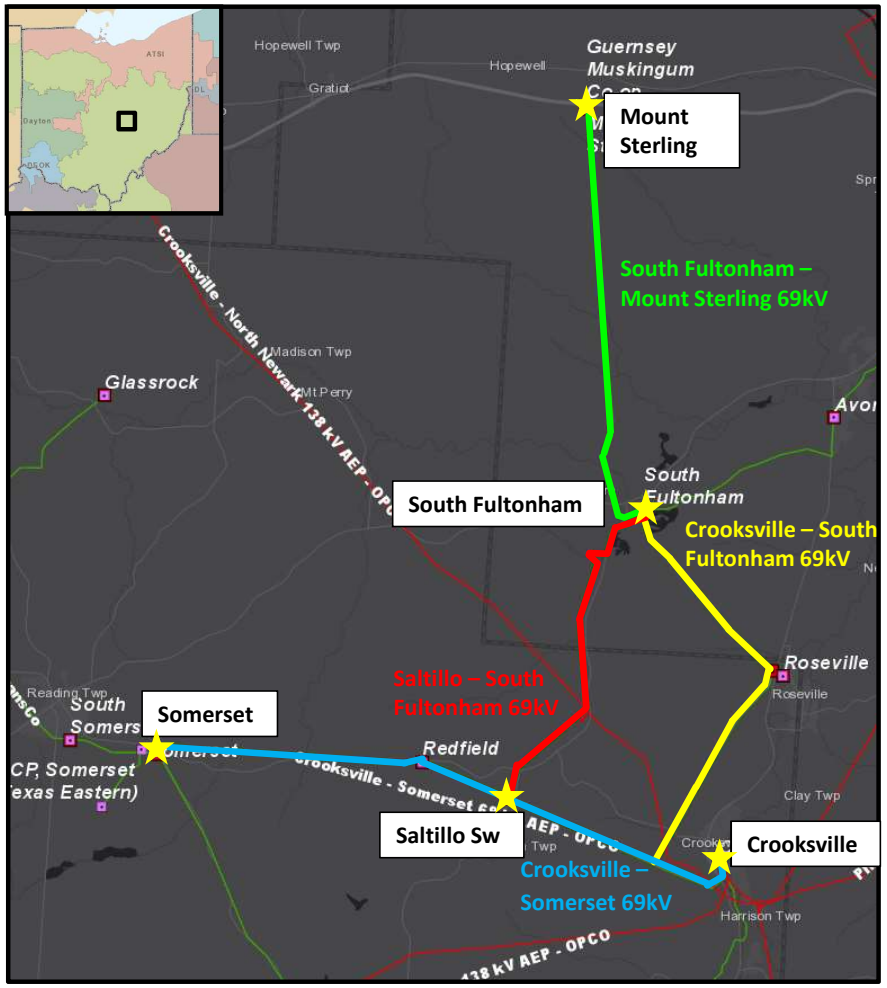
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Crooksville – Somerset 69kV (1916):

- Line Length: ~10.4 Miles
- Total Structure Count 150
  - Structure Type: Wood / Steel Lattice
- Conductor Type: 3/0 ACSR 6/1 (Pigeon), 2/0 Cu 7 (20COP), & 4/0 ALUM/6201
- Outage History: 12 Momentary and 4 Permanent Outages, total CMI = 25,389 between 11/2016 – 11/2021.
- Open Conditions: 64 total. 13 are structure related open conditions including rust, rotted, broken, and burnt conditions, and vines, 1 open condition related to burnt conductor, 32 shielding/grounding conditions including broken and missing wires, 18 hardware based open conditions consisting of burnt, broken, missing, and chipped insulators as well as damaged guy wires.
- The line was originally constructed with wood monopoles and steel lattice towers. The ceramic horizontal post insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements. The conductors from Structure 41 to Structure 139A are 2/0 copper 7 with a shield wire of #1 copper 3 strand which do not meet current AEP standards for conductors and shield wires. The shield angle on a typical tangent structure is measured at 18° degrees, which is inadequate for AEP current shield angle requirements.
- 8 structures were further assessed by a ground crew. 100% of those structures had reported conditions including rusty shield wires, wear on connections, insulator deterioration, woodpecker holes, and ground line structure decay.



AEP Transmission Zone M-3 Process
Muskingum & Perry Counties, OH

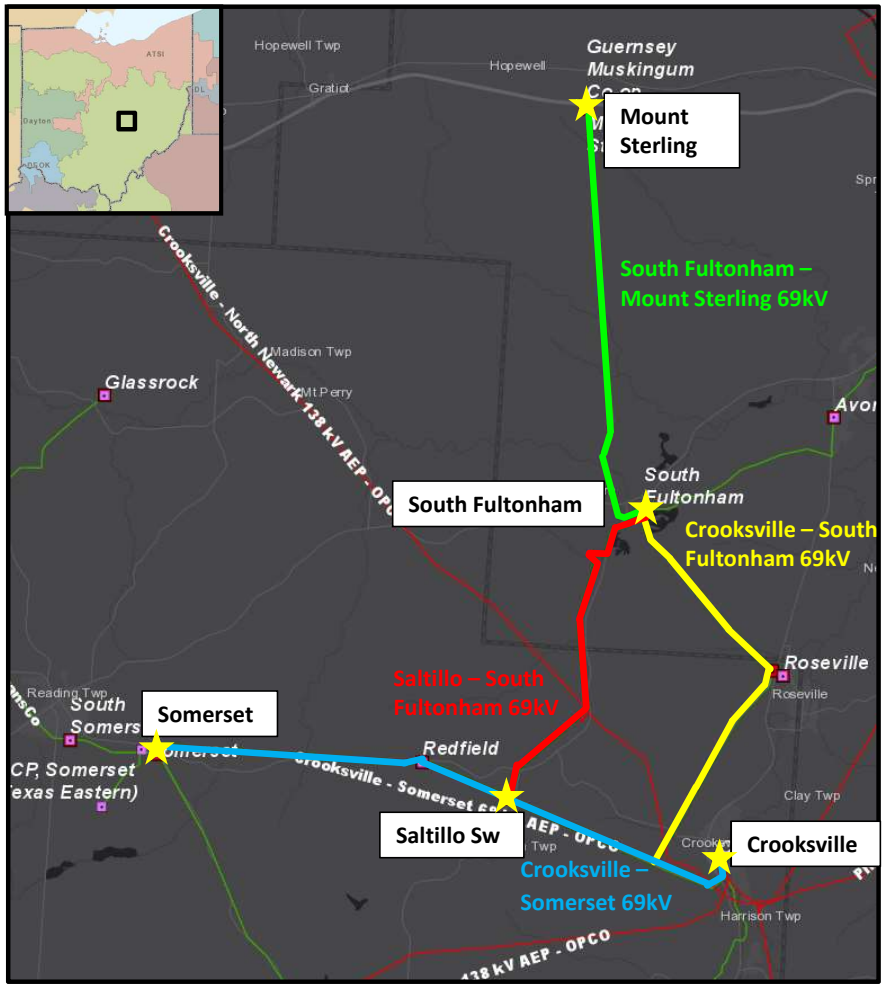
Problem Statement Continued:

Saltillo - South Fultonham 69 kV (1952):

- Line Length: ~5.91 Miles (Normally open point at Saltillo Switch towards Crooksville)
- Total Structure Count 58
  - Structure Type: Wood
- Conductor Type: 4/0 ACSR 6/1 (Penguin) and 4/0 ALUM ALLOY
- Outage History: 3 Momentary and 1 Permanent Outages between 11/2016 – 11/2021
- Open Conditions: 22 total. 5 are open structure related conditions, 2 conductor related conditions, 3 shielding/grounding conditions and 12 hardware related conditions.

South Fultonham – Mount Sterling 69kV (1958):

- Line Length: ~7.2 Miles
- Total Structure Count 75
  - Structure Type: Wood
- Conductor Type: 1/0 ACSR 6/1 (Raven), 336.4 MCM ACSR 18/1 (Merlin)
- Outage History: 12 Momentary and 7 Permanent Outages, total CMI = 1,221,812 between 11/2016 – 11/2021.
- Open Conditions: 24 total. 6 are structure related open conditions including rot top, split pole, rot heart, and burnt pole, 7 open condition related to damaged conductor splice/dead ends, 8 shielding/grounding conditions related to damaged shield wires and a broken ground lead wire, 3 hardware based open conditions consisting of burnt insulators and a chipped insulator.
- Structures on South Fultonham – Mount Sterling 69kV line does not meet 2017 NESC Grade B loading criteria, does not meet current AEP structural strength requirements, and does not meet the current ASCE structural strength requirements. The line is insulated with ceramic horizontal post insulators which do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line grounding is butt wrap, which does not meet AEP standards.



AEP Transmission Zone M-3 Process
Muskingum & Perry Counties, OH

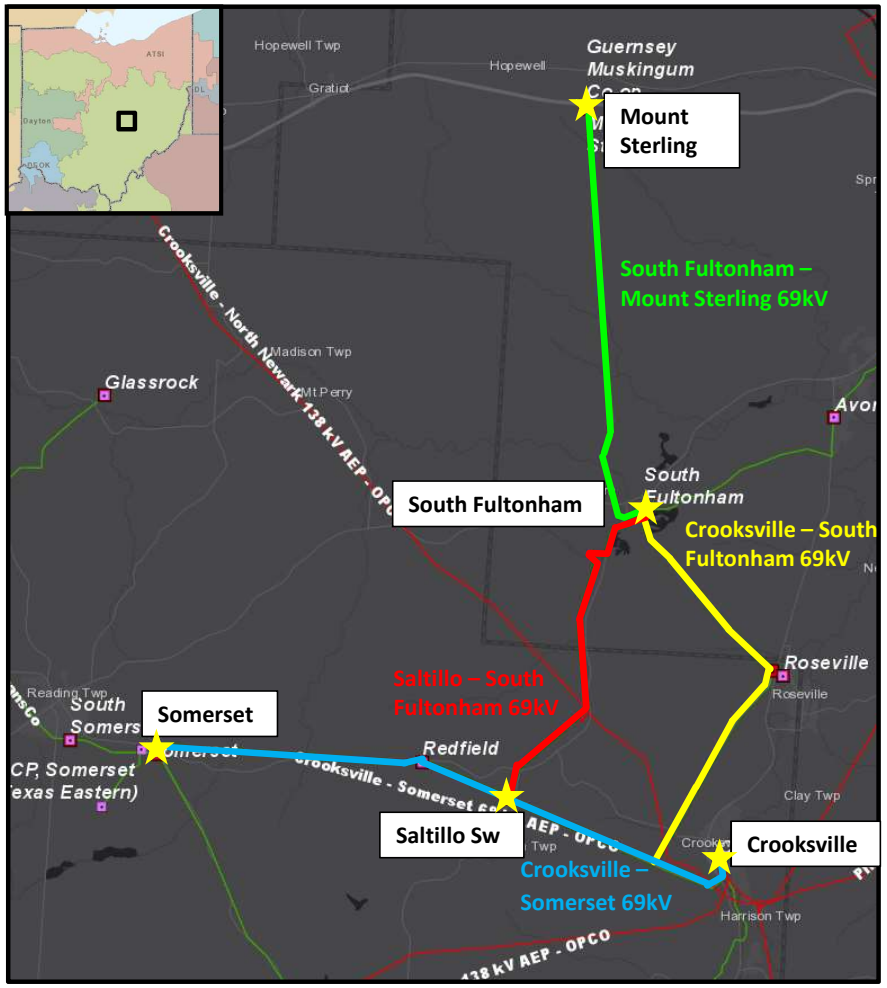
Problem Statement Continued:

Crooksville – South Fultonham 69kV (1958):

- Line Length: ~7.4 Miles
- Total Structure Count 67
  - Structure Type: Wood
- Conductor Type: 3/0 ACSR 6/1 (Pigeon), 2/0 Cu 7 (20COP), & 4/0 ACSR 6/1 (Penguin)
- Outage History: 10 Momentary and 2 Permanent Outages, total CMI = 700,805 between 11/2016 – 11/2021.
- Open Conditions: 39 total. 13 are structure related conditions rot top of poles/crossarms, split poles, insect and woodpecker damage, 12 open conditions related to conductor issues including broken strands, 14 hardware based open conditions consisting of burnt insulators and broken insulators.
- Structures on the Crooksville – South Fultonham 69kV Line fails to meet 2017 NESC Grade B loading criteria and fails to meet current AEP structural strength requirements. The ceramic horizontal post insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line shielding angle on the typical tangent structure, H1B7, is measured at 27.2 degrees for phases one and two and 57 degrees for three, which is inadequate for AEP current shield angle requirements.
- 5 structures were futher assessed by a ground crew. 100% of those structures had reported conditions including pole weathering, rot top, hardware weathering, bowing, no top present, topper deterioration, weathering at ends of crossarms, woodpecker and holes.

Crooksville 69kV Circuit Breaker "W":

- Breaker Age: 1962
- Interrupting Medium: (Oil)
- Fault Operations: 19
- This breaker is oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require



AEP Transmission Zone M-3 Process
Muskingum & Perry Counties, OH

Need Number: AEP-2022-OH008

Process Stage: Solutions Meeting 6/15/2022

Proposed Solution:

- **Crooksville Station, 69 kV**: Replace 69 kV oil filled FK type breaker CB-W with a 3000A, 40 kA breaker . **Estimated Cost: $0.67M**
- **South Fultonham, 69 kV**: Retire CB-B. **Estimated Cost: $0.09M**
- **Saltillo Switch, 69 kV**: Retire Saltillo Switch. **Estimated Cost: $0.05M**
- **Crooksville – South Fultonham 69 kV line**: Rebuild approximately 7.4 miles of single circuit 69 kV line between the Crooksville and South Fultonham stations. **Estimated Cost: $12.47M**
- **Crooksville – Somerset 69 kV line**: Rebuild approximately 8.8 miles of single circuit and 1.6 miles of double circuit 69 kV line between the Crooksville and Somerset stations. **Estimated Cost: $19.92M**
- **South Fultonham – Mount Sterling 69 kV line**: Rebuild approximately 7.2 miles of single circuit 69 kV line between the South Fultonham and Mount Sterling stations. **Estimated Cost: $13.88M**
- **South Fultonham – Saltillo 69 kV line**: Retire approximately 5.9 miles of single circuit 69 kV line between the South Fultonham station and Saltillo Switch. **Estimated Cost: $3.22M**

Total Estimated Cost: $50.3M

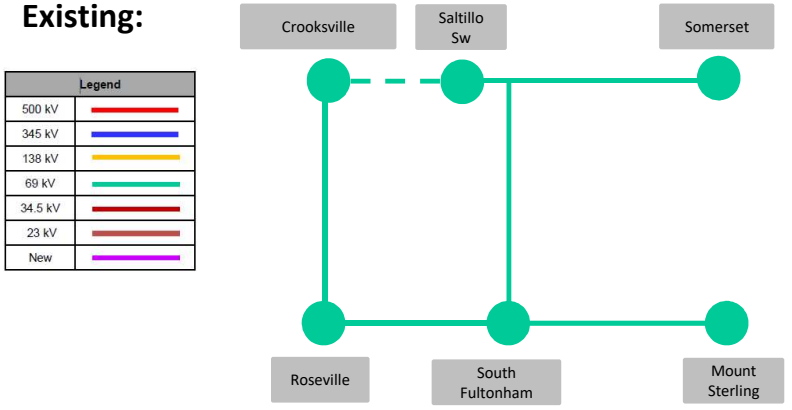
Alternatives Considered:

Alternatively, South Fultonham – Saltillo line asset (~5.9 miles) was considered for rebuilt instead of line section between Crooksville and Saltillo (~4.2 miles). However, a section of Crooksville – Saltillo line (~1.6 miles) will be part of Crooksville – South Fultonham circuit rebuild as the two lines are currently double circuited today. Therefore, the cost of rebuilding ~5.9 miles of 69 kV line would be higher compared to the additional ~2.6 miles of single circuit line to rebuild the remaining portions of the Crooksville – Saltillo line section.

Projected In-Service: 1/2/2026

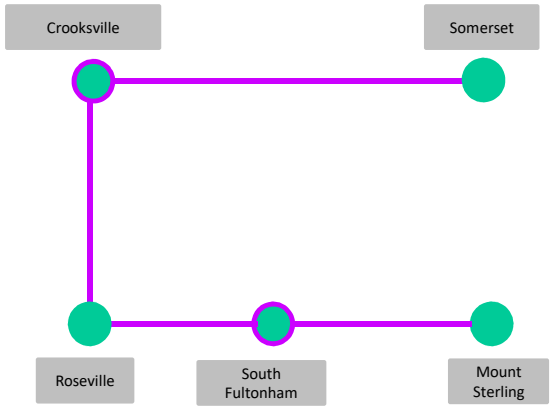
Project Status: Scoping

Existing:



Bubble Diagram

Proposed:



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q2 138 kV

Need Number: ATSI-2021-015
Process Stage: Solution Meeting – 07/22/2022
Previously Presented: Need Meeting – 08/16/2021

Supplemental Project Driver(s):
Equipment Material Condition, Performance, and Risk
Infrastructure Resilience

Specific Assumption Reference(s):
Global Factors

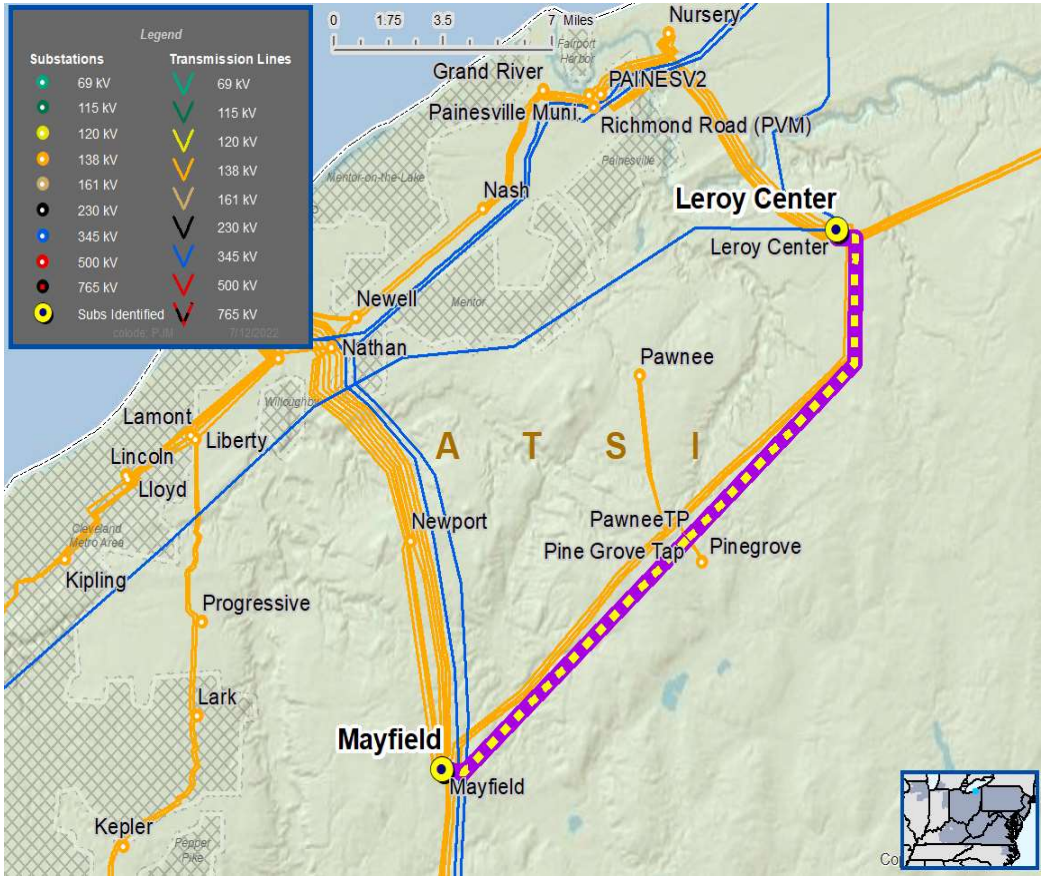
- System Reliability and Performance
- Load at risk in planning and operational scenarios
- Increase line loading limits
- Age/condition of transmission line conductors

Line Condition Rebuild/Replacement

- Transmission lines with loading at 80% or greater
- End of Life Methodology

Problem Statement

- The Leroy Center – Mayfield Q2 138 kV line loads to 95% under contingency conditions in the 2020 RTEP Case.
- The Leroy Center – Mayfield Q2 138 kV line has the potential to feed 7,017 customers and 20 MW at the Pawnee Substation, back up feed to LC-MF Q1 138 kV line.
- The existing conductor is 4/0 CU and can cause protection issues due to not being able to handle the short circuit current for faults.



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ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q2 138 kV

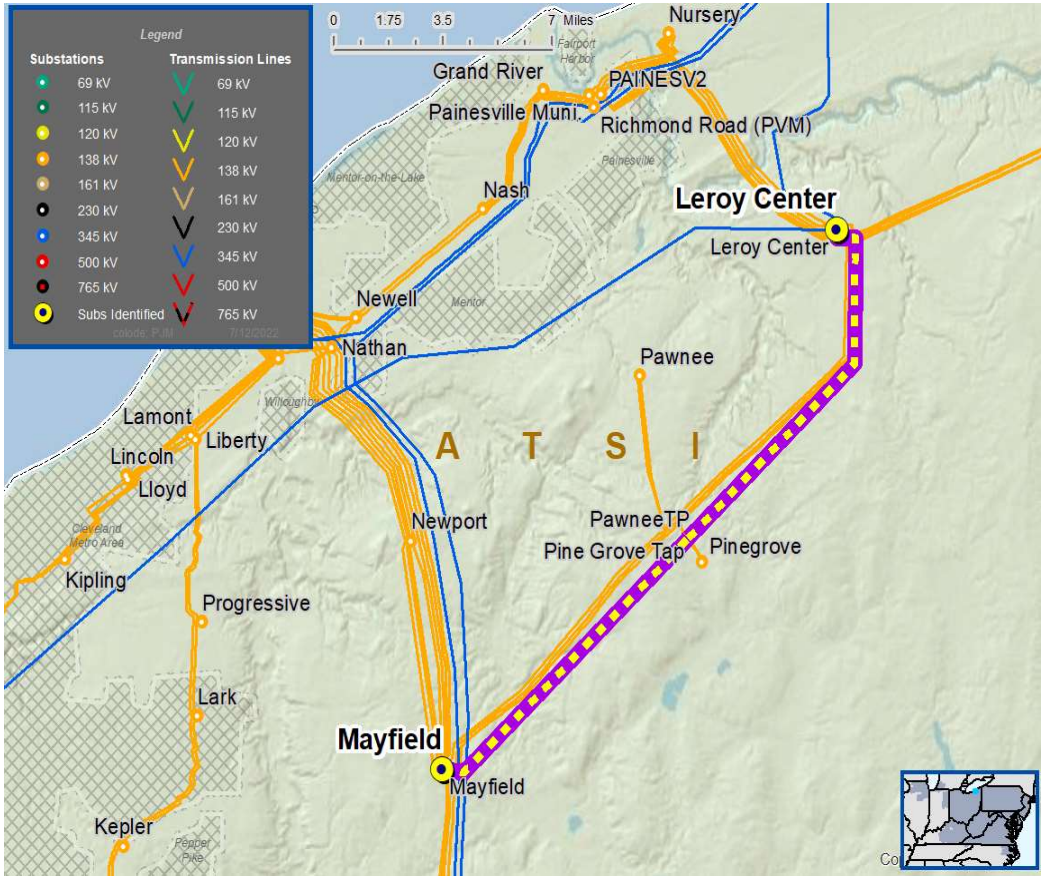
Need Number: ATSI-2021-015

Process Stage: Solution Meeting – 07/22/2022

Presently Presented: Need Meeting – 08/16/2021

Problem Statement Continued…

- Age/condition of transmission line conductors and hardware (mid 1940s).
- The Leroy Center – Mayfield Q2 138 kV line has experienced one (1) sustained outage in the past five years.



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q2 138 kV

Need Number: ATSI-2021-015
Process Stage: Solution Meeting – 07/22/2022
Presently Presented: Need Meeting – 08/16/2021

Proposed Solution:

- Reconductor the Leroy Center-Mayfield Q2 138 kV Line (~16 miles) from Leroy Center - Pawnee Tap and Pawnee Tap - Mayfield with 336 ACSS. Replace tower structures, insulators and hardware as needed to address condition items and support new conductor.

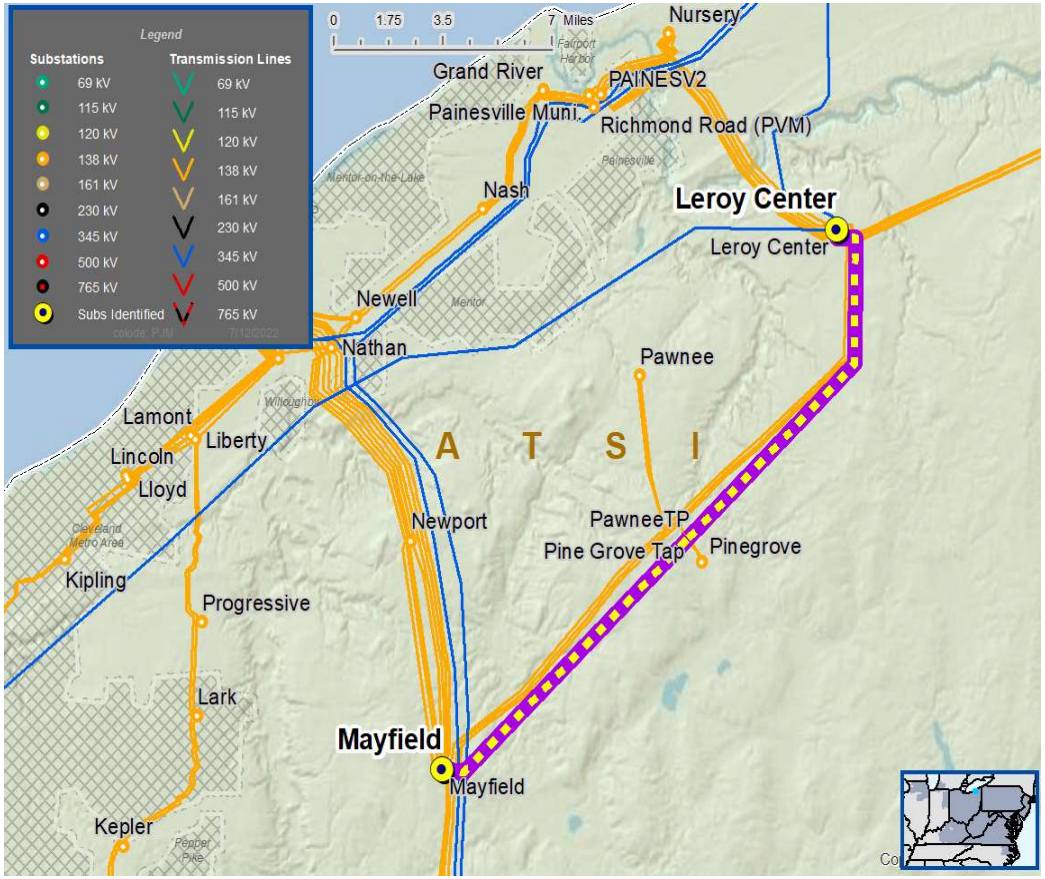
Transmission Line Ratings:

- Leroy Center - Mayfield Q2 138 kV Line
  - Before Proposed Solution: 115 MVA SN/ 115 MVA SE
  - After Proposed Solution: 252 MVA SN / 291 MVA SE

Alternatives Considered:

- Maintain existing condition. No alternatives considered for this project

Estimated Project Cost: $14.9M
Projected In-Service: 06/01/2026
Status: Engineering
Model: 2020 Series 2025 Summer RTEP 50/50



Need Number: Dayton-2022-003

Previously Presented: Need Presented, 3/18/2022

Project Driver: Customer Service

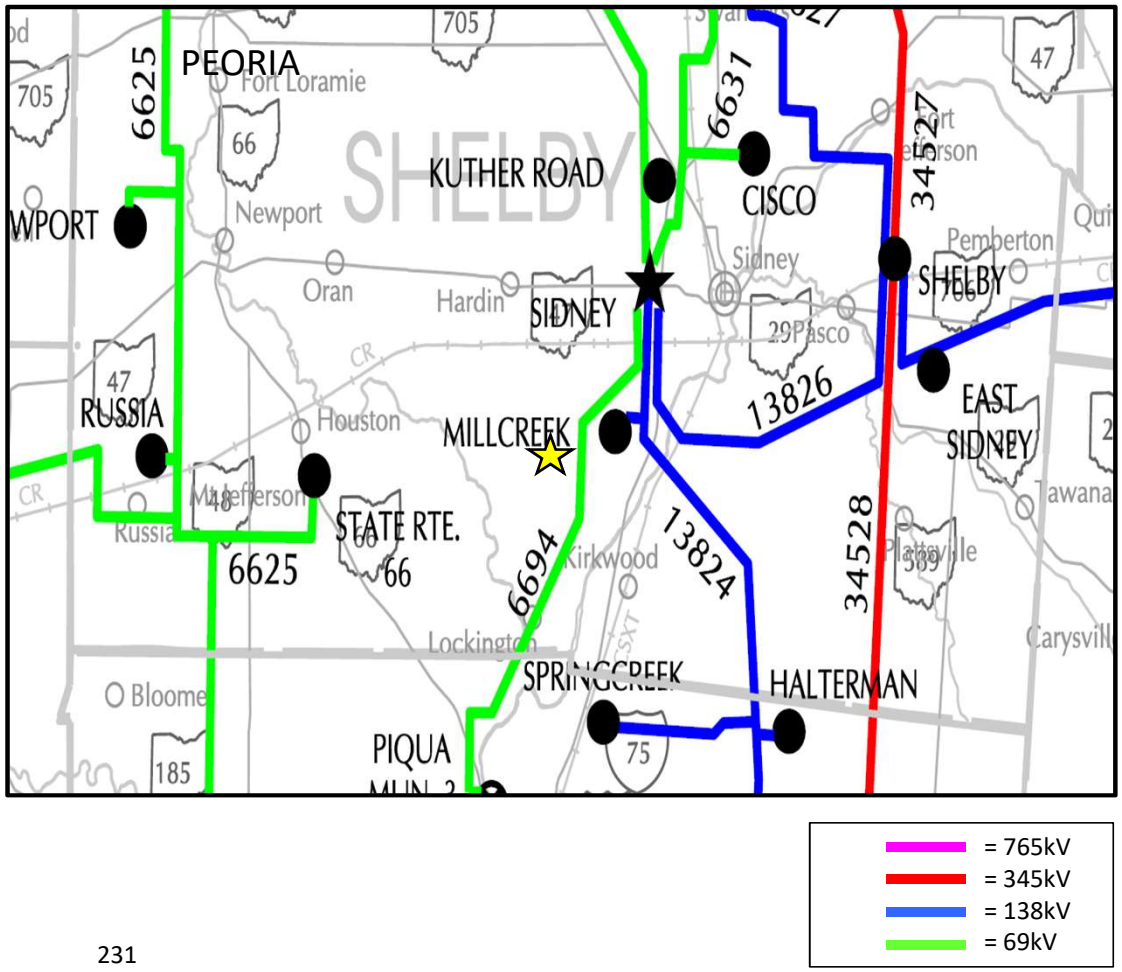
Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Problem Statement:

- AES has received multiple customer requests for new interconnections in the vicinity of its Millcreek Substation
- Total MW load requests, associated timelines, & load totals

Request	In-Service Date	Total New Connected Load
+5.0 MWs	10/1/2023	5 MWs
+14.4 MWs	4/1/2024	19.4 MWs
+14.0 MWs	10/1/2024	33.4 MWs
+14.4 MWs	4/1/2025	47.4 MWs
+19.0 MWs	10/1/2025	66.4 MWs

Model: 2021 RTEP Series, 2026 Summer Case



Dayton Transmission Zone M-3 Process

Need Number: Dayton-2022-003

Previously Presented: Need Presented, 3/18/2022

Process Stage: Solution Presentation, 07/22/2022

Project Driver: Customer Service

Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

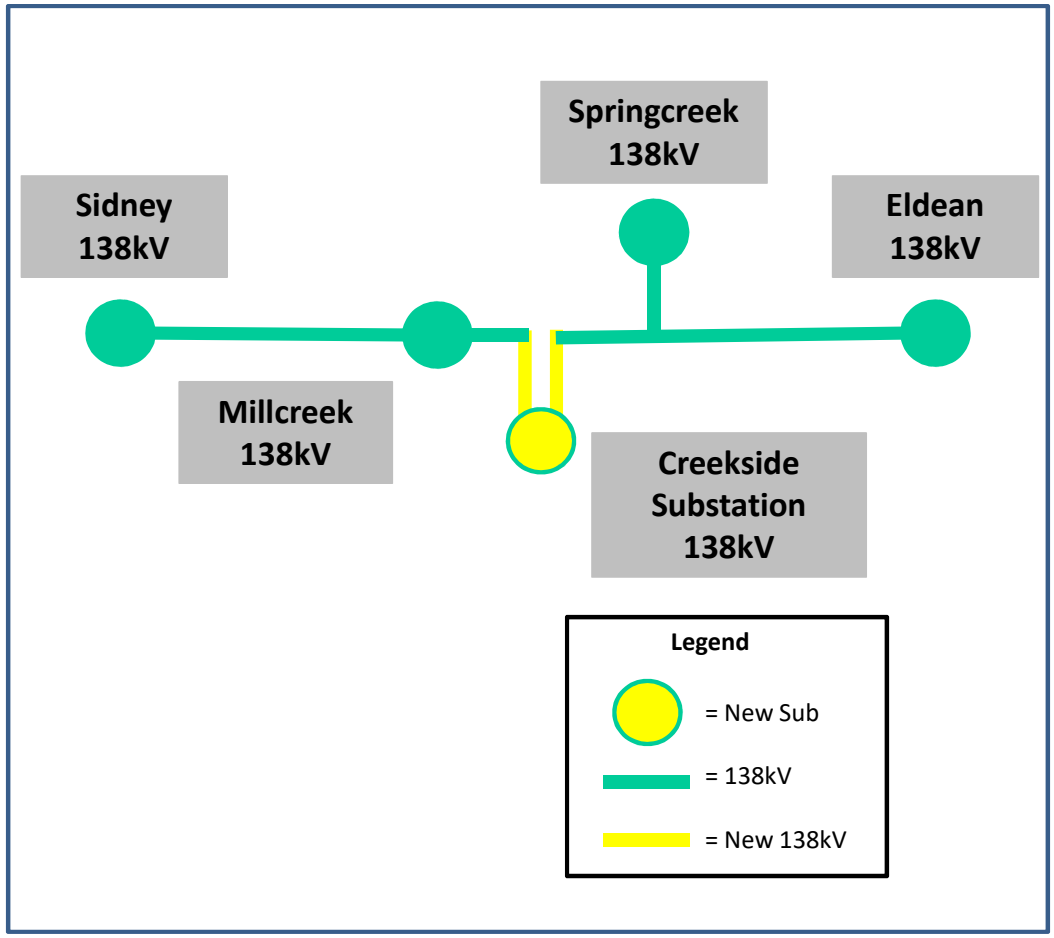
Proposed solution:

Dayton has developed a comprehensive distribution and transmission solution to meet the needs identified in the problem statement. The proposed customer load center is less than a mile from the existing 138kV substation at Millcreek. With this solution, a double circuit 138kV line will tap the Millcreek to Eldean line and loop in and out to the new Creekside sub. Three 138/12kV transformers will be installed in the additional breaker positions to provide express service to the customer.

- **Estimated Cost: $13.5M**

Projected In-Service: 06/1/2024

Project Status: Conceptual



Model: 2021 RTEP Series, 2026 Summer Case

DEOK Transmission Zone M-3 Process
Willey

Need Number: DEOK-2022-005

Process Stage: Solutions Meeting 07-22-2022

Previously Presented: Needs Meeting 04-22-2022

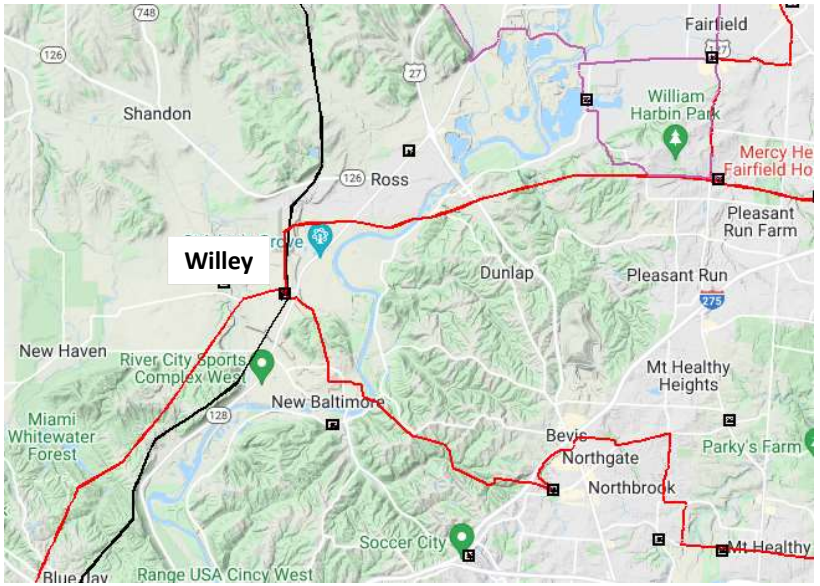
Project Driver: Costumer Service

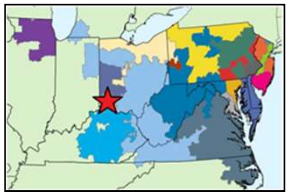
Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Problem Statement:

Duke Energy Distribution has asked for a second delivery point at Willey substation. The single 138/34 kV, 56 MVA distribution transformer at Willey is peaking at 100% of rated capacity.





345kV
138kV
69kV

DEOK Transmission Zone M-3 Process
Willey

Need Number: DEOK-2022-005

Process Stage: Solutions Meeting 07-22-2022

Previously Presented: Needs Meeting 04-22-2022

Project Driver: Costumer Service

Specific Assumption Reference:

Duke Energy Ohio & Kentucky Local Planning Assumptions slide 9

Potential Solution:

Install a new, second 138/34 kV, 60MVA transformer to feed a new, second 34 kV bus. Install a new 138 kV circuit breaker to connect the new transformer. Move two of the four existing 34 kV feeders to the new 34 kV bus to distribute load between transformers.

Alternatives: none

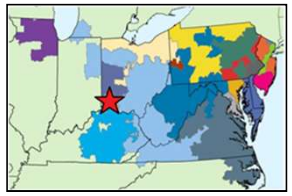
Estimated Transmission Cost: $0

Proposed In-Service Date: 08-10-2023

Project Status: Scoping

Model: 2021 RTEP

Bubble Diagram Not Applicable
Station Modifications Only



AEP Transmission Zone M-3 Process
Findlay, OH

Need Number: AEP-2021-OH030

Process Stage: Solution Meeting 08/19/2022

Previously presented: Need Meeting 05/21/2021

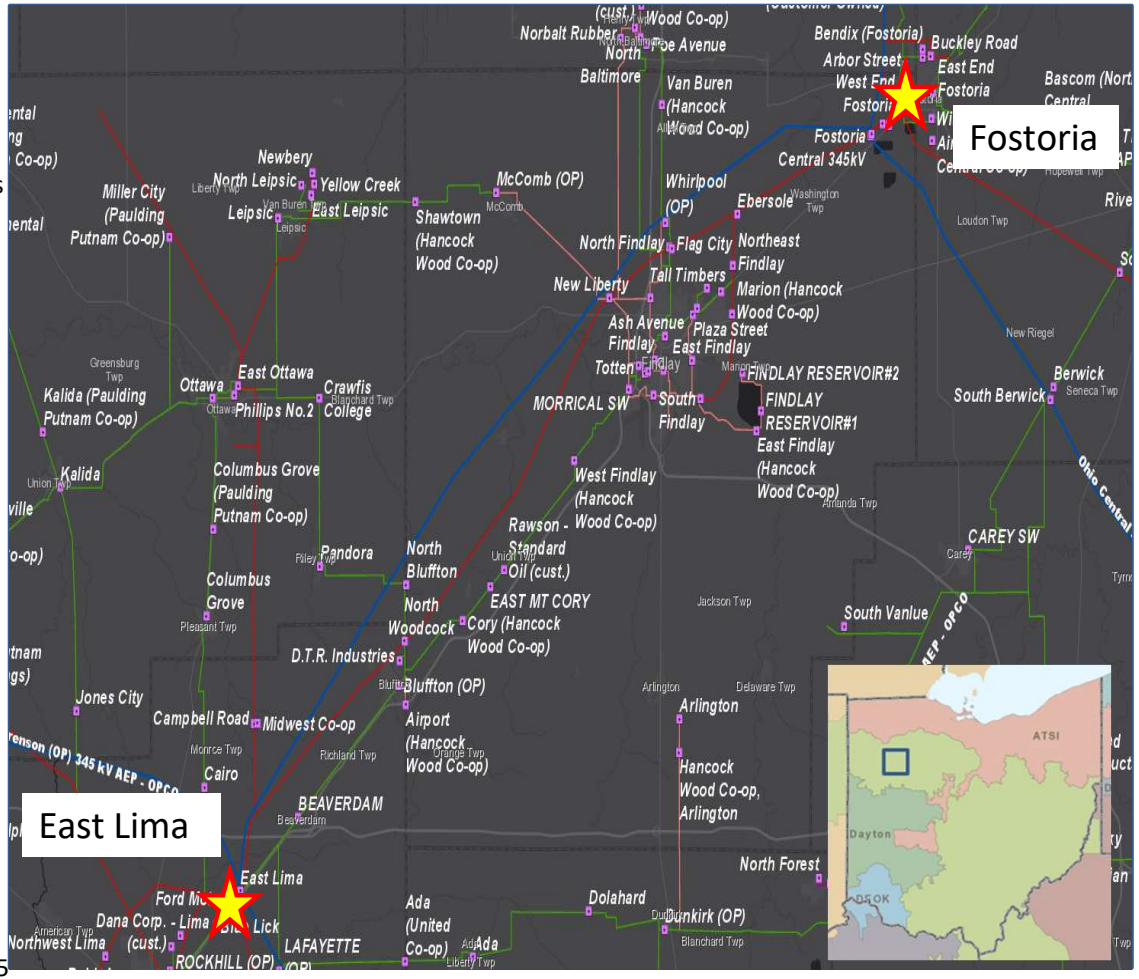
Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13), AEP Presentation on Pre-1930s Lines

Problem Statement:

Fostoria – East Lima 138kV

- **Original Construction Date:** 1924
- **Length:** 41.26 miles
- **Total structure count:** 205
- **Original Line Construction Type:** Double circuit steel lattice towers with vertical insulators
- **Conductor Types**: 397,500 CM ACSR 30/7 (Lark) & 336,400 CM ACSR 30/7 (Oriole)
- **Outage History:** Since 2015, there have been 2 permanent outages and 6 momentary outages. The Ebersole – New Liberty Circuit has accounted for 19,640 customer minutes of interruption for 326 distribution customers at the Flag City Substation.
- **Condition Summary**: Currently, there are 44 structures with at least one open condition, which relates to 22% of the structures on this line.



AEP Transmission Zone M-3 Process
Findlay, OH

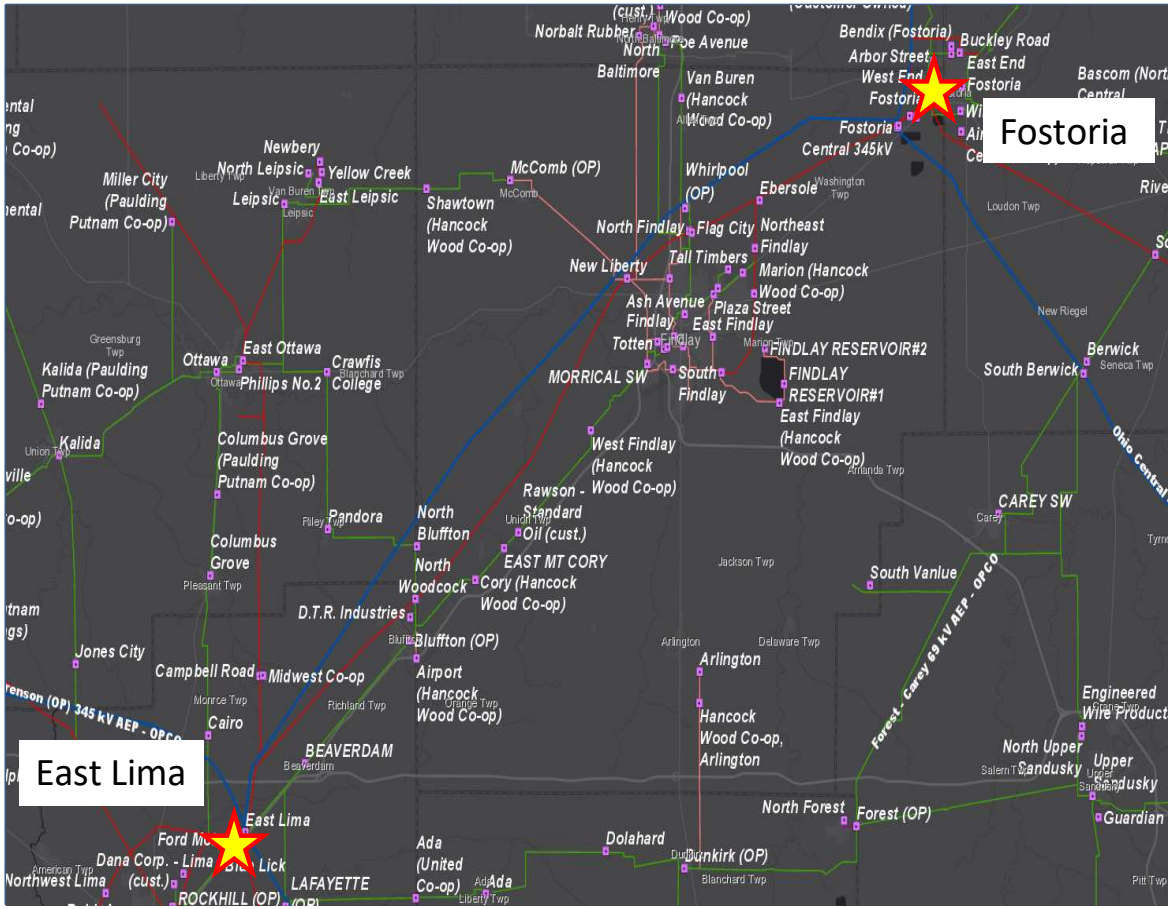
Problem Statement (contd.):

Additional Information: Multiple issues are starting to emerge on this line indicating accelerated deterioration phase of its life. Structures inspected either aerially or by ground crews showed heavy visible corrosion on conductors and shield wire, surface rust on towers, insulator end fittings and dampers.

Additional Info on Insulator & Hardware Corrosion:

- Section Loss: The connecting elements including the tower attachment hole and the insulator hook have experienced serious cross-section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection
- Corrosion: The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or significantly compromised, the bare steel corrodes at an accelerated rate
- Tower members with corrosion and damage. Lattice tower structures have little structural redundancy. A failure of one member of the structure will impact the integrity of the structure and may cause the entire tower to collapse.

- **Customer Impact:** This double-circuit line provides significant support to the Findlay area 34.5 kV and 69 kV systems via transformers at North Woodcock, New Liberty, North Findlay, and Ebersole and Flag City. Simultaneous outages at both ends of the double-circuit line would likely lead to a major area-wide outage.
- **Risk:** Significant deterioration results in loss of strength and performance posing a significant risk of failure under conditions the assets should be able to withstand.
  - May cause frequent and extended outages
  - May create significant economic losses
  - May endanger public safety



AEP Transmission Zone M-3 Process
Fostoria - East Lima Rebuild Project

Need Number: AEP-2021-OHO30
Process Stage: Solutions Meeting 08/19/2022

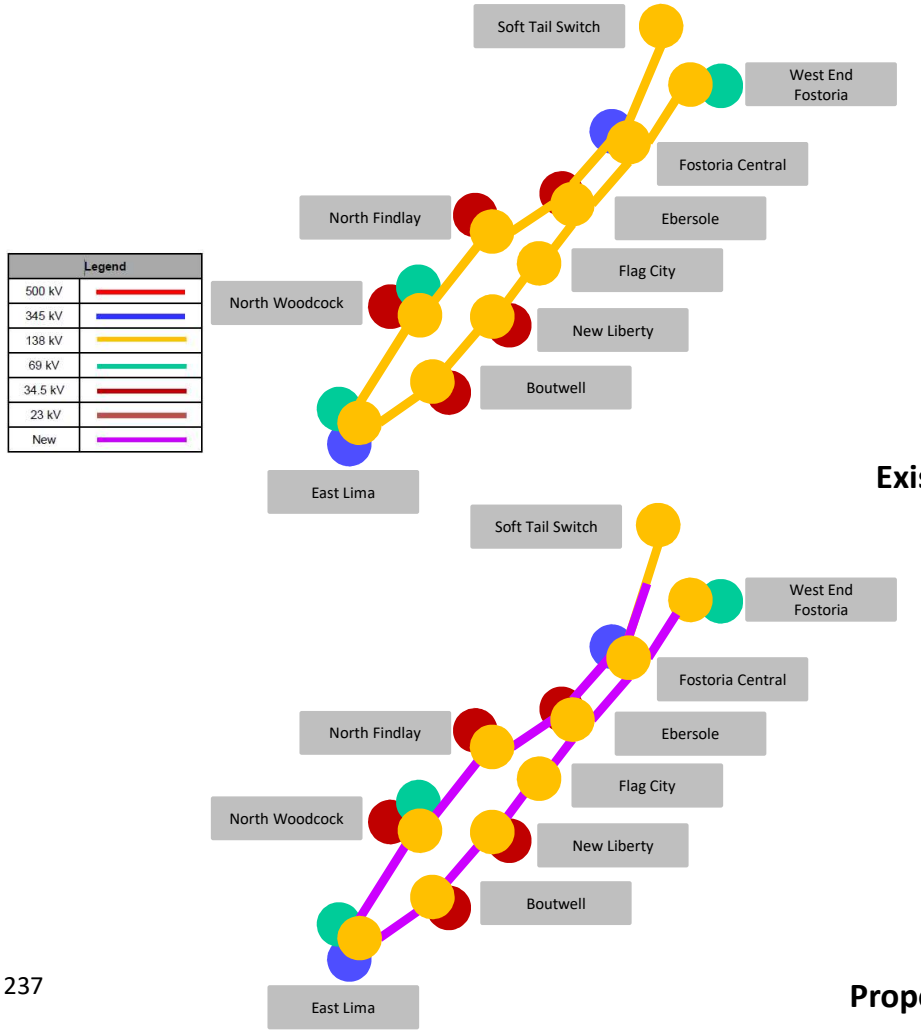
Proposed Solution:

- **Fostoria - East Lima 138:** The 41.3 mile long line will be rebuilt using double circuit 795 ACSR Drake conductor. OPGW shield wire will be installed. Approximately one mile of line is being considered for greenfield construction to avoid encroachments and ROW challenges. The Boutwell, Flag City and Ebersole stations were installed recently, these line cut-ins will not be rebuilt. **Estimated Cost: $95.9 M**
- **North Findlay - N Main & North Findlay - Findlay 69kV lines:** The North Findlay - N Main and North Findlay - Findlay 69kV lines will be modified for the Fostoria - East Lima 138kV line crossing. **Estimated Cost: $0.08M**

Total Estimated Transmission Cost:$95.98M

Alternatives Considered:
The Fostoria - East Lima line serves as an important source to the Woodcock, Lima, Findlay and Fostoria sub-transmission systems. The line has been selected as a POI for several IPPs. Retirement of the line is not a viable alternative.

Projected In-Service: 09/15/2026
Project Status: Scoping



AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Need Number: AEP-2022-AP005

Process Stage: Solution Meeting 08/19/2022

Previous Stage: Needs Meeting 02/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

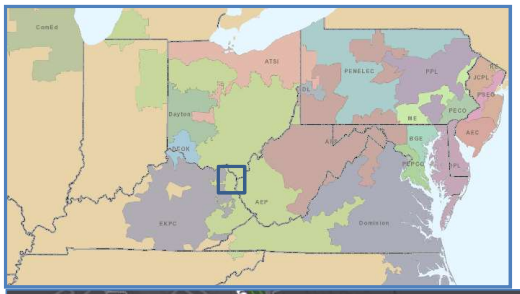
Specific Assumption Reference:

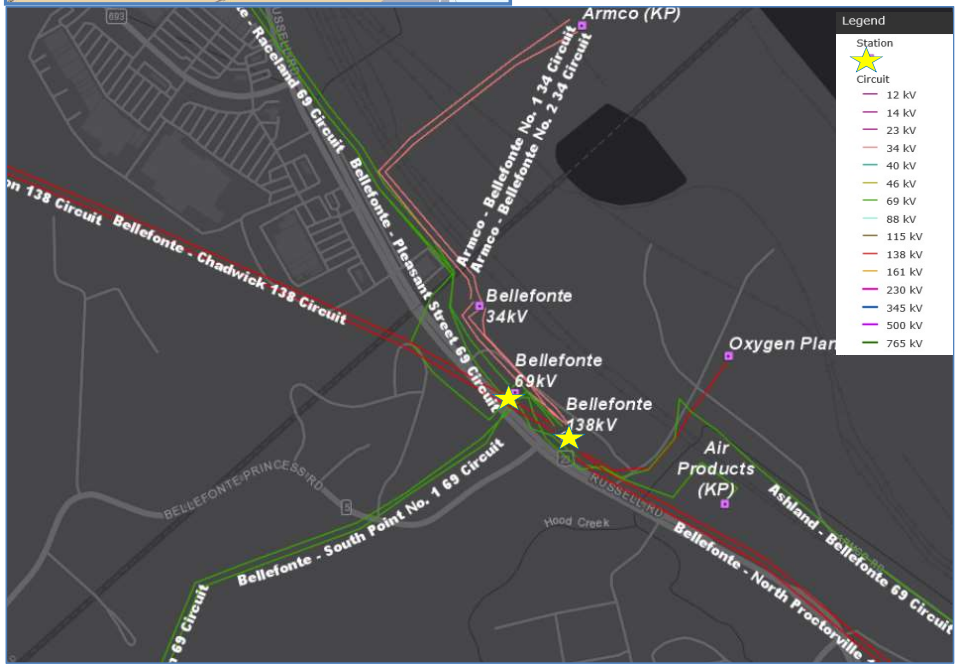
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

<u>Bellefonte 138kV Yard:</u>

- 138/34kV 45MVA Bank #1:
  - 1950s Vintage, originally manufactured in 1951,
  - The dielectric strength of the overall insulation system (oil and paper) is in poor condition, which impairs the unit's ability to withstand electrical faults.
  - The rising and elevated levels of carbon dioxide, indicate increased decomposition of the paper insulation materials. The presence of carbon dioxide indicates decomposition of the increasingly brittle, non-thermally upgraded paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
  - The high side bushings have seen increased capacitance, indicative of capacitive layer deterioration. The low side bushings lack sufficient dielectric testing data and were commissioned in 1996. The low side bushings are on the recommended replacement list due to the population being advanced in age and degradation, leading to high risk of violent failures from arcing through the ground sleeve.
  - The majority of this family of bushings were manufactured pre-1952. As a bushing ages, O-rings, gaskets, and seals may become more brittle, which may result in moisture ingress. The change in high side bushing dielectric data, the low side bushing type, and the age of all the bushings indicates these bushings are at a greater risk of failure. Failure of a bushing may cause a failure or loss of service of the transformer.
  - Active Oil leaks.
- 138/69-34kV 196 MVA Bank #2:
  - 1970s Vintage, originally manufactured in 1970,
  - Low side bushings have Capacitive layer deterioration.
  - This unit has severe nitrogen leaks. There are racks installed with manifolds in order to keep the nitrogen pressure on this transformer. This unit also has active oil leaks. One third of the fans on this unit have failed.





AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 138kV Yard (cont):

- 138/69-34kV 115MVA Bank #5:
  - 1960s Vintage, originally manufactured in 1961,
  - Unit's paper insulation and lack of thermally upgraded paper insulation indicate higher Short circuit. As the insulating paper materials age, they become brittle. This increasingly brittle, non-thermally upgraded paper insulation impairs the unit's ability to withstand future short circuit or through fault events.
  - Elevated levels of acetylene indicates increased decomposition of the paper insulating materials. The presence of acetylene indicates electrical discharge faults of low energy have occurred within the main tank causing electrical breakdown of the unit.
  - This unit has severe nitrogen leaks. There are racks installed with manifolds in order to keep the nitrogen pressure on this transformer. This unit also has active oil leaks.
- 138/12kV 20MVA Bank #6:
  - 1970s Vintage, originally manufactured in 1971,
  - Unit's paper insulation and lack of thermally upgraded paper insulation indicate higher Short circuit. As the insulating paper materials age, they become brittle. This increasingly brittle, non-thermally upgraded paper insulation impairs the unit's ability to withstand future short circuit or through fault events.
  - There is an upward trend in the insulation power factor indicating an increase in particles within the oil. The overall dielectric strength of the insulation system (oil and paper) is in declining health, which impairs the unit's ability to withstand electrical faults.
  - This unit has active oil leaks. One quarter of the fans on this unit have failed.
- Relaying 138 kV Yard:
  - 97 of the 110 (88%) relays at the 138kV yard station are in need of replacement.
  - 76 are electromechanical, 3 are static and 18 relays are microprocessor type.
  - The electromechanical type and Static type relays that have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. Where as the microprocessor relays that are of legacy design and/or utilize legacy firmware

AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 69kV Yard:

69kV circuit breakers AB, C, G, I, JJ and Z are FK type oil filled breaker, without oil containment.

- As of May 25, 2021, there are 20 remaining FK-72.5-27000-10 circuit breakers on the AEP System, including the 6 at this station. GE provides no support for this fleet of circuit breakers and spare parts are increasingly more difficult to obtain; components are often taken from out of service units with remaining usable parts. Oil filled breakers need more maintenance due to the oil handling required.
- A common failure mode documented in AEP malfunction records are compressor failures and valve defects, which cause low pressure and oil leaks. Another failure mode includes trip or reclose failures, caused primarily by spring latching and charging motor component failures. In addition, these oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.
- Circuit Breakers AB, C, G, I, JJ, and Z are 1970s vintage, manufactured in 1971, with Fault Ops: 1, 23, 8, 60, 57, 17 respectively

69kV circuit breakers H and T CF-48-69-2500 type oil filled breaker, without oil containment.

- Bus Tie Breaker H: 1960s vintage, Manufactured in 1965, Type: Oil , Fault Ops: 3,
- Circuit Breaker T: 1960s vintage, Manufactured in 1967, Type: Oil , Fault Ops: 1,

- There is no vendor support for this family of circuit breakers and spare parts are increasingly more difficult to obtain.
- This model family has experienced major malfunctions associated with their OA-3 hydraulic mechanism, which includes low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off. These mechanism malfunctions have led to several failures to close and other types of mis-operations across the AEP fleet.

69kV circuit switcher KK is a Mark V type , without gas monitor. The neutral shift device is heavily corroded.

AEP Transmission Zone M-3 Process
Johnson County, Kentucky

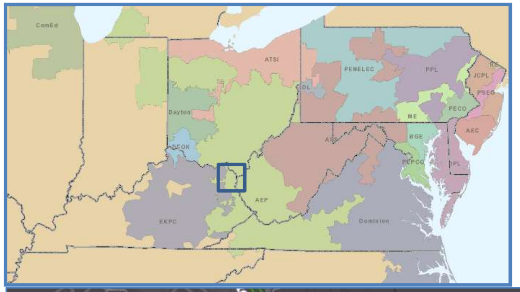
Bellefonte 69kV Yard (cont):

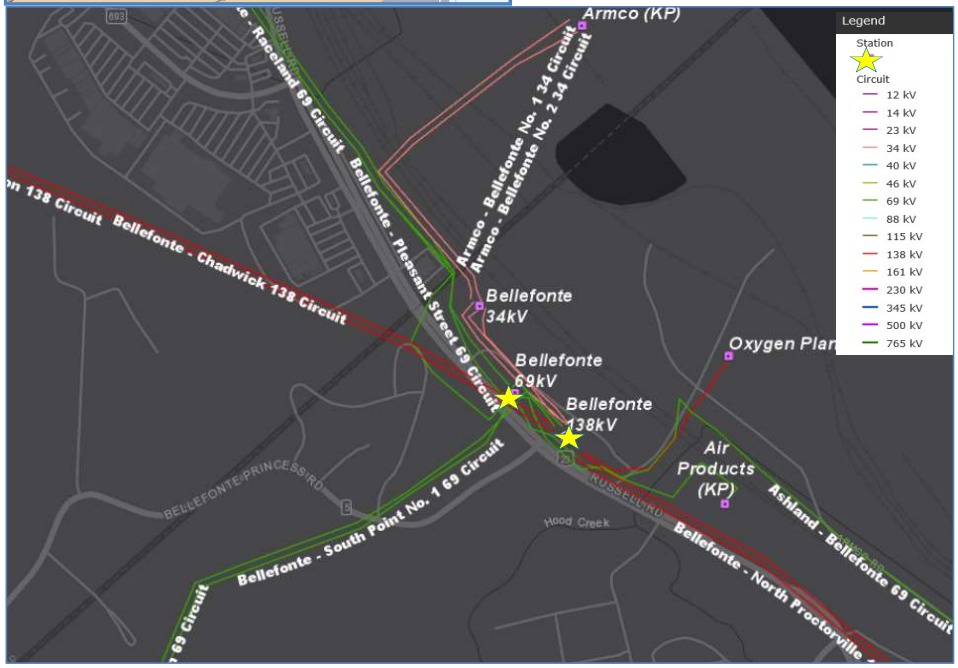
Relaying:

- 44 of the 52 (85%) relays at the 69kV yard station are in need of replacement.
- 41 are electromechanical, 2 are static and 1 relay is microprocessor type.
- The electromechanical type and Static type relays that have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. Where as the microprocessor relays that are of legacy design and/or utilize legacy firmware

Others:

- Flooding occurs frequently during heavy rains at the 138kV and 69kV control houses.
- Transite (asbestos) paneling is present on the interior walls of the control house.
- The HVAC Systems are inadequate for providing proper air circulation for the relays, batteries, and chargers inside the buildings. Free standing space heaters are used.
- Cable entrances are at full capacity.
- The perimeter fences and gates are in need of replacement due to excessive corrosion.
- The two legacy 138kV bus PTs for Buses #1 and #2 have elevated PCB concentrations. These PTs are leaking oil.
- The 69kV capacitor Bank KK is installed on the Raceland 69kV line instead of the 69kV Bus.

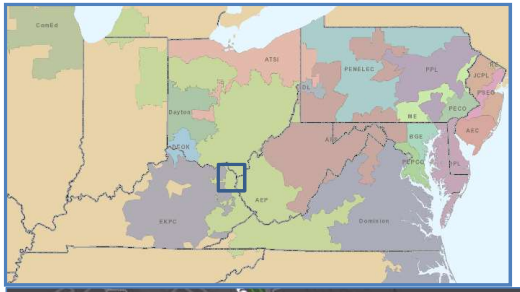


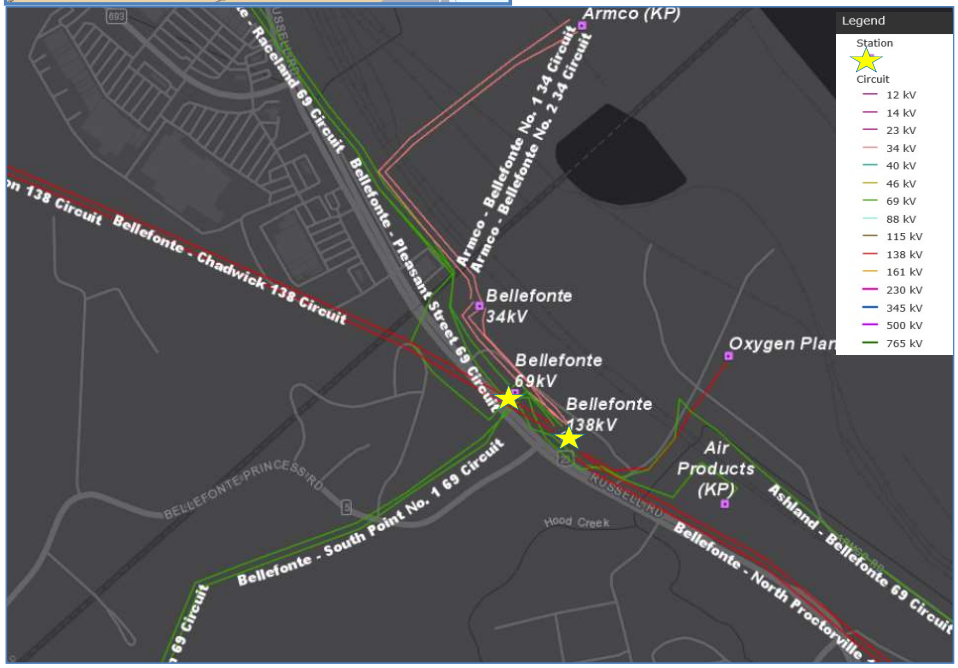


AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 34kV Yard:

- 34.5kV Circuit Breakers E, F, K, M:
  - The four 34.5kV transmission owned circuit breakers E, F, K, and M are FK-family model type, oil filled breakers. These breakers are of 1950's and 1970's vintages. These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require.
  - As of October 7, 2021, there are 13 remaining FK-339-34.5-2500 circuit breakers on the AEP System, including the 3 (E, F, & K) at this station. Also as of October 7, 2021, there are 8 remaining FKA-38-22000-5Y circuit breakers on the AEP System, including the 1 (M) at this station. There is no vendor support for this fleet of circuit breakers and spare parts are increasingly more difficult to obtain; components are often taken from out of service units with remaining usable parts.
  - A common failure mode documented in AEP malfunction records are compressor failures and valve defects, which cause low pressure and oil leaks. Another failure mode includes trip or reclose failures, caused primarily by spring latching and charging motor component failures. In addition, the oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.
  - Circuit Breaker E: 1950s vintage, Manufactured in 1953, Type: Oil , Fault Ops: 3, Circuit Breaker F: 1950s vintage, Manufactured in 1953, Type: Oil , Fault Ops: 3, Bus Tie circuit Breaker K: 1950s vintage, Manufactured in 1952, Type: Oil , Fault Ops: 7, Bus Tie circuit Breaker M: 1970s vintage, Manufactured in 1971, Type: Oil , Fault Ops: 2,
- Relaying:
  - 34 of the 34 relays at the station are in need of replacement
  - All 34 relays are electromechanical type which have significant limitations with regards to fault data collection and retention.
  - The existing RTU installed at Bellefonte 34.5kV Metering Station is a legacy TLG DOS unit which has high failure and malfunction rates, lacks telecom infrastructure compatibility, lacks software compatibility, lacks vendor support, lacks spare parts availability, lacks vendor supplied training, lacks an active warranty, and has poor RTU resource utilization. This particular unit has experienced 5 recorded malfunction over its in-service life including loss of communication and being down.





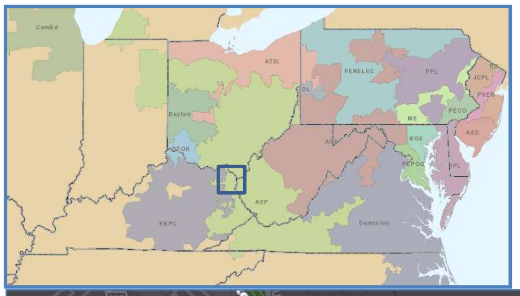
AEP Transmission Zone M-3 Process
Johnson County, Kentucky

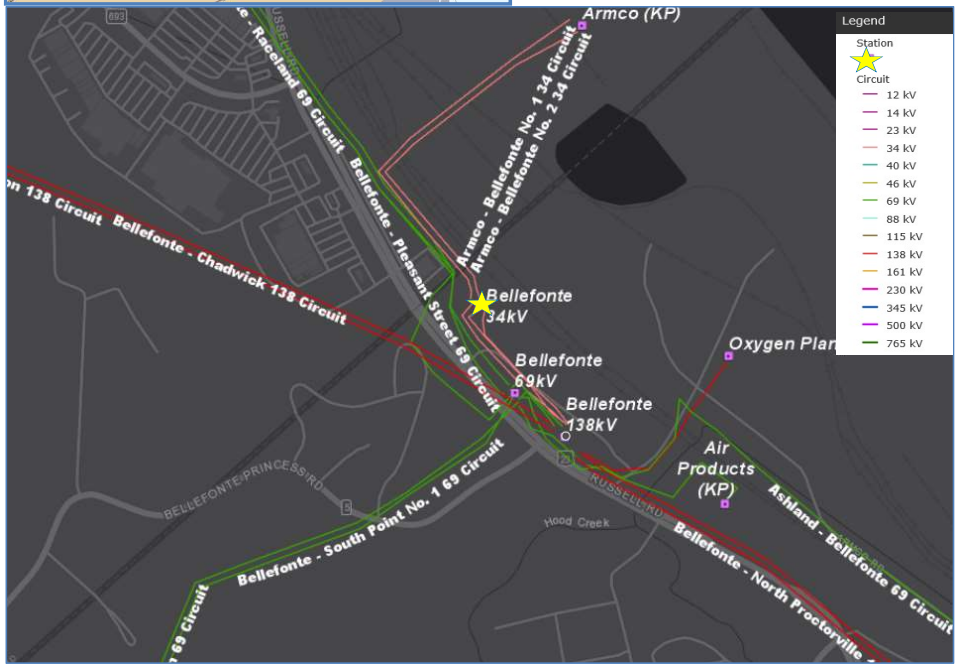
Bellefonte 34kV Yard (cont):

- 34.5/2.5kV kV Grounding Transformer #7:
  - 1950s Vintage, originally manufactured in 1951,
  - Increased decomposition of the paper insulation materials. Electrical discharges of high energy have occurred within the main tank. The low and declining levels of IFT (interfacial Tension) indicates that sludge has formed and is hardening and layering; in addition, this indicates that the insulation is shrinking and weakening.
  - Oil interfacial tension is strongly indicating an aged oil with polar contaminants and oxidation byproducts. This is a contaminated oil favoring accelerated aging of the insulation and formation of sludge which will impair proper oil circulation. Dielectric strength levels are also low and declining.
  - The presence of acetylene confirms the insulation system (oil and paper) is in poor condition and also indicates electrical discharge faults of high energy have occurred within the main tank causing electrical breakdown of the unit.

- 34.5/2.5kV kV Grounding Transformers #8 (three single phase units):
  - 1950s Vintage, originally manufactured in 1945,
  - The low and declining levels of IFT (interfacial Tension) indicates that sludge is dissolved in Oil (phase #1) or that the sludge is in the radiator, core and coil (for phase #2 & Phase #3).
  - Oil interfacial tension is strongly indicating an aged oil with polar contaminants and oxidation byproducts. This is a contaminated oil favoring accelerated aging of the insulation and formation of sludge which will impair proper oil circulation. Dielectric strength levels are also low and declining.
  - The presence of acetylene in GRD Bank-8 300 (phase #1) confirms the insulation system (oil and paper) of that unit is in poor condition and also indicates mixtures of electrical and thermal faults have occurred within the main tank causing electrical breakdown of the unit.
  - The presence of acetylene in GRD Bank-8 300 (phase #1) indicate increased decomposition of the paper insulation materials.
  - The lack of thermally upgraded paper insulation. As the insulating paper materials age, they become brittle. These characteristics of brittleness and lack of a thermal upgrade diminishes of the unit's ability to withstand future short circuit or through fault events due to the state of the paper insulation.

- 34.5/2.5kV kV Grounding Transformer #9:
  - 1980s Vintage, originally manufactured in 1984,
  - The elevated levels of carbon dioxide and carbon monoxide indicate excessive decomposition of the paper insulating materials. The presence of carbon dioxide and carbon monoxide indicate decomposition of the paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.





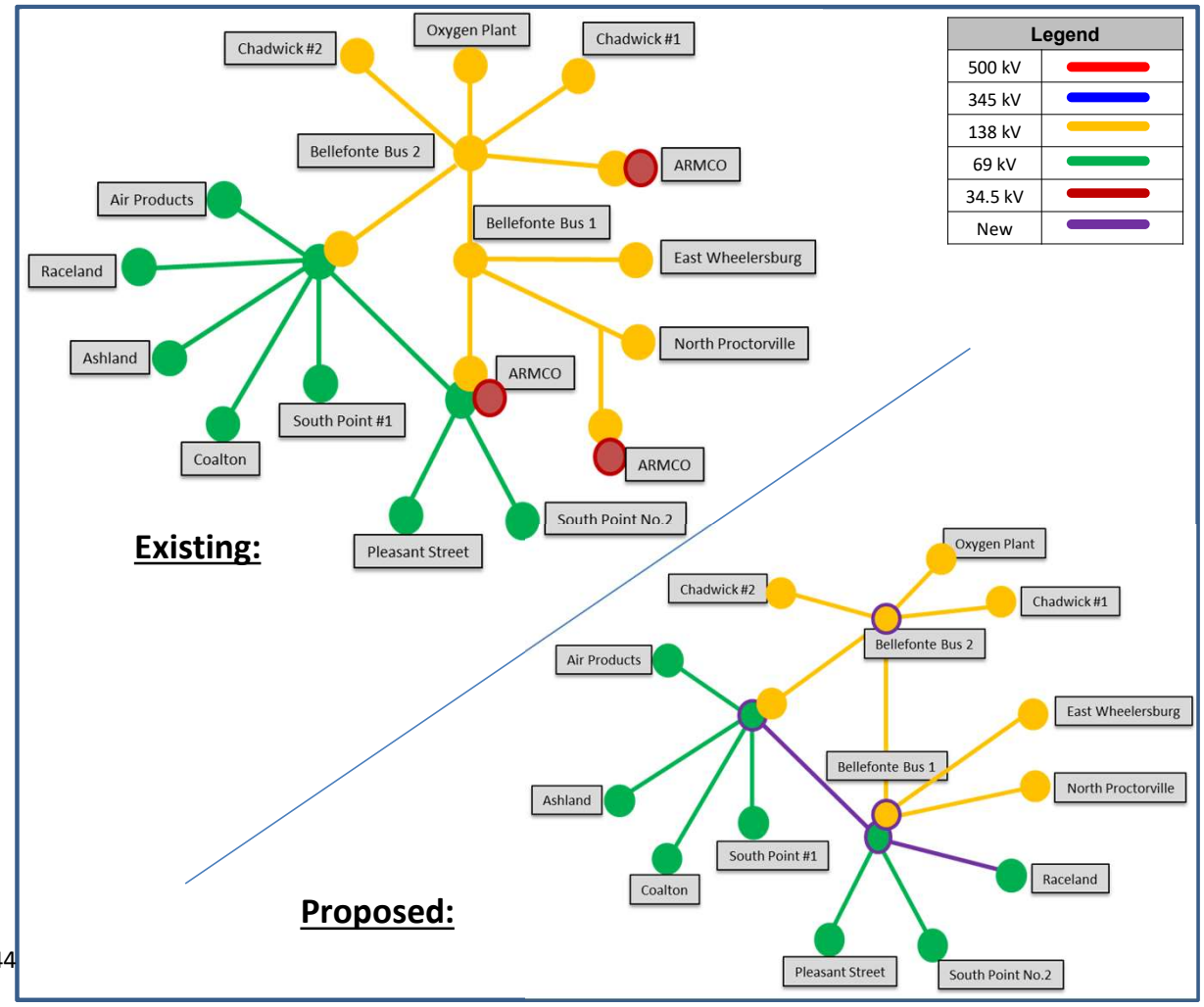
AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Need Number: AEP-2022-AP005

Process Stage: Solution Meeting 08/19/2022

Proposed Solution:

- Replace XFR #2 with a 200MVA Auto unit and retire XFR #1 & #5. The U/G feeder for XFR #3 69kV riser is getting reconductored under B3349. Reconductor sections of 138kV Bus #1 and 138kV Bus #2. Replace remaining oil PTs connected to Bus #1 and Bus #2. Upgrade Primary and back up station service. Replace 69kV bus tie breaker H. Replace the hook stick disconnects switches for the tie breaker H and 69kV tie breaker location will be relocated one bay south of the existing location and 69kV buses will be reconfigured. Replace the hook stick disconnects switches for Raceland breaker D. Relocate the Raceland feeder to bus #1 after extending the 69kV bus #1. The cap bank switcher/moab Mark 5 combo unit will get replaced with 69kV breaker and set of breaker disconnects and relocated to bus #1. 69kV breaker is needed instead of circuit switcher due to the high fault current. Relocate the cap bank to bus #1 after extending the 69kV bus #1. 69kV Air Products line MOABs will be replaced with 2000A SW. Replace hook-stick switches for Oil CB – AB, JJ, I, G, Z, T and C. These Breakers are replaced as part of B3350. Install 16'x48' DICM for 69kV Yard and a 16'x48' DICM for the 138kV Yard. Replace cable trench, single phase AC system & cable work, entire fence replacement and ground grid extension for 100'X10' expansion toward the Northwest of the 69kV yard. Both 138kV and 69kV control house will be retired. **Estimated Cost: $12.59 M**

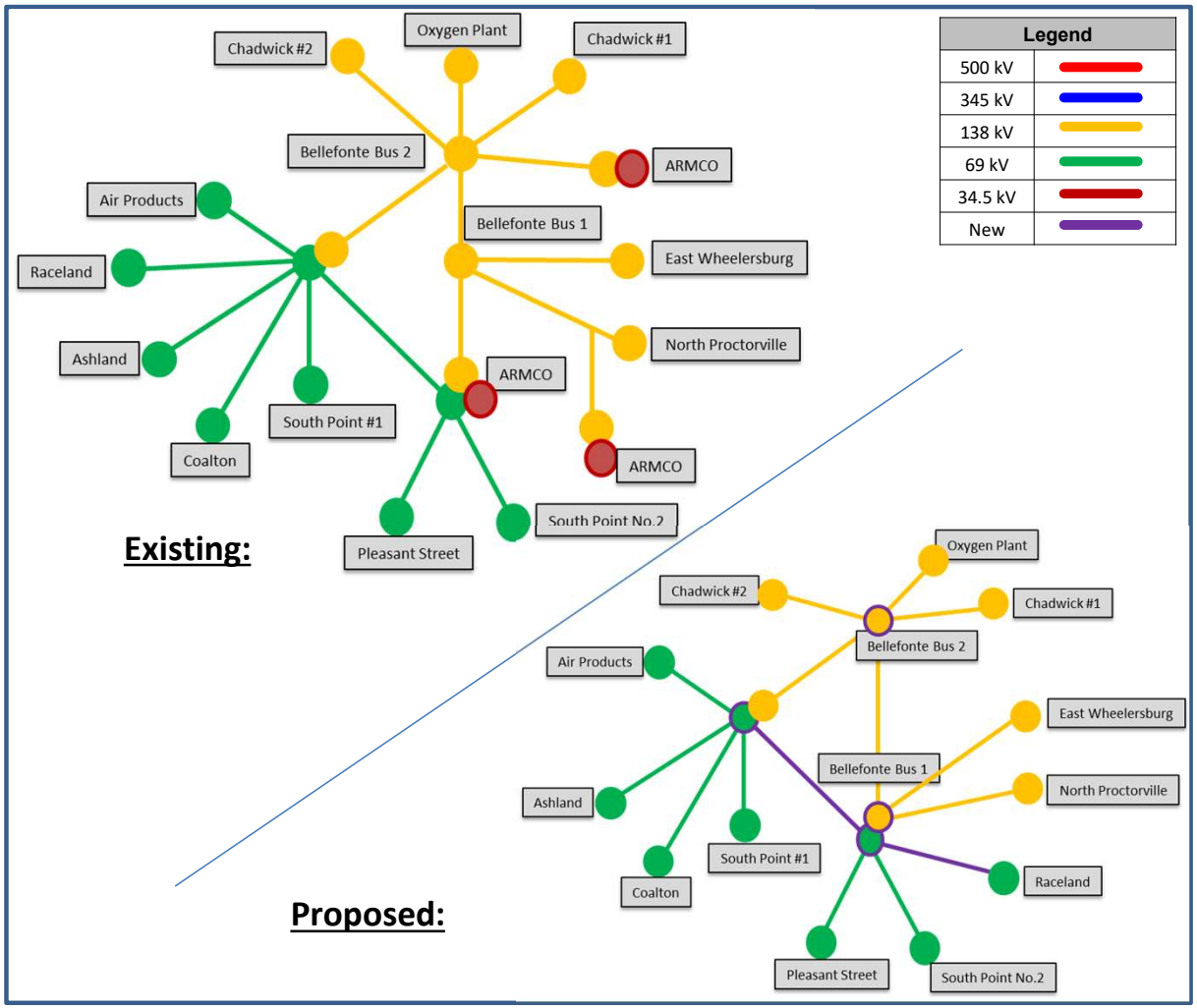


AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Proposed Solution (Cont.):

- The customer served out of 34.5 kV Yard has plans for demolition of their facilities. Retire entire 34kV Yard, contingent on the timing of the customer being removed from service. **Estimated Cost: $2.67 M**
- Retirement of the Bellefonte 34.5kV Bus Tie Line that connects the Bellefonte 138kV Station to the Bellefonte 34kV Station. This removal involves removing 3- Double Circuit Lattice Towers, 1-Triple Circuit Lattice Towers, and 1 Single Wood Pole Structure. **Estimated Cost: $0.46 M**
- Retire the existing Bellefonte – Armco 34.5kV operated line. The major removal work involves removing 4 lattice steel towers, 1 H-Frame wood structure, and 2 single wood poles. The line being removed is approximately 0.55 miles long. **Estimated Cost: $1 M**
- Remote end relaying at Raceland substation to install 2 new CCVTs on a custom two-phase single column stand for the Bellefonte 69kV line exit. The existing CCVT mounted on a single phase CCVT stand will be reused and will remain as it is. **Estimated Cost: $0.37 M**
- Provide 0.2 miles of fiber from Distribution structures outside the station to the new DICMs. **Estimated Cost: $0.49 M**

Total Estimated Transmission Cost: $17.58 M



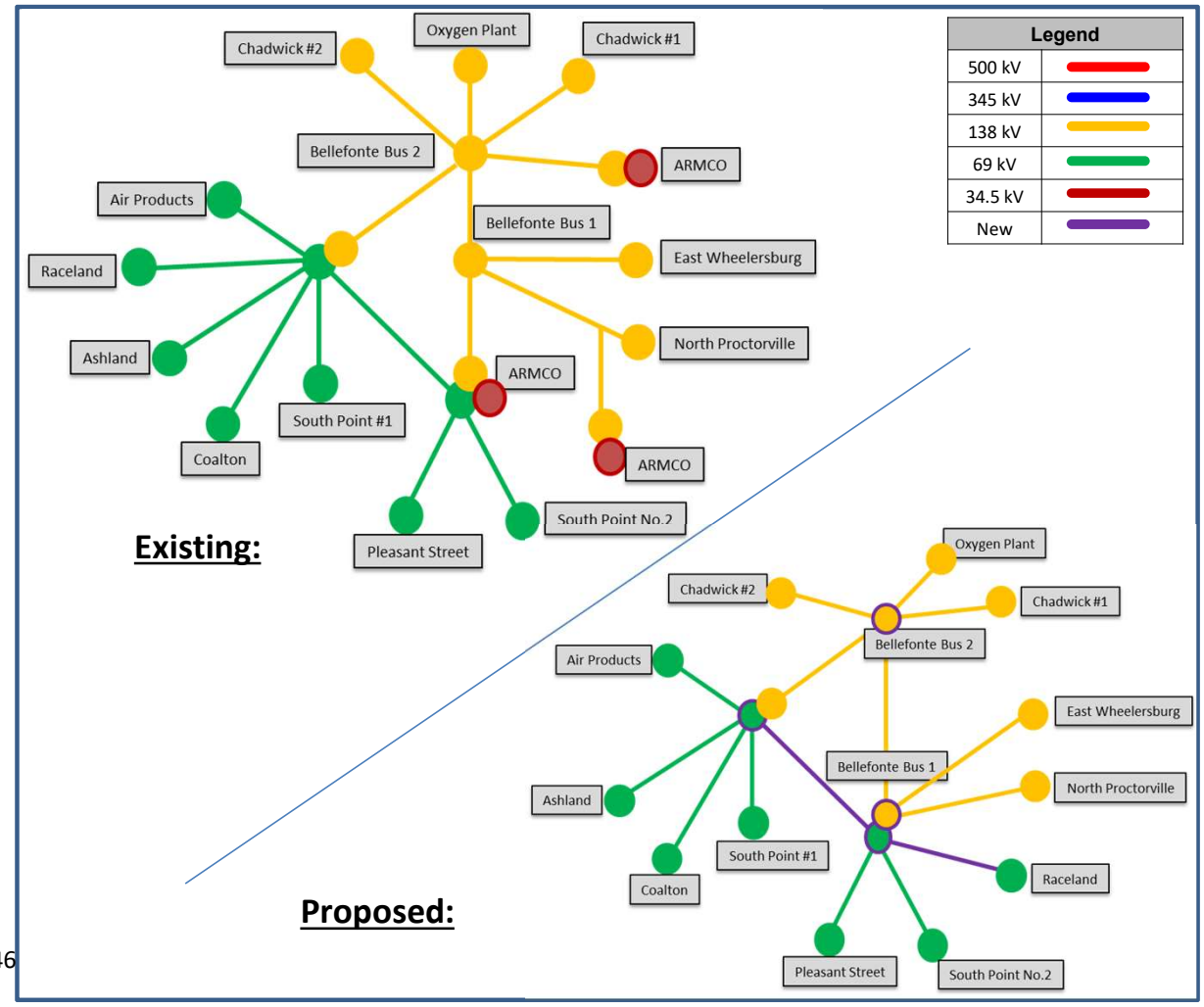
AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Alternatives Considered:

- Consideration was given to building the 69kV equipment in a customized ring bus that will use 10 - 69kV breakers for 7- 69kV line feeds and 2 – 69kV Transformer feeds. However, due to complexity and cost of this configuration this option was not chosen because of the lack of space to fit the ring or breaker and a half station in the existing station footprint. **Estimated Cost: $30 M**

Projected In-Service: 12/01/2025

Project Status: Scoping



AEP Transmission Zone M-3 Process
Logan and Mingo County, West Virginia

Need Number: AEP-2021-AP033

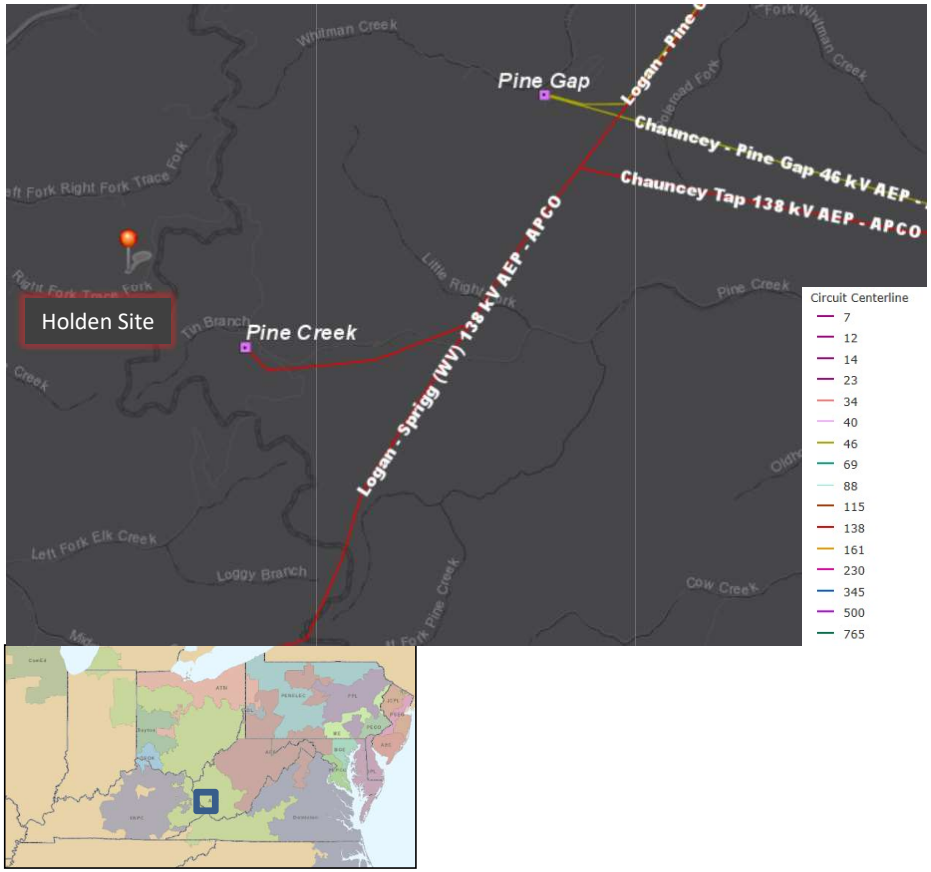
Process Stage: Solutions Meeting 08/19/2022
Previously Presented: Needs Meeting 11/19/2021

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

Problem Statement:

- AEP Distribution has requested new transmission service to a new distribution station, Holden, supporting the Buck Harless Industrial Park site in Whitman, WV.
- This station is the result of West Virginia House Bill 144. The intent of the program is to support the development of Business Ready Sites in WV.
- Initial load at the Holden Site will transfer from the existing Pine Creek station site. Pine Creek Station is constructed using wood poles in an arrangement that is not expandable. There are also site constraints at Pine Creek preventing station expansion onto adjacent property. The site constraints prevent the industrial park site from being served by the existing Pine Creek station location. Adding new circuits for the industrial park would require replacement of the distribution structures and expansion of the station which is not feasible in the current location.
- At Pine Creek, 138 kV Circuit Breaker XT1 is an oil breaker that are difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. There are 7 remaining AHE-54-138-5000 circuit breakers on the AEP system, including the 1 at this station. Spare parts are increasingly more difficult to obtain because the manufacturer no longer supports this model type.



AEP Transmission Zone M-3 Process
Logan and Mingo County, West Virginia

Need Number(s): AEP-2021-AP033

Process Stage: Solutions Meeting 08/19/2022

Proposed Solution:

- Construct a new greenfield station (Holden) with a 138/12 kV 25 MVA transformer and high side circuit switcher. There will be two 12 kV feeders from the station. The 138 kV side will be a straight bus with one 138kV circuit breaker facing Ragland and one 138kV MOAB switch facing Tin Branch. The intent of the greenfield station is to support the business ready site and the 138kV circuit breaker will provide added protection for sensitive industrial customers. The existing Pine Creek station will be retired. **Estimated Cost: $0 (Distribution cost)**
- Tap the Logan – Sprigg #2 138kV line and build 3.5 miles of greenfield double circuit 138kV line to serve Holden station. The higher estimated cost is due to a large amount of new access roads and environmental studies that are required for this greenfield line that will be built through mountainous terrain. **Estimated Cost: $12.18M**
- Build 0.6 miles of 96 ADSS Telecom underbuilt cable to connect Holden station to the existing fiber network. **Estimated Cost: $0.18M**
- Remove 1.85 mile long Pine Creek 138kV Tap. **Estimated Cost: $1.74M**

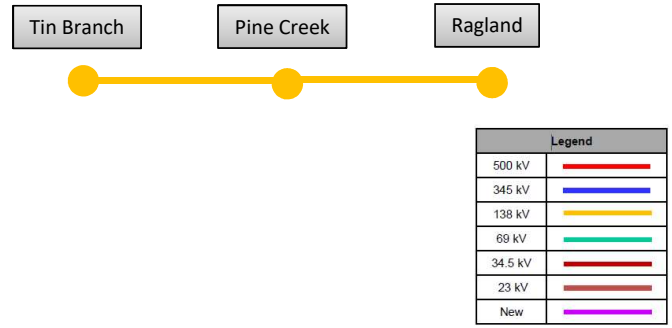
Total Estimated Transmission Cost: $14.1 M

Ancillary Benefits: The existing Pine Creek Distribution customers will be served from the new Holden station improving their reliability due to receiving service from a Holden station that has looped Transmission service and a high side circuit breaker. This proposal also eliminates a hard tap on the existing 138 kV line currently serving Pine Creek station.

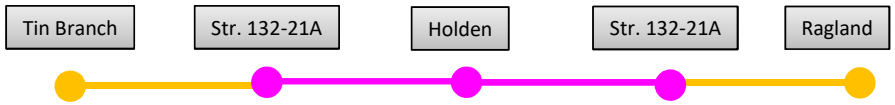
Alternatives Considered: Extend the existing Pine Creek 138kV tap to the greenfield Holden station to provide 138kV service and construct a new line back to the existing 138 kV corridor to provide looped service to the industrial park. This option was not used due to the exiting 138kV tap being a radial single circuit that is hard tapped to the Logan – Sprigg #2 circuit and would have resulted in additional work needed to eliminate the hard tap. Estimated Cost: $20M

Projected In-Service: 6/1/2024
Project Status: Scoping

Existing



Proposed



AEP Transmission Zone M-3 Process
Montgomery County, VA

Need Number: AEP-2022-AP002
Process Stage: Solutions Meeting 08/19/2022
Previously Presented: Needs Meeting 1/21/2022

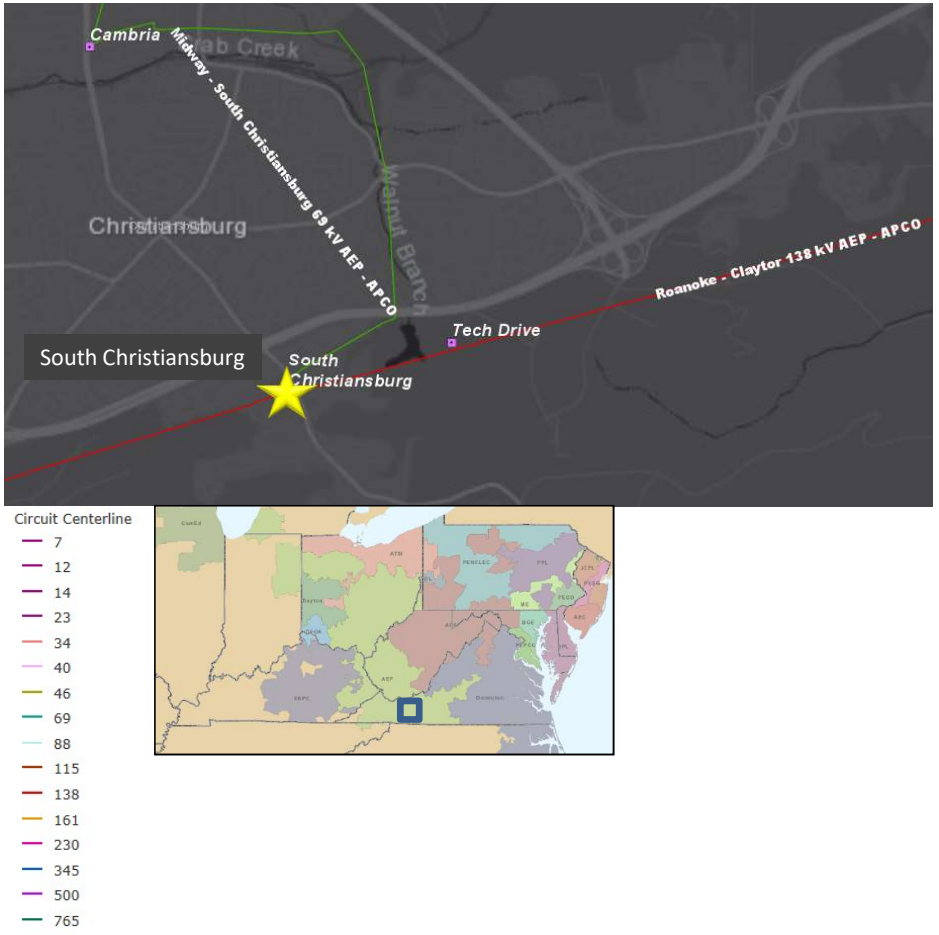
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

South Christiansburg Station:

- 138/69-12 kV Transformer #1
  - 1972 Vintage Transformer
  - Elevated levels of carbon dioxide in the DGA indicates decomposition of the increasingly brittle paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
  - Rising power factor and decreasing dielectric strength are both indications of an increase in particles within the oil. This decreases the ability of the oil to withstand fault events, which can further damage the paper insulation. The values of dielectric strength and power factor indicate the dielectric strength of the insulation system (oil and paper) is in declining condition, which impairs the unit's ability to withstand electrical faults.
  - The advanced age of this unit's insulation materials (49 years old) is of concern. As the insulating paper materials age, they become brittle.
  - This unit regularly leaks nitrogen. Loss of nitrogen is typically related to small leaks that are difficult to locate and repair.
  - There are oil leaks around the temperature wells.
- The 69kV circuit breaker at South Christiansburg station is 1965 vintage and is oil filled without oil containment. This circuit breaker has exceeded the manufacturer's designed number of full fault operations. The manufacturer provides no support for this type of breaker and spare parts are not available. As of March 24, 2021, there are 54 remaining FK-69-2500-5 circuit breakers on the AEP system, including the 1 at this station.
- The transformers use obsolete 138kV MOAB/ground-switch protection systems, which require remote-breaker tripping for isolating transformer faults



AEP Transmission Zone M-3 Process
Montgomery County, Virginia

Need Number: AEP-2022-AP003
Process Stage: Solutions Meeting 08/19/2022
Previously Presented: Needs Meeting 1/21/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Line Name: Midway – South Christiansburg 69kV Line

Original Install Date (Age): 1967

Length of Line: ~5.7 mi

Total structure count: 111

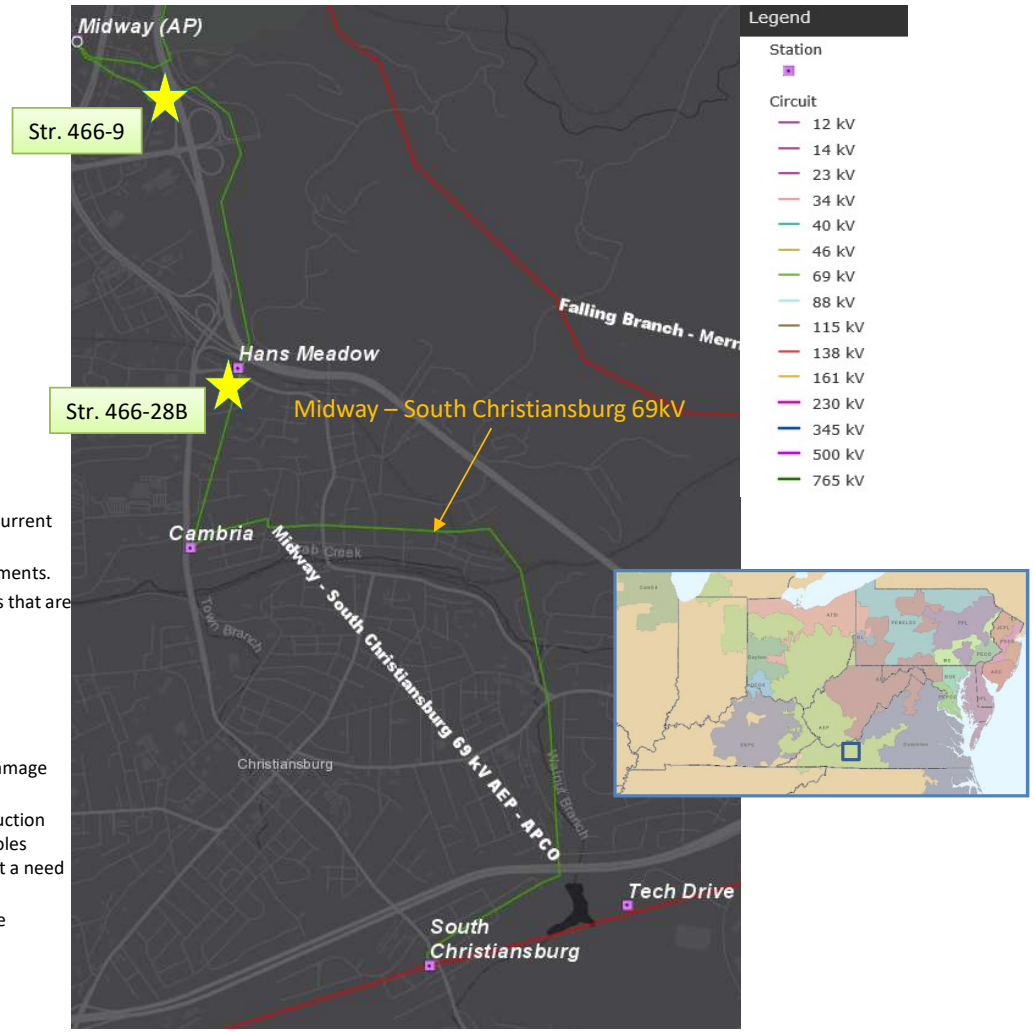
Original Line Construction Type: Wood

Conductor Type: 3/0 ACSR, 4/0 ACSR, 336,400 ACSR, 556,500 ACSR

Momentary/Permanent Outages: 4 Momentary and 0 Permanent

Line Conditions:

- The line structures fail to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements.
- The vertical post insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- Additional assessments were taken on a representative sample of the 1960s era structures, indicating numerous conditions that are expected to be present on the remainder of the line. The results showed:
    - Pole top weathering on multiple structures
    - Weathered/splitting/cracking crossarms
    - Woodpecker damage
    - Corroded hardware and insulator end fittings
- 19 structure related open conditions affecting the crossarm, knee/ vee brace, or pole including rot, damaged, and insect damage conditions.
- 80 of 111 structures are 1960s vintage. There is a 1.3 mile segment from Structure 466-9 to 466-28B of more recent construction associated with the previous widening of U.S. Route 460. This section utilizes 14 steel poles installed in 2007 and 7 wood poles installed in 1999 or 2007. In addition, the conductor on this section is 2007 vintage 556,500 CM ACSR 26/7 (Dove) and is not a need at this time.
- 16 independent structures with at least one open condition, 18% of the structures on this circuit, excluding the 21 structure segment from Structure 466-9 to 466-28B.



AEP Transmission Zone M-3 Process
Montgomery County, Virginia

Need Number: AEP-2022-AP003

Process Stage: Solutions Meeting 08/19/2022

Previously Presented: Needs Meeting 1/21/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

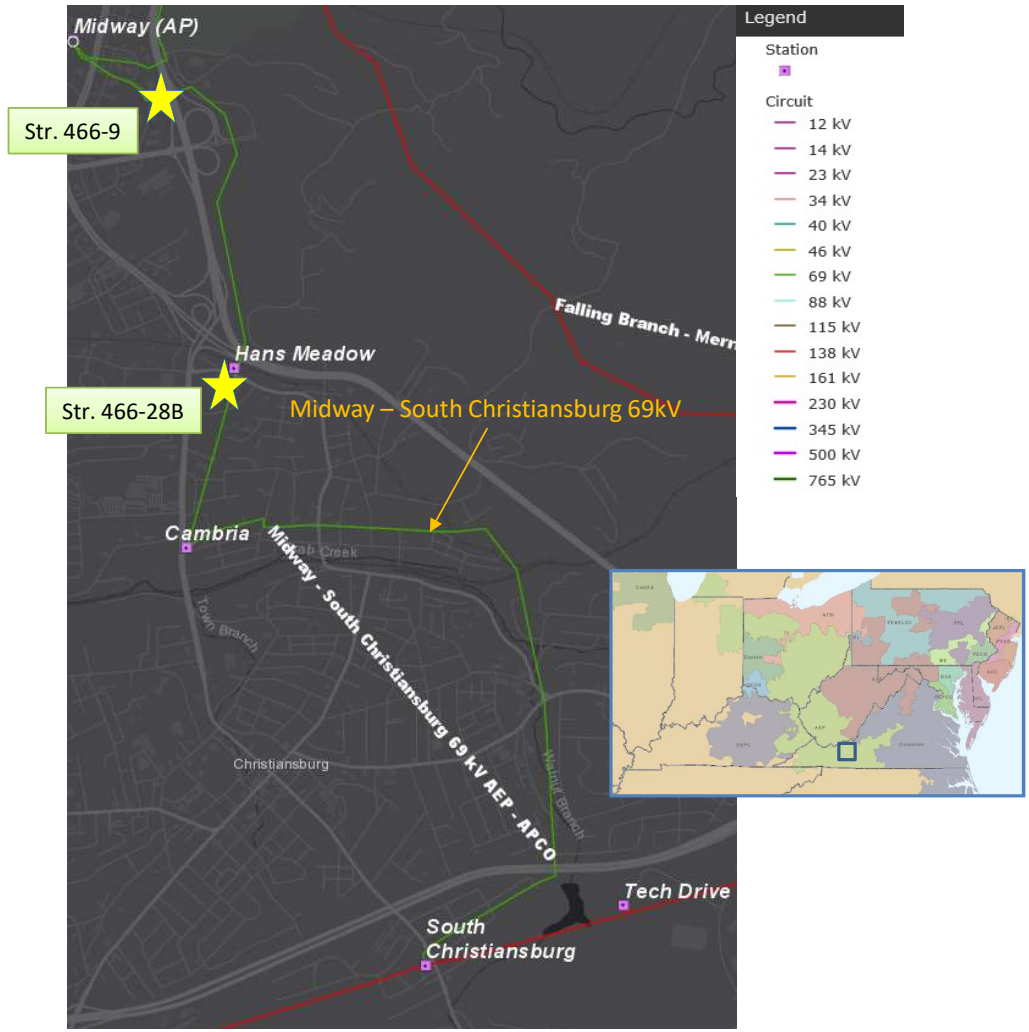
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement Continued:

Line Conditions Con't:

- The butt wrap grounding and typical shield angle is inadequate per current AEP Standards and can cause poor lightning performance. The current grounding system, poor shielding angle, and the electrical strength of the insulators do not meet current AEP and industry accepted criteria, making the line susceptible momentary and permanent outages, affecting customer reliability.
    - The inadequate grounding limits the available path to ground during any type of line fault, increasing the intensity the conductor and related hardware have to withstand during the fault. The reduced electrical strength of the insulators could lead to electrical damage to structures and hardware during a fault if the insulator were to fail from elevated electrical stresses.
    - The line serves a peak load of 43 MVA at Cambria and Hans Meadow Substations.



AEP Transmission Zone M-3 Process
Montgomery County, VA

Need Number(s): AEP-2022-AP002, AEP-2022-AP003

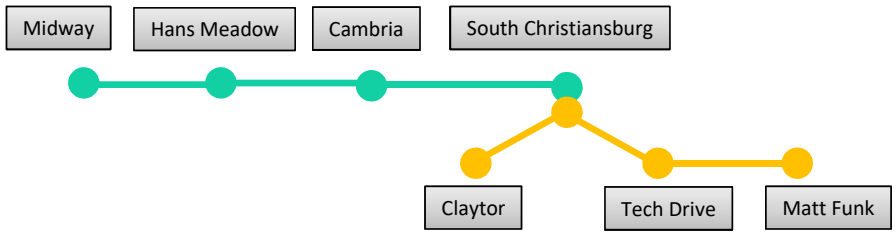
Process Stage: Solutions Meeting 08/19/2022

Proposed Solution:

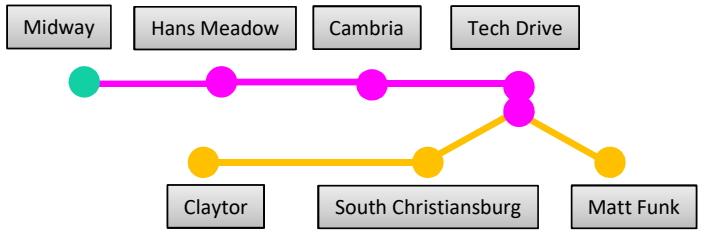
- Rebuild the Midway – South Christiansburg 69kV line from Midway station to Str. 466-9 (0.45 miles). Rebuild the Midway – South Christiansburg 69kV line from Str. 466-28B to Str. 466-98 (3.8 miles). At Str. 466-98 build new 69kV line to the existing Tech Drive station (0.35 miles). The cost per mile is due to the need for matted access roads to minimize property damage in the urban environment. 50 permanent encroachments have been identified within the existing ROW and require a greater number of line structures than normal to reroute the line. Also, due to numerous encroachments on the existing centerline, the rebuild will consist of 1.8 miles rebuilt on existing centerline and 2.8 miles near centerline or greenfield. **Estimated Cost: $21.33M**
- Remove the Midway – South Christiansburg 69kV circuit from Midway station to Str. 466-9 (0.45 miles). Remove the Midway – South Christiansburg 69kV circuit from Str. 466-28B to Str. 466-98 (3.4 miles). Retire the Midway – South Christiansburg 69kV circuit from South Christiansburg station to Str. 466-98 (0.7 miles). **Estimated Cost: $2.7M**
- At South Christiansburg station, remove the existing 138/69kV transformer and 69kV circuit breaker. **Estimated Cost: $1.29M**
- Build 4 fiber station transitions using OPGW at Midway, Hans Meadow, Tech Drive and South Christiansburg. Retire 4.3 miles of ADSS fiber currently on the Midway – South Christiansburg 69kV circuit. Build 4.6 miles of OPGW on the new Midway - Tech Drive 69kV Line. **Estimated Cost: $1.03M**
- At Hans Meadow station, replace the MOAB switch facing Cambria station with a 69kV circuit breaker. **Estimated Cost: $0 (Distribution cost)**
- At Cambria station, replace existing 69kV line CCVTs, bus conductors, and pass-through riser connectors on both line exits to match the 69kV line capacity. **Estimated Cost: $0 (Distribution cost)**
- At Midway station, replace existing risers to support the 69kV line rebuild. **Estimated Cost: $0 (Distribution cost)**
- At Tech Drive station, replace the manual switch facing South Christiansburg station with a 138kV circuit breaker and remove the 138kV bus tie switch. Install a 138kV circuit switcher and a 90 MVA 138/69 kV transformer. Add a 69kV circuit breaker to the 69kV side of the transformer. **Estimated Cost: $0 (Distribution cost)**

Total Estimated Transmission Cost: $26.35 M

Existing



Proposed



Proposed solution Continued:

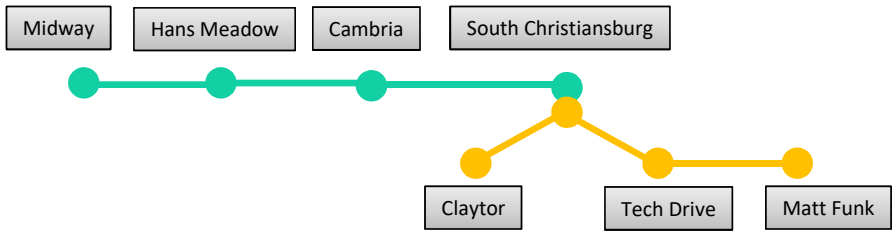
Ancillary Benefits: The new 69kV breaker at Hans Meadow will break up the current system configuration of 5 MOABs in series, providing greater protection for Distribution customers served from Hans Meadow and Cambria stations. Tech Drive station is newer and in an industrial park instead of South Christiansburg station that is older and in a residential neighborhood, reducing the need to expand the station footprint. Building the 69kV line to Tech drive instead of South Christiansburg will remove 0.7 miles of Transmission lines in a residential neighborhood and free up room at the already congested South Christiansburg station.

Alternatives Considered: Rebuild the Midway – South Christiansburg 69kV circuit from Midway station to Str. 466-9. Rebuild the Midway – South Christiansburg 69kV circuit from Str. 466-28B to South Christiansburg station. Replace the existing 138/69 kV transformer with a new 138/69kV transformer and replace the 69kV circuit breaker at South Christiansburg station. Two 138kV circuit breakers will be added at South Christiansburg station. One 69kV circuit breaker will be added at Hans Meadow station. This option was not preferred due to space constraints at South Christiansburg station and the existing ROW congestion in and around the existing line section. Estimated cost: $30M

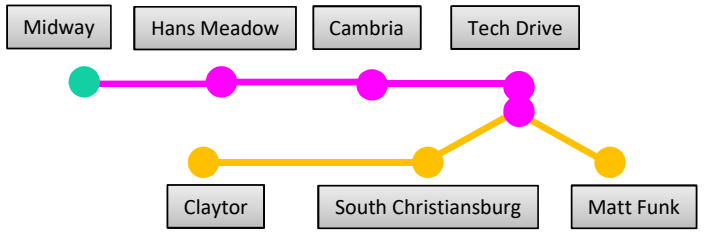
Projected In-Service: 6/1/2027

Project Status: Scoping

Existing



Proposed



AEP Transmission Zone M-3 Process
Logan County, West Virginia

Need Number: AEP-2022-AP033

Process Stage: Solutions Meeting 8/19/2022

Previously Presented: Need Meeting 06/15/2022

Supplemental Project Driver: Operational Flexibility and Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 14)

Problem Statement:

Line Name: Chauncey Tap 138kV Line

Original Install Date (Age): 1949

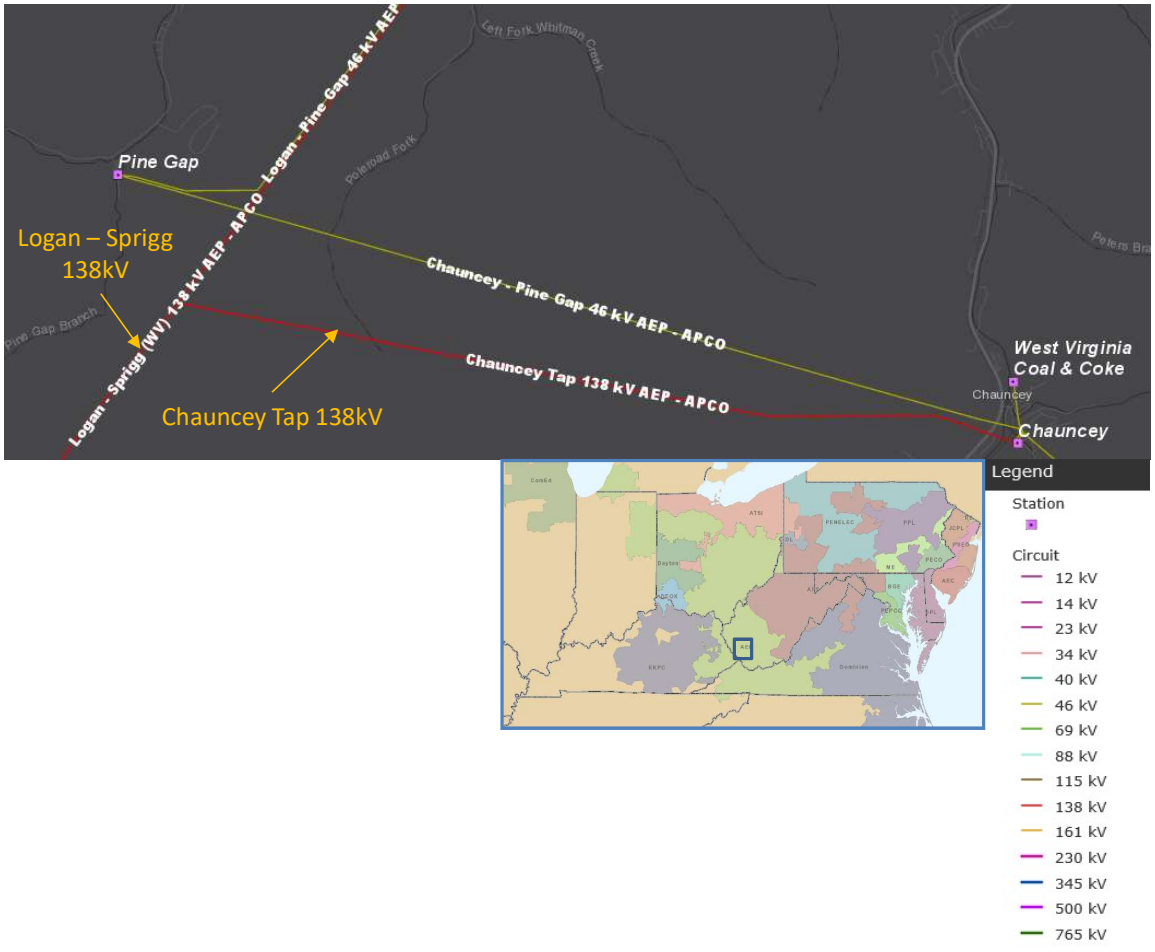
Length of Line: ~3.7 mi

Total structure count: 15

Conductor Type: 397,500 ACSR

Momentary/Permanent Outages: 11 Momentary and 1 Permanent (2017 – 2021)

- The outages include the Logan – Sprigg 138kV line because the Chauncey Tap is hard tapped to the Logan – Sprigg line and the outages travel onto the Chauncey Hard Tap and vice versa.
- Hard tapped lines are difficult when there is a line fault, the fault will take out the through line and leave no way for Transmission Operations to restore the tapped station. Requiring a Transmission Line crew to "open loops" means (1) finding a dead–end structure that is accessible with a bucket truck, (2) having an available and usable access road and (3) having a Transmission Line crew available.
- This consideration also extends to the tap line, where a fault on this section will outage the through–path with no readily available restoration procedure. While the primary consideration is forced outages, these considerations also apply to planned outages such that much more effort and planning is required to perform the above steps than if switches are available to be used to separate the line sections.



AEP Transmission Zone M-3 Process
Logan County, WV

Need Number(s): AEP-2022-AP033

Process Stage: Solutions Meeting 08/19/2022

Proposed Solution:

- Add two additional 138kV circuit breakers to the already proposed and approved Tin Branch station (b3348), transforming the designed station from a 138kV two-breaker straight station to a four-breaker ring bus station. **Estimated Cost: $1.9M**
- Disconnect the Chauncey hard tap from the Logan – Sprigg circuit and build 1.5 miles of greenfield 138kV line to connect the Chauncey 138kV Tap into the new Tin Branch station. The higher estimated cost is due to the difficult mountainous terrain, expensive access roads and required environmental studies. **Estimated Cost: $5.6M**

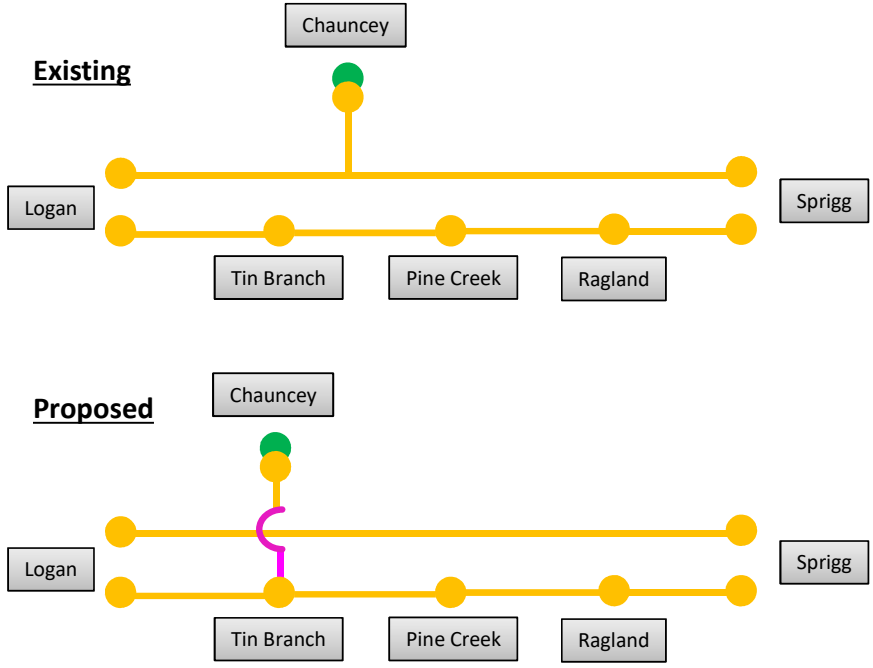
Estimated Total Transmission Cost: $7.5 M

Ancillary Benefits: Addressing the hard taps improves the overall system reliability and operational flexibility. There are also outage and cost efficiencies with completing this scope of work with the baseline work at Tin Branch (B3348).

Alternatives Considered: Continue to use the Chauncey hard tap in the current set up. This set up would continue to expose Distribution customers to outages on 18 additional miles of exposure on the 138 kV Logan – Sprigg circuit.

Projected In-Service: 3/1/2027

Project Status: Scoping



Legend	
345 kV	
138 kV	
69 kV	
46 kV	
34.5 kV	
New	

Dayton Transmission Zone M-3 Process

Need Number: Dayton-2021-010

Process Stage: Need Meeting 08/16/2021

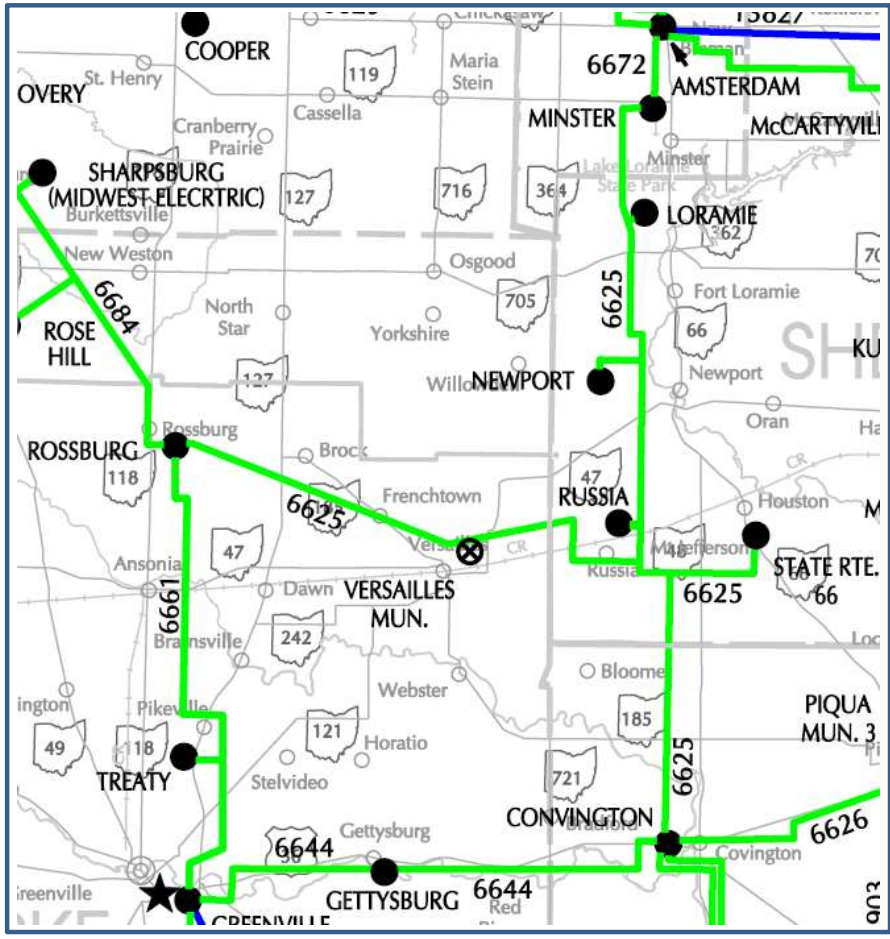
Project Driver: Requested Customer Upgrade, Operational Performance

Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Problem Statement:

- The Village of Versailles has requested additional sectionalizing improvements to improve local delivery point reliability. Currently Versailles' peak load totals to 16.5MWs and is served via two-way 69kV MOABs switch arrangement.
- Presently, Versailles is the largest served via the 42-mile 69kV transmission circuit and are projected to increase to 17.6 MWs by 2025.
- Also, Buckeye Electric cooperatives served at Newport (peak load of 6.3MWs) and St. Rt. 66 (peak load of 6.2MWs) have delivery points along this line.
- AES Ohio serves distribution via the Loramie (peak load of 8.5MWs) and Russia (peak load of 3.2MWs) Substations.
- The existing 42 mile 69kV transmission line (6625) from Covington-Minster-Rossburg was constructed using wood pole, cross-arm and brace design in 1971. This line provides transmission and distribution level service to 6 different substations serving nearly 7,000 customers in Darke, Mercer, Miami, and Shelby Counties in Ohio and totaling approximately 40MWs of load.
- Since 2016, the line has experienced 41 outages (11 permanent and 30 momentary), with a total outage duration of ~6,400 minutes. A vast majority of the permanent outages were equipment related issues while most of the momentary outages have been the result of weather.
- Additionally, in 2020 AES Ohio committed to a local area upgrade (Russia 4-breaker ring: S2254). This project also targets to minimize impacts associated with 6625 circuit outages by splitting the 42 miles 69kV circuit into three 69kV circuits:
    - Rossburg – Versailles - Russia: 12.0 miles
    - Minster – Russia: 13.0 miles
    - Covington – Russia: 17 miles
- There is a need here to further evaluate the condition and sectionalizing improvements along 6625 after the Russia 4-breaker ring is complete in 2023 for more localized sections of this line where cross-arm and tap design is prevalent.

Model: 2021 RTEP Series, 2026 Summer Case



Dayton Transmission Zone M-3 Process

Need Number: Dayton-2021-010

Previously Presented: Need Presented, 08/16/2021

Process Stage: Solution Presentation, 08/19/2022

Project Driver: Requested Customer Upgrade, Operational Performance

Specific Assumption Reference: Dayton Local Plan Assumptions (Slide 5)

Proposed solution:

Russia – Minster 69kV Line Rebuild: Rebuild and reconductor the 13-mile 69kV line from Russia – Minster utilizing 1351 AAC conductor and ductile iron poles. This project will directly improve one of the worst performing circuits in the AES Ohio footprint. This rebuild along with other area improvements will greatly reduce both permanent and momentary outages to the co-op delivery points along this line and will help improve the reliability area by reinforcing this important south to north 69kV corridor on the AES Ohio system.

Estimated Transmission Cost: $18.2M, ISD 12/31/2026

Russia – Covington 69kV Line Rebuild: Rebuild and reconductor the 14-mile 69kV line from Russia - Covington. Like above, this project will reinforce a historic poor performing circuit and reduce permanent and momentary outages to customers served in this area. Replacing the wood pole cross-arm and brace design with ductile iron poles will significantly improve reliability for the customers served from this line.

Estimated Transmission Cost: $19.6M, ISD 6/1/2027

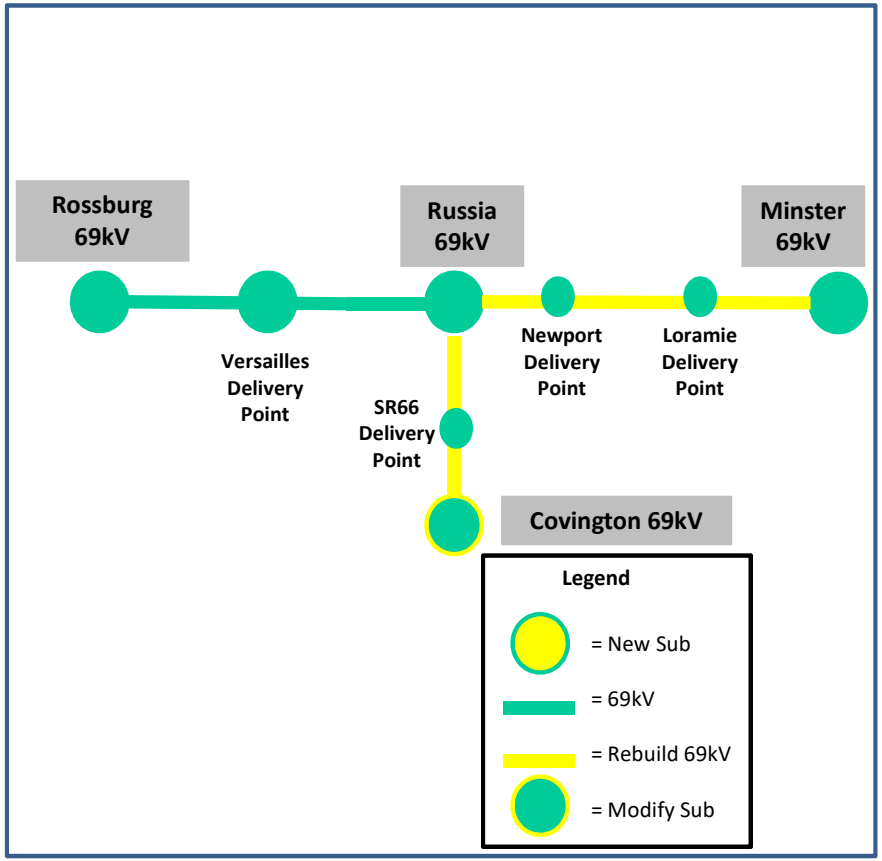
Covington Substation: Replace 5 - 1940's era oil breakers, relaying, and establish another 69kV bus tie for operational flexibility. These breakers have experienced operational issues and should also be replaced at the time of the rebuild to ensure modern relaying is in place which will also help improve area reliability.

Estimated Transmission Cost: $3M, ISD 6/1/2027

Total Estimated Transmission Cost: $40.8M

Project Status: Conceptual

Model: 2022 RTEP Series, 2027 Summer Case



AEP Transmission Zone M-3 Process
Apple Grove Area Project

Need Number: AEP-2020-AP016

Process Stage: Solution Meeting 9/16/2022

Previously Presented: Need Meeting 2/21/2020

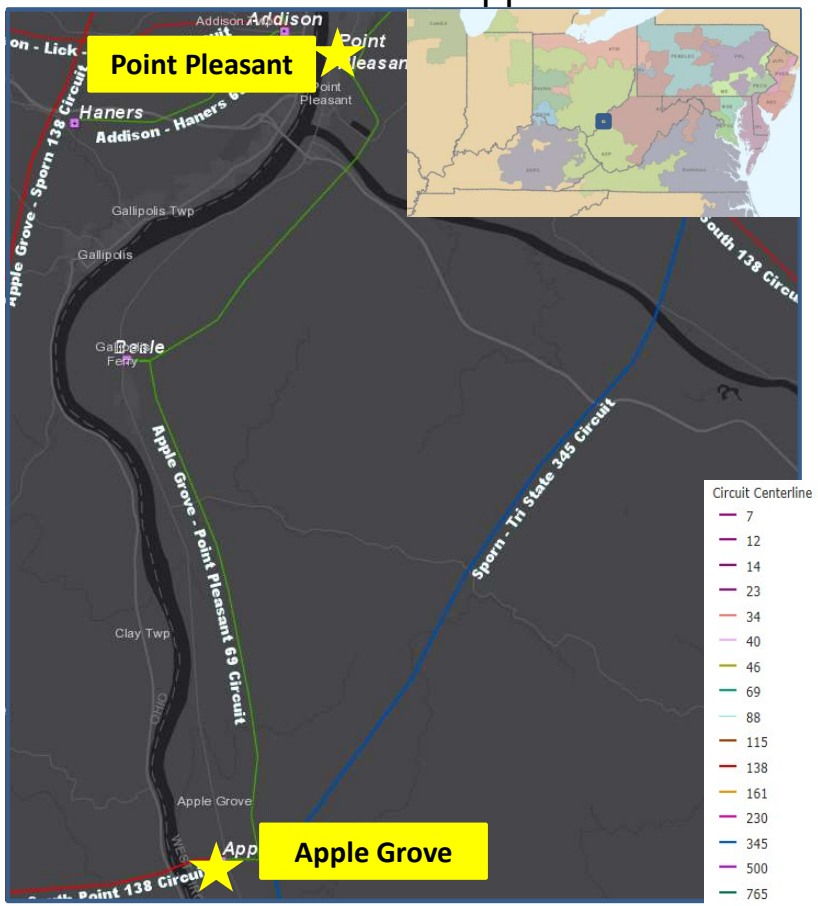
Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Apple Grove – Point Pleasant 69 kV (17 miles)

- The line consists of mainly 1960s wood pole structures. The circuit utilizes steel lattice towers with grillage foundations on the Big Sandy River Crossing.
    - The circuit was originally installed in 1960, primarily with 4/0 ACSR conductor and 5-bell porcelain insulators.
    - Structures on the line failed to meet 2017 NESC Grade B loading criteria, failed to meet current AEP structural strength requirements, and failed to meet current ASCE structural strength requirements
    - The insulators do not meet current AEP standards for CIFO and minimum leakage distance requirements.
    - There are currently 79 structures (61% of the line) with at least one open condition
        - A total of 171 open conditions on the line, related to damaged/worn shield wires, rotted crossarms and poles, woodpecker damage, broken or burnt insulators.
- Since 2014 there have been 6 momentary and 6 permanent outages on the circuit
- CMI: 1.5 million



AEP Transmission Zone M-3 Process
Apple Grove Area Project

Need Number: AEP-2020-AP018

Process Stage: Solution Meeting 9/16/2022

Previously Presented: Need Meeting 2/21/2020

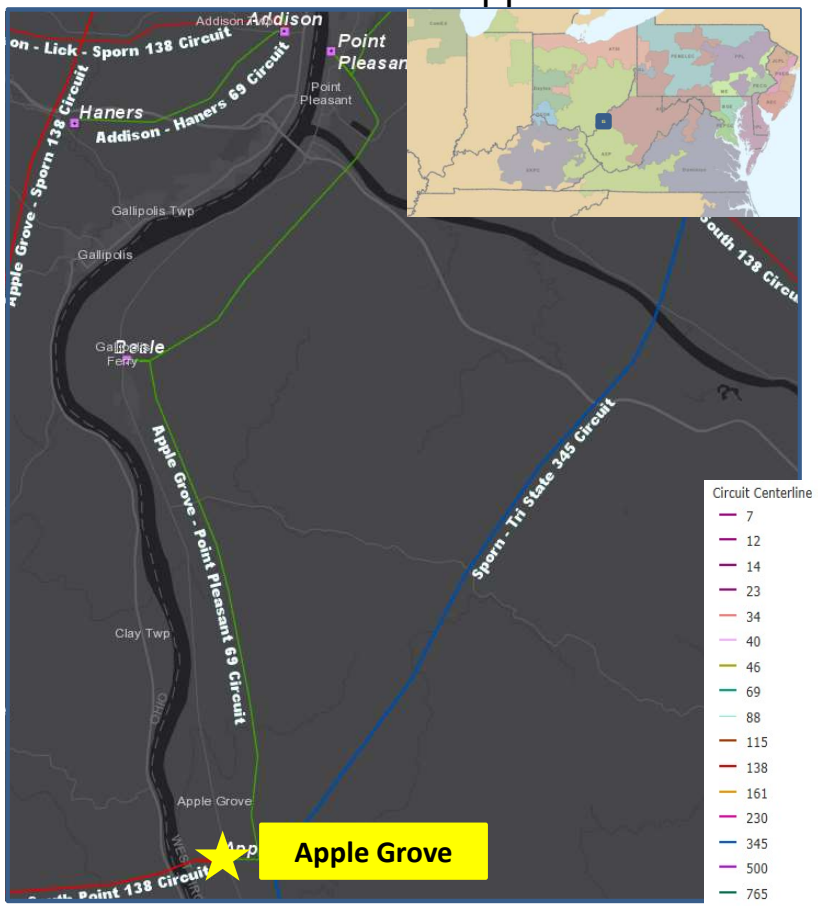
Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Apple Grove Station

- 69 kV circuit breaker L is an FK type oil filled breaker, without oil containment.
  - 1960s vintage
  - Oil filled breakers need more maintenance due to the oil handling required and oil spills can result in significant cost associated with environmental mitigations
  - The manufacturer does not provide support for this type of breaker and spare parts are increasingly more difficult to obtain.
- 138/69 kV transformer bank #1 was manufactured in 1965
  - Elevated moisture levels
  - Elevated Carbon Monoxide and Carbon Dioxide levels
    - Indicates abnormal paper insulation deterioration
  - In 2004 one fan was destroyed by a failed fan blade
  - Oil containment inspection indicates deficiencies in the existing containment
  - The bank is connected directly to the 138 kV bus with a high side MOAB switch.
    - This can cause a fault in the station to signal the remote end breakers to open which is a known safety hazard in legacy station designs.
- 54 of the 66 relays (82% of all station relays) have needs associated with them
  - 51 are electromechanical type and 3 are static type which have significant limitations with regards to spare part availability and fault data collection/retention
- Overlapping zones of protection in existing station configuration
  - Apple Grove – Point Pleasant 69 kV line terminates directly into the 69 kV bus



AEP Transmission Zone M-3 Process
Apple Grove Area Project

Need Number: AEP-2020-AP016, AEP-2020-AP018

Process Stage: Solutions Meeting 09/16/2022

Proposed Solution:

Rebuild existing Apple Grove – Point Pleasant 69 kV line to 138 kV standards. (approx. 17.3 miles) **Estimated Trans. Cost $50.3M**

Apple Grove Station: Replace existing 69 kV CB-L with a new 69 kV 3000 A 40 kA CB. Replace existing 138/69 kV XFR #1 with a new 138/69 kV 90 MVA XFR and install new high side circuit switcher. Add 138 kV CB on 138 kV bus increasing sectionalizing, by separating existing customer facilities from AEP facilities. Upgrade metering at station. Install new DICM. Replace existing 69/12 kV XFR #2 with a new 138/12 kV XFR. **Estimated Trans. Cost $6.7M**

Estimated Total Trans. Cost: $57.0M

Ancillary Benefits: Baseline project B3279 at Apple Grove will be combined and executed with this supplemental work.

There have been numerous inquiries for new load customers in the area; building to 138 kV standards allows for increased capacity in the future with minimal cost today.

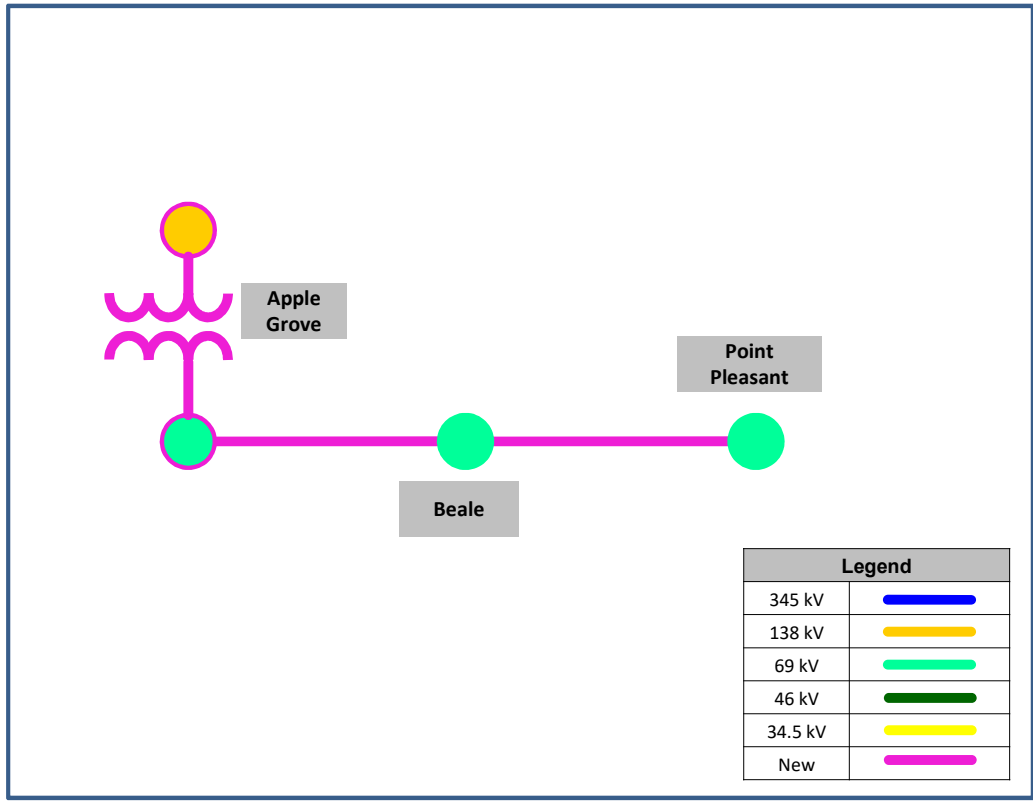
Alternatives Considered:

Retiring the existing line was considered but after determining that service would still need to be maintained at the existing Beale Station the best course of action was to keep the existing infrastructure.

Projected In-Service: 4/1/2025

Project Status: Scoping

Model: 2027 RTEP

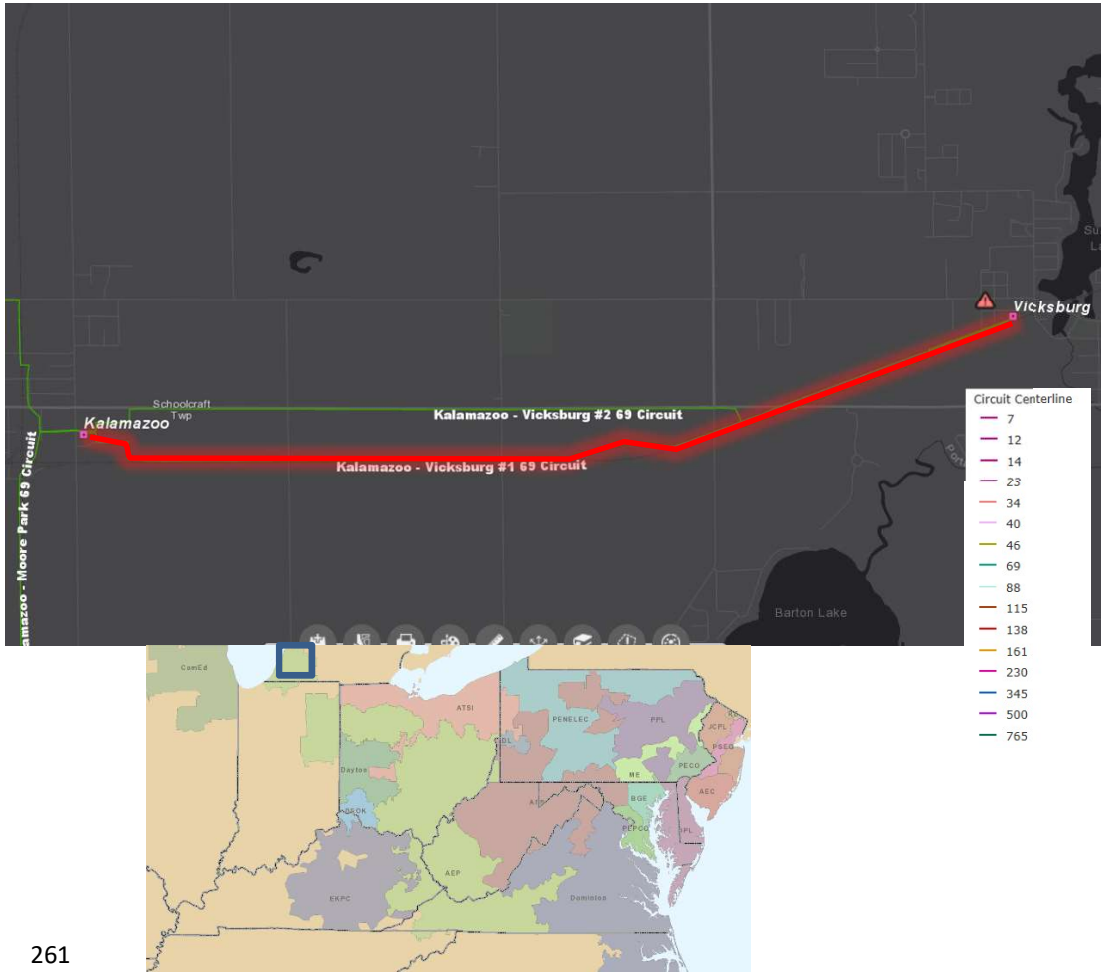


AEP Transmission Zone M-3 Process
Kalamazoo – Vicksburg 69kV Rebuild

Need Number: AEP-2021-IM023
Process Stage: Solution Meeting 9/16/2022
Previously Presented: Needs Meeting 5/21/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Kalamazoo - Vicksburg 69kV line:

- 4.72 miles of mostly 1972 wood pole
- Conductor is 3/0 ACSR
- Since 2015 there have been 7 momentary and 1 permanent outages
- Structures fail NESC Grade B, AEP Strength requirements and ASCE structural strength standards
- There are 26 structures with open conditions (41% of line). 17 of these are structure related including pole rot, split and woodpecker damage



AEP Transmission Zone M-3 Process
Kalamazoo – Vicksburg 69kV Rebuild

Need Number: AEP-2021-IM023

Process Stage: Solution Meeting 9/16/2022

Proposed Solution:

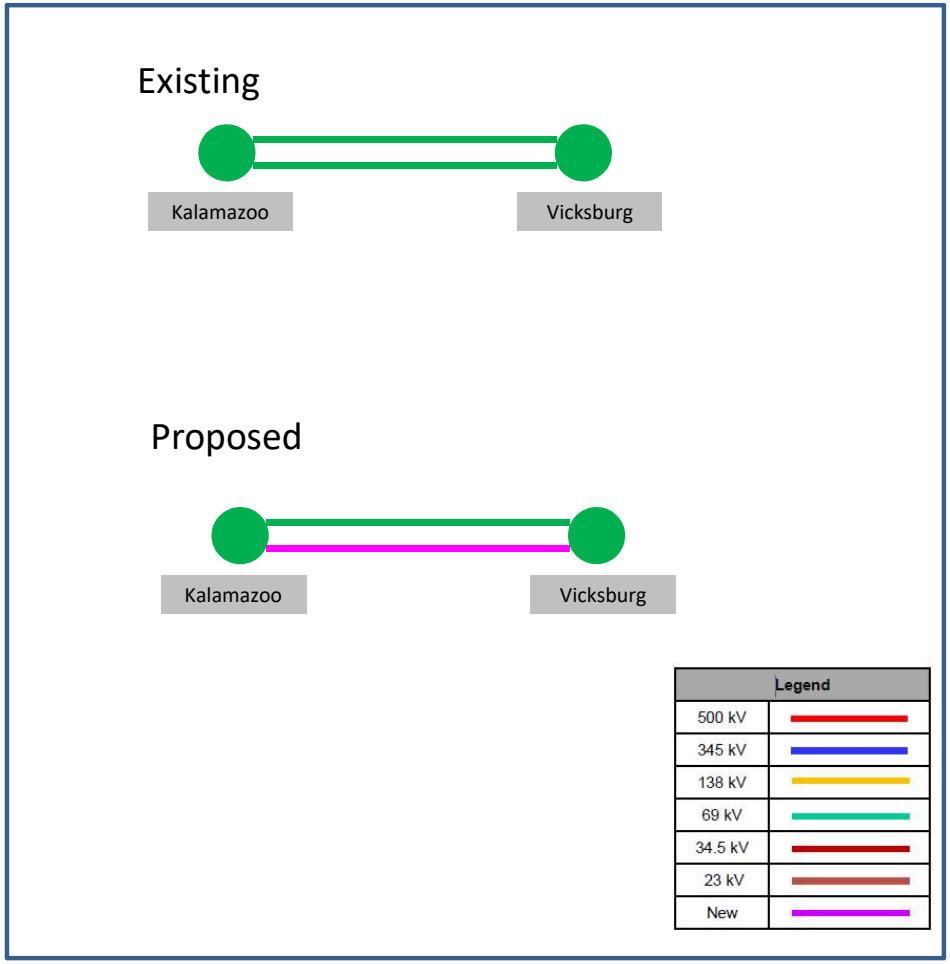
Kalamazoo – Vicksburg 69kV line:
Rebuild the 4.72 Kalamazoo – Vicksburg #1 69kV line with 336 30/7 ACSR Oriole and eliminate line crossings with Kalamazoo – Vicksburg #2 69kV.
Estimated Cost: $8.45M

Alternates:

Rebuild the last mile of the line as double circuit. This option would make the line difficult to maintain without dropping Vicksburg and would introduce the possibility of a double circuit tower outage, so this option was not chosen. Further, Circuit #2 was energized in 2018 as part of s1523. That project allows for rebuilding this line on centerline without taking an outage to customers served from Vicksburg, eliminating the concern with the radial feed and providing looped service to customers that have no capability from being picked up from another source.

Projected In-Service: 11/2/2026

Project Status: Scoping



AEP Transmission Zone M-3 Process
Wagenhals Station Upgrade

Need Number: AEP-2021-OH001

Process Stage: Solution Meeting 10/14/2022

Previously Presented: Need Meeting 1/15/2021

Project Driver:

Equipment Material/Condition/Performance/Risk; Operational Flexibility and Efficiency

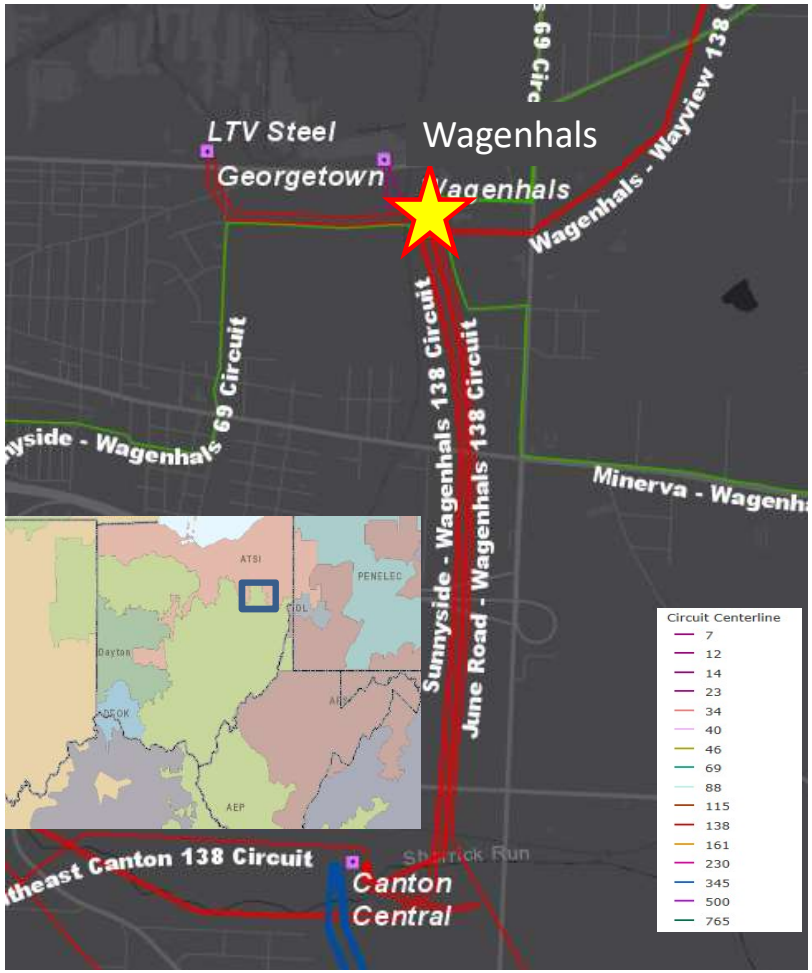
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (slide 13-14)

Problem Statement:

Equipment Material/Condition/Performance/Risk:

- The Wagenhals 138-69-23kV station was originally constructed in 1943.
- The station directly serves approximately 140 MW of industrial load (130 MW steel mill at 138kV; 10 MW casting plant at 23kV).
- The 138-23kV transformer #1 (vintage 1957) has the following asset concerns: insulation breakdown, elevated levels of CO2, high moisture readings, leaks, and wood-tie foundations in poor condition.
- The 138-69-23kV transformer #2 (vintage 1967) has the following asset concerns: insulation breakdown, elevated ethane and ethylene levels, high moisture readings, and low dielectric strength, and wood-tie foundations in poor condition.
- The control house has various issues: water intrusion, animal-related damage, lead paint, leaking roof, and asbestos.
- The 23kV yard has corroded steel and crumbling foundations, along with cap-and-pin insulators. In addition, energized equipment does not meet current clearance requirements.
- There are environmental concerns: positive tests for PCB's; lead paint and asbestos, which are a safety risk to field personnel.
- The ground grid is inadequate and the AC station service and DC cabinets are in very poor condition.
- All 3 station transformers lack an oil containment system.



AEP Transmission Zone M-3 Process
Wagenhals Station Upgrade

Need Number: AEP-2021-OH001

Process Stage: Solution Meeting 10/14/2022

Previously Presented: Need Meeting 1/15/2021

Project Driver:

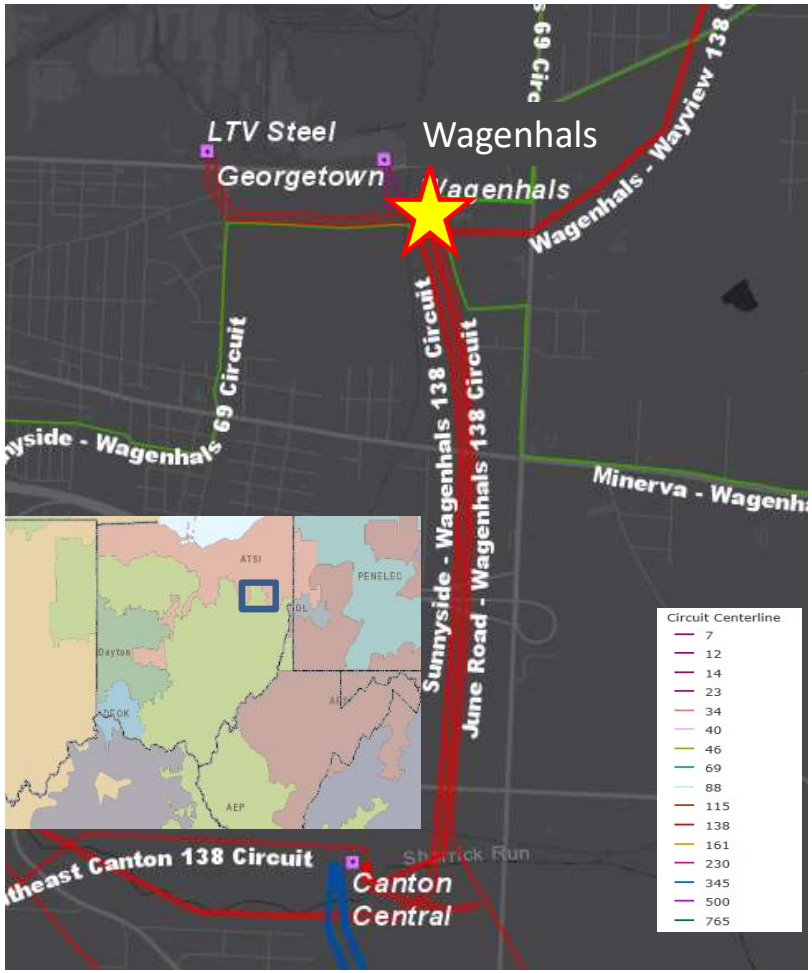
Equipment Material/Condition/Performance/Risk; Operational Flexibility and Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (slide 13-14)

Problem Statement:

- 138kV breaker 'H' has routine SF6 leaks and 138kV breaker 'A' has an oil leak.
- There are 3- 69kV oil-filled breakers (P, Q, S), installed between 1962-1970, that are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling requirements. In addition, spare parts or technical support for these breakers are not available. This model of breakers has been prone to hydraulic mechanism malfunctions.
- The 2- 23kV breakers are oil-filled and were installed in 1977. These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. In addition, spare parts or technical support for these breakers are not available. This model of breakers has been prone to hydraulic mechanism malfunctions.
- There are a large number of 69kV and 23kV transmission hook-stick switches identified in need of replacement with Gang Operated Air-Breaker Switches (GOAB)
- The 138kV & 23kV PT's are original to the station (1943) and have significant rusting and are at risk of oil spills.
- The station contains 103 electromechanical relays and 1 static relay. These relays have significant limitations with regard to spare part availability, SCADA functionality, and fault data collection and retention. In addition, these relays lack vendor support. The relays of concern are involved with 138kV, 69kV, & 23kV circuit protection, 69kV & 23kV bus protection, and transformer protection.



AEP Transmission Zone M-3 Process
Wagenhals Station Upgrade

Need Number: AEP-2021-OH001

Process Stage: Solution Meeting 10/14/2022

Previously Presented: Need Meeting 1/15/2021

Project Driver:

Equipment Material/Condition/Performance/Risk; Operational Flexibility and Efficiency

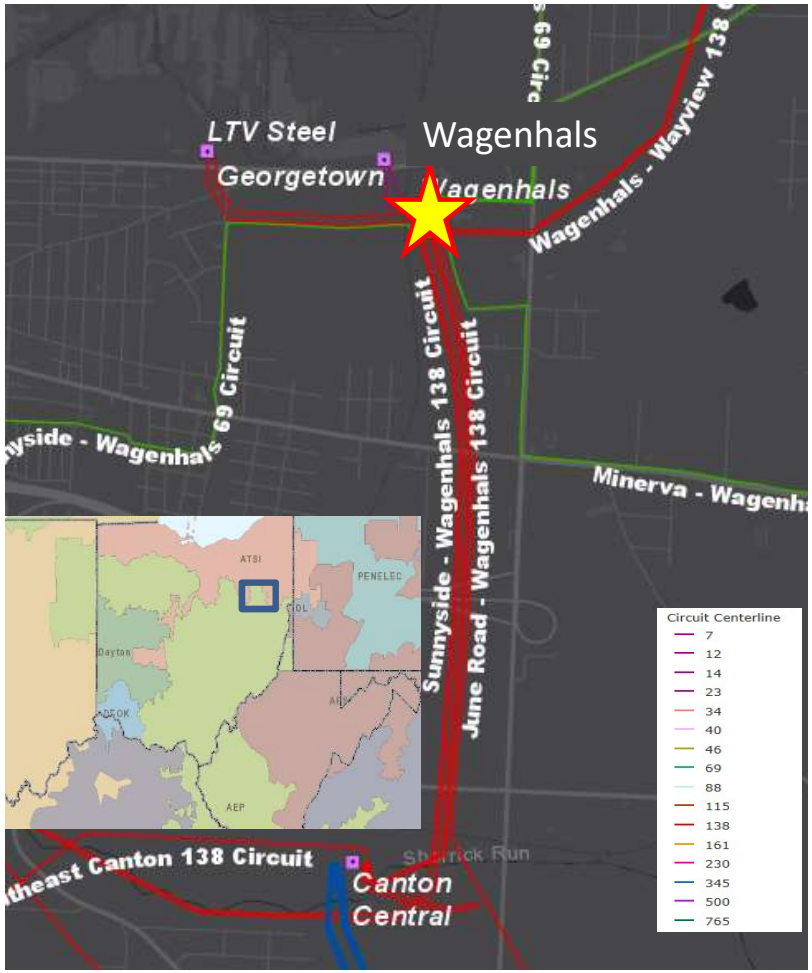
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (slide 13-14)

Problem Statement:

Operational Flexibility and Efficiency:

- The 3- transformers lack a high-side fault interrupting devices and require tripping an entire 138kV bus to clear a fault. These dissimilar zones of protection can cause over tripping and mis-operations.
- The 138kV design consists of 2- straight buses with a single bus-tie breaker, this configuration causes extended outages for maintenance, especially for a station serving a major steel customer. A stuck-breaker contingency on the 138kV bus-tie breaker requires tripping 9- 138kV breakers, 4- 69kV breakers, and 2- 23kV breakers (15 total breakers), taking the entire station out of service. This contingency would result in load loss of approximately 140 MW, loss of a 138kV cap bank, plus the loss of 2 sources to the local 69kV system.



AEP Transmission Zone M-3 Process
Wagenhals Station Upgrade

Need Number: AEP-2021-OH001

Process Stage: Solution Meeting 10/14/2022

Proposed Solution:

Wagenhals Station: Construct a new Wagenhals 138-69kV station on greenfield property owned by AEP to the south of the existing station. The 138kV portion will be a breaker-and-a-half design, with a total of 17 breakers. The 69kV will be a 5-breaker ring bus. The existing 138-69kV transformer #3 and 138kV cap bank will be transferred, while the 138-69-23kV transformer #2 will be retired. **Estimated Cost: $27.45 Million**

Retire the existing 138-69-23kV station, including structures and control house. **Estimated Cost: $3.71 Million**

Relocate 8- 138kV transmission lines and 4- 69kV transmission lines to connect to the new station location. **Estimated Cost: $10.48 Million**

Required environmental remediation at the existing station property. Dispose of PCB-contaminated soils, drainage tile, legacy oil piping and storage tanks, and synchronous condenser system. Final abatement plan to be determined with EPA. **Estimated Cost: $1.17 - $23.51 Million**

Wayview: Remote-end 138kV relay upgrades. **Estimated Cost: $0.36 Million**

Sunnyside: Remote-end 69kV relay upgrades. **Estimated Cost: $1.02 Million**

Stanley Court: Remote-end 69kV relay upgrades. **Estimated Cost: $0.49 Million**

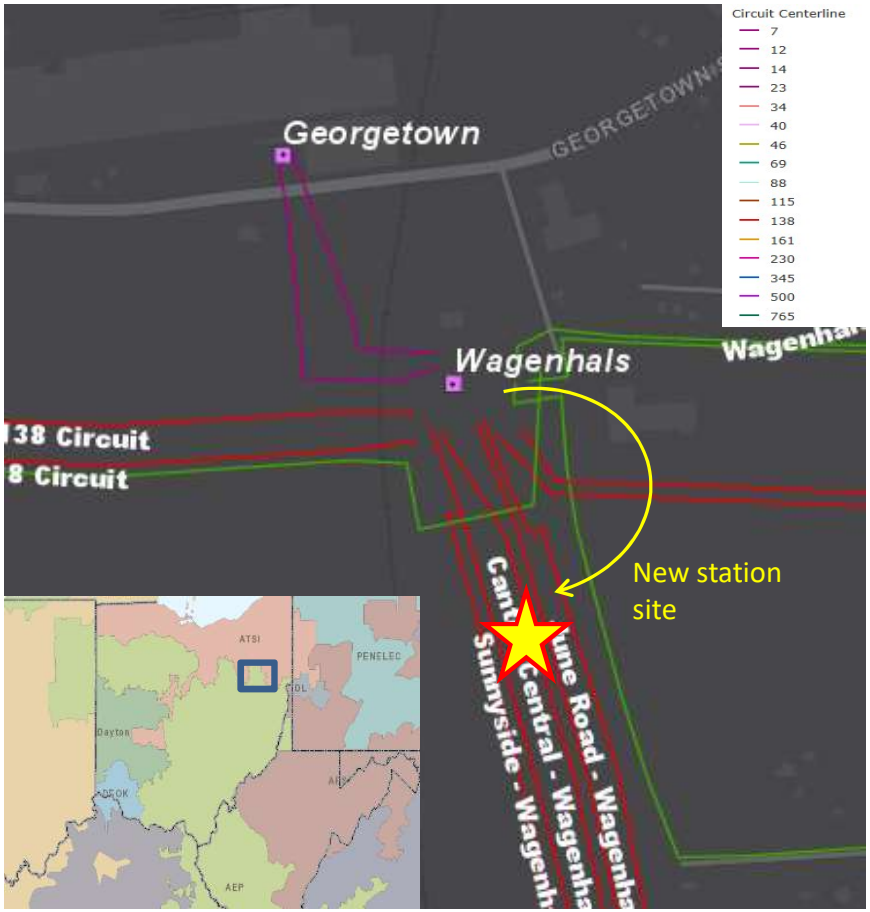
Total Estimated Transmission Cost: $44.68 - 67.02 Million

Ancillary Benefits: The build-in-the-clear approach allows for the future environmental clean up and remediation of the existing station and also permits continuous service to the two industrial customer facilities served directly from Wagenhals.

Alternatives Considered: No viable alternatives. Given the extensive environmental concerns at the site rebuilding in place would not be feasible given the extended outages that would be required in order to be able to remediate the site.

Project In-Service: 6/1/2025

Project Status: Scoping



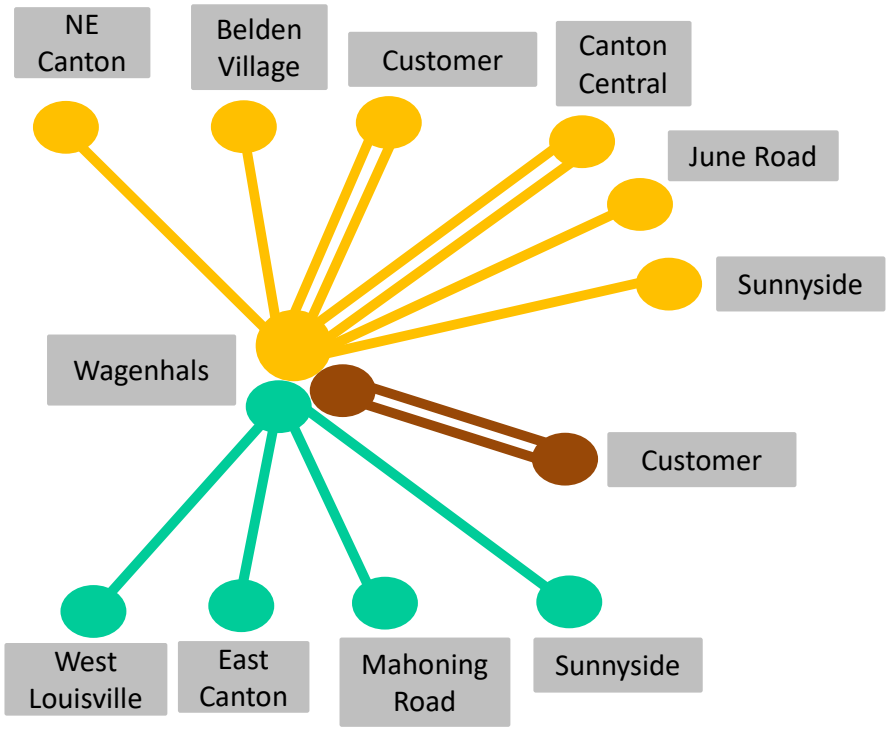
AEP Transmission Zone M-3 Process
Wagenhals Station Upgrade

Need Number: AEP-2021-OH001

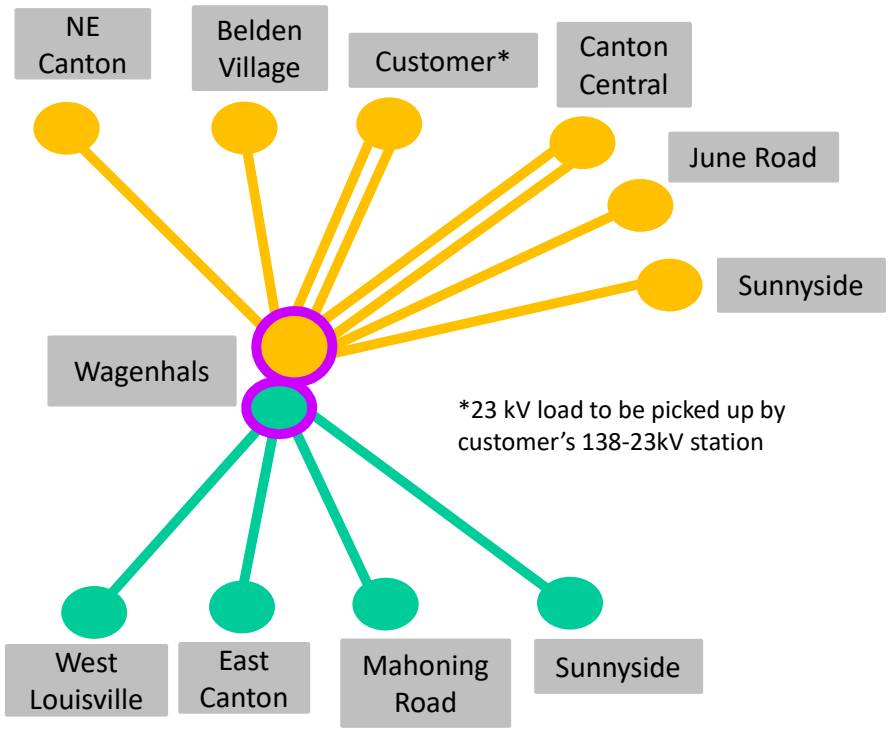
Process Stage: Solution Meeting 10/14/2022

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

Existing:



Proposed:

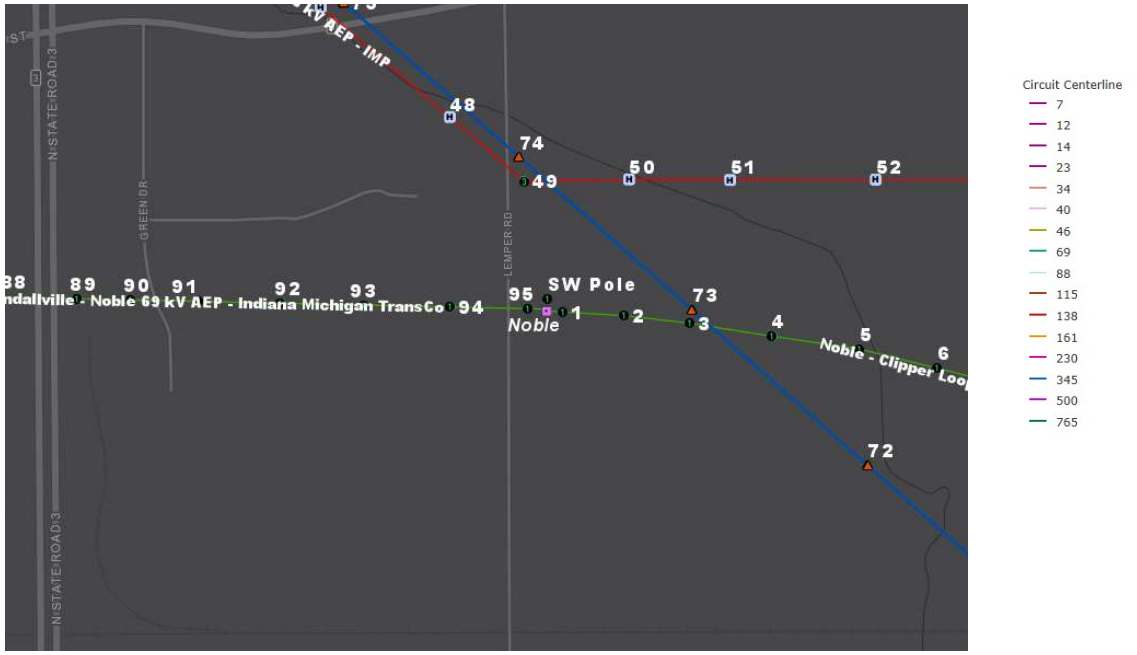


AEP Transmission Zone M-3 Process
Noble Station rebuild

Need Number: AEP-2022-IM011
Process Stage: Solution Meeting: 10/14/2022
Previously Presented: Needs Meeting: 6/15/2022
Supplemental Project Driver: Customer Need
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Noble 69kV Station:
Noble Station is a vintage 1950's wood pole station that is currently loaded beyond its capacity. The peak 2021 loading reached 12.04MVA which is 103% over the transformer's capacity.

Because of this, I&M Distribution has requested a new delivery point in this area.



AEP Transmission Zone M-3 Process
Albion Area Improvements

Need Number: AEP-2022-IM011
Process Stage: Solution Meeting 10/14/2022

Proposed Solution:

Noble 69kV Station:

Rebuild Noble 69/12kV distribution station on neighboring property with a bus tie breaker and line Moab.

Cost: $1.5M

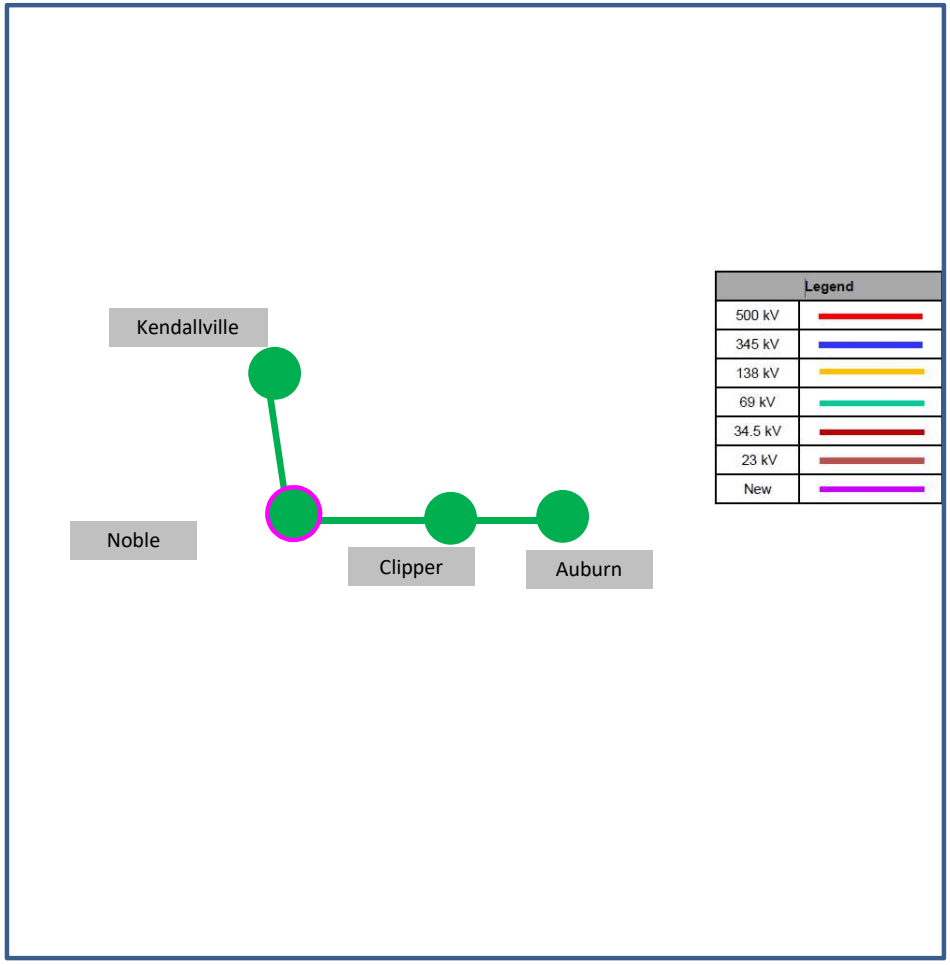
Reconnect the Auburn – Kendallville 69kV line to the new station

Cost: $0.5M

Total Transmission Cost: $2M

Alternatives Considered:
Alternate 1
Rebuild Noble on the neighboring 138kV line. Considering the availability of land in the same area as the existing station and more line work required, this alternative was not chosen. Estimated Cost: $3M

Projected In-Service: 12/31/2024
Project Status: Scoping



ComEd Transmission Zone M-3 Process
Line 15518

Need Number: ComEd-2022-004

Process Stage: Solutions Meeting 10/14/2022

Previously Presented: Need Meeting 8/19/2022

Project Driver:

Equipment Material Condition, Performance and Risk

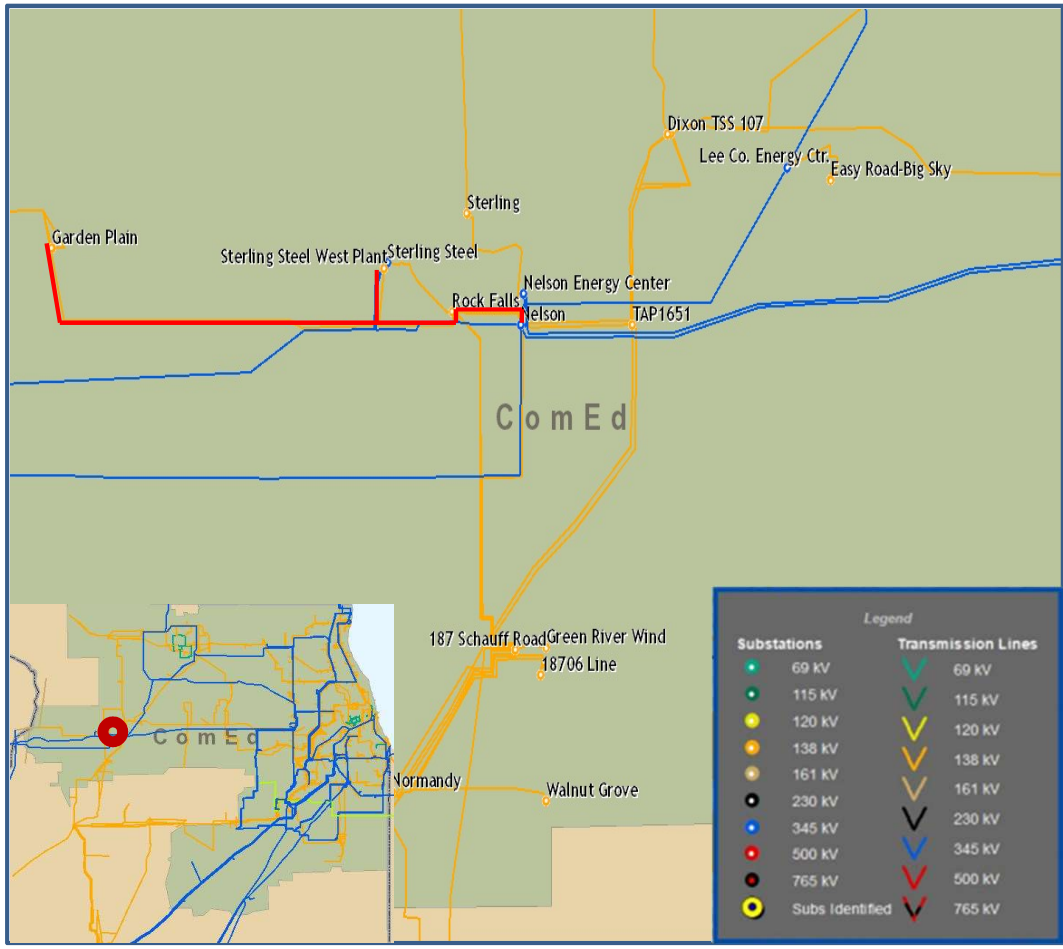
Operational Flexibility and Efficiency

Specific Assumption Reference:

- Transmission infrastructure replacements (EOL/condition/obsolescence) that are consistent with efficient asset management decisions
- Programmatic review and/or replacement of breakers, relays, wood poles, etc.
- Enhancing system functionality, flexibility, visibility, or operability

Problem Statement: 138 kV L15518 is a three-terminal line between Rock Falls, Nelson, and Garden Plain.

- 202 structures built in 1965 with single wood poles are undersized by today's standards
- 104 structures built in 1951 are wood H-frame construction and are reaching end-of-life.
- In 2020 two different wind events caused failure of 11 wood pole structures. Another wood pole failed in the spring of 2022.
- An area of loose peat is causing existing structures to lean which require costly repairs.



ComEd Transmission Zone M-3 Process
Line 15518

Need Number: ComEd-2022-004

Process Stage: Solutions Meeting 10/14/2022

Proposed Solution:

Rebuild 23 miles of wood poles with 1113 kCMIL conductor on steel towers. Eliminate three terminal line by extending 1113 kCMIL conductor from Rock Falls to the structure going to Garden Plain.

Line Rating capability:

Description	Summer Normal	Summer Emergency	Winter Normal	Winter Emergency
Existing	114	182	172	202
Proposed	351	449	421	500

Estimated Cost: $ 94M

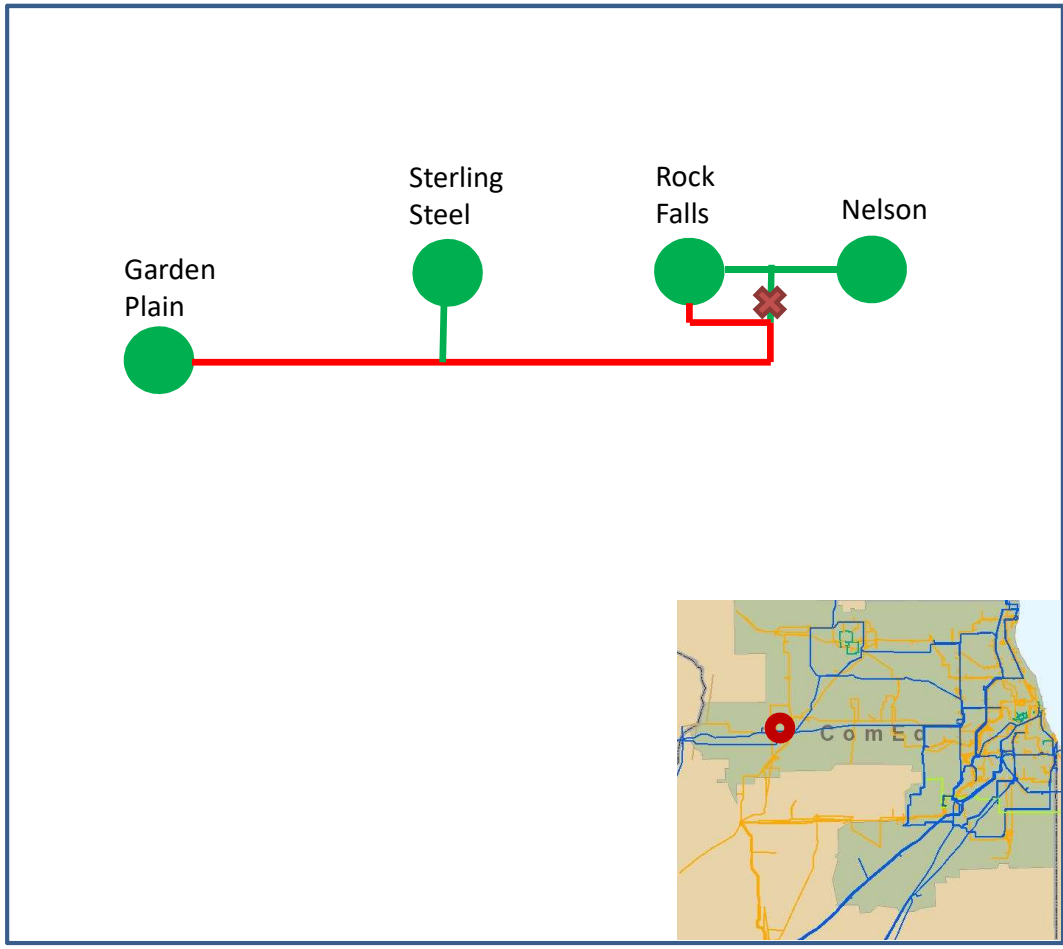
Alternatives Considered:

None

Projected In-Service: 12/31/2026

Project Status: Conceptual

Model: RTEP 2027



EKPC Transmission Zone M-3 Process
Dale – Newby 69 KV

Need Number: EKPC-2022-004

Process Stage: Solution Meeting – October 14, 2022

Previously Presented:

Needs Meeting –May 19, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

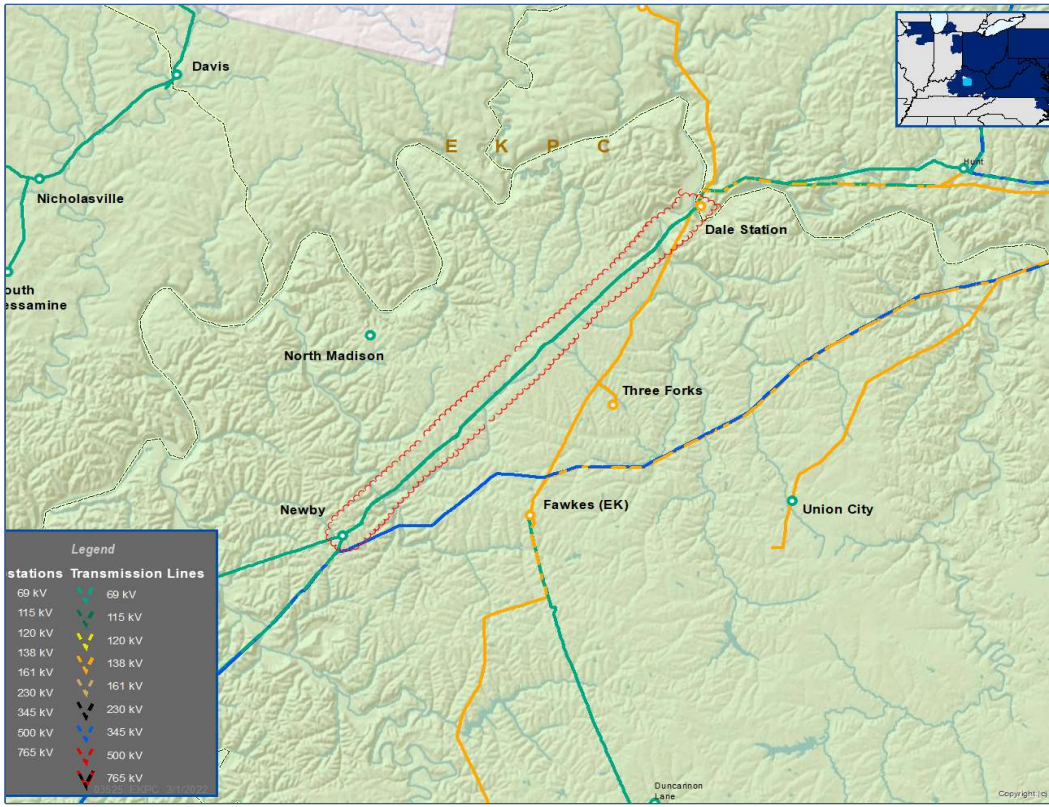
EKPC Assumptions Presentation Slides 13

Problem Statement:

The 11.1 mile, Dale - Newby double circuit 69 KV transmission line section is 70 years old.

Testing from the LineVue robot from Kinectrics Corporation deemed the condition of the line as unacceptable. The testing identified instances of rusting, pitting, and broken strands. Based on this testing information, the EKPC Reliability team has concluded that this line should be addressed due to the condition assessment.

Model: N/A



EKPC Transmission Zone M-3 Process
Dale-Newby 69 KV

Need Number: EKPC-2022-004

Process Stage: Solutions Meeting – October 14, 2022

Proposed Solution:

Rebuild 11.1 mile Dale-Newby line section as double-circuit 69 kV using 556 ACSR Conductor.

Transmission Cost: $12.6M

Ancillary Benefits:

- None

Alternatives Considered:

Alternative 1 - Retire Dale-Newby; Construct a new 69 KV line from Fawkes-Crooksville to serve Newby.

Transmission Cost: $5.8M

Alternative 2 - Retire Dale-Newby; Construct a new 138 KV line from Fawkes-West Berea. Rebuild Newby as 138/12.5 KV to serve Newby from new line.

Transmission Cost: $8.5M

Alternative 3 - Rebuild Dale-Newby as single-circuit 69 kV and serve Newby from this line. Construct 69 KV line from Lancaster to Toddville.

Transmission Cost: $18.1M

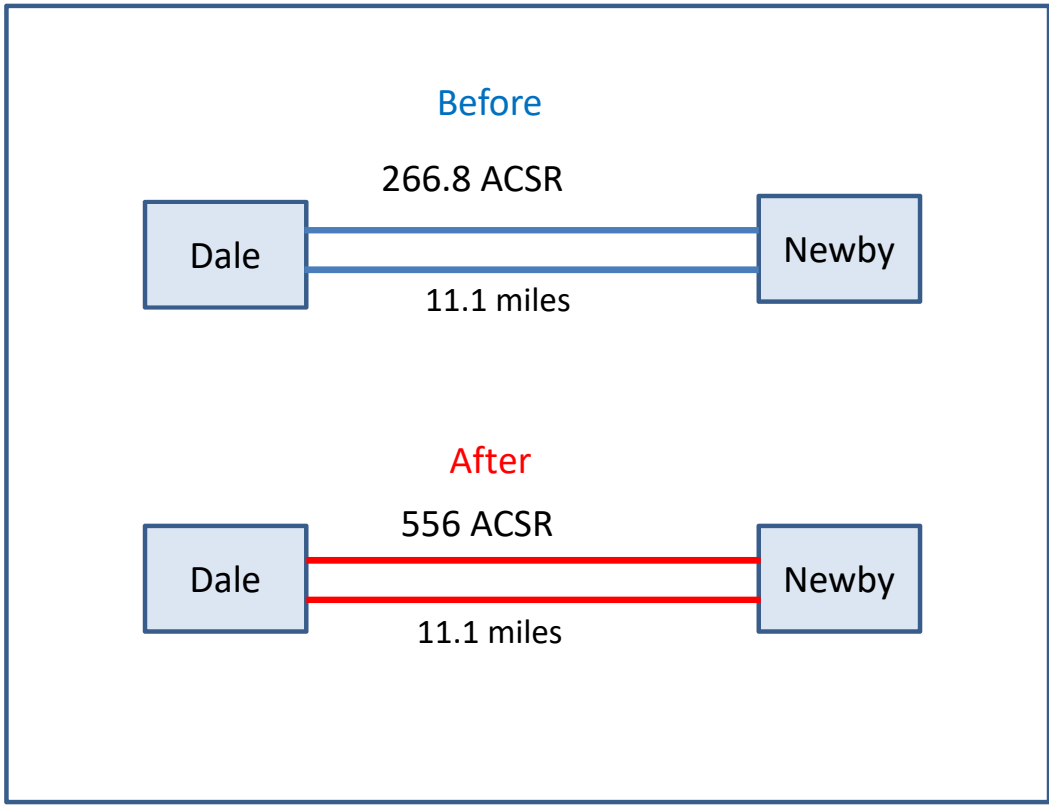
Alternative 4 - Retire Dale-Newby; Construct EK Fawkes-Newby 138 kV and rebuild Newby as 138/12.5 KV to serve from new line.

Transmission Cost: $14.2M

Projected In-Service: 12/31/2028

Project Status: Engineering

Model: N/A



AEP Transmission Zone: Supplemental
Albion Area Improvements

Need Number: AEP-2021-IM007
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting 5/21/2021

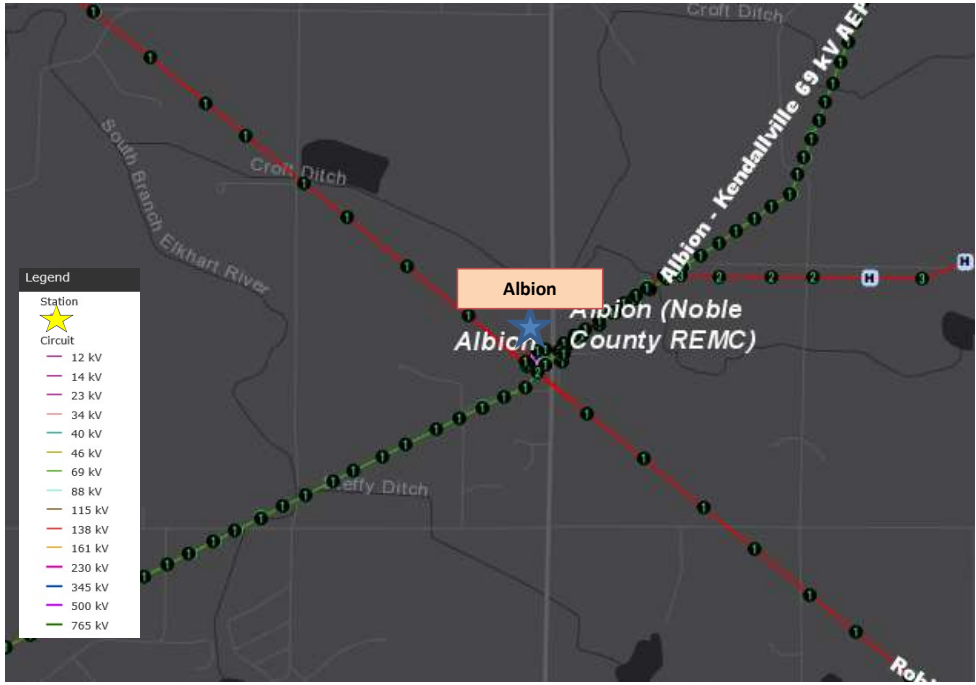
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Albion 138/69kV

- Circuit Breaker "F" is a 1994 138kV 145-PA type Breaker.
  - The 145-PA Type Breakers are experiencing marked increases in malfunctions. There have been 437 recorded malfunctions on 132 total units of this model type on the AEP System. The most common issues are related to loss of SF6 gas and mis-operations. The expected life of the bushing gaskets and door inspection port seals is 25 years. Seals that are no longer adequate can cause SF6 leaks to become more frequent. Low SF6 pressure in the breaker reduces the ability of the breaker to correctly interrupt a fault. Additionally, low pressure alarms and SF6 leaks lead to increased maintenance costs. The manufacturer provides no support or parts for this model of circuit breakers. Finally, SF6 leaks impact the environment.
  - This breaker has experienced 17 faults, over the manufacturer recommended 10.
- Cap Switcher "BB" is a 1980's vintage 138kV Mark V Cap Switcher.
  - Due to numerous malfunctions, cost of repair and lack of monitoring, AEP is replacing these units where viable.

Model: N/A

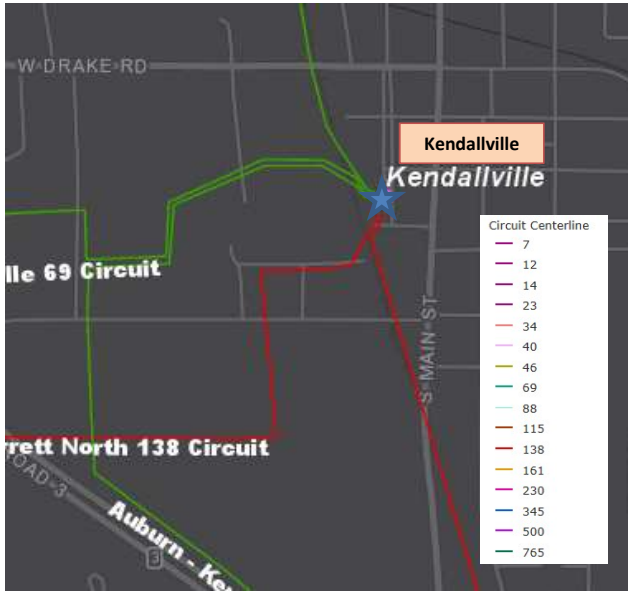


AEP Transmission Zone: Supplemental
Albion Area Improvements

Need Number: AEP-2020-IM026
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting 11/20/2020
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Kendallville 138/69kV Station:

138/69kV Transformer 1
- Manufactured in 1971
- Transformer has increased levels of Ethane and CO2 indicated in the dissolved gas analysis
- Increased levels of CO2 and Ethane indicates decomposition of the paper insulating materials, which impairs the units ability to withstand faults.
- The downward Interfacial Tension trend paired with upward power factor trend and increased moisture content indicate that there are increased particles within the oil, decreasing the dielectric strength of the transformer.



AEP Transmission Zone: Supplemental
Albion Area Improvements

Need Number: AEP-2021-IM006
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting 02/17/2021

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

- **Wolf Lake Tap 69kV ~5.44 Miles**
  - **Original Construction Date:** 1958
  - **Original Construction Type:** Wood pole with 4/0 ACSR conductor (57/68 structures original from 1958)
  - **Outage History (2015-2020)**
    - 697,305 CMI with 8 momentary and 1 permanent outages
    - Radial service to Wolf Lake. Radial service severely restricts the ability to perform routine maintenance and restoration activities, which can degrade the reliability of the associated lines/equipment in comparison to other non-radial facilities.
  - **Additional Info:**
    - 12 of 30 structures assessed by ground crew/UAV showed some level of wood pole decay
    - Structures do not meet 2017 NESC Grade B loading criteria, do not meet current AEP structural strength requirements, and do not meet the current ASCE structural strength requirements.

Model: N/A

AEP Transmission Zone: Supplemental
Albion Area Improvements

Need Number: AEP-2021-IM031
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting: 11/19/2021
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Albion – Kendallville 138kV line (9.75 miles):

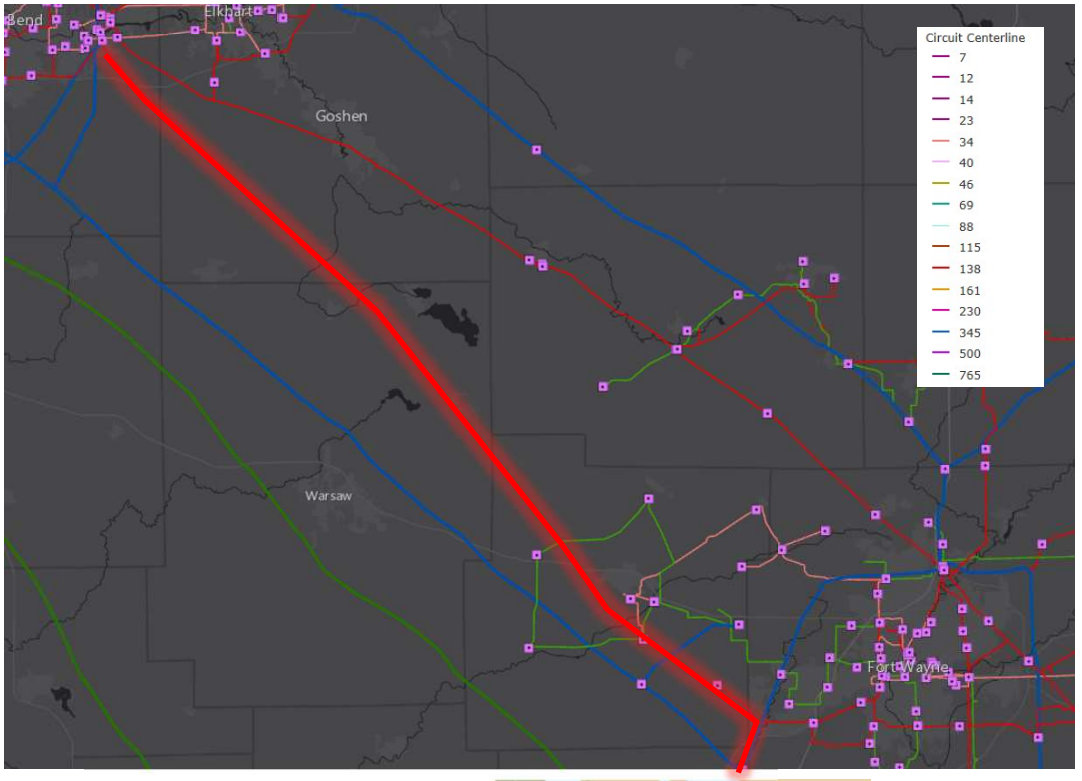
- 1972 wood H frame construction
- Since 2015 there have been 2 momentary outages to this line
- The structures on this line fail to meet NESC Grade B, AEP structural strength standards, grounding standards and shield angle requirements.
- 10 structures were investigated at the ground and 44 structures were assessed by drone. The following conditions were noted.
    - Nearly all structures had moderate to heavy insect or woodpecker damage, and light to moderate shell decay. A few also had decay pockets at ground line.
    - All H Frames have light to moderate decay
    - ~14% had flashed insulators
    - Light to moderate corrosion on hardware
- Currently 23 (25% of line) structures have at least one open condition
    - 28 total conditions include rotting, cracked, burnt, leaning or woodpecker affected structures; broken conductor, shield wire and ground lead wire

AEP Transmission Zone: Supplemental Albion Area Improvements

Need Number: AEP-2022-IM002
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting: 1/21/22
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Twin Branch - Sorenson 138kV line (65.1 miles):

- Line is 1949 Steel lattice construction
- Since 2014 there have been 6 momentary outages to this line
- Currently there are 172 (47%) structures with at least one open condition.
- Currently there are 222 open conditions including damaged legs, broken strands, damaged conductor, broken shield wire strand, broken/burnt insulators, broken/burnt insulators, or broken and missing shield wire hardware.
- The Shielding Angle is inadequate for AEP standards which can lead to poor performance of the line for lightening strikes.



AEP Transmission Zone: Supplemental
Albion Area Improvements

Need Number: AEP-2022-IM003
Process Stage: Solution Meeting 10/14/2022
Previously Presented: Needs Meeting: 1/21/2022
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:
Line Name: Richland – Tri Lakes 69kV

Original Install Date (Age): 1965

- Length of Line: 8.66 Miles
- Total structure count: 122
- Original Line Construction Type: 1960s Wood Pole
- Conductor Type: 4/0 ACSR
- Outage History since 2015
    - Momentary/Permanent Outages and Duration: 20 Momentary and 6 Permanent
    - CMI: 125,904
- Condition Summary
    - 71 structures (58%) have at least one open condition including cracked, rotten, woodpecker damaged and leaning poles; Chipped, Loose, Contaminated and rusted Insulators.
    - 40 representative structures were assessed by drone with 12 assessed by a ground crew. Of these the following was observed
        - Wood decay was moderate to advanced on structures at ground line and poles have rot top.

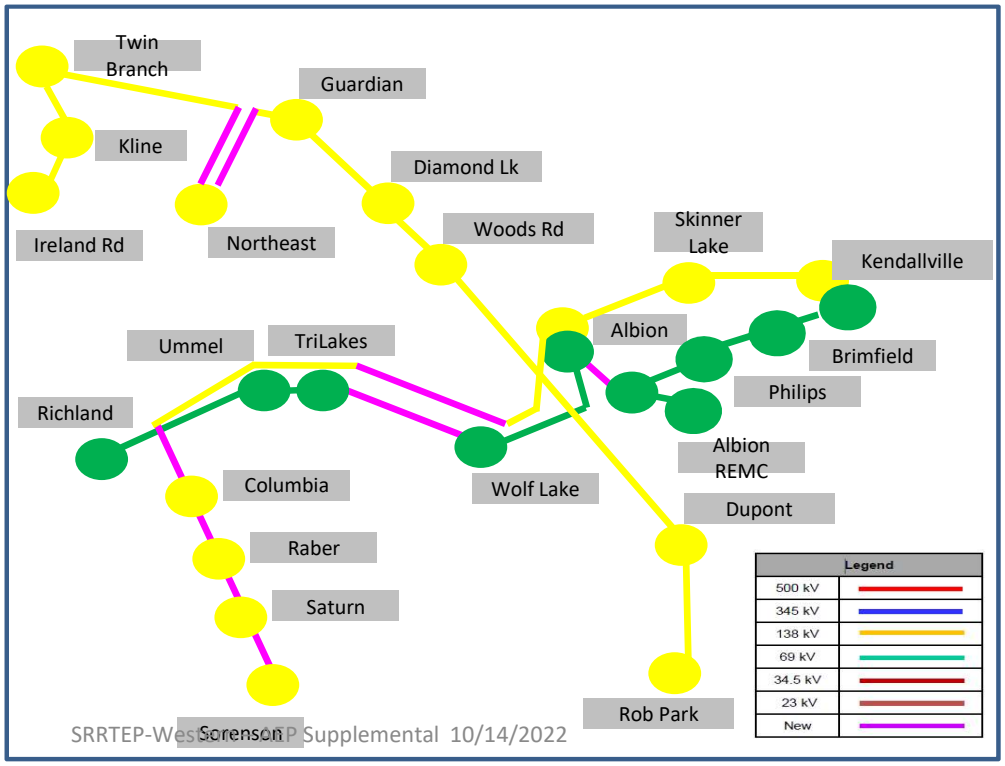
AEP Transmission Zone: Supplemental
Albion Area Improvements

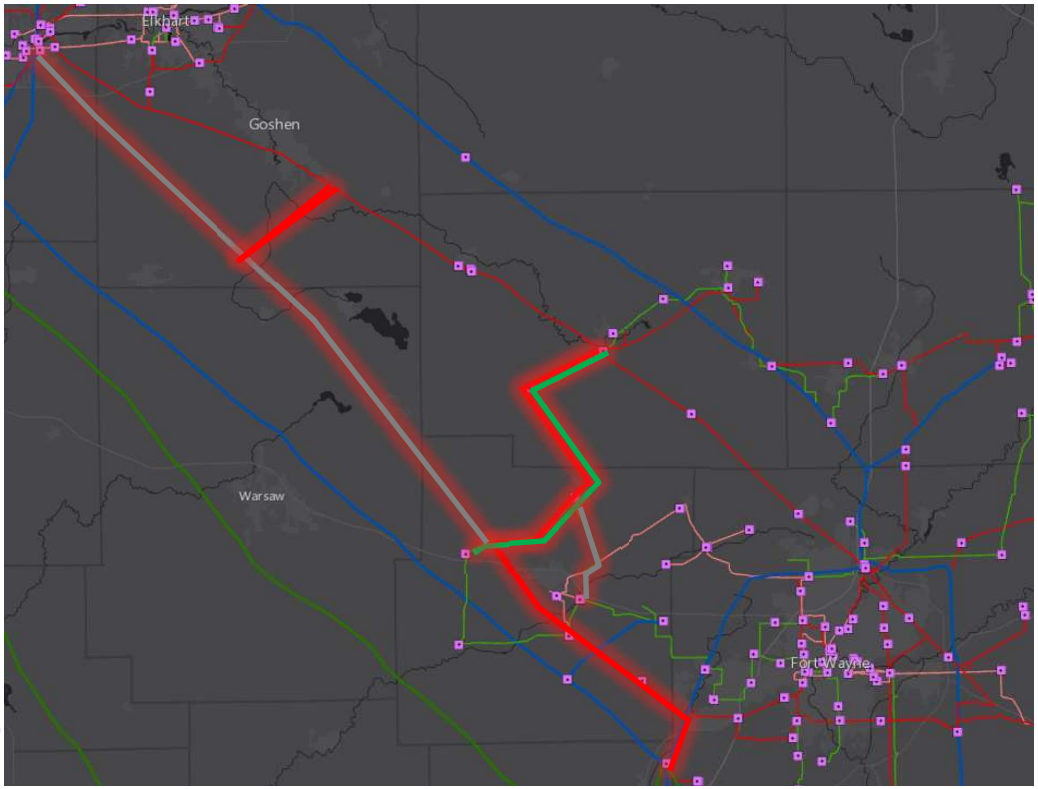
Need Number: AEP-2022-IM003, AEP-2021-IM031, AEP-2021-IM007, AEP-2021-IM006, AEP-2020-IM026 & AEP-2022-IM002

Process Stage: Solution Meeting 10/14/2022

138kV Plan summary

Twin Branch – Sorenson is a 65.1 mile 1940's line that AEP can retire due to other improvements made in the area and multiple paths on both 138 kV and 345 kV lines. By building Richland – Tri Lakes and Wolf Lake tap to 138kV double circuit standards in phase 1, the network is set up so that in phase 2, AEP will not need to rebuild the full 65.1 miles that exist currently and can instead retire a good portion of it.





AEP Transmission Zone: Supplemental
Albion Area Improvements Phase 1

Need Number: AEP-2022-IM003, AEP-2021-IM031, AEP-2021-IM007, AEP-2021-IM006, AEP-2020-IM026 & AEP-2022-IM002
Process Stage: Solution Meeting 10/14/2022

Proposed Phase 1 Solution:

Richland – Ummel/Tri Lakes 69kV line:
Rebuild the ~8.7 mile line using double circuit 138kV construction and 795 ACSR Drake construction but energize only one side at 69kV
Estimated Cost: $17.1M

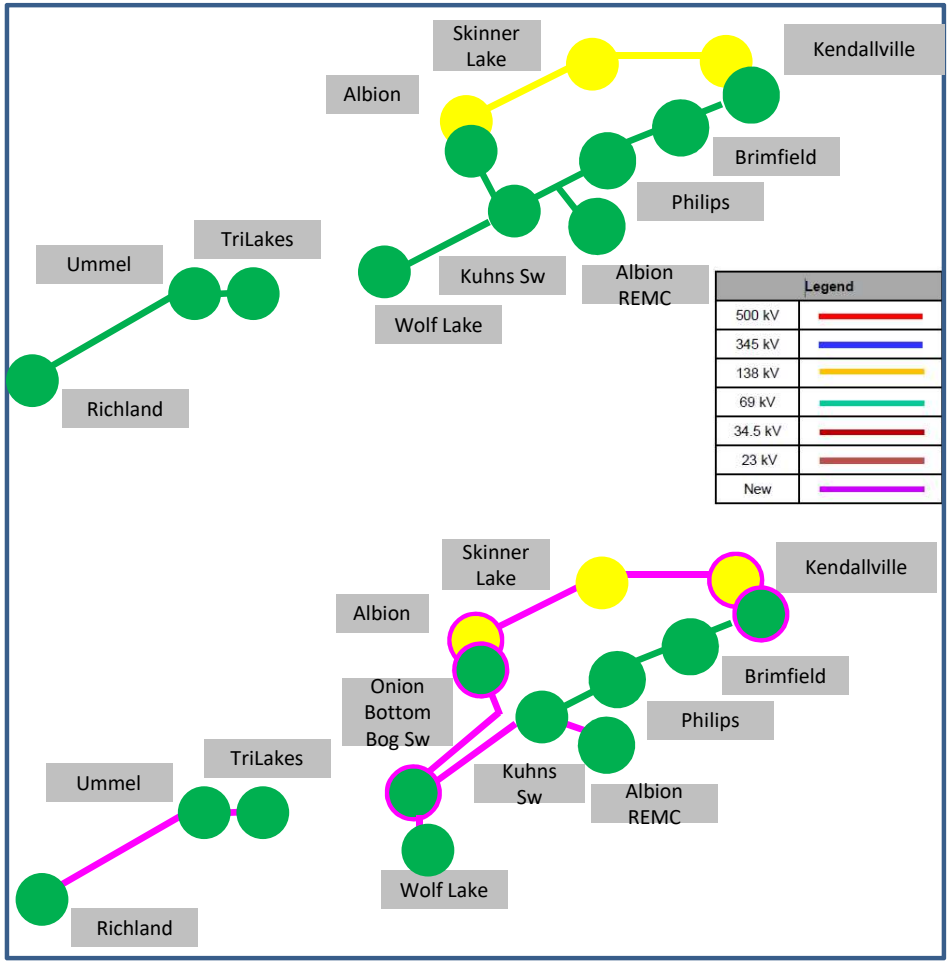
Rebuild the Albion – Kendallville 138kV
Rebuild the ~8.5 mile Albion – Kendallville 138kV circuit using 795 ACSR Drake
Estimated Cost: $15.8M

Wolf Lake 69kV Tap
Rebuild the ~5.5 mile Wolf Lake tap as double circuit 138kV using 795 ACSR Drake. This line will be energized at 69kV.
Estimated Cost: $13.6M

Albion 138/69kV:
Replace 138kV CB "F" and cap switcher "BB". In addition to this, this station had significant ancillary work needed including foundation repairs, new control cable runs and DICM installation. Construction at this station will be aligned with B3248
Estimated Cost: $ 4.6M

Kuhns / Albion REMC 69kV:
Reconnect Kuhns Sw to serve the currently hard tapped Albion REMC load

Estimated Cost: $0.6M



AEP Transmission Zone M-3 Process
Albion Area Improvements Phase 1

Need Number: AEP-2022-IM003, AEP-2021-IM031, AEP-2021-IM007, AEP-2021-IM006, AEP-2020-IM026 & AEP-2022-IM002
Process Stage: Solution Meeting 10/14/2022

Proposed Phase 1 Solution:

Albion REMC 69kV Radial Tap:
Reterminate the line into Kuhns Sw 69kV.
Estimated Cost: $0.2M

Albion – Kendallville 69kV Line:
Reterminate the line into Kuhns Sw 69kV.
Estimated Cost: $0.8M

Kendallville 138/69kV:
Replace the 138/69kV transformer with a 90MVA unit. This work will be aligned with S2431.
Estimated Cost: $2.2M

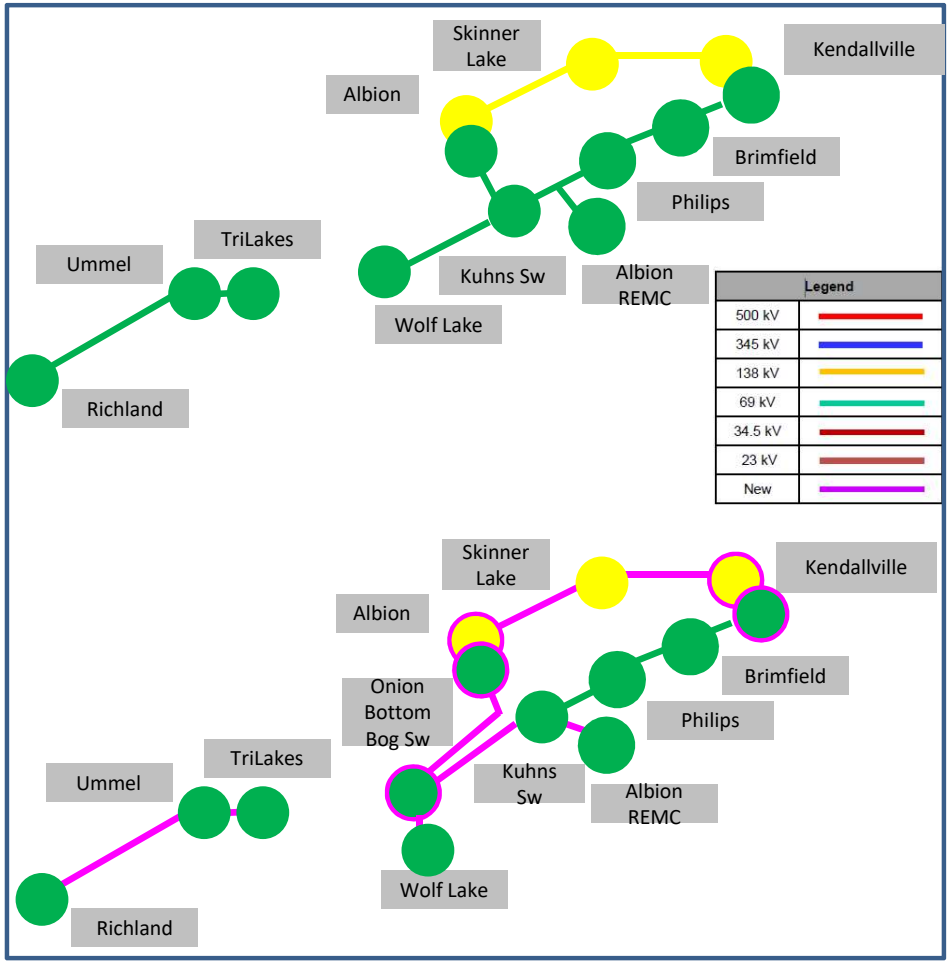
Onion Bottom Bog Sw/Wolf Lake 69kV
Install a 69kV POP "Onion Bottom Bog" Switch to serve Wolf Lake station. This switch will be re-used from the "Whitford Sw" that was removed with S2431

Estimated Cost: $ 0.4M

Total Estimated Transmission Cost (Phase 1): $55.3M

Projected In-Service: 11/3/2025

Project Status: Scoping



AEP Transmission Zone M-3 Process
Albion Area Improvements Phase 2

Need Number: AEP-2022-IM003, AEP-2021-IM031, AEP-2021-IM007, AEP-2021-IM006, AEP-2020-IM026 & AEP-2022-IM002
Process Stage: Solution Meeting 10/14/2022

Proposed Phase 2 Solution:

Rebuild ~21 miles of the circuit from Sorenson to north of Columbia. Retire the remaining 44.1 miles of the line. **Estimated Cost: $65.7M**

Build a new ~7.5 mile double circuit extension from the Twin Branch – Guardian line to connect the existing Northeast station. **Estimated Cost: $21M**

Build a new ~11.7 mile double circuit 138/69kV line from Tri Lakes – Onion Bottom Bog Sw and re-energize the 138kV circuit from Columbia – Albion. **Estimated Cost: $32.8M**

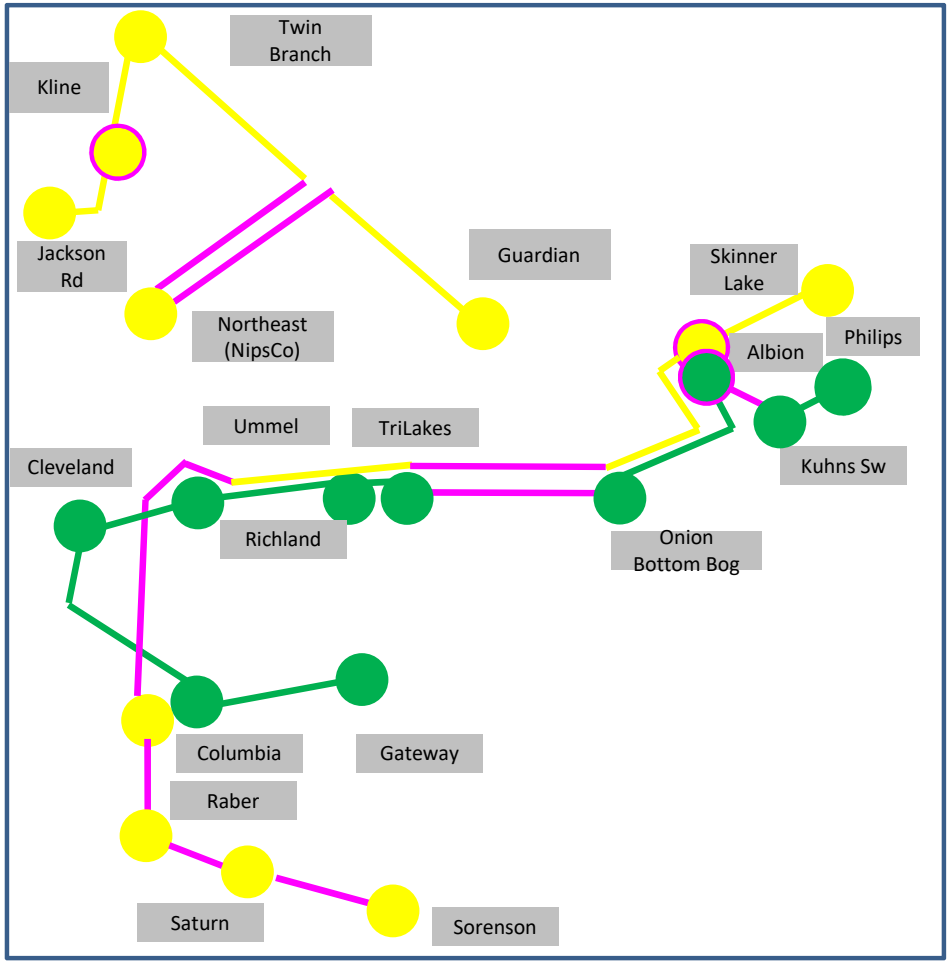
Retire the ~7.8 mile Tri Lakes – Gateway 69kV line. **Estimated Cost: $2.3M**

Install a new 138kV CB and a new 69kV CB to connect the new lines at Albion station. **Estimated Cost: $2M**

Reconnect Kline station to the Twin Branch – Jackson Rd 138kV line and install a new 138kV breaker. **Estimated Cost: $1M**

Total Estimated Transmission Cost (Phase 2): $124.8M

Projected In-Service: 12/1/2032
Project Status: Scoping



AEP Transmission Zone M-3 Process
Albion Area Improvements

Need Number: AEP-2022-IM003, AEP-2021-IM031, AEP-2021-IM007, AEP-2021-IM006, AEP-2020-IM026 & AEP-2022-IM002
Process Stage: Solution Meeting 10/14/2022

Alternatives Considered:
Alternate 1
Rebuild the ~65.1 mile Sorenson – Twin Branch 138kV as it exists today. Rebuild Richland – Tri Lakes as single circuit 69kV using 556.5 Dove ACSR and rebuild the Wolf Lake tap as single circuit 69kV using 556.5 Dove.
Cost: $215M

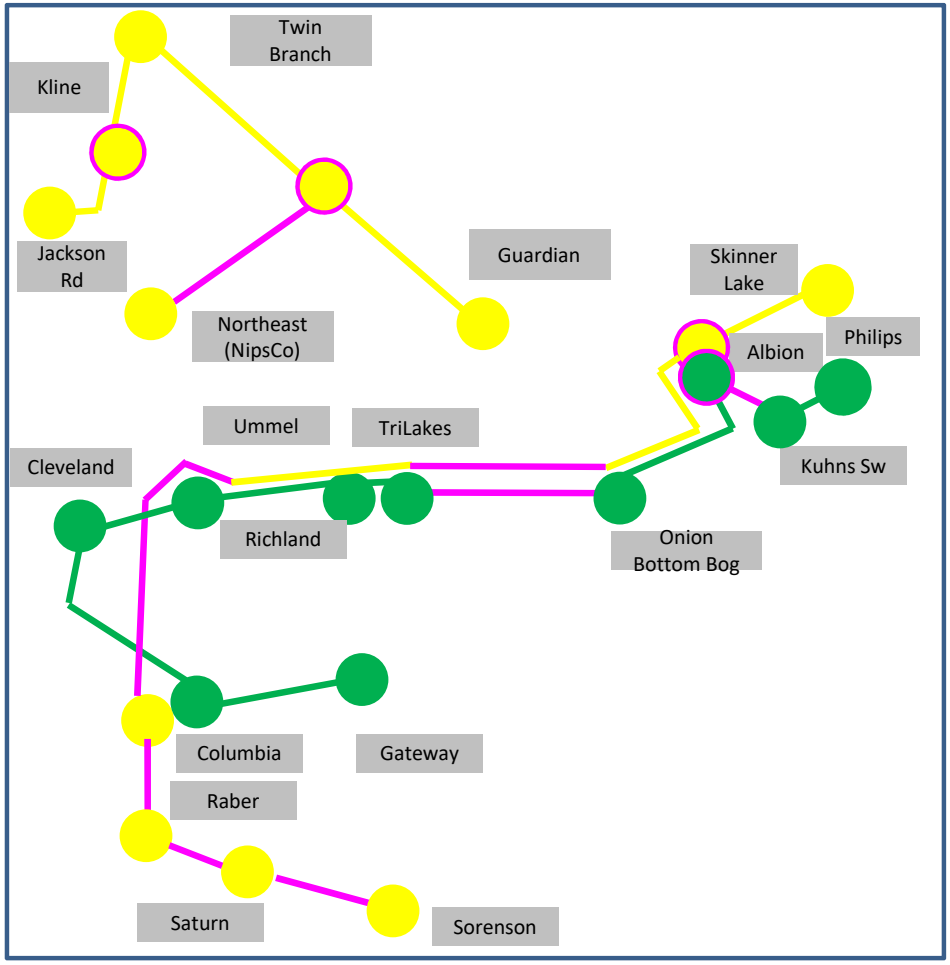
Alternate 2
Instead of building the Northeast Extension, Build a 3 breaker ring and run a single circuit 138kV line to Northeast station. This would be more expensive and would load up the NIPSCO Leesburg – Northeast line to over 97% for N-1-1 scenarios so it wasn't chosen.
Cost: $187M

Ancillary Benefits
By looping Wolf Lake, the customers at this station will have increased reliability.
By removing the hard tap feeding Albion REMC, the customers at this station will have improved reliability and the line will not be subject to extended outages due to customer equipment failures.
Looping Tri-Lakes into Onion Bottom Bog allows retirement of Tri-Lakes – Gateway 69kV which is a 1978 wood line.
This connection will also provide more voltage support to the Albion 69kV network

Total Estimated Transmission Cost: $180M

Projected In-Service: 11/3/2025

Project Status: Scoping



ComEd Transmission Zone M-3 Process
Line 15518

Need Number: ComEd-2022-004

Process Stage: Solutions Meeting 10/14/2022

Previously Presented: Need Meeting 8/19/2022

Project Driver:

Equipment Material Condition, Performance and Risk

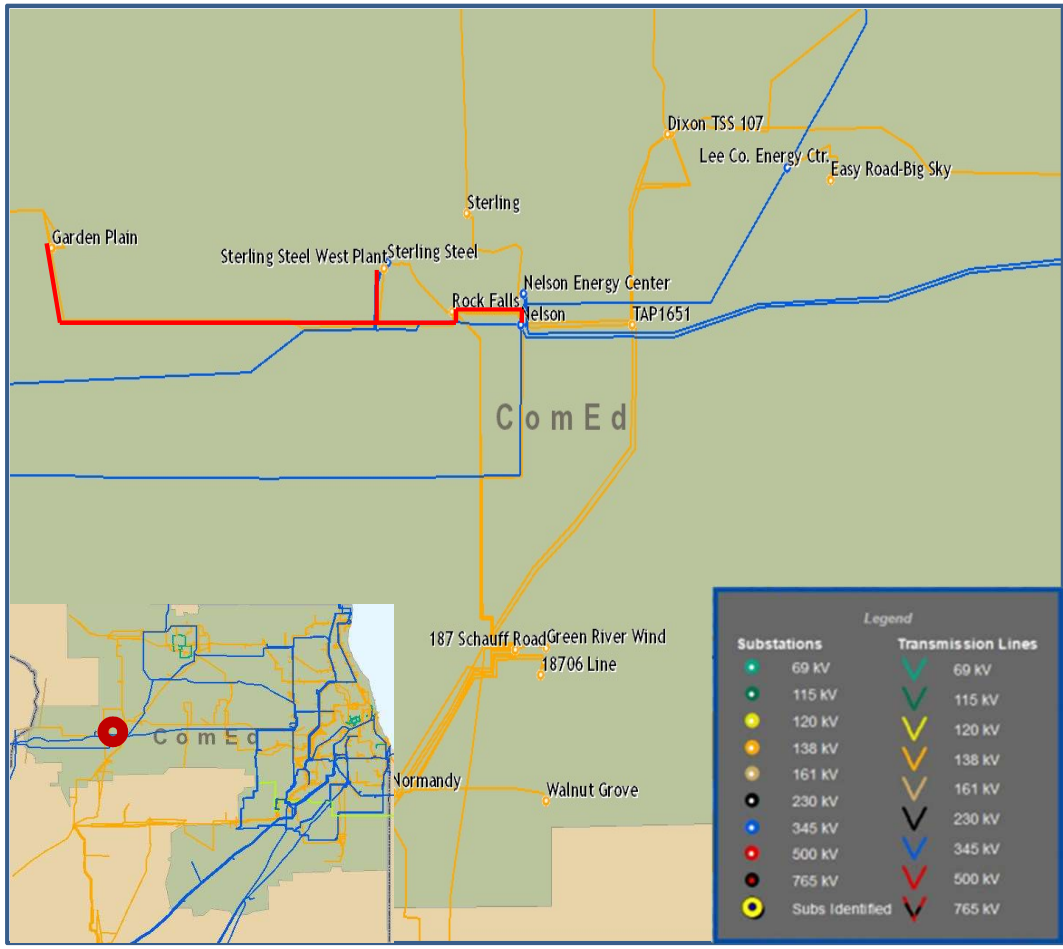
Operational Flexibility and Efficiency

Specific Assumption Reference:

- Transmission infrastructure replacements (EOL/condition/obsolescence) that are consistent with efficient asset management decisions
- Programmatic review and/or replacement of breakers, relays, wood poles, etc.
- Enhancing system functionality, flexibility, visibility, or operability

Problem Statement: 138 kV L15518 is a three-terminal line between Rock Falls, Nelson, and Garden Plain.

- 202 structures built in 1965 with single wood poles are undersized by today's standards
- 104 structures built in 1951 are wood H-frame construction and are reaching end-of-life.
- In 2020 two different wind events caused failure of 11 wood pole structures. Another wood pole failed in the spring of 2022.
- An area of loose peat is causing existing structures to lean which require costly repairs.



ComEd Transmission Zone M-3 Process
Line 15518

Need Number: ComEd-2022-004

Process Stage: Solutions Meeting 10/14/2022

Proposed Solution:

Rebuild 23 miles of wood poles with 1113 kCMIL conductor on steel towers. Eliminate three terminal line by extending 1113 kCMIL conductor from Rock Falls to the structure going to Garden Plain.

Line Rating capability:

Description	Summer Normal	Summer Emergency	Winter Normal	Winter Emergency
Existing	114	182	172	202
Proposed	351	449	421	500

Estimated Cost: $ 94M

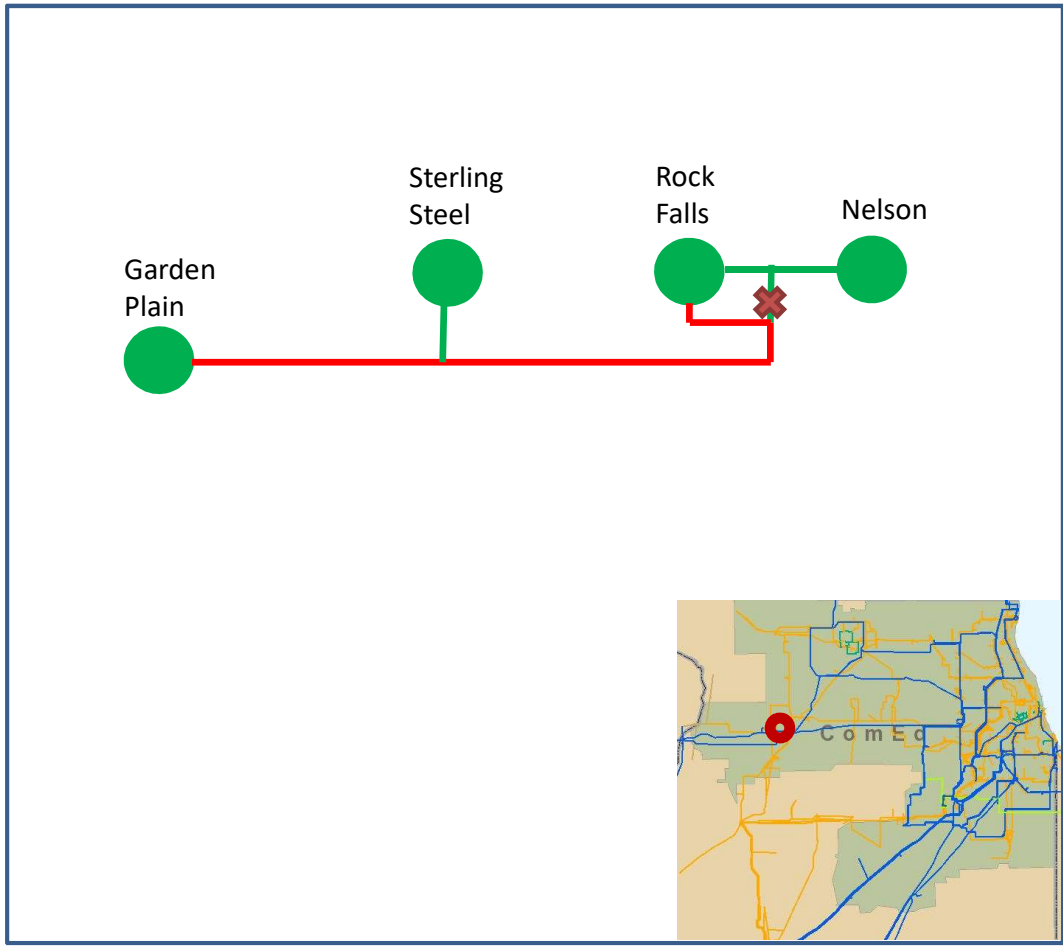
Alternatives Considered:

None

Projected In-Service: 12/31/2026

Project Status: Conceptual

Model: RTEP 2027



ComEd Transmission Zone M-3 Process
Waterman

Need Number: ComEd-2022-005

Process Stage: Solutions Meeting 10/14/2022

Previously Presented: Need Meeting 8/19/2022

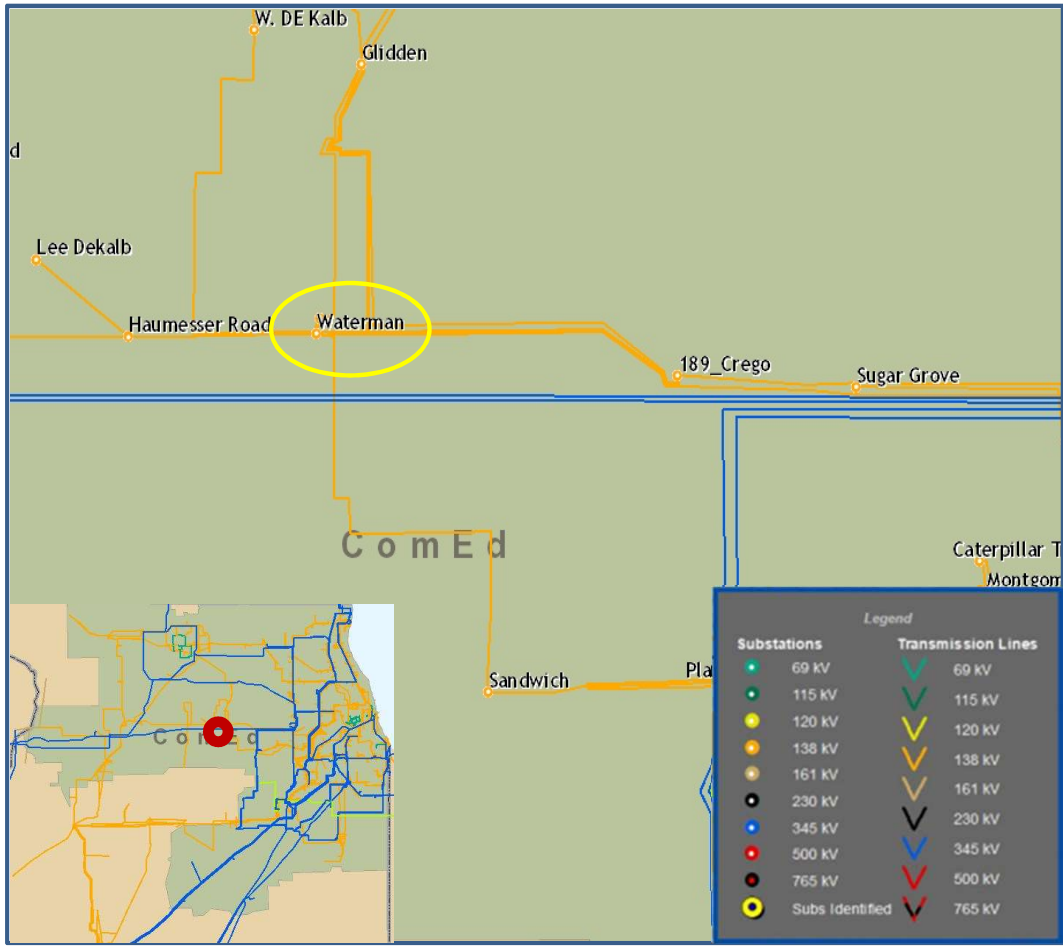
Project Driver:

Customer Service

Specific Assumption Reference:

- Transmission System configuration changes due to new or expansion of existing distribution substations

Problem Statement: Distribution load is increasing by 18 MVA at Waterman by 12/31/2023.



ComEd Transmission Zone M-3 Process
Waterman

Need Number: ComEd-2022-005

Process Stage: Solutions Meeting 10/14/2022

Proposed Solution:

Expand 138 kV bus at Waterman and install 138-34 kV 60 MVA transformer. Reconfigure 138 kV bus at Waterman and install 138 kV line CBs on Waterman to Crego 138 kV line and Waterman to Haumesser Road 138 kV line.

Estimated Transmission Cost: $ 11.4 M

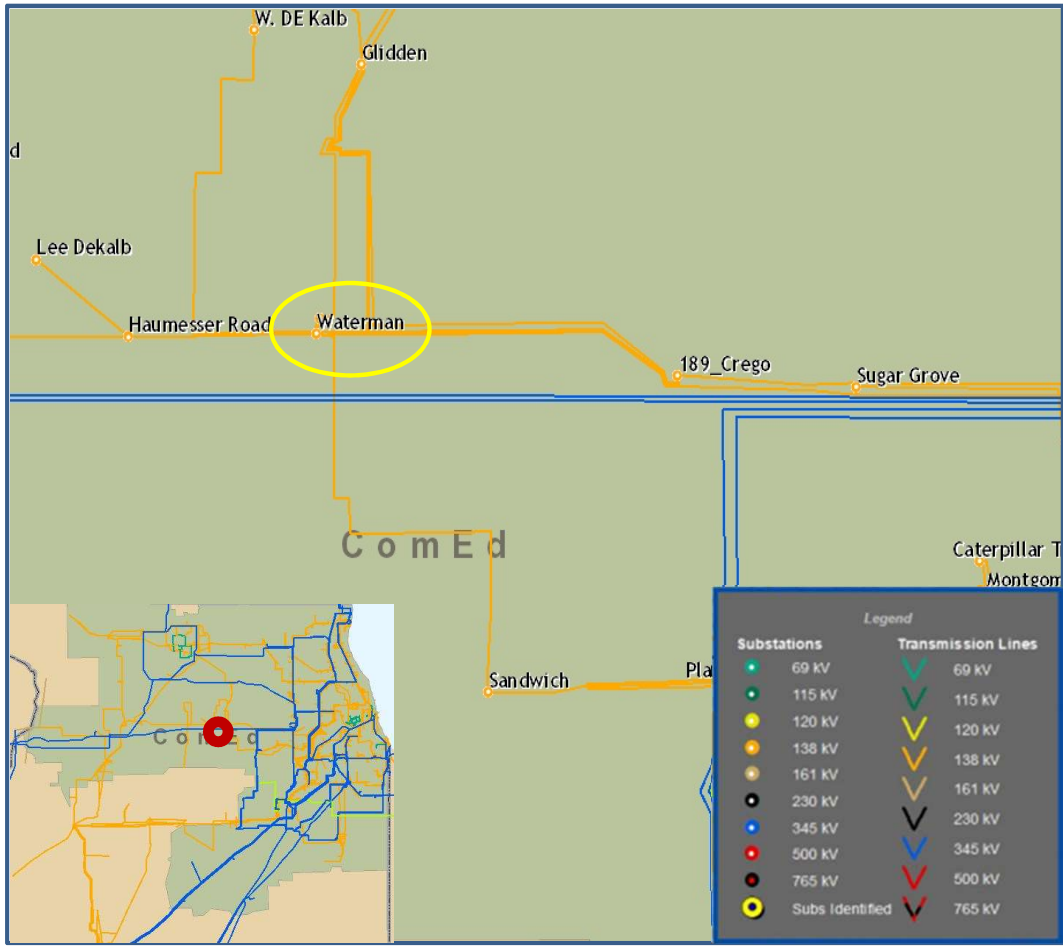
Alternatives Considered:

None

Projected In-Service: 12/31/2023

Project Status: Engineering

Model: RTEP 2027



EKPC Transmission Zone M-3 Process
Dale – Newby 69 KV

Need Number: EKPC-2022-004

Process Stage: Solution Meeting – October 14, 2022

Previously Presented:

Needs Meeting –May 19, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

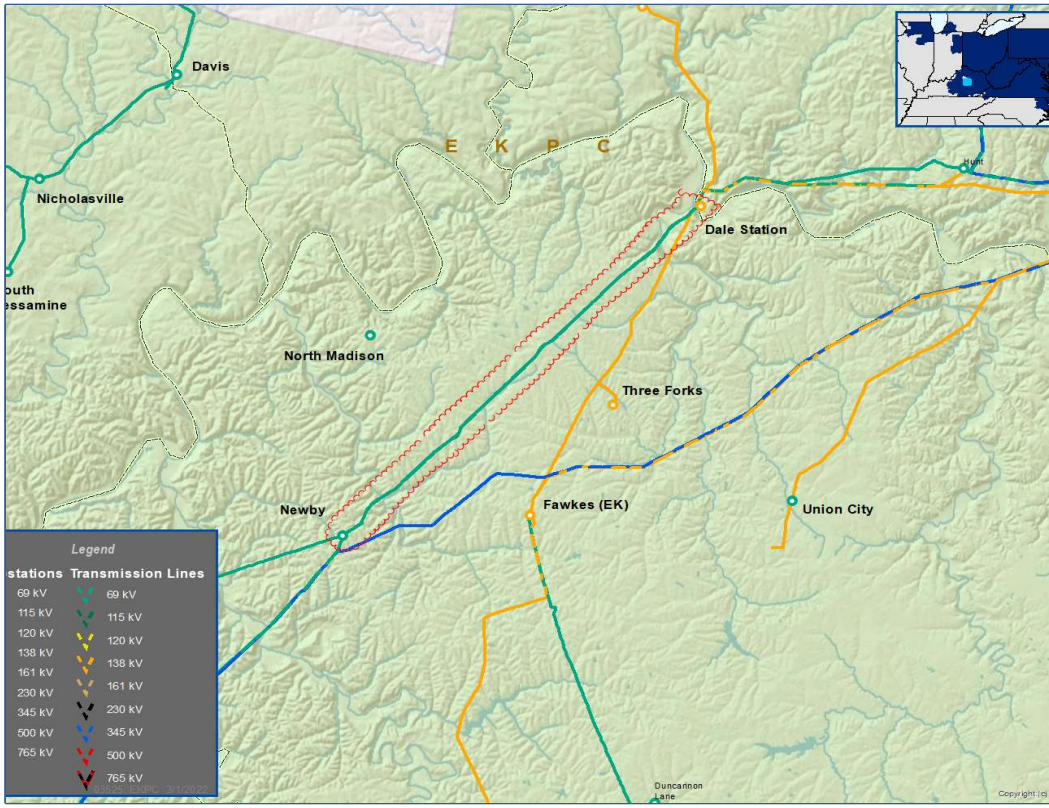
EKPC Assumptions Presentation Slides 13

Problem Statement:

The 11.1 mile, Dale - Newby double circuit 69 KV transmission line section is 70 years old.

Testing from the LineVue robot from Kinectrics Corporation deemed the condition of the line as unacceptable. The testing identified instances of rusting, pitting, and broken strands. Based on this testing information, the EKPC Reliability team has concluded that this line should be addressed due to the condition assessment.

Model: N/A



EKPC Transmission Zone M-3 Process
Dale-Newby 69 KV

Need Number: EKPC-2022-004

Process Stage: Solutions Meeting – October 14, 2022

Proposed Solution:

Rebuild 11.1 mile Dale-Newby line section as double-circuit 69 kV using 556 ACSR Conductor.

Transmission Cost: $12.6M

Ancillary Benefits:

- None

Alternatives Considered:

Alternative 1 - Retire Dale-Newby; Construct a new 69 KV line from Fawkes-Crooksville to serve Newby.

Transmission Cost: $5.8M

Alternative 2 - Retire Dale-Newby; Construct a new 138 KV line from Fawkes-West Berea. Rebuild Newby as 138/12.5 KV to serve Newby from new line.

Transmission Cost: $8.5M

Alternative 3 - Rebuild Dale-Newby as single-circuit 69 kV and serve Newby from this line. Construct 69 KV line from Lancaster to Toddville.

Transmission Cost: $18.1M

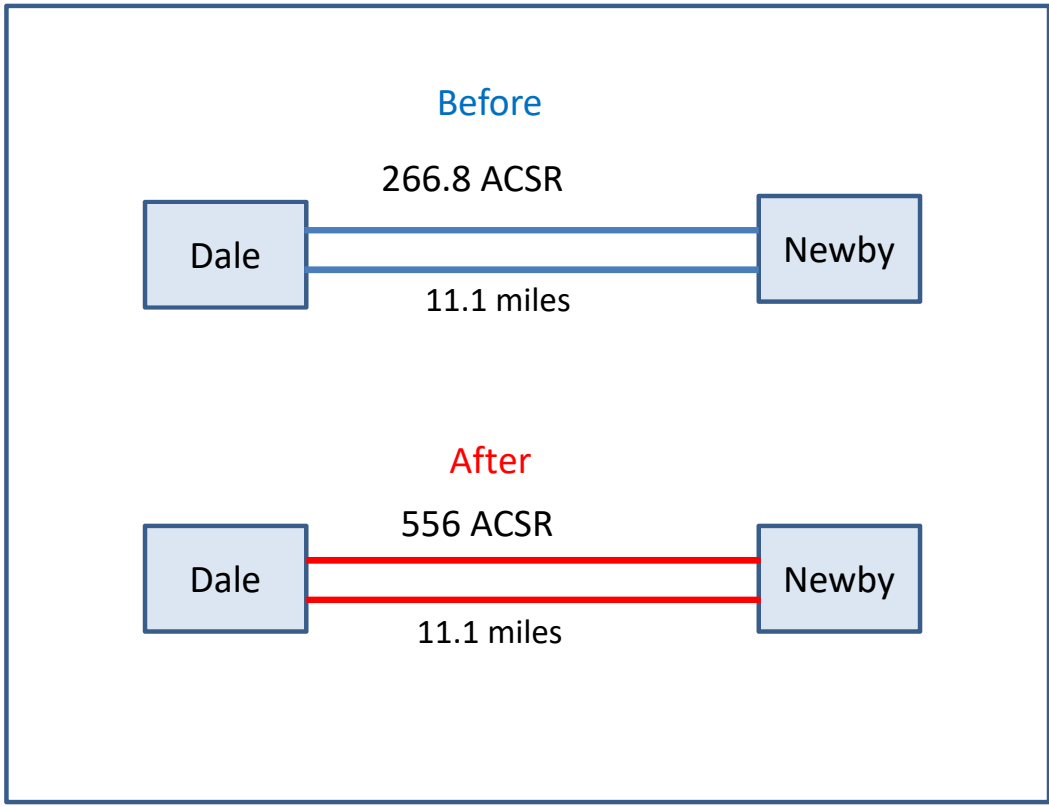
Alternative 4 - Retire Dale-Newby; Construct EK Fawkes-Newby 138 kV and rebuild Newby as 138/12.5 KV to serve from new line.

Transmission Cost: $14.2M

Projected In-Service: 12/31/2028

Project Status: Engineering

Model: N/A



EKPC Transmission Zone M-3 Process
Stephensburg – Vertrees 69 KV

Need Number: EKPC-2022-005

Process Stage: Solutions Meeting – November 18, 2022

Previously Presented:

Needs Meeting –October 14, 2022

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

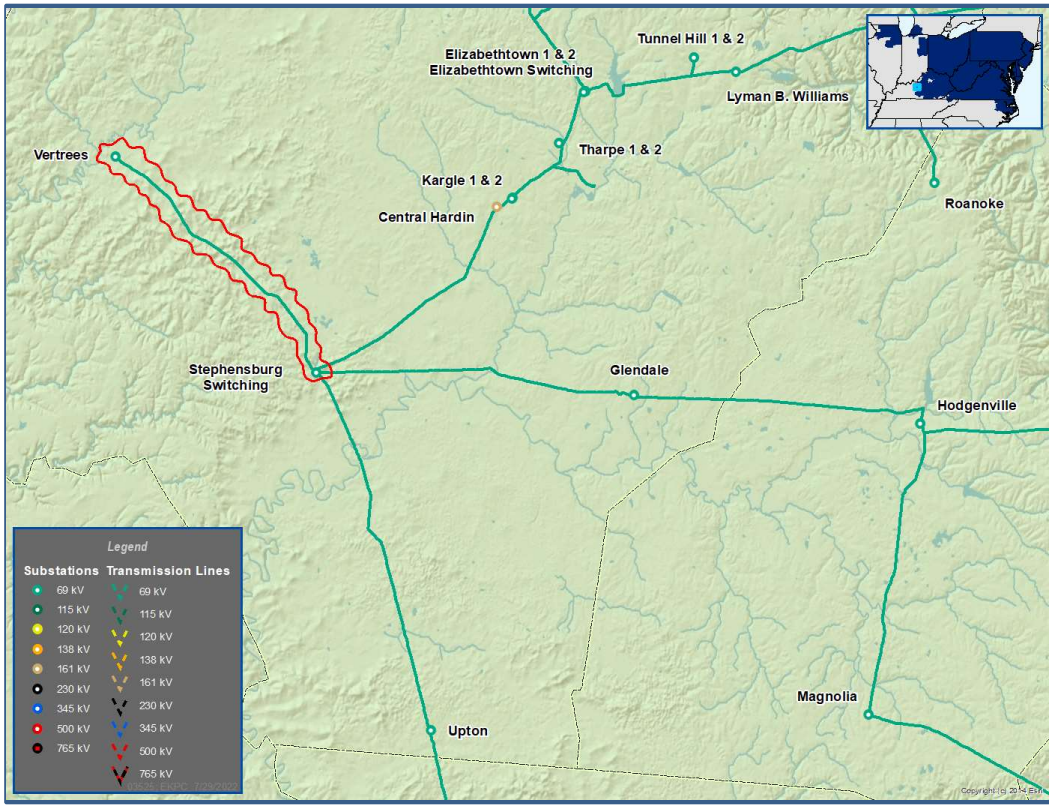
EKPC Assumptions Presentation Slides 13

Problem Statement:

The 8.7 mile, Stephensburg-Vertrees 69 KV transmission line section is 65 years old.

Testing from the LineVue robot from Kinectrics Corporation deemed the condition of the line as unacceptable. The testing identified instances of rusting, pitting, and broken strands. Based on this testing information, the EKPC Reliability team has concluded that this line should be addressed due to the condition assessment.

Model: N/A



EKPC Transmission Zone M-3 Process
Stephensburg – Vertrees 69 KV

Need Number: EKPC-2022-005

Process Stage: Solutions Meeting – November 18, 2022

Proposed Solution:

Build a new 8.7 mile Stephensburg – Vertrees 69 KV line using 556 ACSR/TW conductor adjacent to the existing line section. Retire the existing line section.

Distribution Cost: $6.83M

Transmission Cost: $0.0M

Ancillary Benefits:

- None

Alternatives Considered:

Alternative 1 – Build a new Vertrees – Rineyville (9.46 miles) 69 KV line section and retire the existing Stephensburg – Vertrees line section. Rebuild Tharp Tap-Elizabethtown KU using 954 ACSR and increase the maximum operating temperature of the EK Elizabethtown-Tharp Tap to 302F.

Distribution Cost: $10.7M

Transmission Cost: $1.4M

Alternative 2 – Build a new Vertrees-Rineyville (9.46 miles) 69 KV line section using 556 ACSR and rebuild Stephensburg –Vertrees using 556 ACSR (8.7 miles).

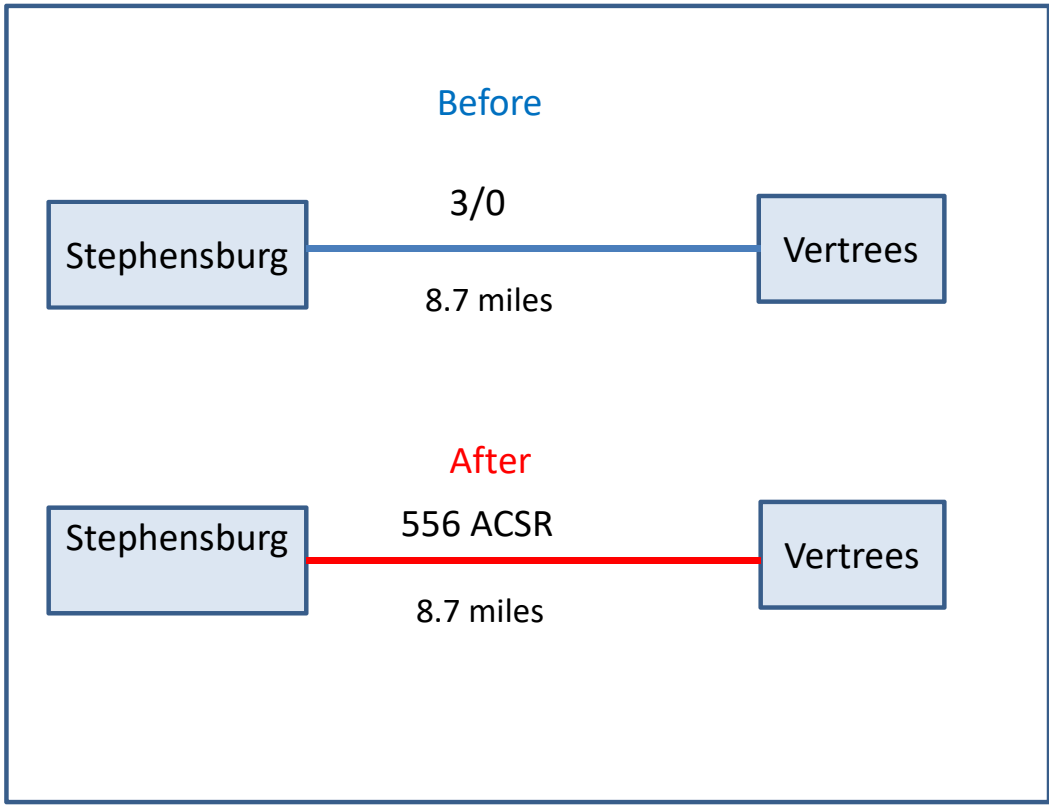
Distribution Cost: $0.0M

Transmission Cost: $17.5M

Projected In-Service: 6/1/2024

Project Status: Engineering

Model: N/A



EKPC Transmission Zone M-3 Process
Laurel Co Industrial Area 69 KV

Need Number: EKPC-2022-006

Process Stage: Solutions Meeting – November 18, 2022

Previously Presented:

Needs Meeting –October 14, 2022

Specific Assumption Reference:

EKPC Assumptions Presentation Slides 15

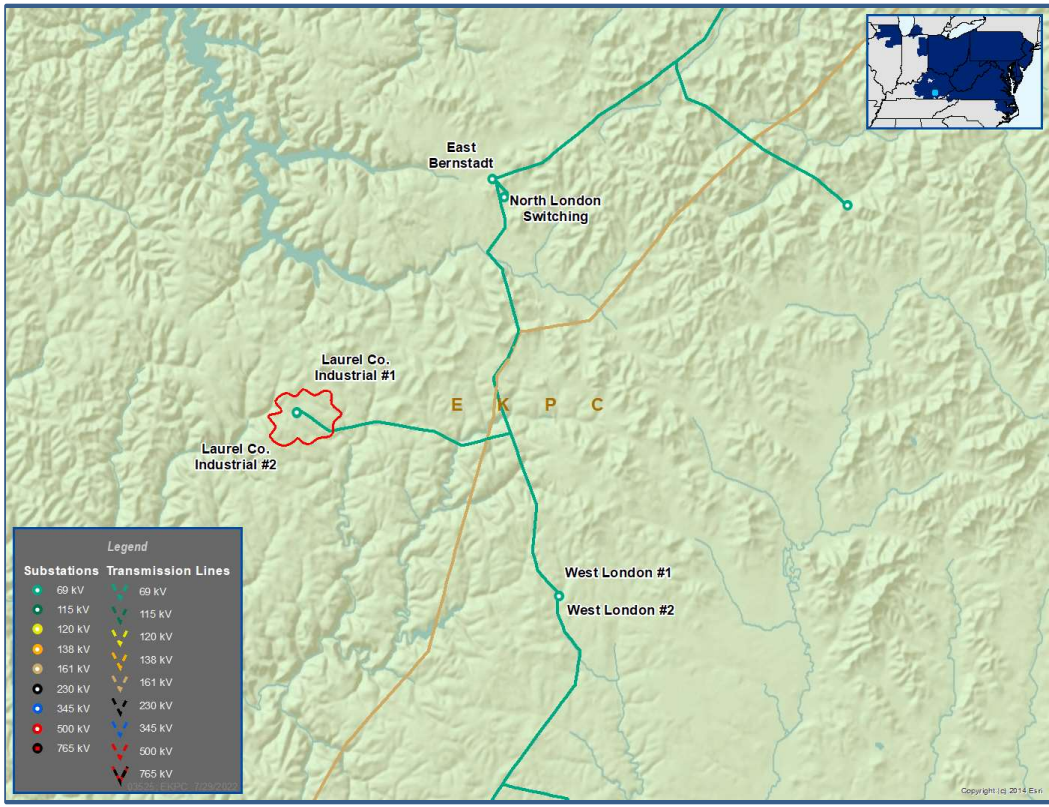
Problem Statement:

The load in the area of the Laurel County Industrial distribution substation has expanded to the maximum capacity of the Laurel County Industrial #1 11.2/14 MVA distribution transformer. Additionally, an industrial customer served from this substation is planning an expansion to add additional load, this would cause the load to exceed the maximum rating of the distribution transformer.

The 69 KV circuit that serves this area currently feeds six distribution substations with one serving a critical hospital load. Distribution outages in the area have been exacerbated due to limited distribution back feed capabilities, limited by loading of nearby distribution feeders.

A solution is needed to address these issues to improve the reliability of the distribution system in the area.

Model: N/A



EKPC Transmission Zone M-3 Process
Laurel Co Industrial Area 69 KV

Need Number: EKPC-2022-006

Process Stage: Solutions Meeting – November 18, 2022

Proposed Solution:

Build a new Dav Lane 4 breaker 69 KV switching station with a 69/12.47 KV, 12/16/20 MVA distribution substation, near the Laurel Co Industrial tap point.

Distribution Cost: $2.9M

Transmission Cost: $3.8M

Ancillary Benefits:

- Increased reliability to critical loads
- Provides operational flexibility
- Reduces restoration times

Alternatives Considered:

Alternative 1 – Build a new Dav Lane 69/12.47 KV, 12/16/20 MVA distribution substation. Construct a new 0.3 mile 69 KV tap line to serve the new distribution station from the North London-Laurel Co Industrial Tap 69 KV transmission line. Create a normally open connection at the Dave Lane tap point to the West London substation. Install a capacitor bank at the new Dav Lane station.

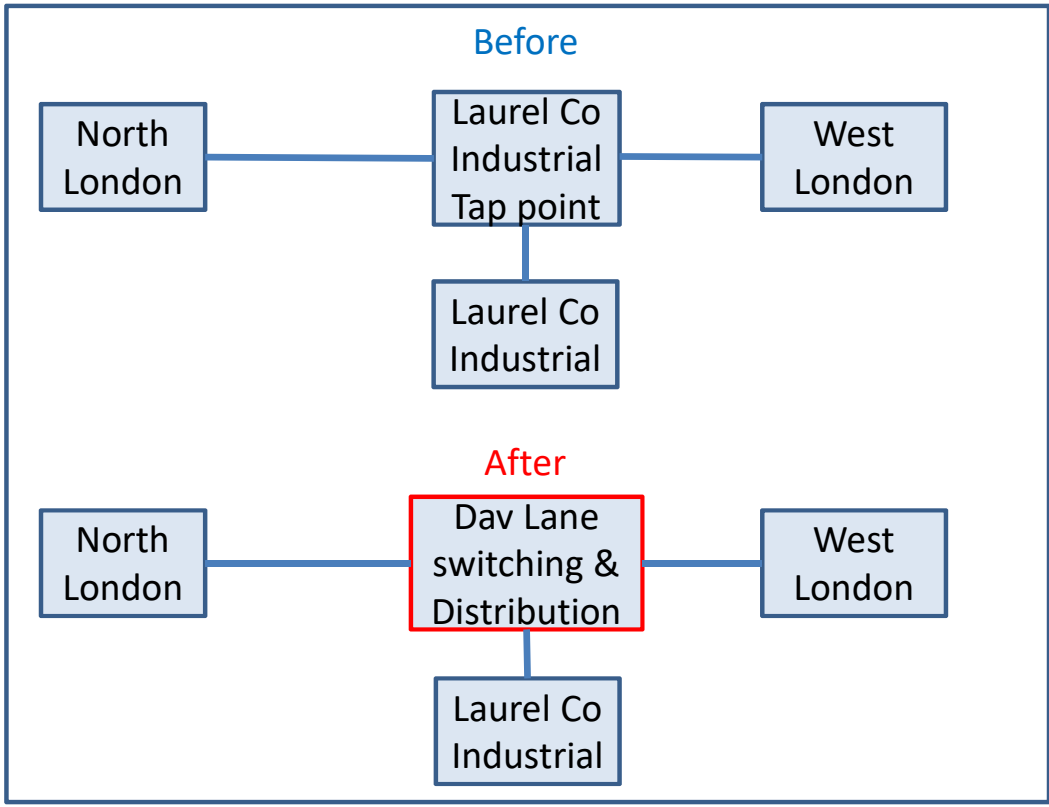
Distribution Cost: $4M

Transmission Cost: $0.6M

Projected In-Service: 6/1/2024

Project Status: Engineering

Model: N/A



EKPC Transmission Zone M-3 Process
Cincinnati/Northern KY Airport Area Customer Service

Need Number: EKPC-2020-002

Process Stage: Solution Meeting – November 18, 2022

Previously Presented:

Needs Meeting –March 19, 2020

Supplemental Project Driver:

Customer Service

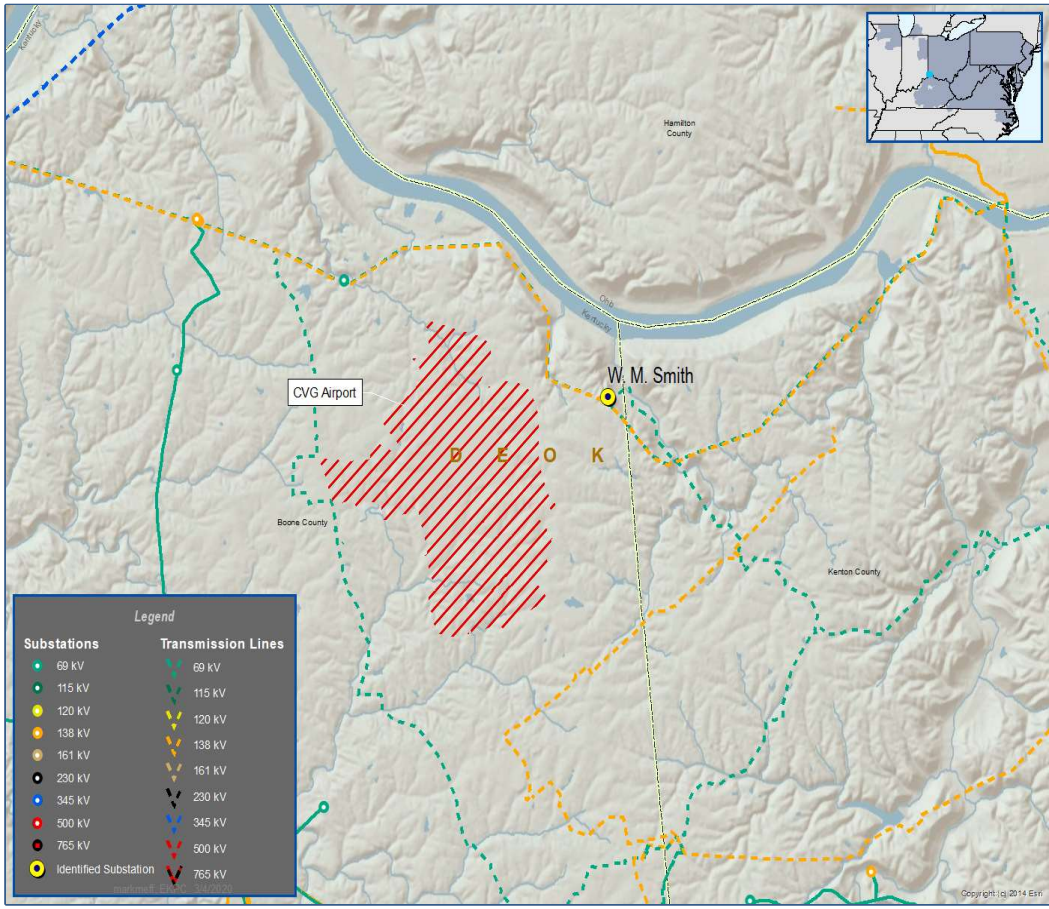
Specific Assumption Reference:

EKPC Assumptions Presentation Slide 15

Problem Statement:

The distribution cooperative serving the area in the vicinity of the Cincinnati/Northern Kentucky International Airport has requested that EKPC develop a solution to improve service reliability to customers, provide back-feed capability, and add substation transformer capacity for expected load growth in the area. This area is currently served by EKPC's W.M. Smith distribution substation. The footprint of that substation is compressed, and future expansion is not possible at that location. Additionally, the existing substation is located on the fringe of the load pocket and is not adjacent to the airport, where the growth is expected to occur.

Model: N/A



EKPC Transmission Zone M-3 Process
Cincinnati/Northern KY Airport Area Customer Service

Need Number: EKPC-2020-002

Process Stage: Solutions Meeting – November 18, 2022

Proposed Solution:
Install a new 69 KV breaker at EKPC's Hebron substation, construct a new 7.6 mile 69 kV transmission line from EKPC's Hebron 69 KV substation to serve a new 69-13.2 kV, 12/16/20 MVA Mineola Pike distribution substation.

Additionally, the Downing substation will be served from this new line section, resulting in changing the Downing normally closed connection to DEOK to a normally-open connection configuration.

Distribution Cost: $26.7M
Transmission Cost: $0.73M

Ancillary Benefits:

- Large long-term NITS savings
- Reduces reliance on foreign utilities
- Provides greater back-feed capabilities to the area

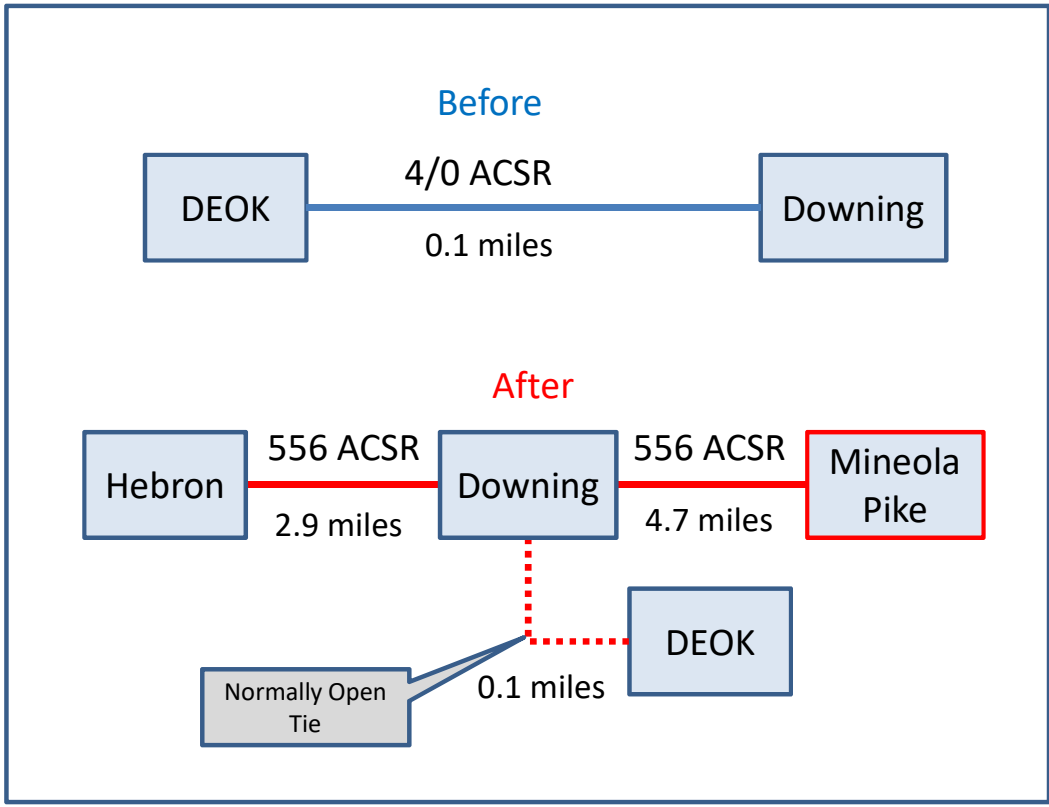
Alternatives Considered:
Install necessary infrastructure at DEOK's Constance 138 KV substation and construct a new 1.0 mile 138 kV transmission line from the Constance substation to serve a new 138-13.2 kV, 12/16/20 MVA Mineola Pike distribution substation.

Distribution Cost: $9.54M
Transmission Cost: $8.01M

Projected In-Service: 12/31/2024

Project Status: Engineering

Model: N/A



ATSI Transmission Zone M-3 Process
Shinrock-Oberlin-Henrietta 69 kV Line Solution

Need Number: ATSI-2022-014
Process Stage: Solution Meeting
Solutions Meeting: 11/18/2022
Process Stage: Need Meeting – 06/15/2022

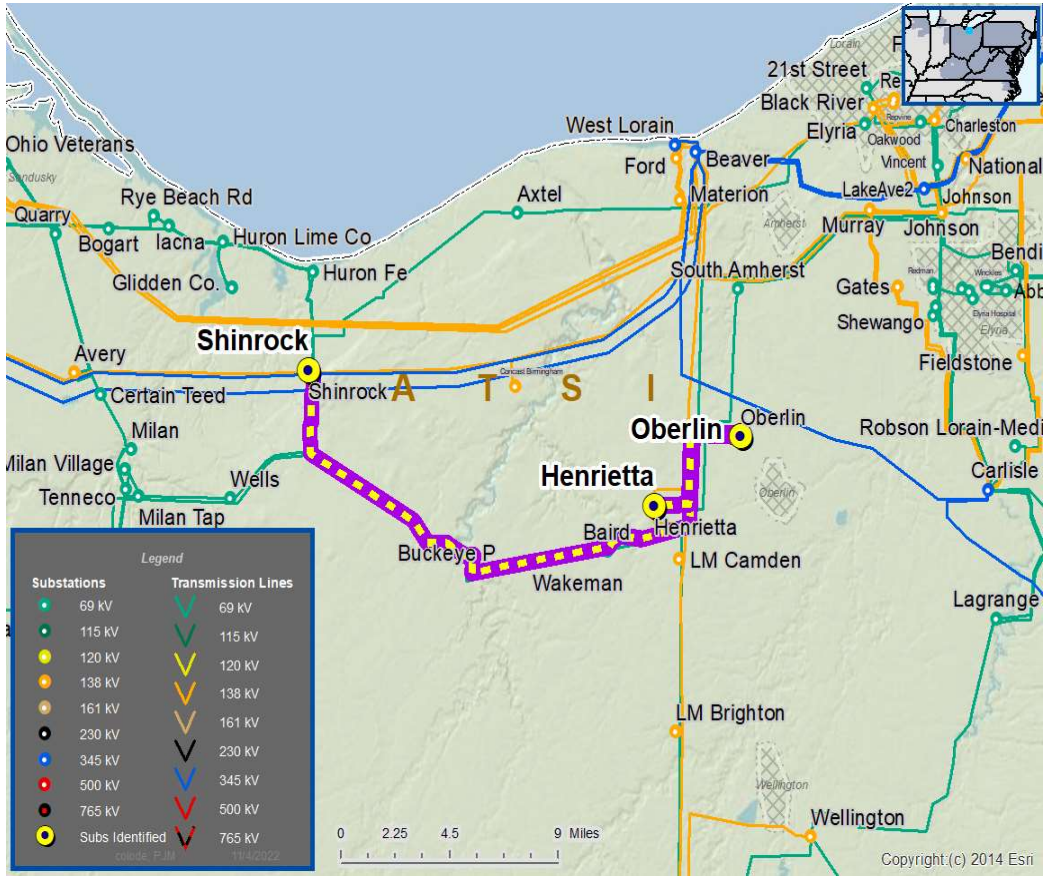
Supplemental Project Driver(s):
Equipment Material Condition, Performance, and Risk
Infrastructure Resilience

Specific Assumption Reference(s):
Global Factors

- System Reliability and Performance
- Increasing negative trend in maintenance findings
- Age/condition of transmission line conductor, hardware and structures
- Negatively impact customer outage frequency and/or duration

Problem Statement

- A common structure outage of the 69 kV line section (Shinrock-Oberlin & Henrietta-Oberlin 69 kV Line, approx. 1.6 miles) will result in a power outage of the Oberlin Muni substation impacting approximately 3,100 customers, 22 MW of load, and 19.2 MW of wholesale generation.
- A maintenance outage of the double circuit section of the 69 kV line (Shinrock-Oberlin & Henrietta-Oberlin 69 kV Line) will require an outage of the Oberlin Muni substation impacting approximately 3,100 customers, 22 MW of load, and 19.2 MW of wholesale generation.
- In 2021, the Oberlin Muni delivery point was outaged two times to address emergency repairs on the double circuit portion of the line (approx. 2-3 hours each outage).



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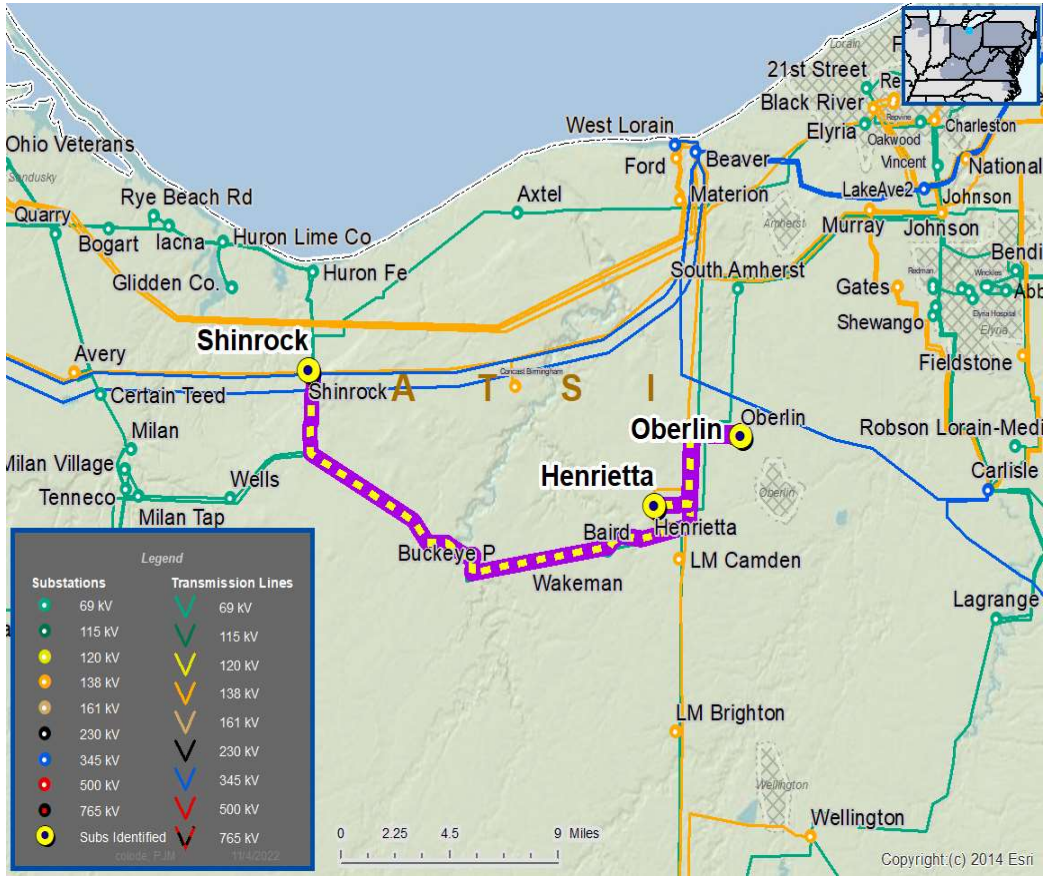
ATSI Transmission Zone M-3 Process
Shinrock-Oberlin-Henrietta 69 kV Line Solution

Need Number: ATSI-2022-014
Process Stage: Solution Meeting
Solutions Meeting: 11/18/2022
Process Stage: Need Meeting – 06/15/2022

Problem Statement

- A ground and aerial CVI inspection conducted in 2021 identified:
  - 18 of the 27 common structures on the 69 kV line section (Shinrock-Oberlin & Henrietta-Oberlin 69 kV Line) have defects including rotten and /or cracked wood poles, cracked crossarms and crossarm braces, woodpecker damage and worn static wire attachments
  - The Shinrock-Oberlin-Henrietta 69 kV Line (approx. 26 miles, excluding the common structure portion of the line), has a 25% defect rate consisting of rotten poles, crossarms, and braces along with cracked insulators, and worn hardware.
- Since 2016:
  - The Shinrock-Oberlin 69 kV Line had four (4) momentary and nine (9) sustained outages.
  - The Henrietta-Oberlin 69 kV Line had two (2) momentary and four (4) sustained outages.



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ATSI Transmission Zone M-3 Process
Shinrock-Oberlin 69 kV Line Solution-Phase 1

Need Number: ATSI-2022-014
Process Stage: Solution Meeting
Solutions Meeting: 11/18/2022
Process Stage: Need Meeting – 06/15/2022

Proposed Solution:

- Reroute and relocate the Shinrock-Oberlin Muni 69 kV line near structure 242 to the Oberlin Muni substation by building approximately 2.0 miles of new 69 kV line with 556 kcmil ACSR conductor in new ROW and on separate structures.
- Terminate new line and coordinate relay settings changes at Oberlin Muni substation.
- Revise relay settings at Shinrock substation.

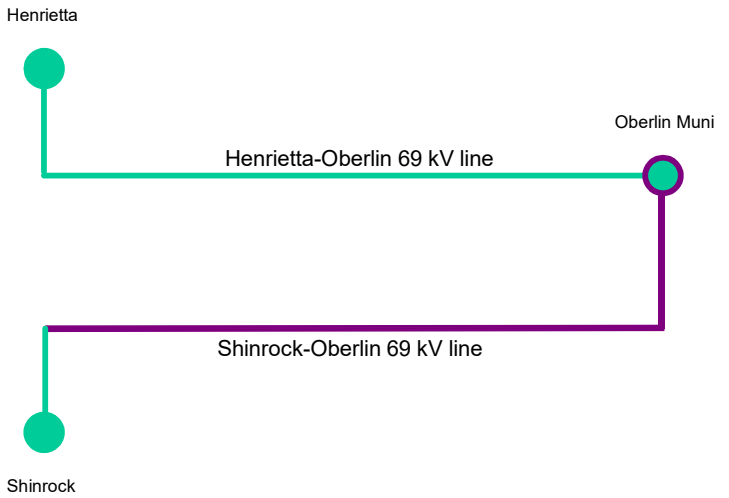
Transmission Line Ratings:

- No change in rating

Alternatives Considered:

- Maintain existing condition and risk of failure.

Estimated Project Cost: $7.3 M
Projected IS Date: 06/01/2024
Status: Engineering



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

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ATSI Transmission Zone M-3 Process
Henrietta-Oberlin 69 kV Line Solution-Phase 2

Need Number: ATSI-2022-014
Process Stage: Solution Meeting
Solutions Meeting: 11/18/2022
Process Stage: Need Meeting – 06/15/2022

Proposed Solution:

- Rebuild the double circuit portion of Shinrock-Oberlin and Henrietta – Oberlin lines into a single circuit from Henrietta to Oberlin Muni using 556.6 kcmil ACSR conductor.
- Remove the Shinrock-Oberlin Muni portion of the double circuit.
- Coordinate relay setting changes at Oberlin Muni substation.
- Revise relay settings at Henrietta substation.

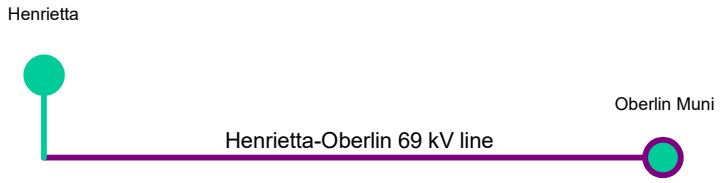
Transmission Line Ratings:

- Before Proposed Solution:
  - Henrietta-Oberlin: 76 MVA SN / 90 MVA SE, 87 MVA WN / 103 MVA WE
- After Proposed Solution:
  - Henrietta-Oberlin : 76 MVA SN / 90 MVA SE, 93 MVA WN / 103 MVA WE

Alternatives Considered:

- Maintain existing condition and risk of failure.

Estimated Project Cost: $3.8 M
Projected IS Date: 12/31/2024
Status: Engineering



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

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ATSI Transmission Zone M-3 Process
Shinrock-Oberlin 69 kV Line Solution-Phase 3

Need Number: ATSI-2022-014
Process Stage: Solution Meeting
Solutions Meeting: 11/18/2022
Process Stage: Need Meeting – 06/15/2022

Proposed Solution:

- Rebuild/rehab wood structures on Shinrock-Oberlin Muni 69 kV Line from Shinrock to structure 201 including taps to Baird and Buckeye Pipeline and reconductor line with 556 kcmil ACSR conductor. Wood structures heading north at structure 201 were installed in 2019 and are not in need of replacement.
- Upgrade substation conductor at Wakeman to make TL the most limiting element.
- Upgrade switches A-74, A-73, A-14, A-16, A-65, and A-45.
- Revise relay settings at Shinrock and Oberlin Muni substations.

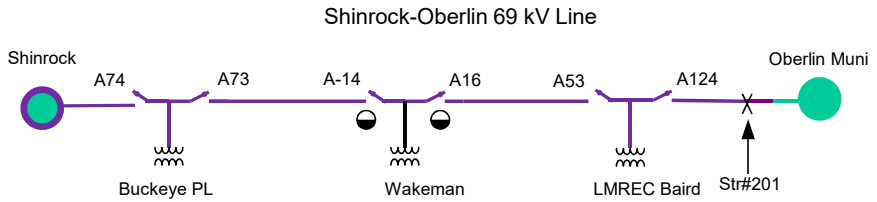
Transmission Line Ratings:

- Shinrock-Oberlin 69 kV Line
  - Before Proposed Solution:
    - Shinrock – Buckeye Tap: 76 MVA SN / 92 MVA SE, 87 MVA WN / 111 MVA WE
    - Buckeye Tap - Wakeman: 60 MVA SN / 62 MVA SE, 69 MVA WN / 69 MVA WE
    - Wakeman – LMREC Baird : 52 MVA SN / 53 MVA SE, 60 MVA WN / 60 MVA WE
    - LMREC Baird – Oberlin : 76 MVA SN / 90 MVA SE, 87 MVA WN / 103 MVA WE
  - After Proposed Solution:
    - Shinrock – Buckeye Tap: 111 MVA SN / 134 MVA SE, 125 MVA WN / 159 MVA WE
    - Buckeye T - Wakeman: 111 MVA SN / 134 MVA SE, 125 MVA WN / 159 MVA WE
    - Wakeman – LMREC Baird : 111 MVA SN / 134 MVA SE, 125 MVA WN / 159 MVA WE
    - LMREC Baird – Oberlin : 76 MVA SN / 90 MVA SE, 93 MVA WN / 103 MVA WE

Alternatives Considered:

- Maintain existing condition and risk of failure.

Estimated Project Cost: $35.8 M
Projected IS Date: 12/31/2027
Status: Conceptual



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

Changes to Existing Supplemental Projects

AEP Transmission Zone Supplement Project
S2270 Scope Change

S2270.1-.7 (2020 AEP local plan)

Supplemental Project Driver: Customer Service

Problem Statement: A customer has requested new service west of Cameron, West Virginia. The forecasted peak demand is 30 MW initially, with long-term prospects of 90 MW. With the addition of this customer load, the Wayman-Gosney-Nauvoo Ridge 138kV radial line has an MVA-mile demand of 896, far exceeding AEP's guideline of 75 MVA-miles. The MVA-mile demand that exists today on the Wayman-Gosney Hill 138kV circuit is 313 without any new load additions

Original Project Scope:

Construct a new 500-138kV station (Panhandle), connecting to the Kammer-502 Junction 500kV circuit (~10.3 miles from Kammer, 31.7 miles from 502 Junction). Install a 3-breaker 500kV ring bus; 450 MVA 500-138kV transformer; 3-breaker 138kV ring bus. (S2270.1) Estimated Cost: $25.0 M

Construct a new 138kV switching station (Nauvoo Ridge) with 8- 138kV breakers in a breaker-and-a-half design. The station will have 1 circuit to Gosney Hill, 2 circuits to the customer's facility, 2 circuits to Panhandle, and a 23 MVAR 138kV cap bank. (S2270.2) Estimated Cost: $16.4 M

At Gosney Hill, install a new 138kV breaker toward Nauvoo Ridge. Update station protection. Replace the 795 kcmil AAC risers and strain bus with 2000 kcmil AAC risers. (S2270.3) Estimated Cost: $1.3 M

Construct a new 4.7-mile 138kV line south of Gosney Hill station to Nauvoo Ridge. Utilize 1033 ACSR conductor. Acquire new right-of-way. (S2270.4) Estimated Cost: $14.7 M

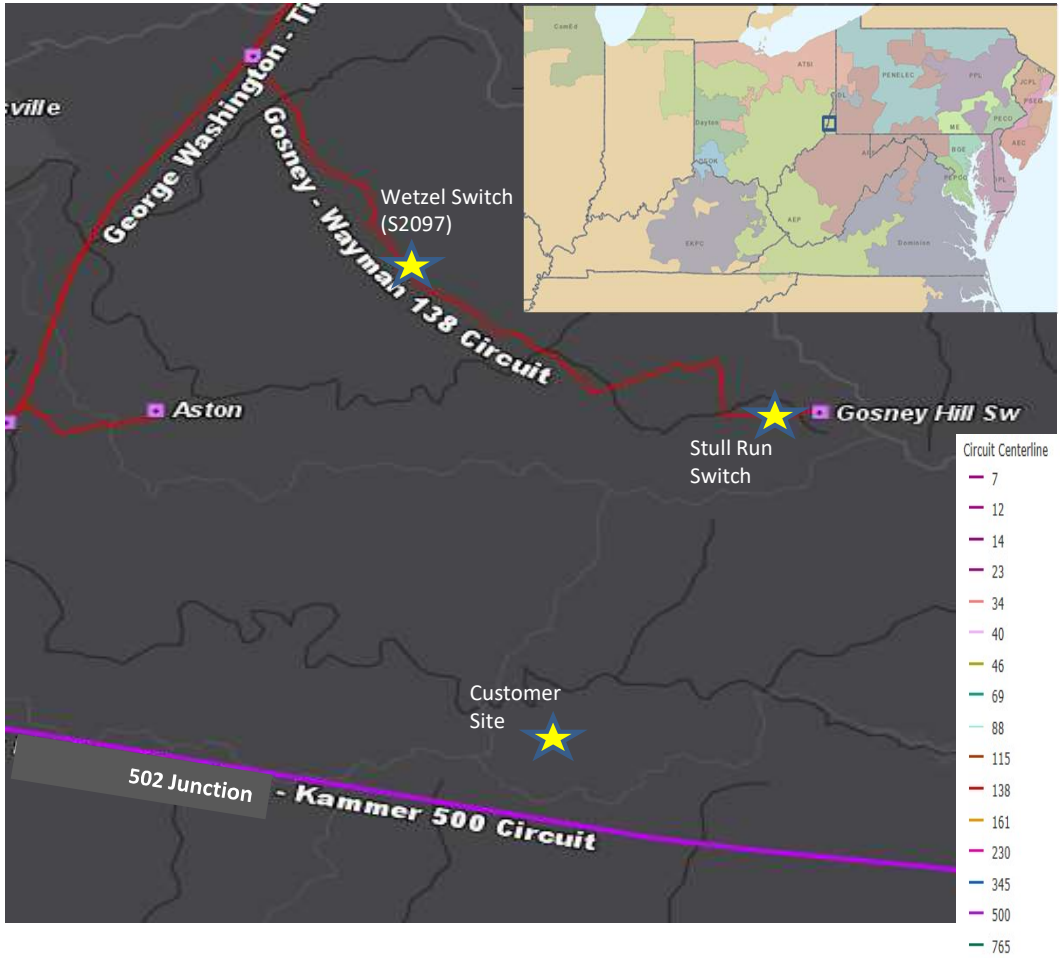
Construct a new 1.3 mile double-circuit 138kV line from Nauvoo Ridge to the customer's substation. Acquire new right-of-way. (S2270.5) Estimated Cost: $4.8 M

Construct a new 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way. (S2270.6) Estimated Cost: $5.0 M

Extend the Kammer-502 Junction 500kV transmission line 0.1-mile into Panhandle station (0.2 mile total). (S2270.7) Estimated Cost: $1.5 M

Original Total Estimated Cost: $68.7 M

Original Projected In-Service: 7/21/2020 (for initial 138kV service to the customer). 3/1/2022 (for the 2nd phase to construct Panhandle station and complete the 138kV loop).



AEP Transmission Zone Supplement Project
S2270 Scope Change

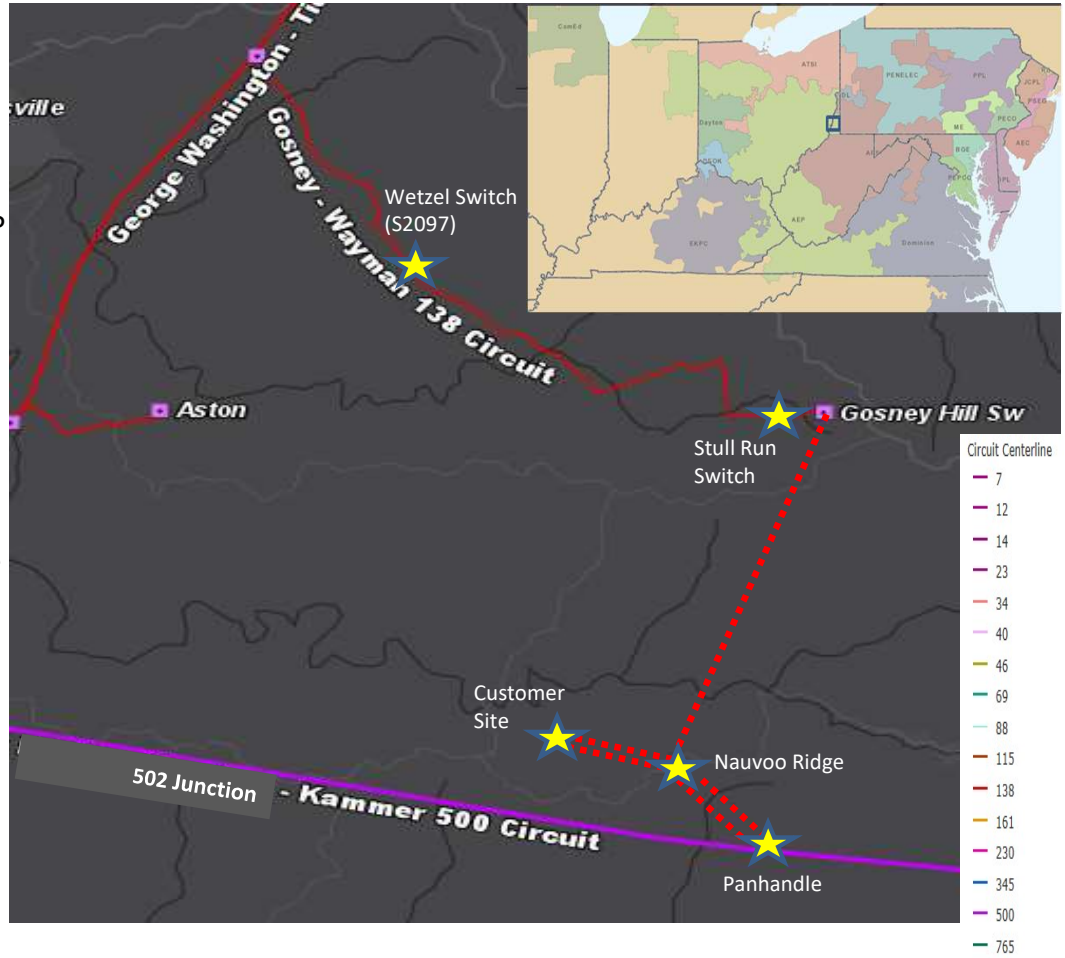
Scope Change Summary:

After further site exploration and preliminary engineering for the Panhandle 500-138kV station, the cost estimates increased significantly, due to the large amount of civil grading scope required, in this very hilly area of West Virginia. The total station cost estimate rose to $105.5 million for a traditional, open-air design. AEP also evaluated a hybrid GIS station design, which used GIS for the 500kV portion of the station; this cost estimate was $95.0 million. In addition, the cost estimate to modify the 500kV transmission line increased to over $4 million. Overall, Panhandle was no longer a cost-effective system upgrade, so alternatives were studied, which are described in the following slides.

<u>Cancel the following Supplemental upgrades:</u>

- S2270.1 – Panhandle 500-138kV station
- S2270.6 – 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge
- S2270.7 – Modify the Kammer-502 Junction 500kV line to connect to Panhandle station
- On S2270.3 (Gosney Hill), this portion can be cancelled, as it is no longer overloaded: Replace the 795 kcmil AAC risers and strain bus with 2000 kcmil AAC risers.

Note that the Gosney Hill to Nauvoo Ridge 138kV scope is in-service, along with service to the new industrial customer.



AEP Transmission Zone Supplement Project
S2270 Scope Change

New Scope:

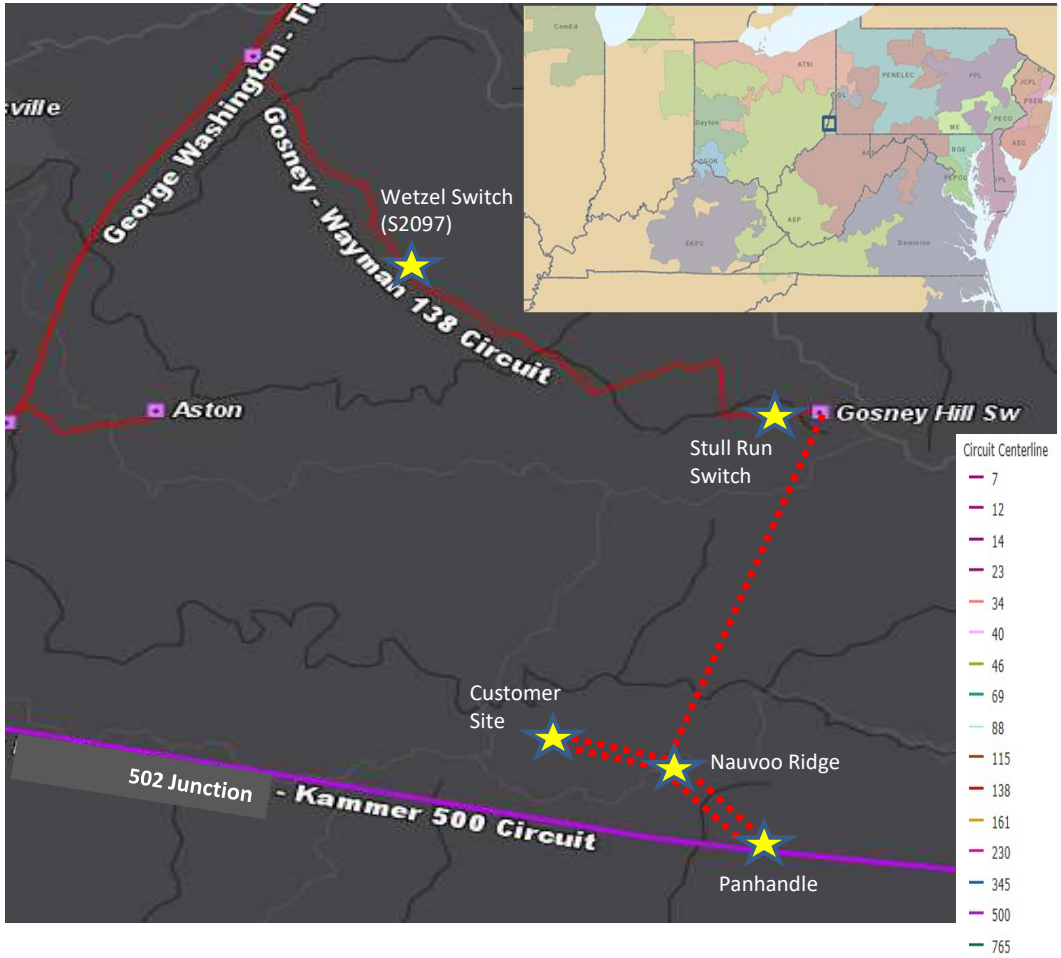
~~Construct a new 500-138kV station (Panhandle), connecting to the Kammer-502 Junction 500kV circuit (~10.3 miles from Kammer, 31.7 miles from 502 Junction). Install a 3-breaker 500kV ring bus; 450 MVA 500-138kV transformer; 3-breaker 138kV ring bus.~~ **~~Estimated Cost: $25.0 M (s2270.1)~~**

Construct a new 138kV switching station (Nauvoo Ridge) with 8- 138kV breakers in a breaker-and-a-half design. The station will have 1 circuit to Gosney Hill, 2 circuits to the customer's facility, ~~2 circuits to Panhandle~~ 1 circuit to George Washington, 1 circuit to Natrium, and a 23 MVAR 138kV cap bank. **Estimated Cost: ~~$16.4 M~~ $15.5 M (s2270.2)**

At Gosney Hill, install a new 138kV breaker toward Nauvoo Ridge. Update station protection. ~~Replace the 795 kcmil AAC risers and strain bus with 2000 kcmil AAC risers~~. **Estimated Cost: ~~$1.3 M~~ $1.0 M (s2270.3)**

Construct a new 4.7-mile 138kV line south of Gosney Hill station to Nauvoo Ridge. Utilize 1033 ACSR conductor. Acquire new right-of-way. **Estimated Cost: $14.7 M (s2270.4)**

Construct a new 1.3 mile double-circuit 138kV line from Nauvoo Ridge to the customer's substation. Acquire new right-of-way. **Estimated Cost: $4.8 M (s2270.5)**



AEP Transmission Zone Supplement Project
S2270 Scope Change

~~Construct a new 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way.~~ **~~Estimated Cost: $5.0 M (s2270.6)~~**

~~Extend the Kammer-502 Junction 500kV transmission line 0.1-mile into Panhandle station (0.2 mile total).~~ **~~Estimated Cost: $1.5 M (s2270.7)~~**

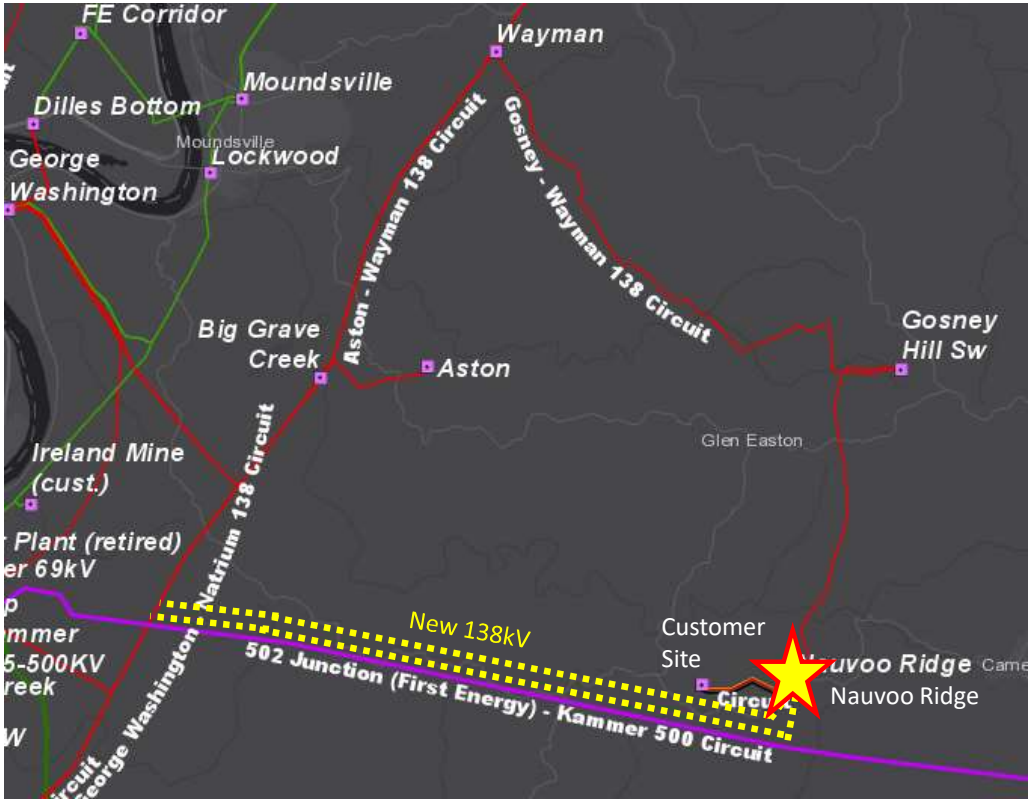
Cut into the George Washington-Natrium 138kV circuit and extend an 8.6-mile double-circuit 138kV loop east to Nauvoo Ridge. (**S2270.8**) $23.13 M

Modify the George Washington-Natrium 138kV line, which is part of a double-circuit lattice tower line. (**S2270.9**) $0.65 M

New Total Estimated Cost: $59.78 million *(compared to a total of approximately $137.9 M, if the Panhandle 500-138kV option had proceeded)*

New Project Status: Scoping (new double-circuit 138kV loop to Nauvoo Ridge). In-service (Gosney Hill to Nauvoo Ridge to the customer)

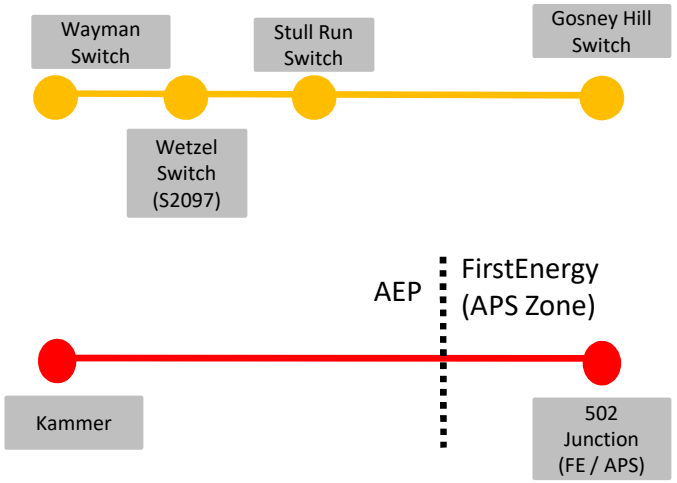
New Projected In-Service Date: 12/1/2023



AEP Transmission Zone Supplement Project
S2270 Scope Change

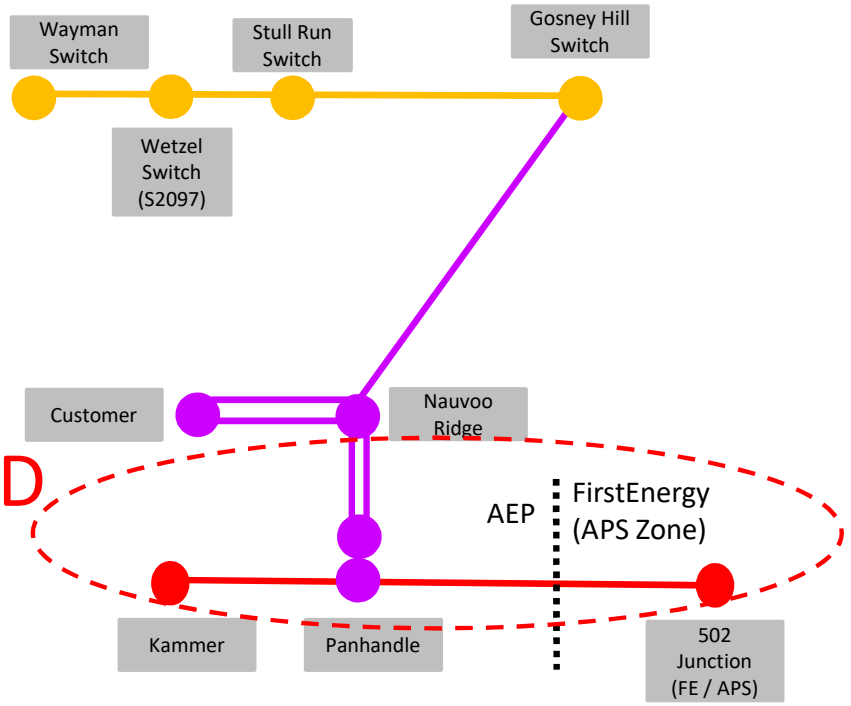
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Existing:



Originally Proposed:

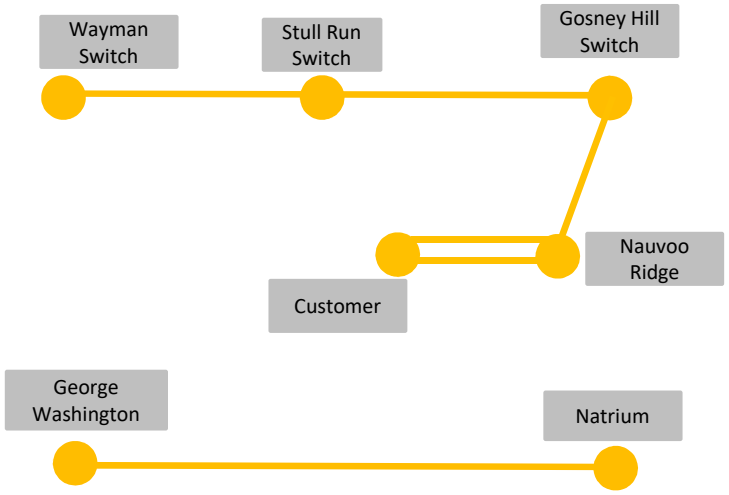
CANCELLED



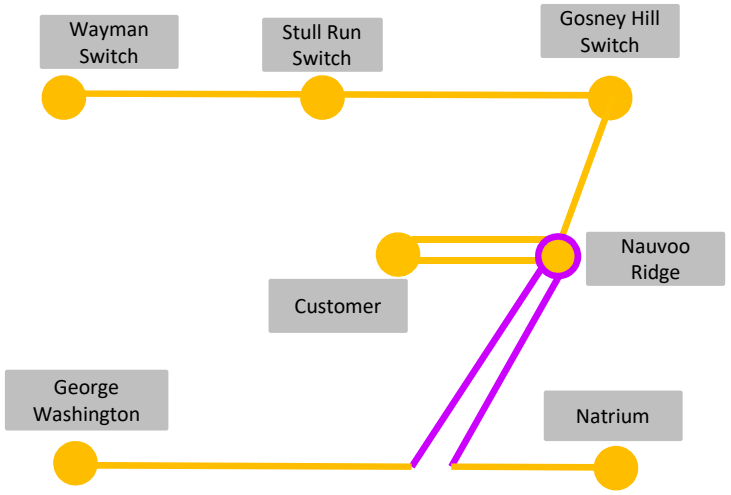
AEP Transmission Zone Supplement Project
S2270 Scope Change

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

Existing:



Proposed (After Scope Change):



ATSI Transmission Zone M-3 Process
Delta – Wauseon 138 kV New Customer

Need Number: ATSI-2021-019
Process Stage: Re-Present Solution Meeting – 03/18/2022
Previously Presented: Solution Meeting – 08/16/2021
Need Meeting – 07/16/2021

Supplemental Project Driver(s):
Customer Service

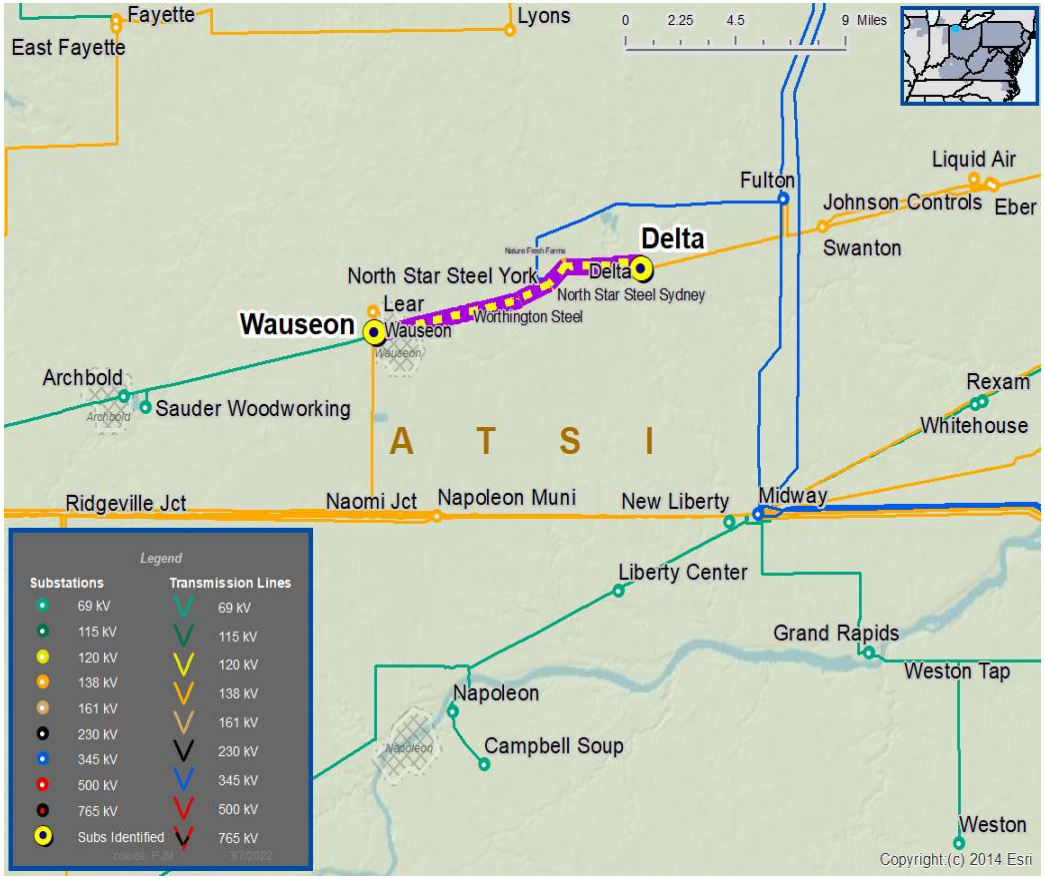
Specific Assumption Reference(s)

Customer connection request evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – A customer requested 138 kV transmission service for approximately 20 MVA of total load near the Delta – Wauseon 138 kV line.

Requested In-Service Dates: 10 MVA by November 1, 2021
10 MVA increase by November 1, 2026



ATSI Transmission Zone M-3 Process
Delta – Wauseon 138 kV New Customer

Need Number: ATSI-2021-019
Process Stage: Re-Present Solution Meeting – 03/18/2022
Previously Presented: Solution Meeting – 08/16/2021
Need Meeting – 07/16/2021

Proposed Solution:

New 138 kV Customer

- Construct a 138 kV tap off the Delta – Wauseon 138 kV line to the customer substation. The customer substation tap location is approximately a 0.9 mile extension from the existing structures to the new customer substation.
- Add MOAB and SCADA to two new switches on the Delta – Wauseon 138 kV line.
- Upgrade 336 ACSR TL Drop at Lemoyne Substation (Dowling Line Exit)

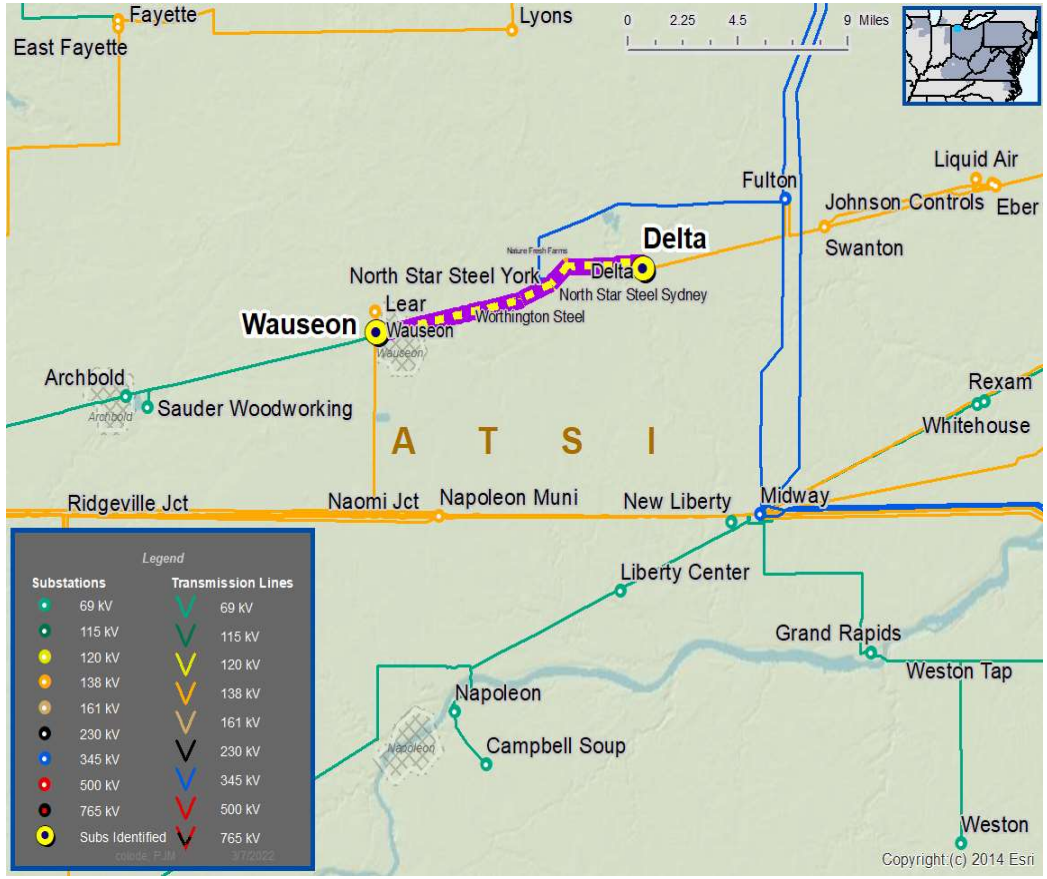
Line Ratings:

Delta-Wauseon 138 kV Line: No ratings change
Dowling-Lemoyne 138 kV Line:
Before proposed project: 160/192 MVA SN/SE
After proposed project: 252/291 MVA SN/SE

Alternatives Considered:

- No alternatives considered for this project

Estimated Project Cost: $2.1M
Projected In-Service: 06/01/2022
Status: Engineering
Model: 2020 Series 2025 Summer RTEP 50/50



AEP Transmission Zone: Supplemental Central South Bend Improvements

Previously Presented: 3/27/2018, 6/26/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

AEP has identified multiple rehab needs at Colfax, Drewry's and Saint Mary's stations. Colfax station is a cubicle switch gear type construction, is obsolete, and spare parts are unavailable. Mobile transformer can't be installed on site due to physical space limitations and complete station outage can only be taken during off-peak months (Sep-May). The 34.5 kV CB C and D at Colfax Station are GE FK oil-filled breakers manufactured in 1950s, have operated through 12 and 20 fault operations, exceeding the manufacturer recommendation of 10. These breakers are oil breakers. Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. The drivers for replacement of these breakers are age, number of fault operations, and a lack of repair parts. The 34.5/12 kV Transformer at Colfax was manufactured in 1974 and is also showing significant signs of deterioration. It has a load tap changer (LTC) and therefore distribution voltage regulation is difficult. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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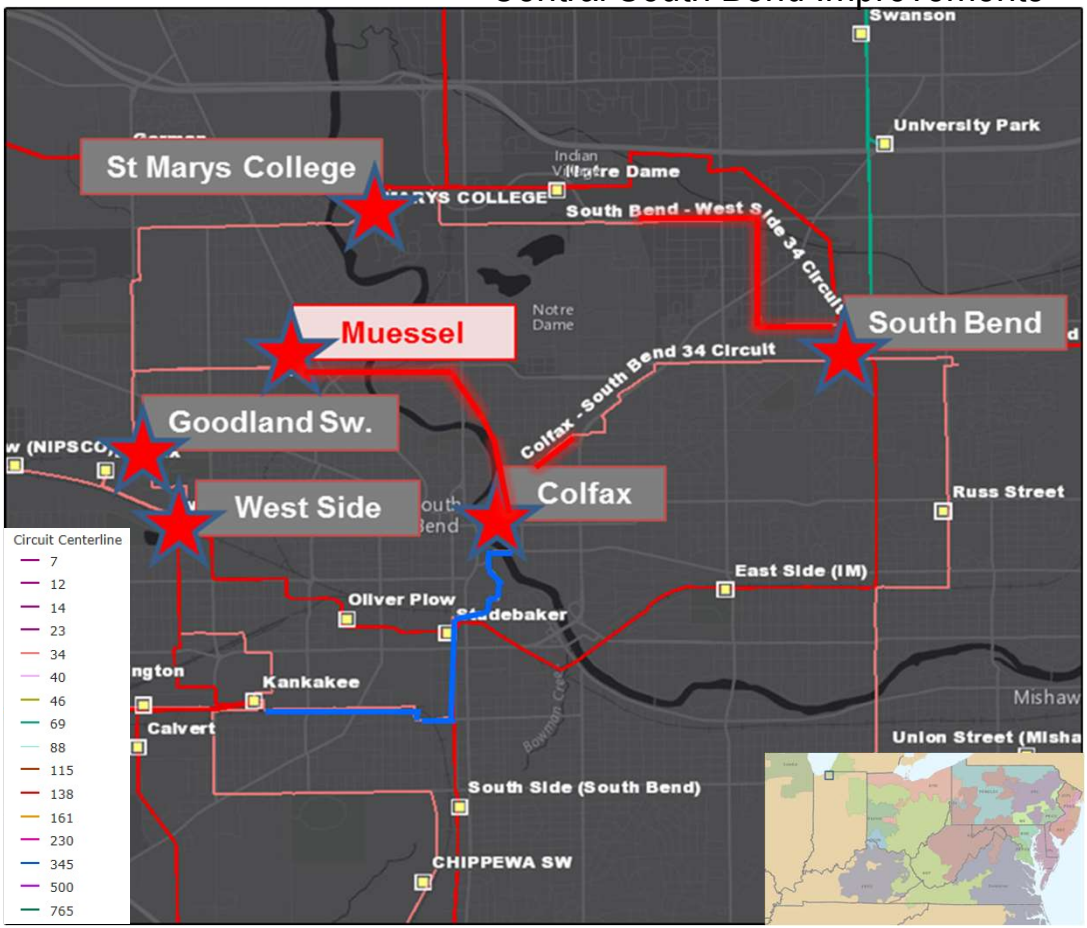

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Drewry's Station is very congested and is located adjacent to Muessel Grove public park. On site mobile transformer can't be installed due to physical space limitations. Station transformers do not meet present day electrical clearance standards. Transformer high side ground switches can't be replaced with circuit switchers and low side breakers can't be installed due to physical space limitations. There is no control house present and 14 out of 20 relays are electromechanical and are obsolete. Station drive path is not available and poses additional maintenance and safety challenges. Station foundations and steel on 12 kV structures are beginning to show signs of deterioration. 12 kV circuit breaker A,B,C & D at Drewry's are 2000 vintage but have severely exceeded the life expectancy of full fault operations. The 34.5/12kV Transformer#2 was manufactured in 1963 and the steady increase in ethylene, methane, and carbon dioxide over the years show that there has been heating of the Transformer #2 at Drewry's which has deteriorated its insulation. Additionally, the LTC is not operating properly.

The 34.5/4kV Transformer at Saint Mary's Station was manufactured in 1952 and is also showing significant signs of deterioration. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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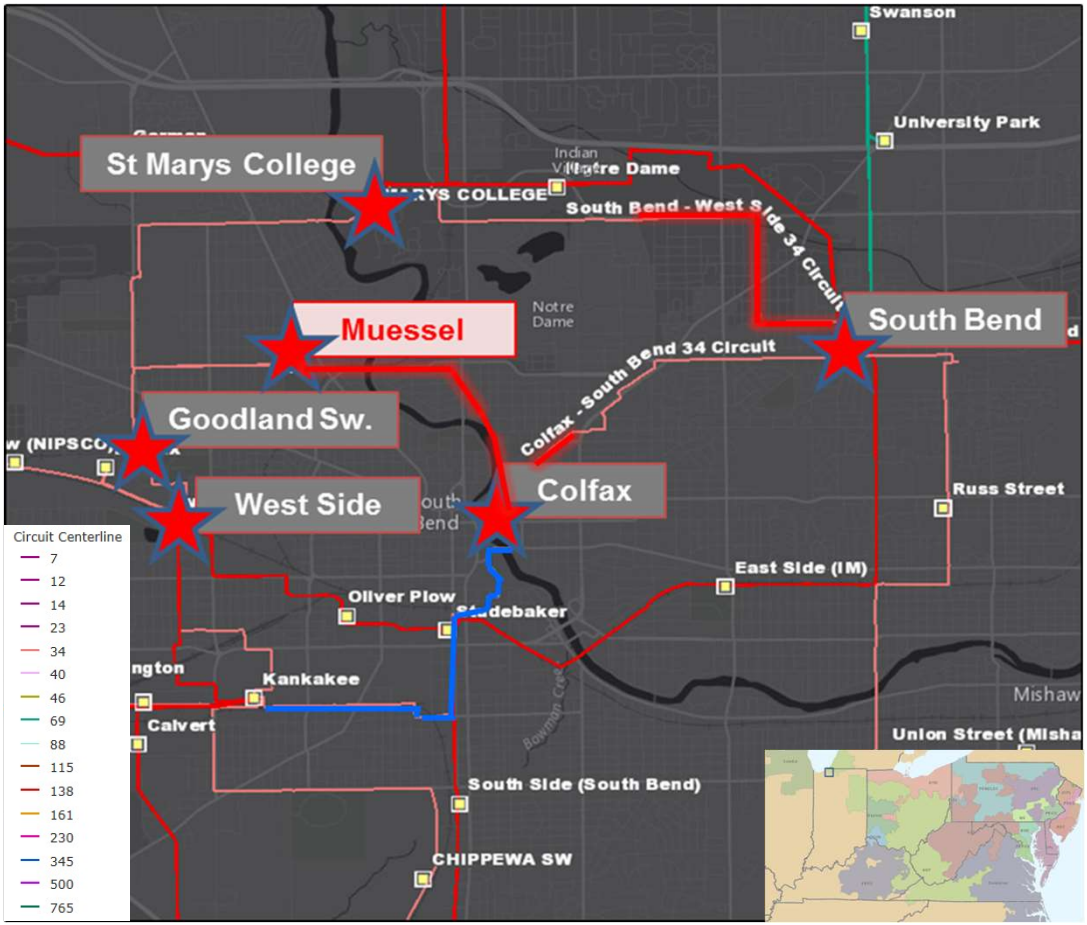

AEP Transmission Zone: Supplemental Central South Bend Improvements

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On the Colfax-Kankakee 34.5 kV circuit, the overhead portion is ~1.5 miles while the underground section is ~1.3 miles. The overhead portion utilizes wood poles cross arm construction which is not a current AEP transmission standard. The overhead portion of this circuit is suspension insulator type construction with smaller cross-section distribution-type cross arms and braces. Historical experience with these types of wood cross arms is a higher frequency of required proactive replacement and occasional failure resulting in forced outages. The underground portion of the line occupies a manhole and conduit system that was not designed for transmission use. The underground portion occupies 33 manholes. Over half of the manholes contain transmission cable splices. An underground transmission cable system of this length should require no more than 4-7 manholes in order to minimize the number of cable splices required. Due to the number of manholes, the required number of cable splices is very excessive. Industry experience is that cable system components such as splices are a far more common failure cause than the transmission cables themselves. Almost all of the manholes are physically undersized for transmission cable system occupation, making splicing very difficult to accomplish. Many conduits are clay tile ducts installed in the 1930s. Since 2009 there have been at least seven documented failures, primarily on cable system components (splices and terminations). Cable testing performed in September 2013 and the cables passed the testing however, nine days later a cable failure occurred, causing the circuit to trip from service.

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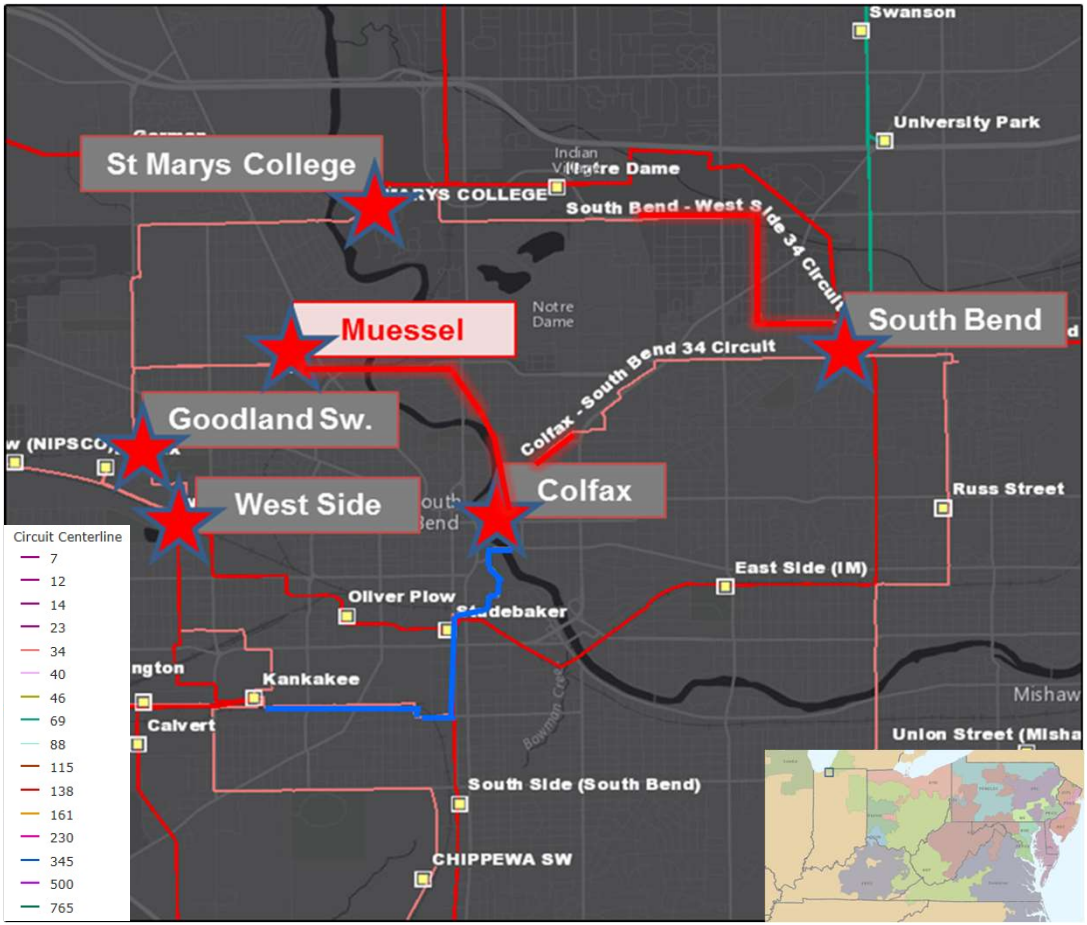

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Operational Flexibility and Efficiency:

Colfax station backs up a portion of distribution load from the South Bend station. South Bend is a 138 kV station while Colfax is 34.5 kV which results in a load drop and pick issue. On average there are between 3 to 5 drop and pick cycles per year that are experienced by Colfax and Drewry's customers. Drewry's station is served by a double circuit transmission line which traverses through residential areas and a gravel pit. An outage involving the double circuit lines results in a complete station outage and the station peak load is not recoverable from an alternate source. Colfax station serves central South Bend load and is presently served from two 34.5 kV sources, South Bend and Kankakee. Kankakee source has an underground line section which is near its useful life and has been forced out multiple times in the recent past. The new Colfax – Drewery 34.5kV Line will be an additional source to Drewry's and Colfax Station. The transformer high side protection at Drewry's and Saint Mary's station is via high side ground switch scheme which is not a standard practice in modern installations. South Bend-West Side 34.5 kV circuit is ~11 miles and serves three stations (Goodland, Drewry's, and St Mary's College). There are two series MOBs each at Drewry's and St Mary's College. Having 4 MOAB in series is an undesirable configuration as it introduces coordination challenges related to P&C.

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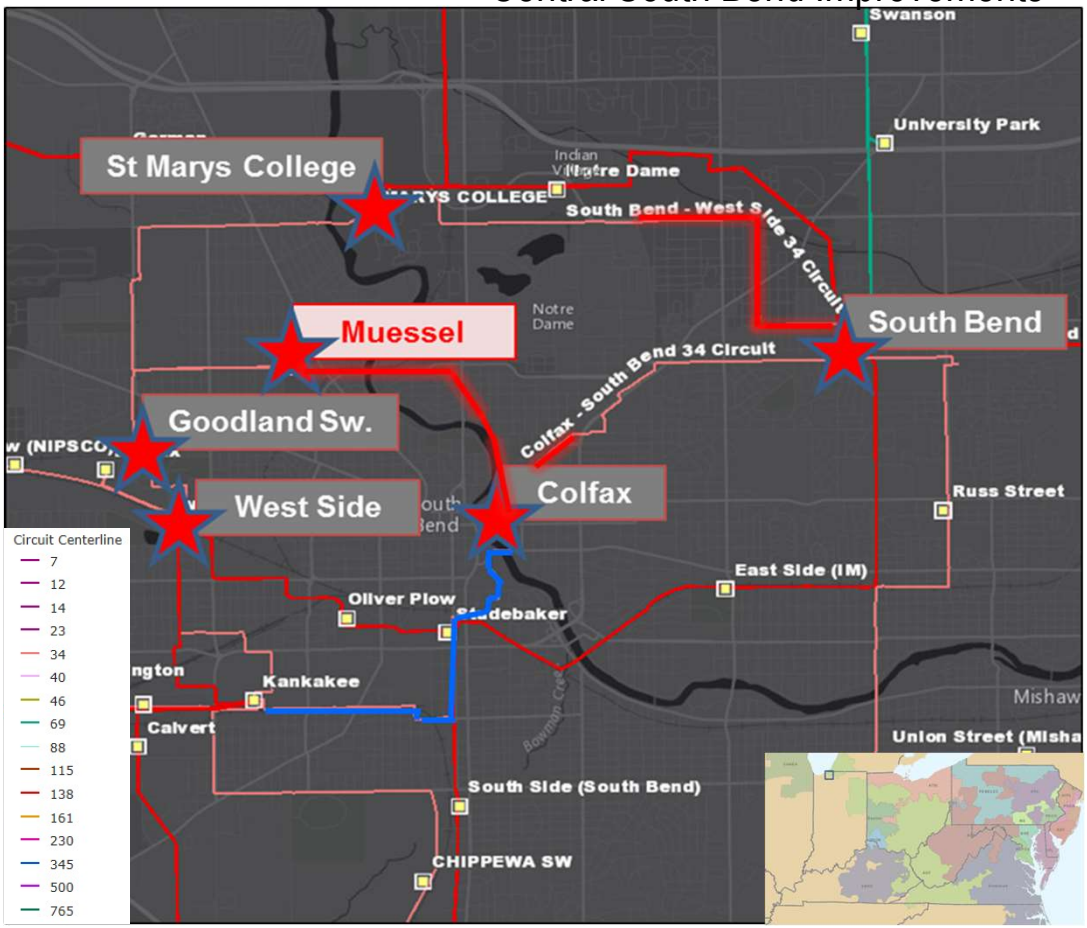

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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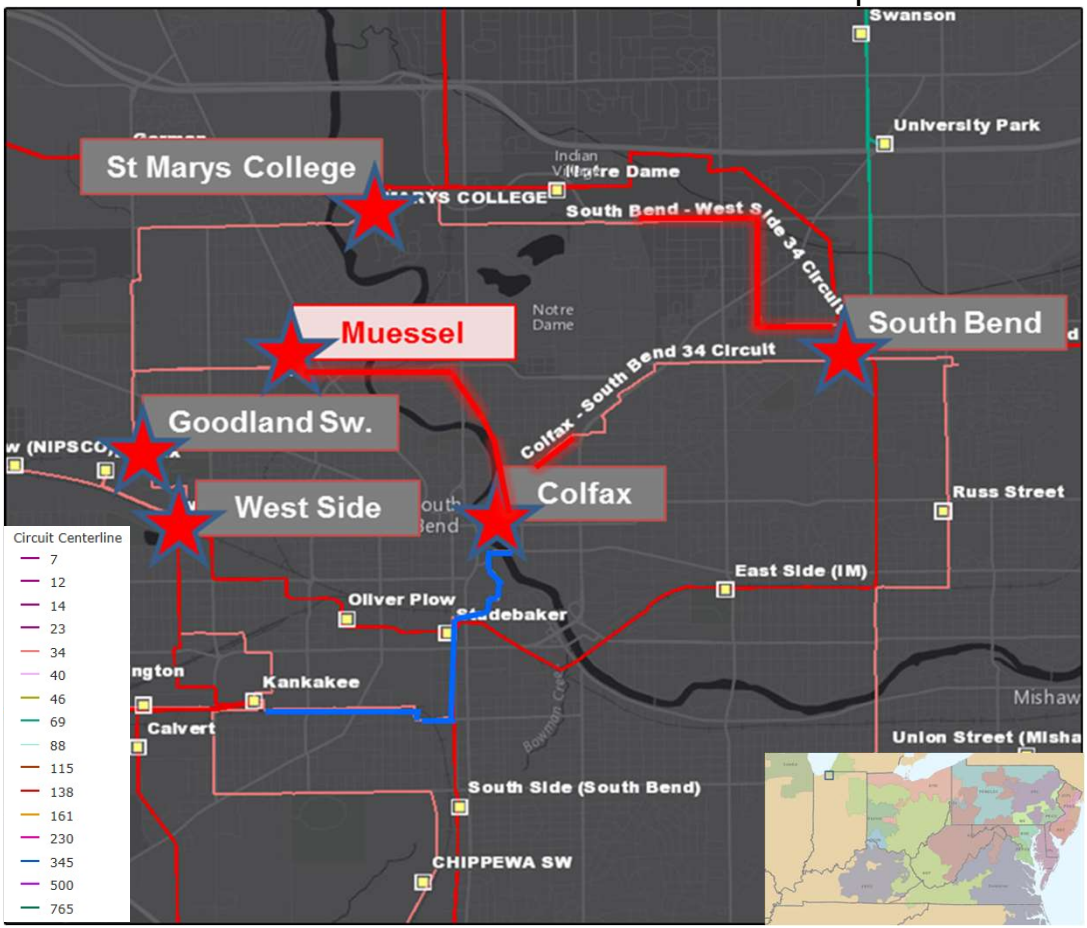
Reason for Revision:

The original project proposed to move Goodland Switch to the Bendix – Kankakee 34.5kV line. Goodland Switch has since moved to Distribution service, which eliminates the need for the line work on Bendix – Kankakee 34.5kV.



AEP Transmission Zone: Supplemental
Central South Bend Improvements

Continued from previous slide…

Selected Solution:

Construction of approximately 2.5 mile 69 kV underground line between Colfax and Muessel using 1750KCMIL Copper XLPE Conductor. (**S1666.1**) **Estimated Cost: $20.1M**

Install Drewry's Extension 34.5kV. (**S1666.2**) **Estimated Cost: $0.7M**

Retire Kankakee – Colfax (UG) 34kV Line. (**S1666.3**) **Estimated Cost: $0.6M**

Rebuild .33 miles of the South Bend - Colfax UG line using 1750KCMIL Copper XLPE Conductor. (**S1666.4**) **Estimated Cost: $4.1M**

Rebuild 1.9 miles of the South Bend – West Side Line using 795 ACSR (64 MVA rating). (**S1666.5**) **Estimated Cost: $3.7M**

~~Bendix – Kankakee 34.5kV Line Work~~. Cancel (**S1666.6**) ~~**Estimated Cost: $0.2M**~~

South Bend station work to set up 69kV energization. (**S1666.7**) **Estimated Cost: $0.6M**

West Side station work to set up 69kV energization. (**S1666.8**) **Estimated Cost: $0.5M**

Completely rebuild Colfax station. Install a 69kV CB towards Muessel Station. Replace 34kV CB D with a 69kV CB towards South Bend Station. Install a 69kV SWR, 69/12kV TR#1 and (4) 12kV CB's. All 69kV CB's are 40kA breakers. (**S1666.9**) **Estimated Cost: $1.8M**

Completely rebuild Drewrys station as Muessel station in the clear. Install (3) 69kV line CB's, (1) Bus Tie CB, (2) 69kV SWR's, (2) 69/12kV TR's and (7) 12kV CB's.All 69kV CB's are 40kA breakers. (**S1666.10**) **Estimated Cost: $5.0M**

At St. Mary's College, install 69kV circuit switcher. Replace 69/12kV TR and (2) 69kV switches. (**S1666.11**) **Estimated Cost: $0.4M**

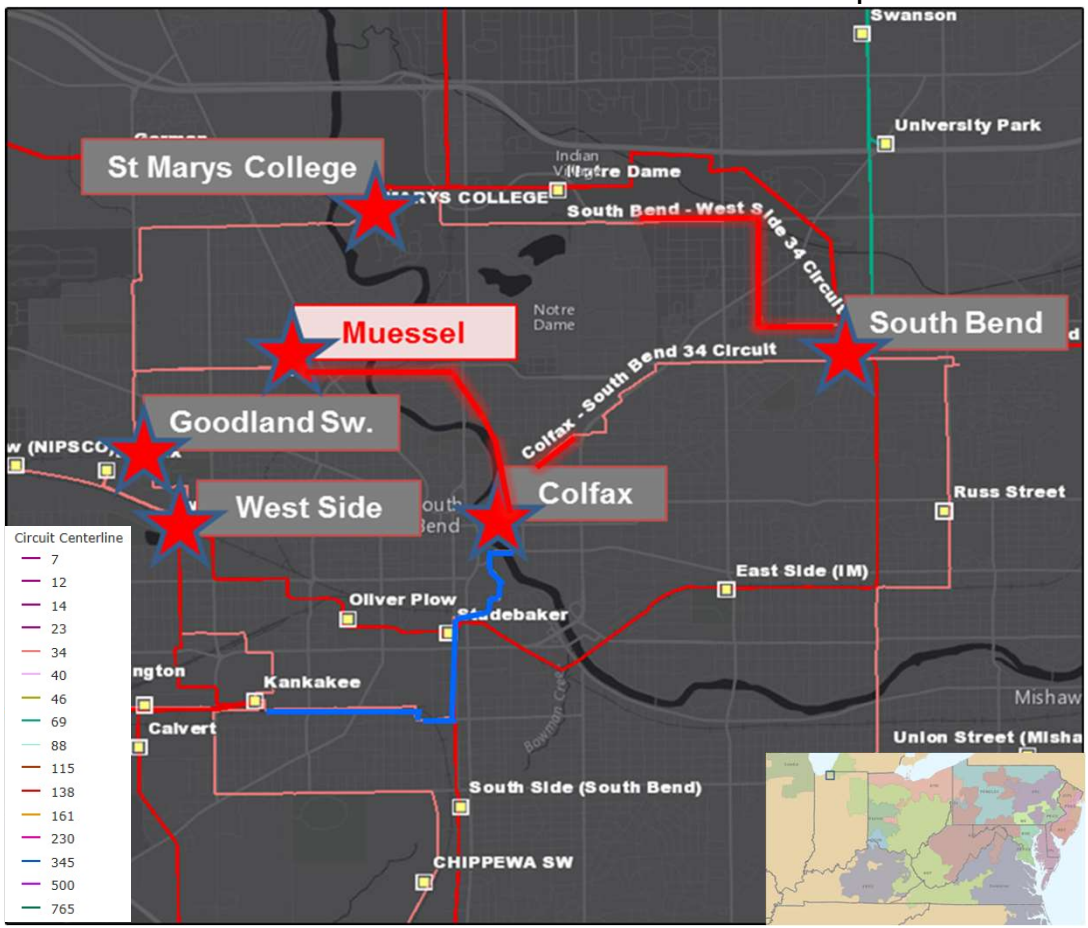
Relocate Goodland Sw to ~~West Side – Bendix 34kV Line~~ distribution service. (**S1666.12**) **Estimated Cost: $1.0M**

Kankakee: Remove 34.5kV breaker I. (**S1666.13**) **Estimated Cost: $0.1M**

Total Estimated Transmission Cost: $38.6M

Projected In-service: 5/10/2020

Project Status: Scoping



AEP Transmission Zone: Supplemental McKinley Area Improvements

Supplemental Project: S2152 (Need AEP-2019-IM018, posted to 2020 AEP local plan)

Project Description (changes are marked in red)
Slater Steel & GE Taylor 34.5kV Feeds: Retire the McKinley – General Electric Taylor West 34kV Line; McKinley – Slater Steel 34kV Line; McKinley – Taylor General Electric 34kV Line and the McKinley – General Electric Taylor East 34kV and in their place build a single ~1 mile 34.5kV feed from McKinley – Slater Steel. As a note, the customer has retired their GE Taylor station so it no longer requires a feed. (S2152.1) **Estimated Cost: $2.8M**

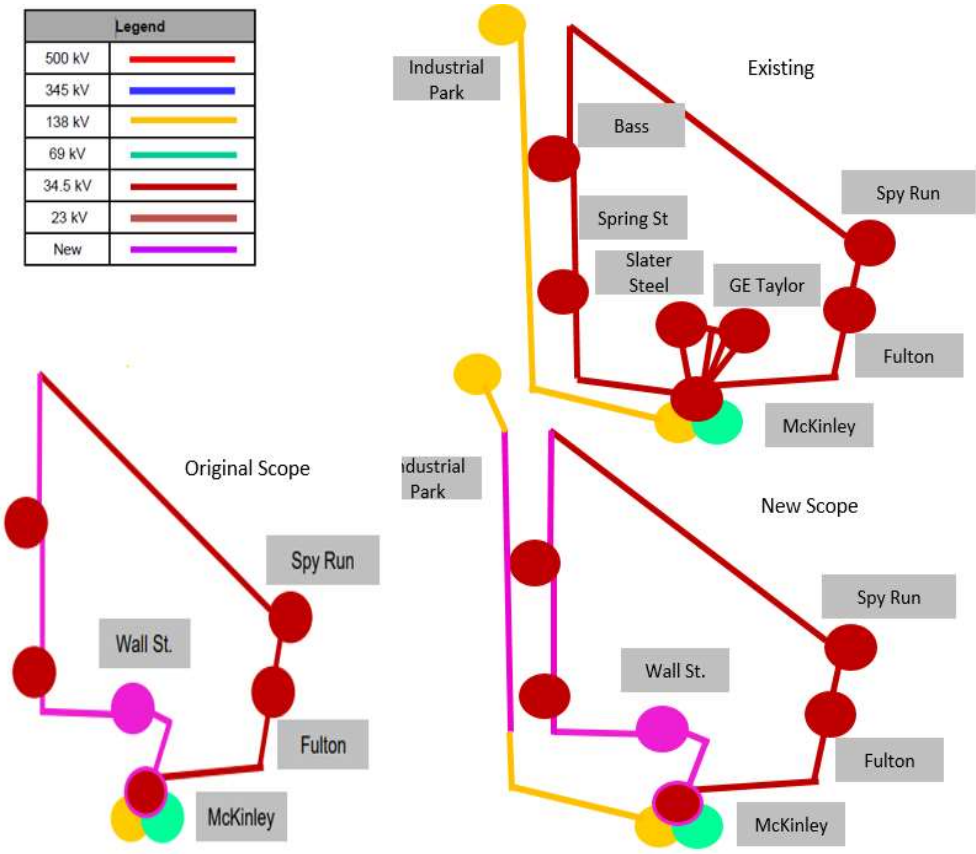
McKinley – Spy Run 34.5kV: Rebuild approximately ~~4.5~~ 2.8 miles ~~of~~ from the McKinley – ~~Spy Run~~ Spring St as single circuit 34.5kV. ~~,Including a line section approximately 2.7 miles long to feed Slater Steel Station.~~ Rebuild the remaining ~1.4 miles north of Spring Street as double circuit 138kV capable to accomidate ~1.4 miles of the Industrial Park – McKinley 138kV line outlined in the AEP-2021-IM019 need. (S2152.2) **Estimated Cost: $~~6.7M~~ 12.3M**

Wall Street 34.5kV station: Install a new PoP switch to feed Slater Steel station. (S2152.3)
Estimated Cost: $0.5M

McKinley 138/69/34.5kV station: Retire 34.5kV CB's "J", "M", "F", "K", and "DD". Consolidate the 34.5kV voltage class into a single bus and relocate the 69kV line exit into the station yard. Install a high side circuit switcher. (S2152.4) **Estimated Cost: $3.7M**

Total Estimated Cost: ~~$13.6 M~~ 19.2M

Projected In-Service: ~~5/16/2022~~ 06/09/2023
Reasons for the scope change: The segment to the north of Spring Street is what is changing, AEP originally proposed rebuilding it as single circuit, but part of AEP-2021-IM019 is along the same corridor north of the station "Spring Street". Due to the urban nature of Fort Wayne, AEP decided to consolidate both lines into a single double circuit line to save ratepayers money and to lessen our impact to the landowners.



AEP Transmission Zone
S2270 Scope Change

S2270.1 -.7 (2020 AEP local plan)

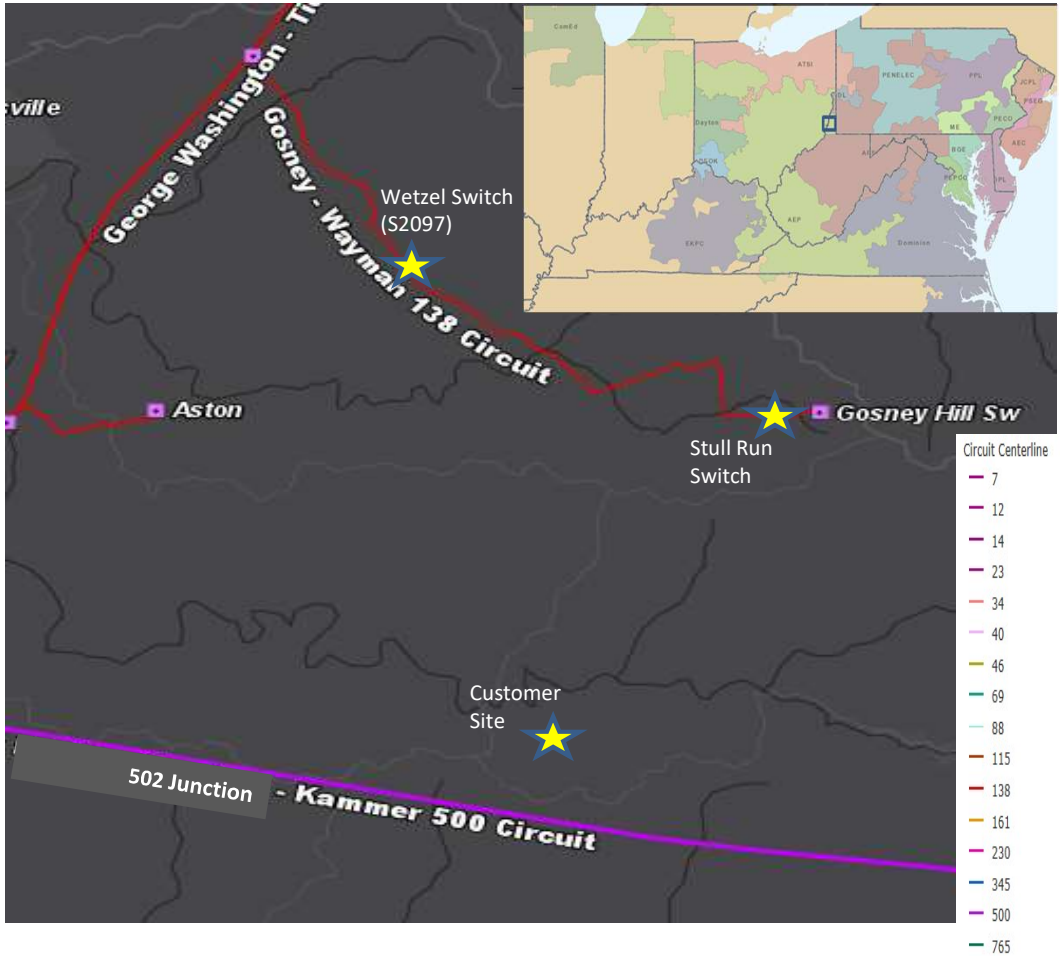
Supplemental Project Driver:

Customer Service: A customer has requested new service west of Cameron, West Virginia. The forecasted peak demand is 30 MW initially, with long-term prospects of 90 MW.

With the addition of this customer load, the Wayman-Gosney-Nauvoo Ridge 138kV radial line has an MVA-mile demand of 896, far exceeding AEP's guideline of 75 MVA-miles. The MVA-mile demand that exists today on the Wayman-Gosney Hill 138kV circuit is 313 without any new load additions

Scope change was presented in 3/8/2022 TEAC

<u>The reason for the scope change:</u> After further site exploration and preliminary engineering for the Panhandle 500-138kV station, the cost estimates increased significantly, due to the large amount of civil grading scope required, in this very hilly area of West Virginia. The total station cost estimate rose to $105.5 million for a traditional, open-air design. AEP also evaluated a hybrid GIS station design, which used GIS for the 500kV portion of the station; this cost estimate was $95.0 million. In addition, the cost estimate to modify the 500kV transmission line increased to over $4 million. Overall, Panhandle was no longer a cost-effective system upgrade, so alternatives were studied.



AEP Transmission Zone
S2270 Scope Change

New Scope presented in 3/8/2022 TEAC**:**

~~Construct a new 500-138kV station (Panhandle), connecting to the Kammer-502 Junction 500kV circuit (~10.3 miles from Kammer, 31.7 miles from 502 Junction). Install a 3-breaker 500kV ring bus; 450 MVA 500-138kV transformer; 3-breaker 138kV ring bus.~~ **~~Estimated Cost: $25.0 M (s2270.1)~~**

Construct a new 138kV switching station (Nauvoo Ridge) with 8- 138kV breakers in a breaker-and-a-half design. The station will have 1 circuit to Gosney Hill, 2 circuits to the customer's facility, ~~2 circuits to Panhandle~~ 1 circuit to George Washington, 1 circuit to Natrium, and a 23 MVAR 138kV cap bank. **Estimated Cost: ~~$16.4 M~~ $15.5 M (s2270.2)**

At Gosney Hill, install a new 138kV breaker toward Nauvoo Ridge. Update station protection. ~~Replace the 795 kcmil AAC risers and strain bus with 2000 kcmil AAC risers~~. **Estimated Cost: ~~$1.3 M~~ $1.0 M (s2270.3)**

Construct a new 4.7-mile 138kV line south of Gosney Hill station to Nauvoo Ridge. Utilize 1033 ACSR conductor. Acquire new right-of-way. **Estimated Cost: $14.7 M (s2270.4)**

Construct a new 1.3 mile double-circuit 138kV line from Nauvoo Ridge to the customer's substation. Acquire new right-of-way. **Estimated Cost: $4.8 M (s2270.5)**

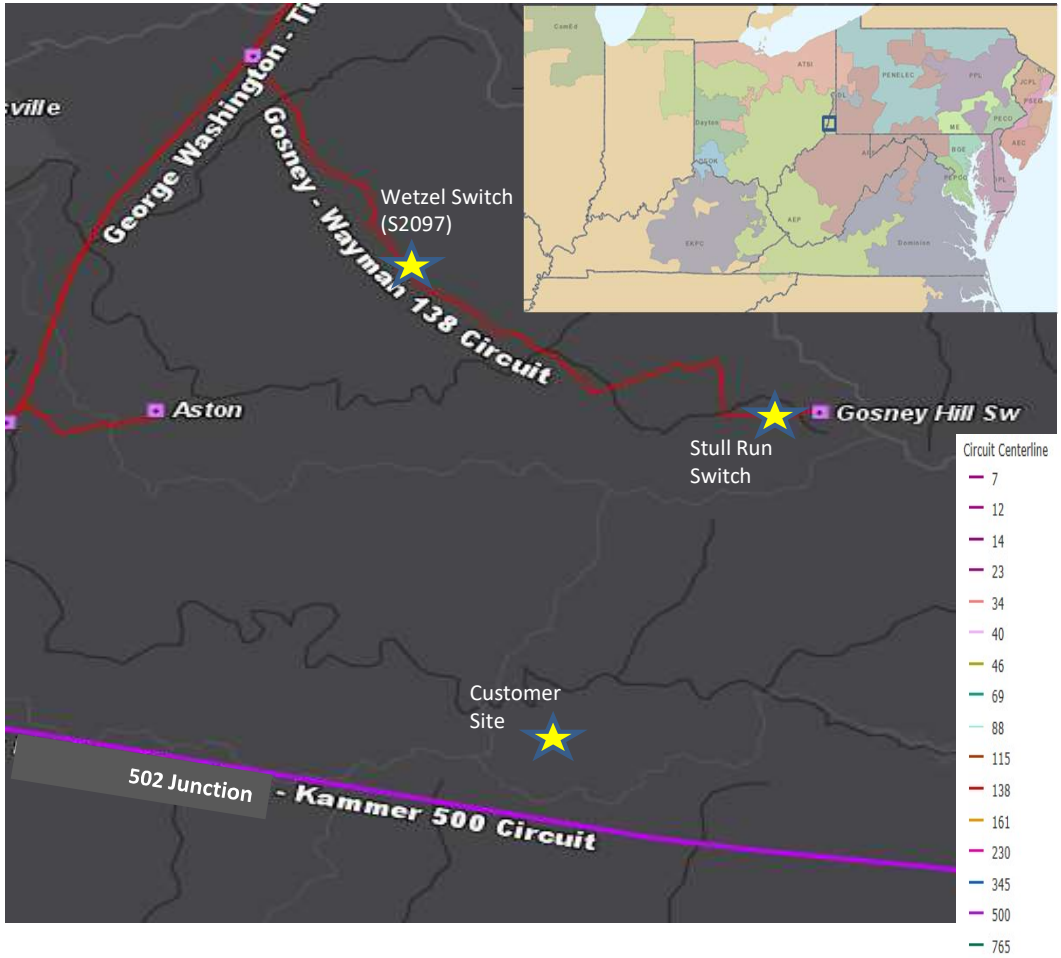
~~Construct a new 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way.~~ **~~Estimated Cost: $5.0 M (s2270.6)~~**

~~Extend the Kammer-502 Junction 500kV transmission line 0.1-mile into Panhandle station (0.2 mile total).~~ **~~Estimated Cost: $1.5 M (s2270.7)~~**

Cut into the George Washington-Natrium 138kV circuit and extend an 8.6-mile double-circuit 138kV loop east to Nauvoo Ridge. (**S2270.8**) $23.13 M

Modify the George Washington-Natrium 138kV line, which is part of a double-circuit lattice tower line. (**S2270.9**) $0.65 M

After additional DNH study by PJM, an overload on Kammer-Natrium 138kV has been identified, due to a slight loading increase attributed to the new scope of s2270.



AEP Transmission Zone
S2270 Scope Change

Additional Project Scope:

Rebuild the Kammer-Natrium 138kV double-circuit line (9.3 miles). The circuit's limiting ratings are currently set by the T-Line conductor (556 ACSR). The rebuilt circuit will utilize 795 ACSS high-temperature conductor, to optimize the new structure sizing and cost. (**S2270.10**) $22.86 Million

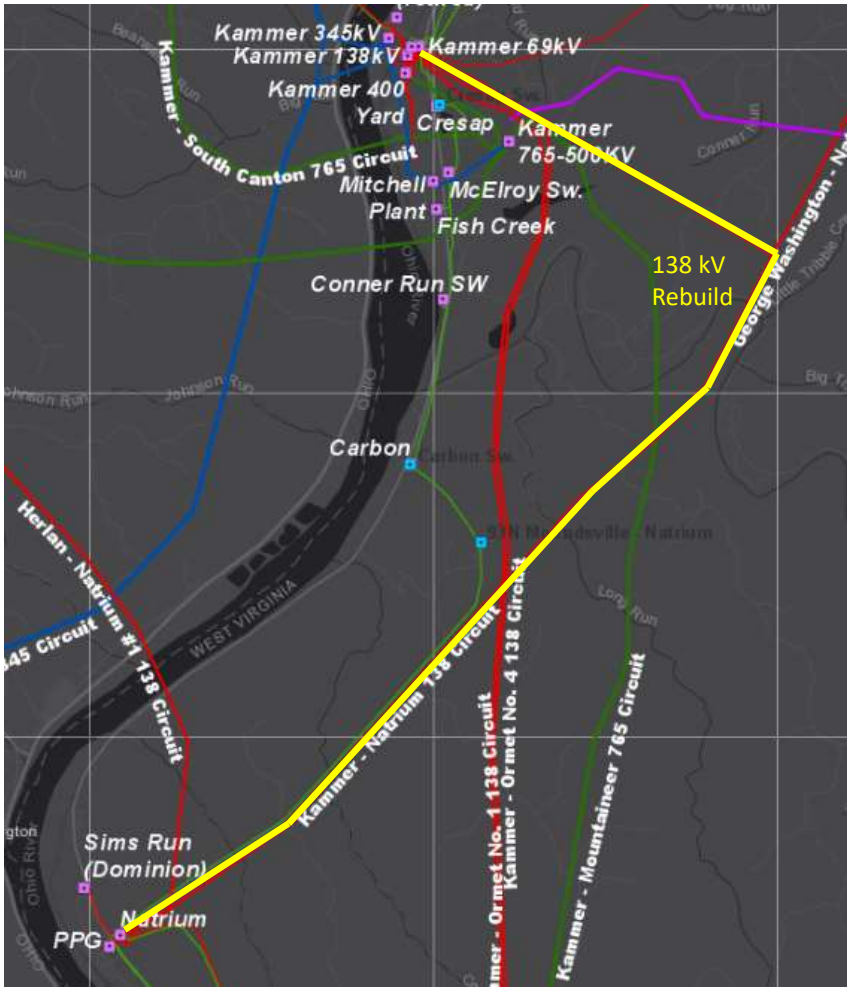
Total Project Cost: $82.64 million *(compared to a total of approximately $137.9 M, if the Panhandle 500-138kV option had proceeded)*

Ancillary Benefits: The rebuild of Kammer-Natrium 138kV addresses end-of-life concerns on this transmission facility. The circuit consists of 6.5 miles of lattice tower line built in 1945 and 2.8 miles of lattice tower line built in 1956. The line has various open conditions including conductor damage, insulator corrosion, and shield wire problems. The line is not built to current AEP engineering design standards.

Alternatives Considered: Instead of a full line rebuild, a reconductor project was also considered. However, given the age and condition of the line asset, it is not prudent to install new conductor on the structures.

Project Status: Scoping (new double-circuit 138kV loop to Nauvoo Ridge and Kammer-Natrium 138kV line rebuild). In-service (Gosney Hill to Nauvoo Ridge to the customer)

Projected In-Service Date: 12/1/2025



AEP Transmission Zone
S2270 Scope change

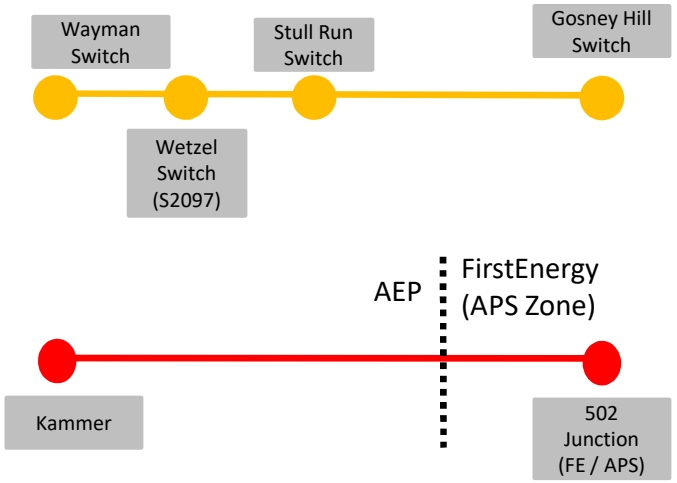
Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 9/16/2022

Proposed Solution:

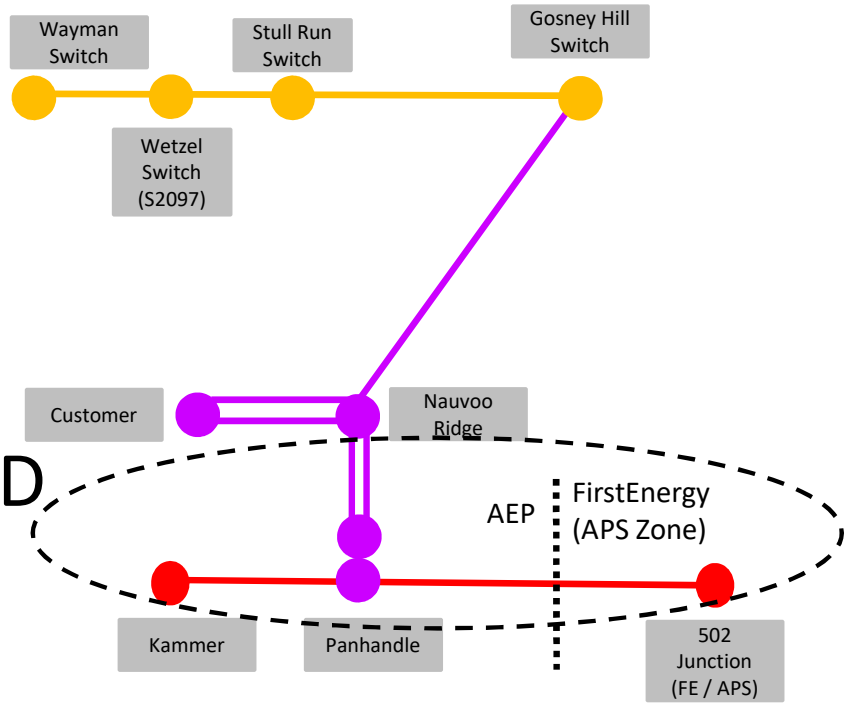
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Existing:



CANCELLED 3/2022

Proposed:



AEP Transmission Zone
S2270 Scope change

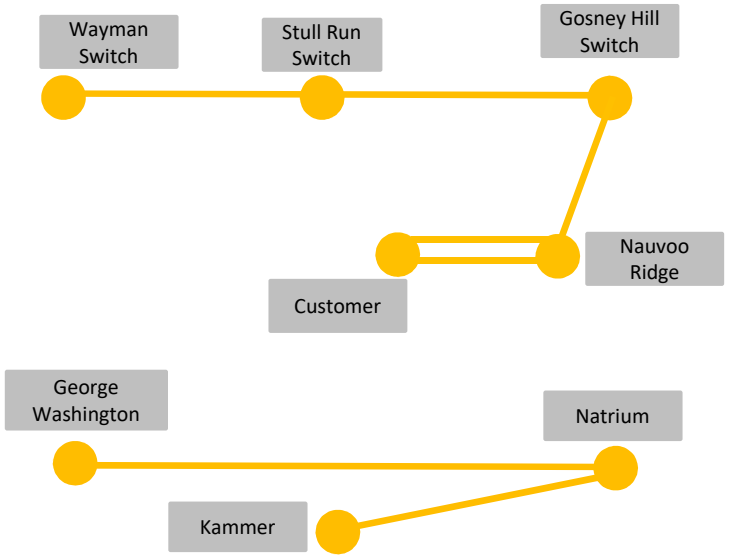
Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 9/16/2022

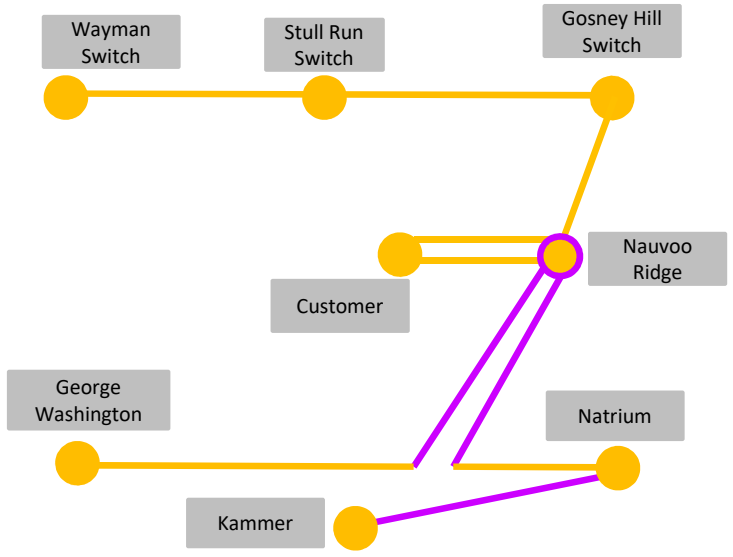
Proposed Solution:

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

Existing:



Proposed (After 2nd Scope Update):



Dayton Transmission Zone: Supplemental Additional Scope for S2585

S2585 (.1-.10) is posted in 2022 Dayton local plan to address Dayton supplemental Needs: Dayton-2020-011, Dayton-2021-001, Dayton-2021-008

Current scope :

Part #1: Project Description:

- **New Westville Substation Replacement:**
  - Establish a new 138kV three breaker ring bus substation that will tie into AEP's Hodgin, connect back to AES Ohio's West Manchester Substation, and serve AES Ohio distribution in the New Westville area. Once the new substation is online, the existin New Westville 33kV Substation will be retired. This will help improve reliability to customers served via New Westville and elimina vintage 33kV system. The new substation will upgrade the obsolete and non-standard equipment at New Westville
  - **Estimated Cost: $6.0M, In-service Date: 12/31/2025 (s2585.1)**

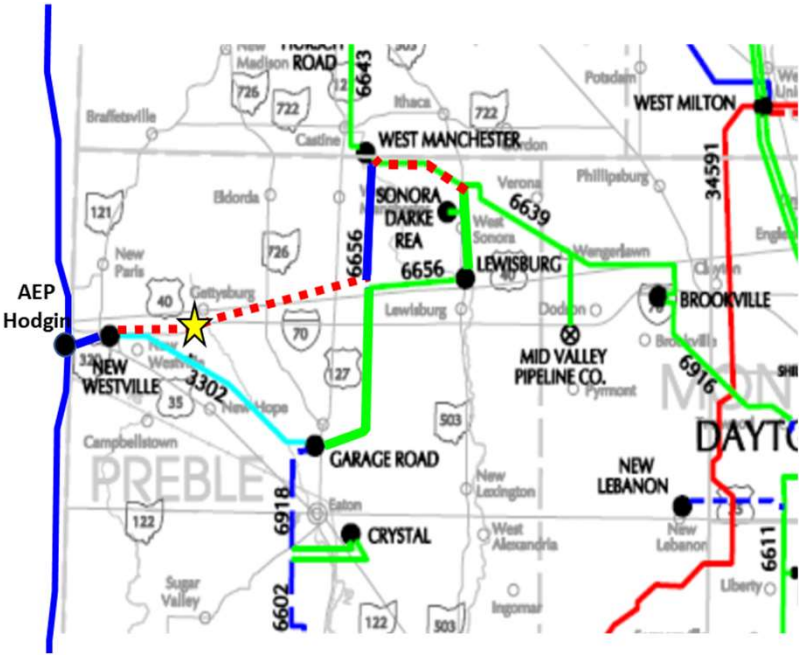
- **New Westville – AEP Hodgin 138kV Line:**
  - Construct a 138kV 1.86-mile single circuit transmission line. This transmission line will help loop the radial load served at New Westville as part of the overall effort to improve reliability in this area. Also, it provides a source to feed New Westville load while t 138kV tie built back into the AES Ohio system.
  - **Estimated Cost: $3.7M , In-service Date: 12/31/2025 (s2585.2)**

- **New Westville – West Manchester 138kV Line:**
  - Construct a new approximate 11-mile single circuit 138kV line from New Westville to the Lewisburg tap off 6656. Convert a portio of 6656 West Manchester – Garage Rd 69kV line between West Manchester - Lewisburg to 138kV operation (circuit is built to 138kV). This will utilize part of the line already built to 138kV and will take place of the 3302 that currently feeds New Westville. T 3302 line will be retired as part of this project.
  - **Estimated Cost: $16.0M, In-service Date: 12/31/2026 (s2585.3)**

- **West Manchester Substation:**
  - The West Manchester Substation will be expanded to a double bus double breaker design where AES Ohio will install one 138kV circuit breaker, a 138/69kV transformer, and eight new 69kV circuit breakers. These improvements will improve help improve a nc standard bus arrangement where there is only one bus tie today and will improve the switching arrangement for the West Sonora Delivery Point.
  - **Estimated Cost: $9.9M , In-service Date: 12/31/2026 (s2585.4)**

- **New Orphan Rd POI (Darke REA):**
  - Install a new three-way phase over phase MOAB to serve a new 138kV delivery point for the Darke REA Electric Co-operative.
  - **Estimated Cost: $0.5M , In-service Date: 12/31/2026 (s2585.5)**

Total Part 1 Cost: $36.1M



Dayton Transmission Zone M-3 Process
Preble & Montgomery County, Ohio

Part #2: Project Description:

- **West Manchester – West Senora Tap Double Circuit Rebuild**
  - Retire the existing single circuit section of the 6639 line tap to Sonora up to West Manchester and rebuild as a 4-mile double circuit 69kV line. One circuit will connect West Manchester to Lewisburg and the other circuit will connect back to West Manchester to Wolfcreek.
  - **Estimated Cost: $8.0M, In-service Date: 12/1/2026 (s2585.6)**

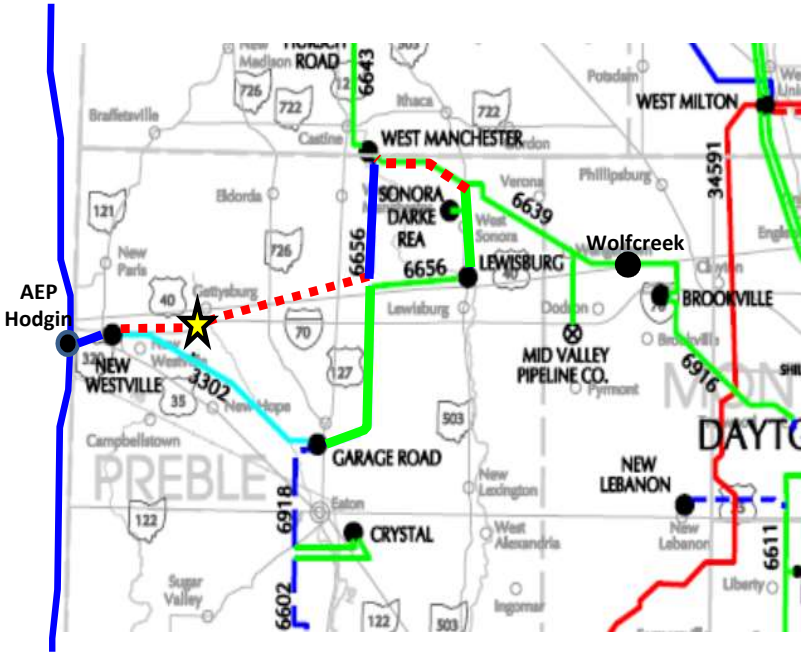
- **Lewisburg Substation**
  - The Lewisburg 69kV Substation will be converted to a new four breaker 69kV ring station and will serve the 7MVA additional customer load that is being added in Lewisburg. Also, this conversion will allow AES Ohio to close in the normally open feed at Lewisburg when complete.
  - **Estimated Cost: $4.5M, In-service Date: 12/1/2025 (s2585.7)**

- **West Sonora (Darke REA)**
  - Install a new three-way phase over phase MOAB to serve the Sonora Darke REA delivery point that is currently served via a one-way switch. Retire the existing switch.
  - **Estimated Cost: $0.5M, In-service Date: 12/1/2025 (s2585.8)**

- **Mid-Valley Pipeline Tap**
  - Replace the existing two-way switch with a new three-way phase over phase MOAB switch. This will provide greater flexibility to switch during outages on the portion of the tap down to the customer.
  - **Estimated Cost: $0.5M, In-service Date: 12/1/2026 (s2585.9)**

- **Brookville Substation:**
  - Modify the bus arrangement at Brookville Substation to install two new 69kV line circuit breakers. This will improve reliability at Brookville Substation by removing tapped transformers from the transmission lines.
  - **Estimated Cost: $2.9M, In-service Date: 12/1/2026 (s2585.10)**

Total Part 2 Cost: $16.4M



Dayton Transmission Zone M-3 Process
Preble & Montgomery County, Ohio

Additional Scope to Previous Solution:

➢ **AEP Hayes Substation & AEP Hayes- New Westville Interconnection**

- Hayes – New Westville 138 kV line: Build ~0.19 miles of 138 kV line to the Indiana/ Ohio State line to connect to AES's line portion of the Hayes – New Westville 138 kV line with the conductor size 795 ACSR26/7 Drake. The following cost includes the line construction and ROW. **(s2585.11)**
- **Cost: $0.38 M (AEP)**
- Hayes – Hodgin 138 kV line: Build ~0.05 miles of 138 kV line with the conductor size 795 ACSR26/7 Drake. The following cost includes the line construction, ROW, and fiber. **(s2585.12)**
- **Cost: $ 1.22 M (AEP)**
- Hayes 138 kV: Build a new 4-138 kV circuit breaker ring bus. The following cost includes the new station construction, property purchase, metering, station fiber and the College Corner –Randolph 138 kV line connection. **(s2585.13)**
- **Cost: $ 7.44 M (AEP)**

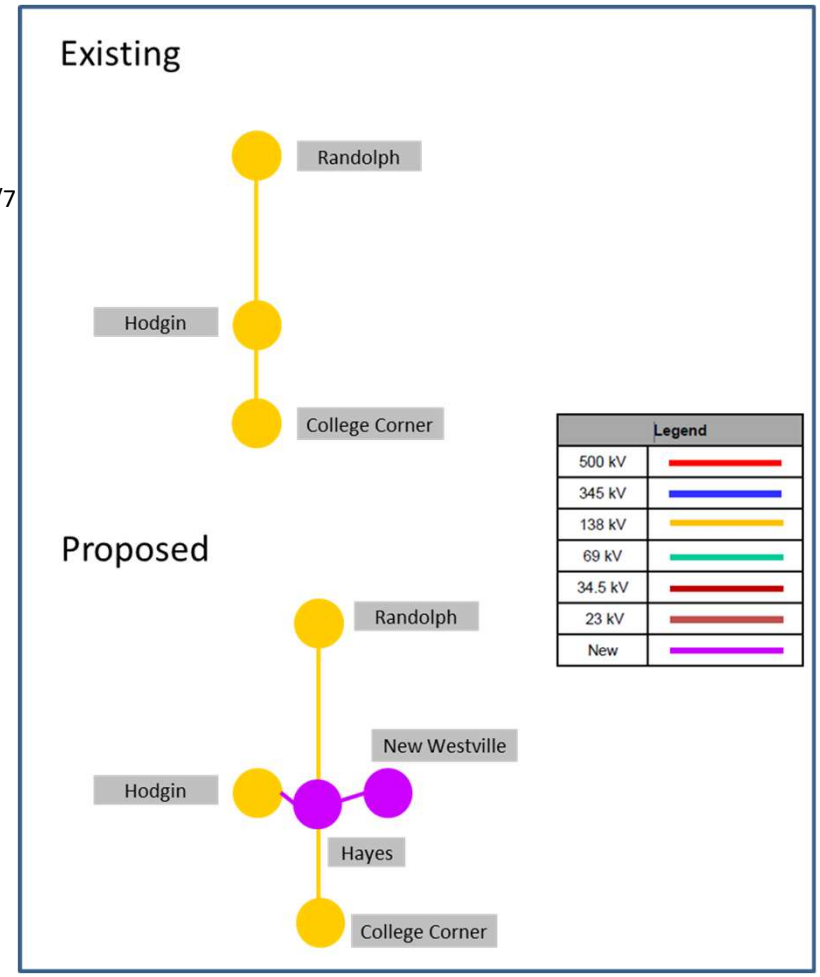
Total Cost: $9 M (AEP)

Alternative considered:

Connecting to Hodgin station is not an option as it is not owned by AEP.

Projected In-Service: 12/31/2025

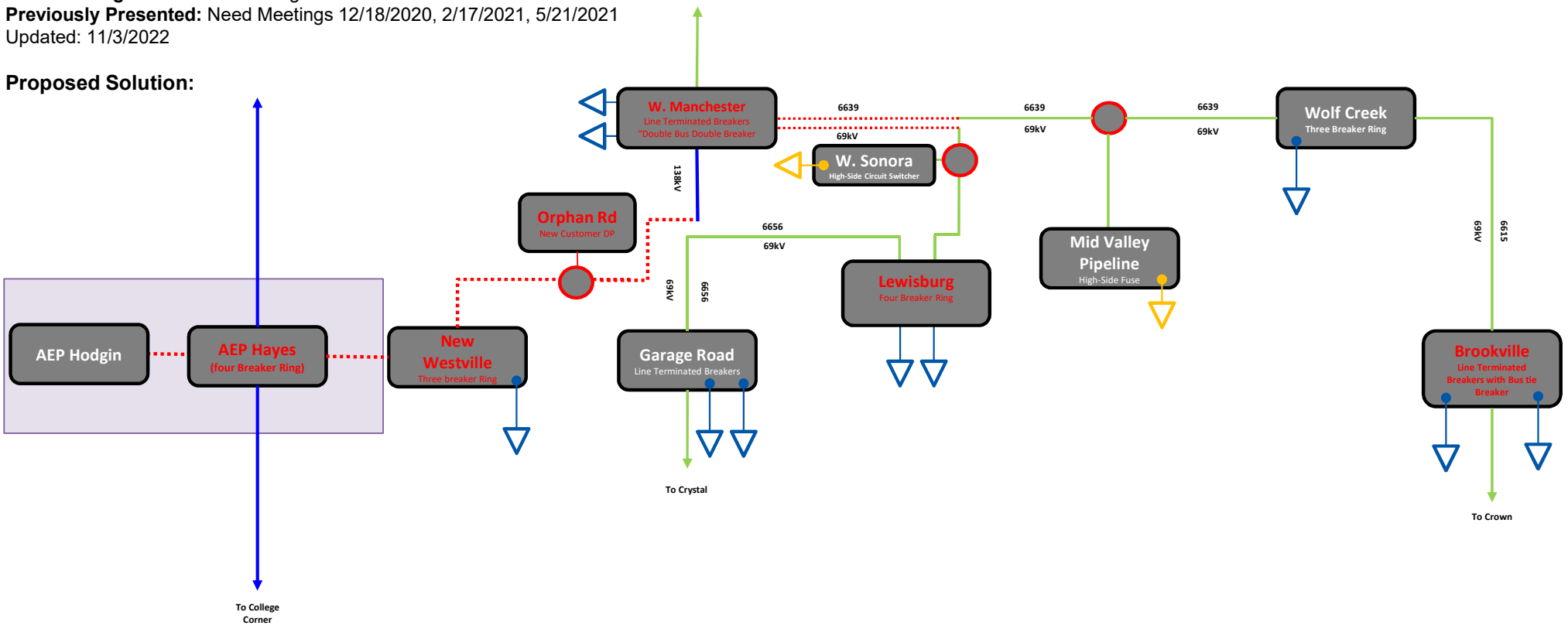
Project Status: Scoping



Dayton Transmission Zone M-3 Process
Preble County, Ohio

Need Number: Dayton-2020-011, Dayton-2021-001, Dayton-2021-008
Process Stage: Solutions Meeting 8/16/2021
Previously Presented: Need Meetings 12/18/2020, 2/17/2021, 5/21/2021
Updated: 11/3/2022

Proposed Solution:



-Updated 11/18/2022