Sub Regional RTEP Committee: Western
AEP Supplemental Projects

Sept 16, 2022

Changes to the Existing Projects

2

AEP Transmission Zone
S2270 Scope Change

S2270.1 -.7 (2020 AEP local plan)

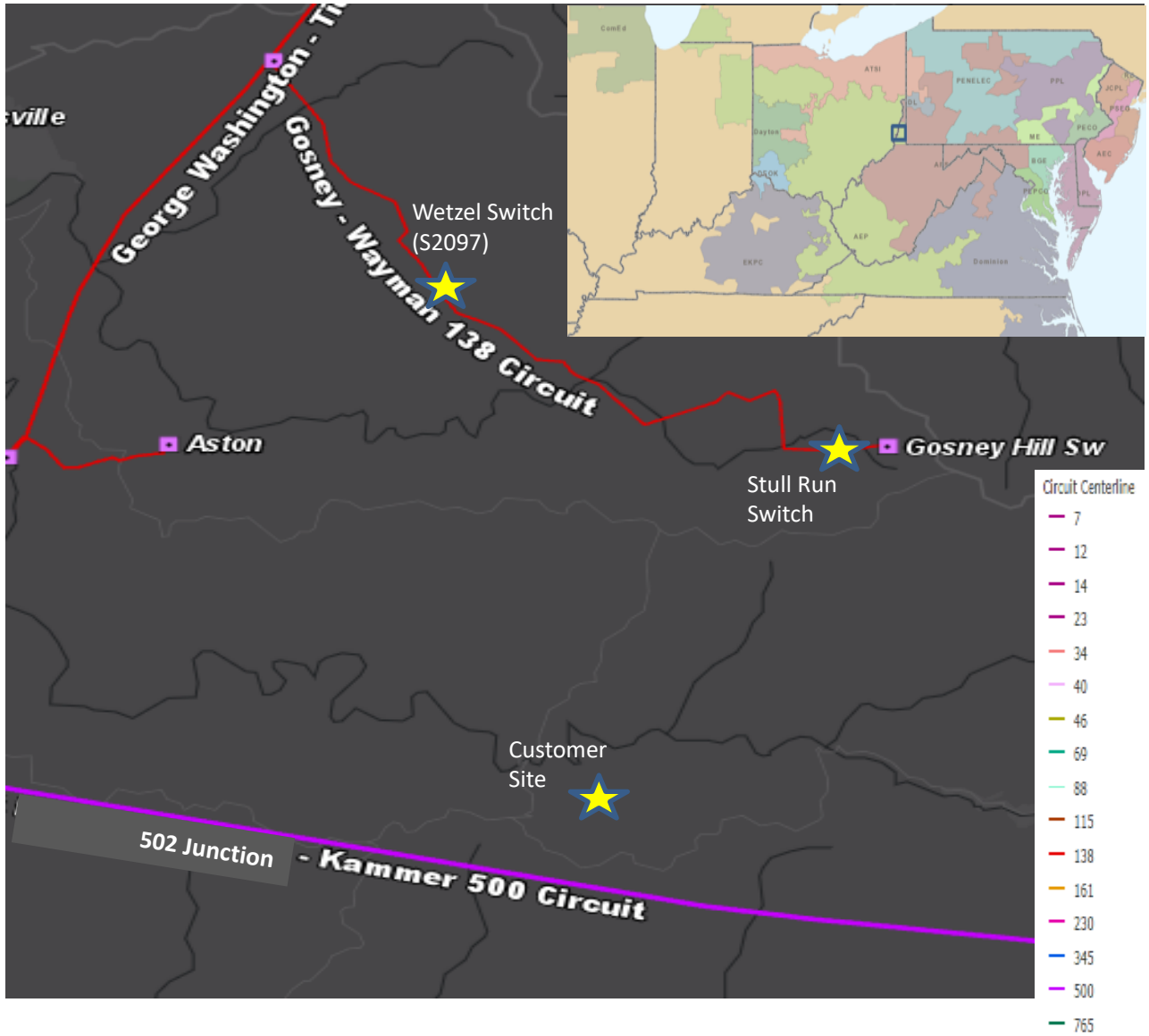
Supplemental Project Driver:

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)**

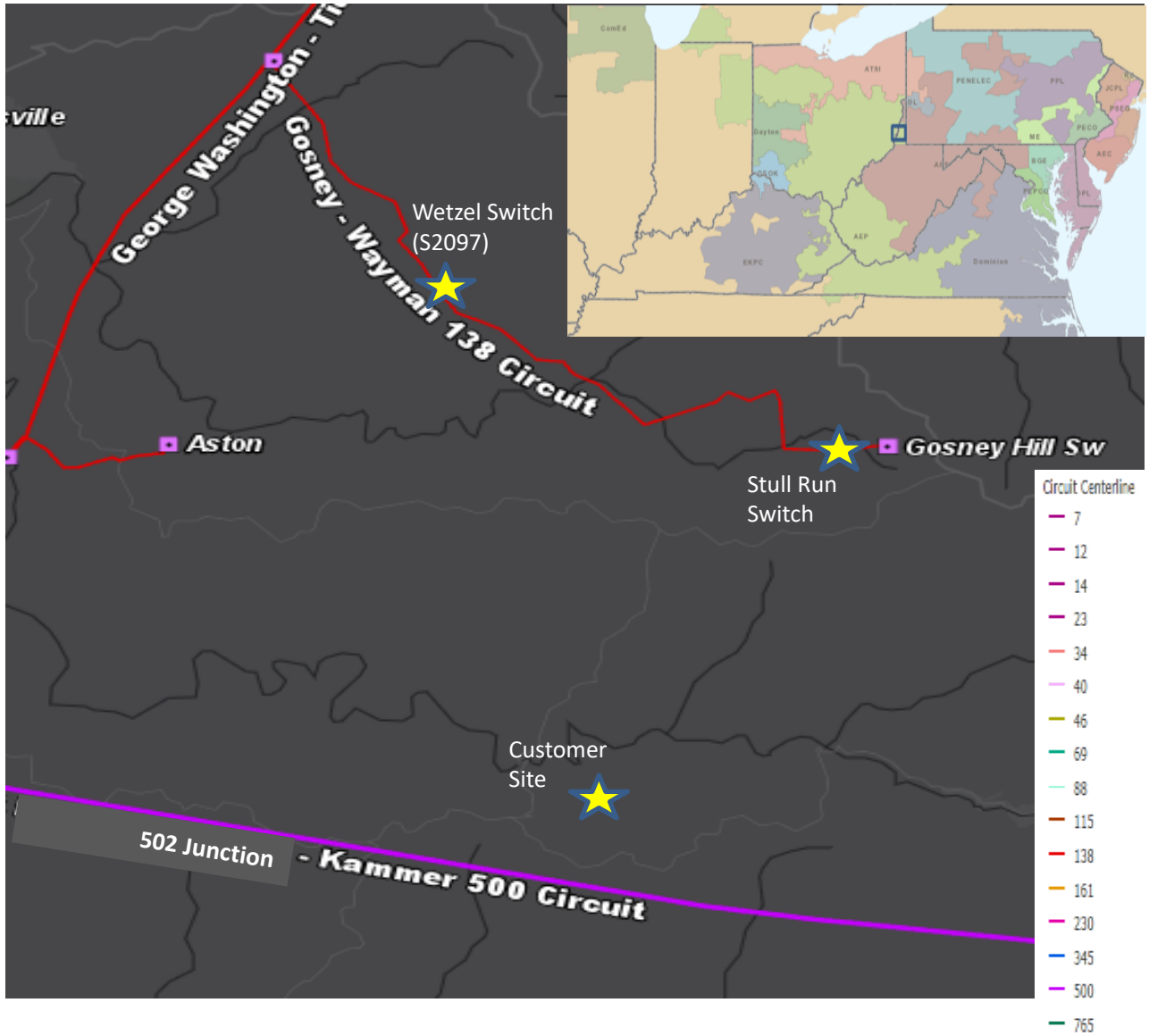
~~Construct a new 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way.~~ **~~Estimated Cost: $5.0 M (s2270.6)~~**

~~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

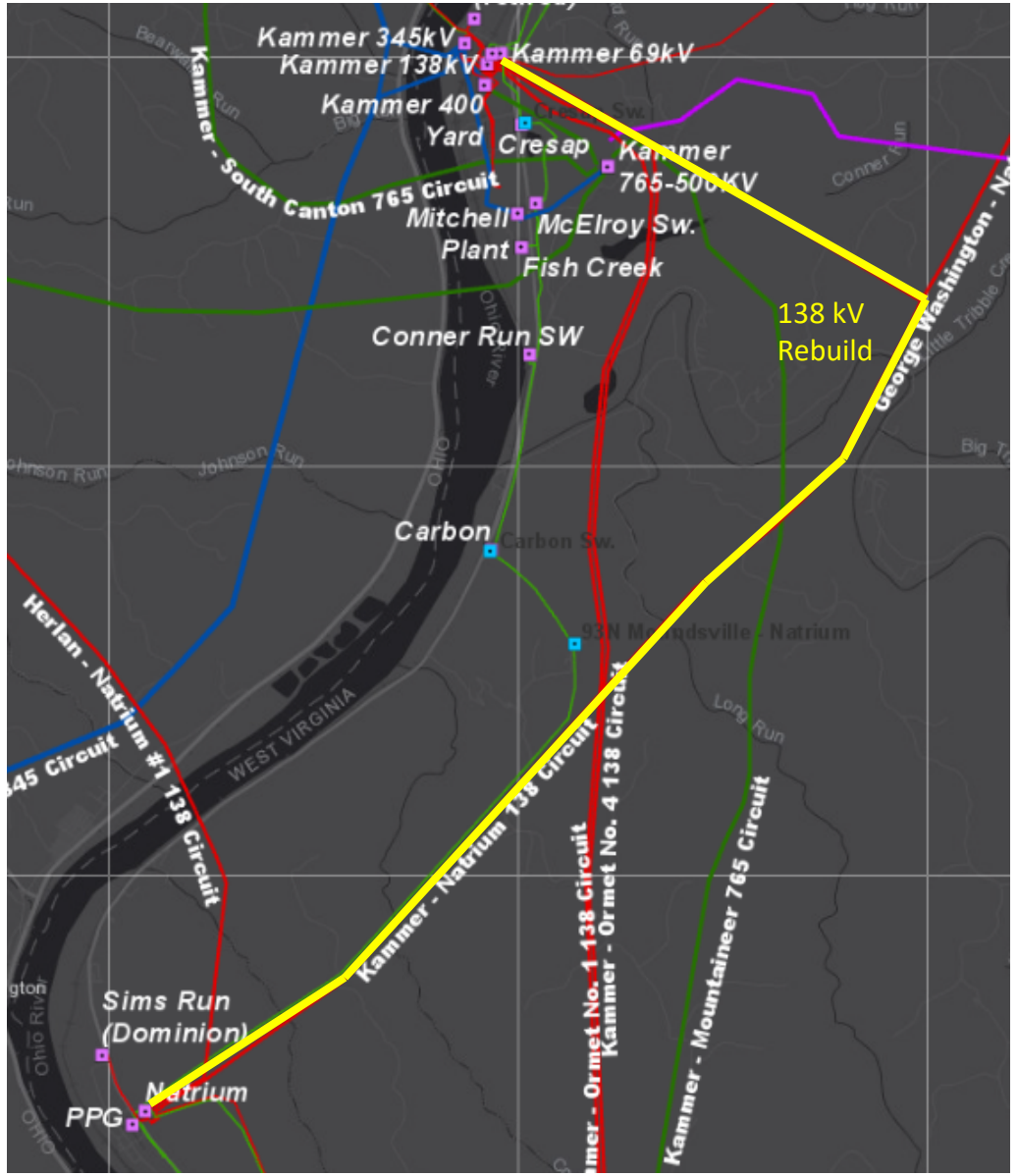
Total Project Cost: $82.64 million *(compared to a total of approximately $137.9 M, if the Panhandle 500-138kV option had proceeded)*

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



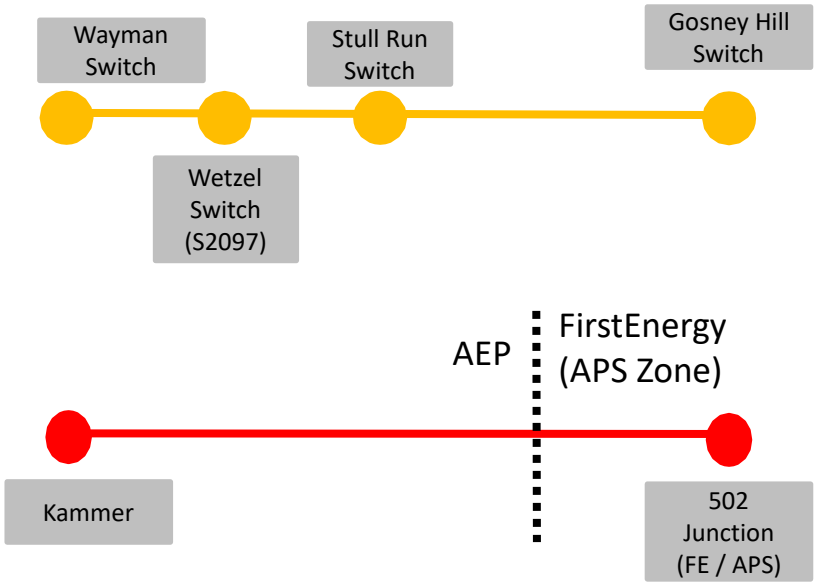
Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 9/16/2022

Proposed Solution:

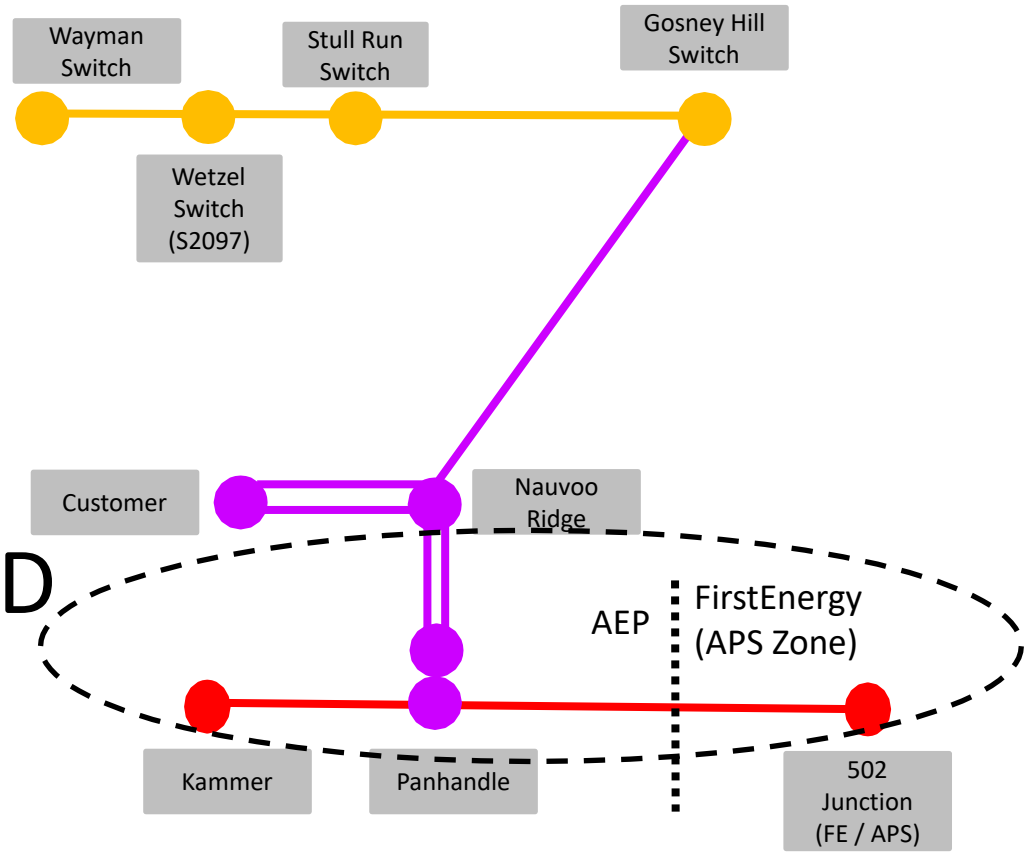
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Existing:



CANCELLED 3/2022

Proposed:



AEP Transmission Zone
S2270 Scope change

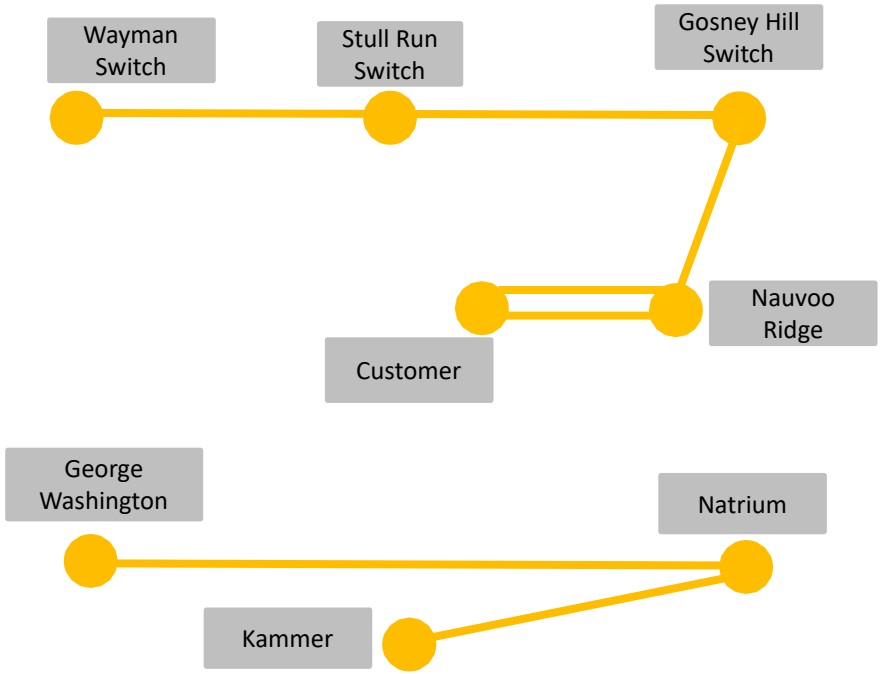
Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 9/16/2022

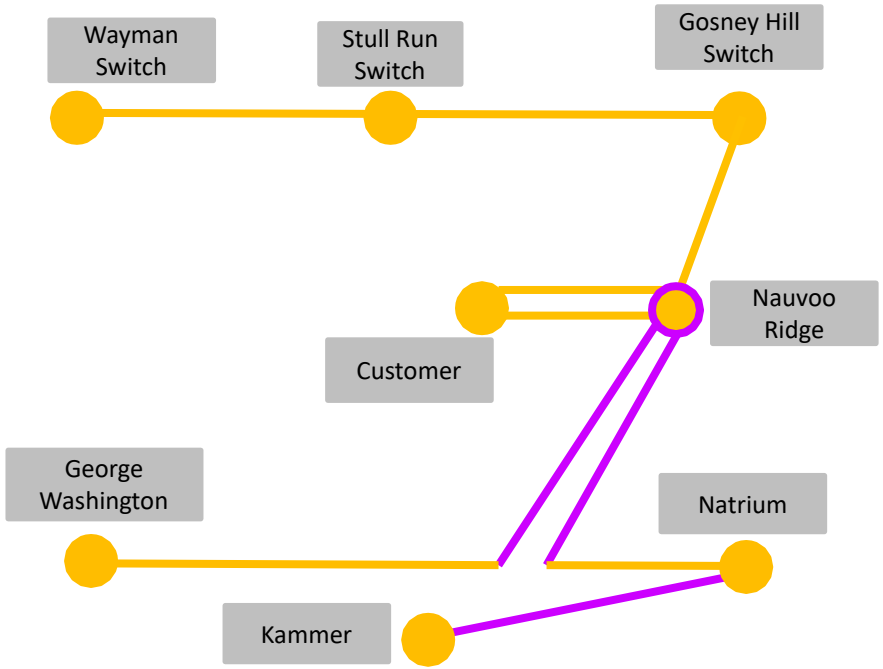
Proposed Solution:

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

Existing:



Proposed (After 2nd Scope Update):



Needs

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

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AEP Transmission Zone M-3 Process
Kanawha County, WV

Need Number: AEP-2022-AP036

Process Stage: Need Meeting 9/16/2022

Project Driver: Equipment Condition/Performance/Risk

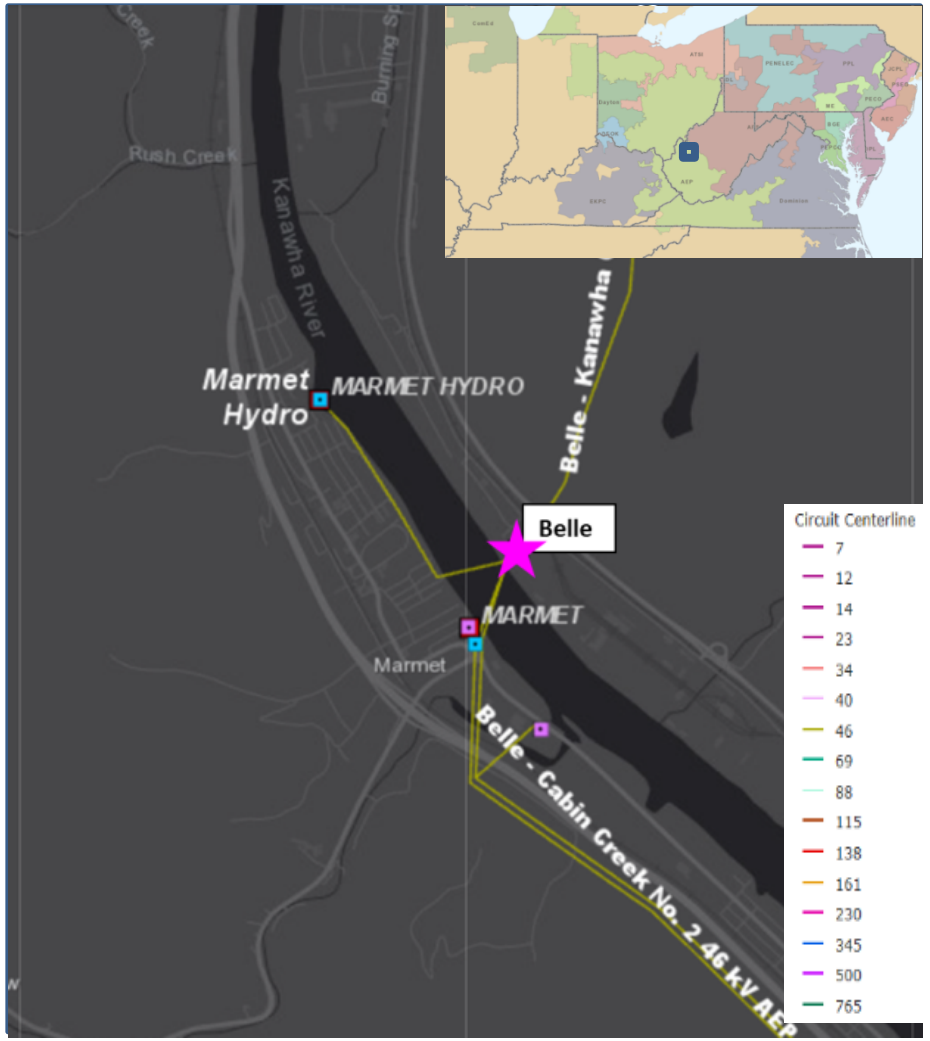
Specific Assumption Reference:

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

Problem Statement:

Belle Station:

- 46kV Circuit breakers C, G, H, and J, and 46kV customer owned circuit breakers, A, D, E, and F, are all 72PM31-20 type, SF6 filled breakers.
    - 1996 vintage, these circuit breakers, F, H, G, and J, have each exceeded the manufacturer's designed number of full fault operations. Circuit breakers of this type across the AEP system have had reports of moisture ingress into the breaker tank. This moisture ingress leads to increased maintenance and a higher risk of failure. These breakers have documented issues with failures to close due to burned up coils. There have been five catastrophic failures involving this model type on the AEP system. There are also 98 malfunction records related to SF6 gas leaks, including circuit breaker F at Belle Substation.
- Belle Substation currently deploys 87 relays, implemented to ensure the adequate protection and operation of the substation. Currently, 73 of the 87 relays (84% of all station relays) are in need of replacement. There are 72 electromechanical relays which have significant limitations with regards to fault data collection and retention. These relays lack vendor support and have little to no access to spare parts.. In addition, PCE has verified there is 1 microprocessor relay, 87LH, that currently utilizes legacy firmware. Also, there are 2 relays, 151B and 151XB, that were retired in place.



Need Number: AEP-2022-AP037

Process Stage: Needs Meeting 9/16/2022

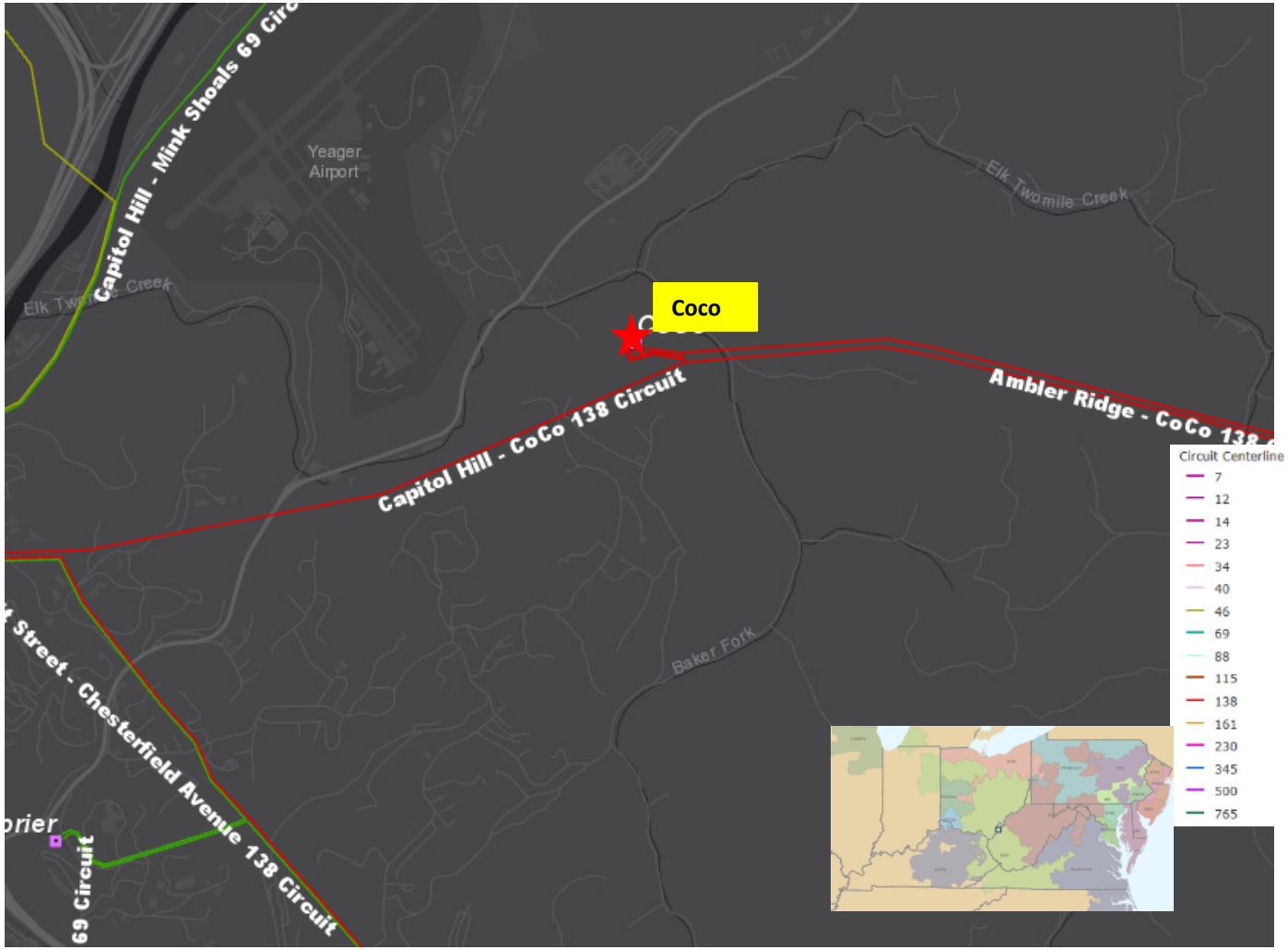
Supplemental Project Driver: Customer Service

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

Problem Statement:

APCO Distribution has requested to install new distribution transformer at the existing Coco 138 kV Transmission Station to support load growth in the Meadowbrook, WV Area.

The projected load at the new Coco transformer is 6.9 MVA and this is being transferred from Mink Shoals and Greenbriar stations.



AEP Transmission Zone M-3 Process
Wells, IN

Need Number: AEP-2022-IM015

Process Stage: Need Meeting 9/16/2022

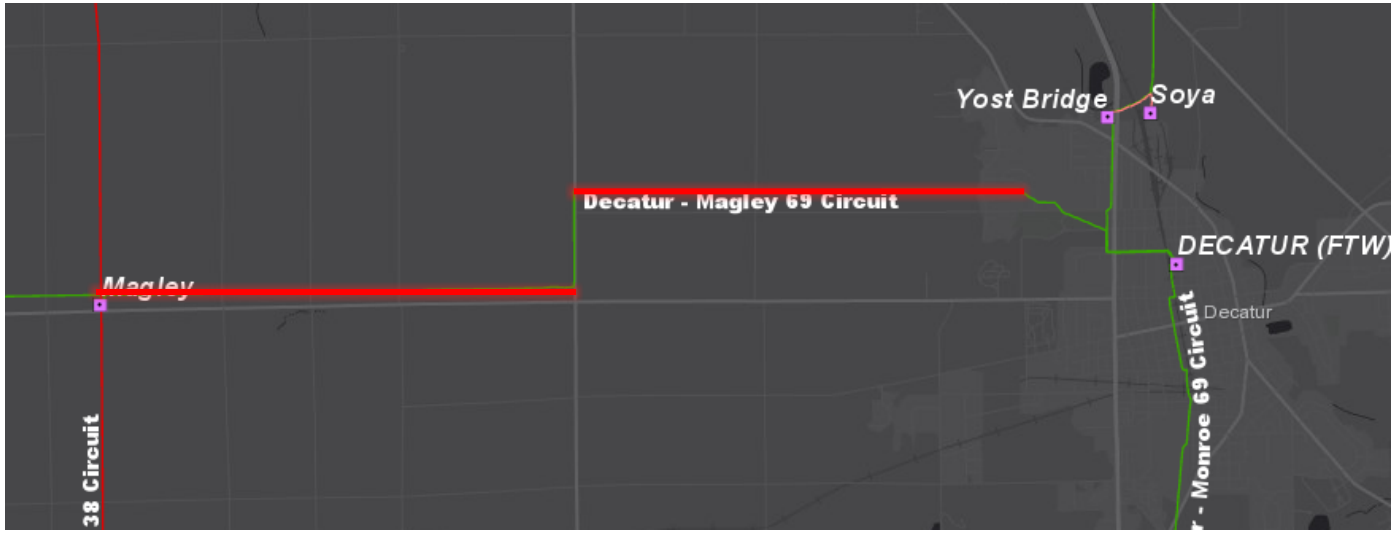
Project Driver: Equipment Material Condition, Performance and Risk

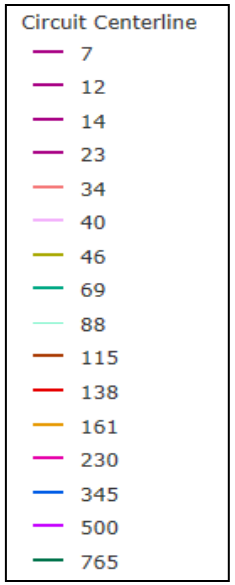
Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 13)

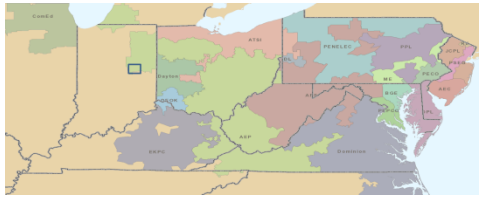
Problem Statement:

Magley – Decatur 69 kV (Vintage 1957/1966)

- Length of line: 5.88 miles
- Total structure count: 24 dating back to 1957, 1 installed in 1965 and 45 installed in 1966.
- Line construction Type:
  - Wood pole and H frame structures
  - 5/16" steel shield wire which has history of failure
- Conductor Type:
  - 6 wired, 4/0 ACSR 6/1 Penguin (1957): 3.16 miles
  - 336,400 CM ACSR 30/7 Oriole (1966): 2.72 miles
- Momentary/Permanent Outages: 7 Momentary and 1 Permanent
- Condition Summary:
  - Number of open conditions: 6 structures have at least one open condition. 43 structures were assessed by drone and 10 assessed by a ground crew and the following were identified
    - H Frame structures had moderate shell damage with some heavy checking.
    - Wood structures on this line are subject to high number of woodpecker and insect damage.
    - Multiple instances of decay, pole split, rot top, crossarm split, pole cavity, brace splitting and flashed/split insulator.
  - Structures fail NESC Grade B, ASCE structural strength requirements, AEP grounding standards, AEP structural strength requirements and the H Frame portions fail AEP shielding angle standards.







AEP Transmission Zone M-3 Process
Hartford, MI

Need Number: AEP-2022-IM016

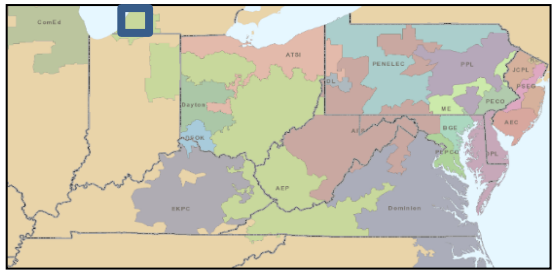
Process Stage: Needs Meeting 09/16/2022

Project Driver: Customer Service

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

Problem Statement:

The City of South Haven has requested a new 69kV delivery point in Hartford, Michigan by the end of May 2023. Anticipated load is approximately 8.5 MVA.



AEP Transmission Zone M-3 Process
East Liverpool, Ohio

Need Number: AEP-2022-OH041

Process Stage: Need Meeting 09/16/2022

Project Driver:

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

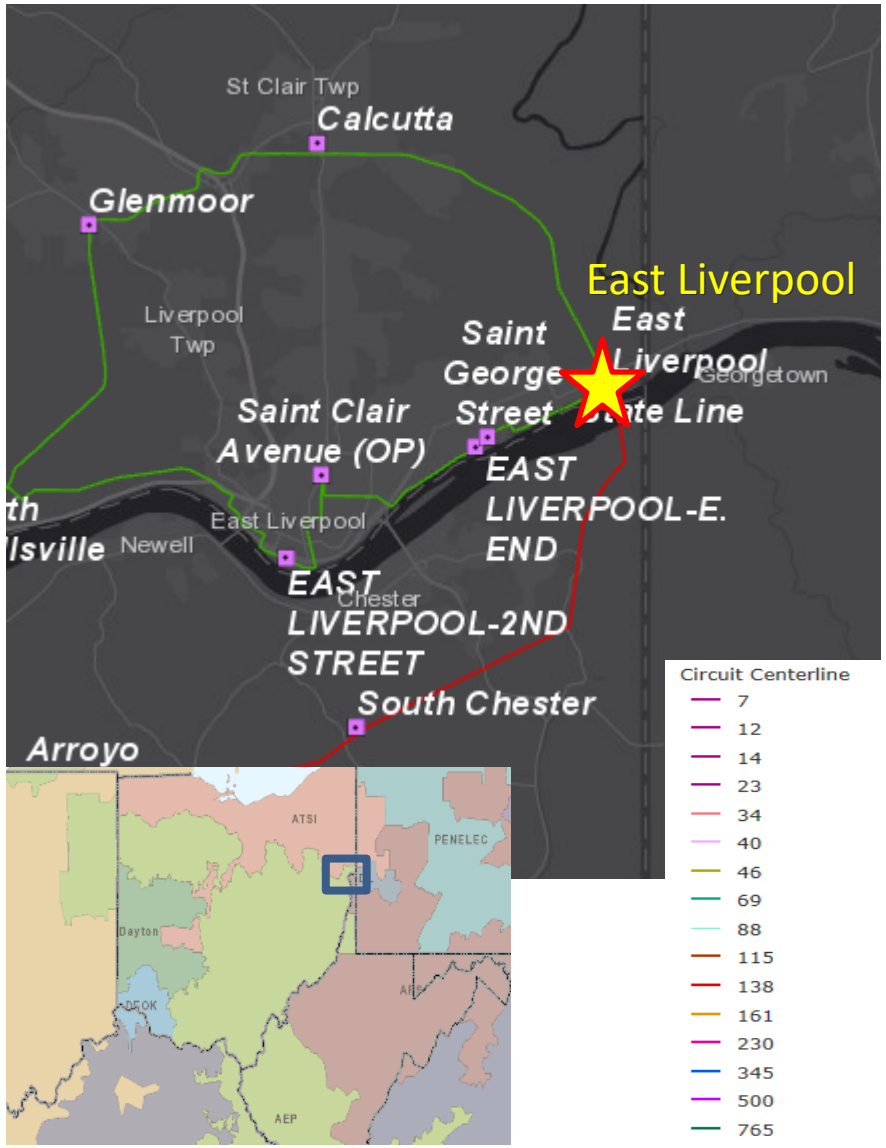
Specific Assumption Reference:

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

Problem Statement:

<u>Equipment Material/Condition/Performance/Risk:</u>

- The East Liverpool – Second Street 69kV circuit protection uses electromechanical relays and a legacy pilot wire communications channel. 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. Pilot wire cables are showing increased rates of failure and signal degradation across the AEP system.
- The 138kV tie-line to FirstEnergy uses electromechanical relays. The power-line-carrier equipment at East Liverpool was installed in 1962, presenting a failure risk. FE has indicated a future project is planned to upgrade relays on their side.
- The 138-69kV transformer protection system also utilizes outdated electromechanical relays.
- The 1962-vintage control house has various issues of concern: lead-based paints, asbestos, no air conditioning or exhaust fans, and small roof leaks.
- The station PT's are original to the station (1962) and are in poor condition with rusting. The AC station service system is in poor condition and uses a corner-ground connection which is a safety concern.
- There is a broken 69kV hook-stick disconnect switch needing replaced.



AEP Transmission Zone M-3 Process
East Liverpool, Ohio

Need Number: AEP-2022-OH041

Process Stage: Need Meeting 09/16/2022

Project Driver:

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

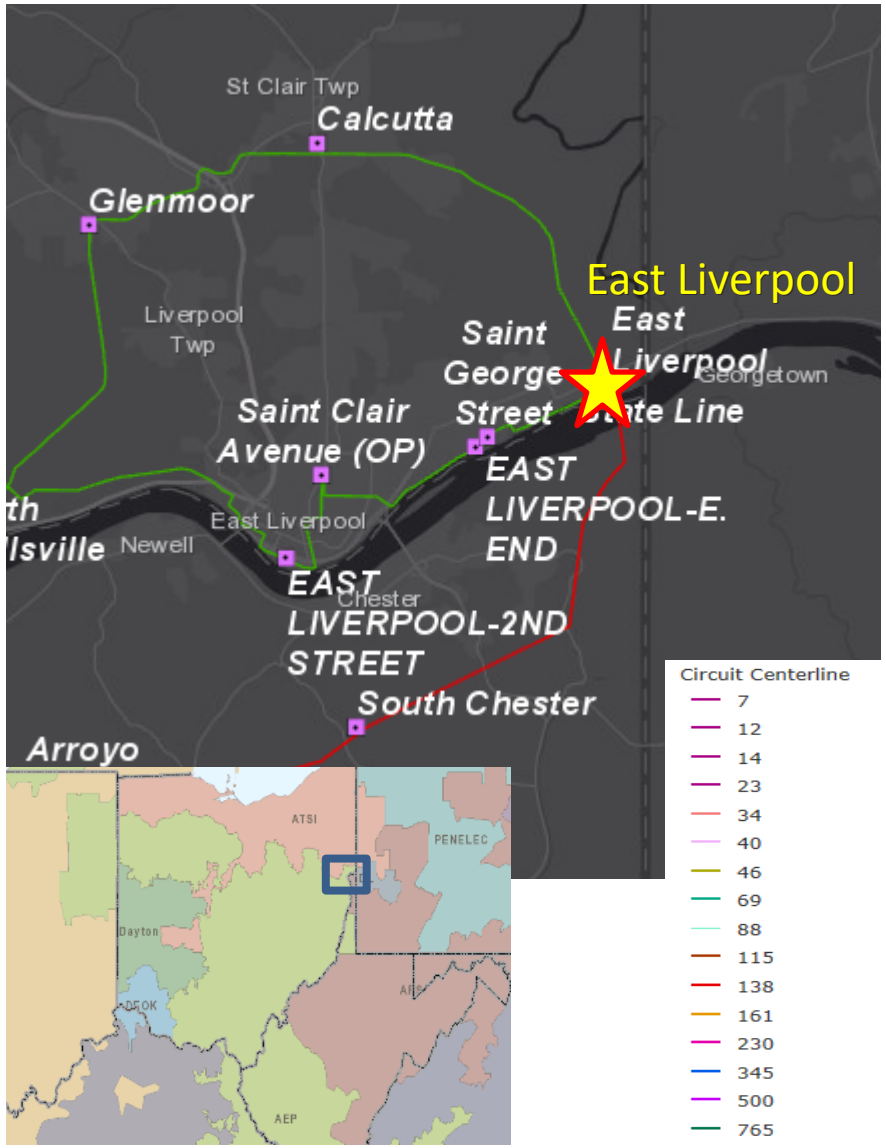
Specific Assumption Reference:

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

Problem Statement:

Operational Flexibility and Efficiency:

- The 138-69kV transformer lacks a high-side fault-interrupting device and only has a MOAB/ground-switch scheme. This requires remote-end fault clearing at FirstEnergy's Wylie Ridge and Arroyo 138kV stations (3-terminal source). This remote-end fault clearing zone also drops FE's South Chester station and distribution customers in the process.
- Due to the lack of circuit breakers at the station, there are 3 overlapping zones of protection: 69kV bus, 138-69kV transformer, and 138kV line. These dissimilar zones of protection can cause over tripping and mis-operations.



AEP Transmission Zone M-3 Process
Zanesville, OH

Need Number: AEP-2022-OH049

Process Stage: Need Meeting 09-16-2022

Project Driver:

Equipment Material/Condition/Performance/Risk

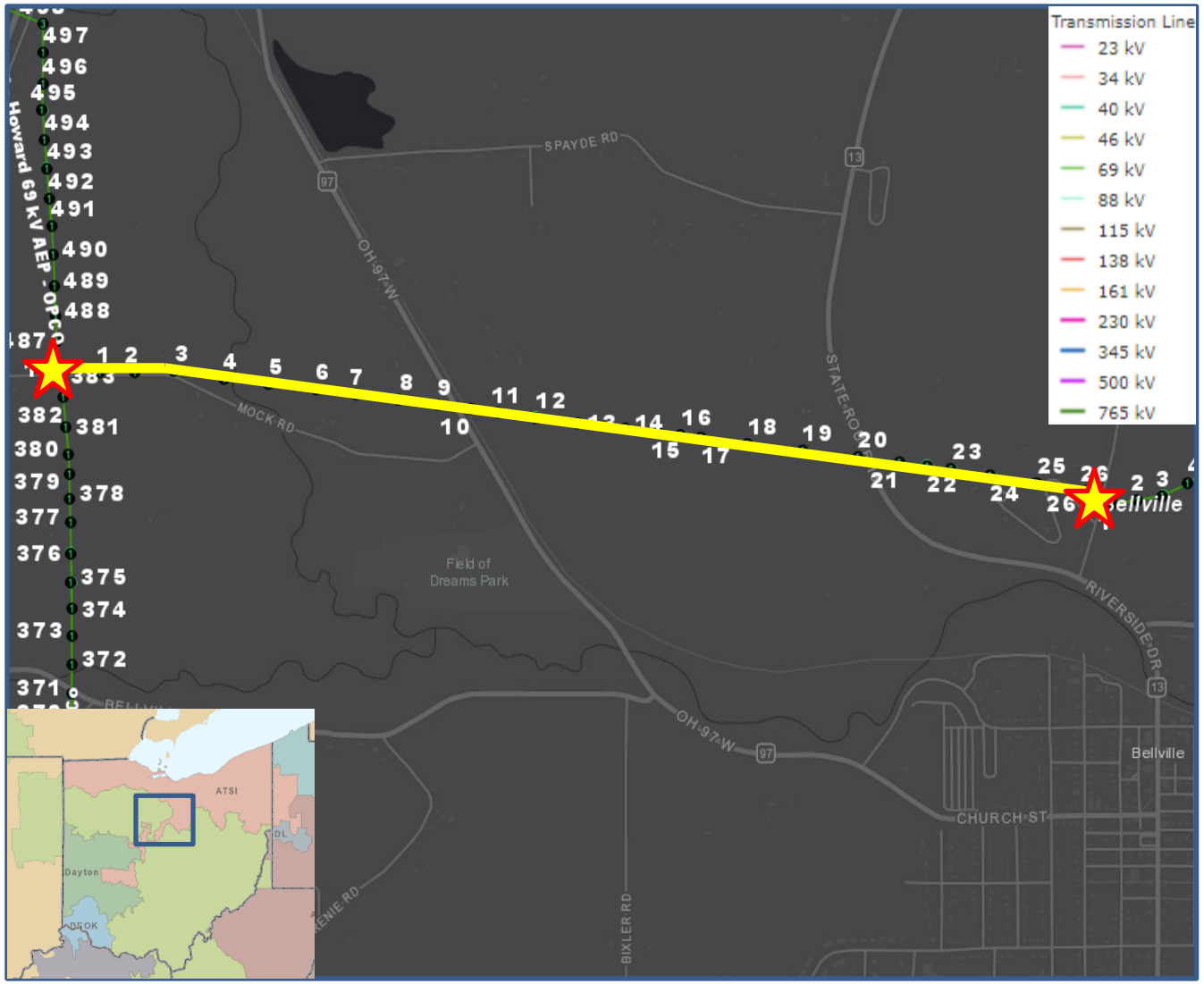
Specific Assumption Reference:

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

Problem Statement:

<u>West Bellville – Bellville 69kV (1953)</u>

- Length of Line**:** 1.87 Miles
- Total Structure count: 28
    - 1 Steel pole structure from 2006
    - 27 wood pole structures
- Conductor Type: 1/0 ACSR 6/1 (Raven)
- Outage History for 2017-2021: 14 Momentary and 9 Permanent outages – estimated 2,998,390 minutes of interruption.
- Open Conditions: 15 structures with open conditions (54% of structures on the line)
    - 23 structure related open conditions specifically affecting the pole and stub pole including rot, woodpecker, and sitting in water conditions.
    - 1 conductor related open condition affecting a broken strand on a conductor.
    - 15 hardware related open conditions affecting broken insulators and molding.



AEP Transmission Zone M-3 Process
Dover, Ohio

Need Number: AEP-2022-OH053

Process Stage: Need Meeting 9/16/2022

Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

69 kV Circuit Breakers G & J:

- Breaker Ages: 1972
- Interrupting Medium: (Oil)
- Number of Fault Operations: G 33 & J 46

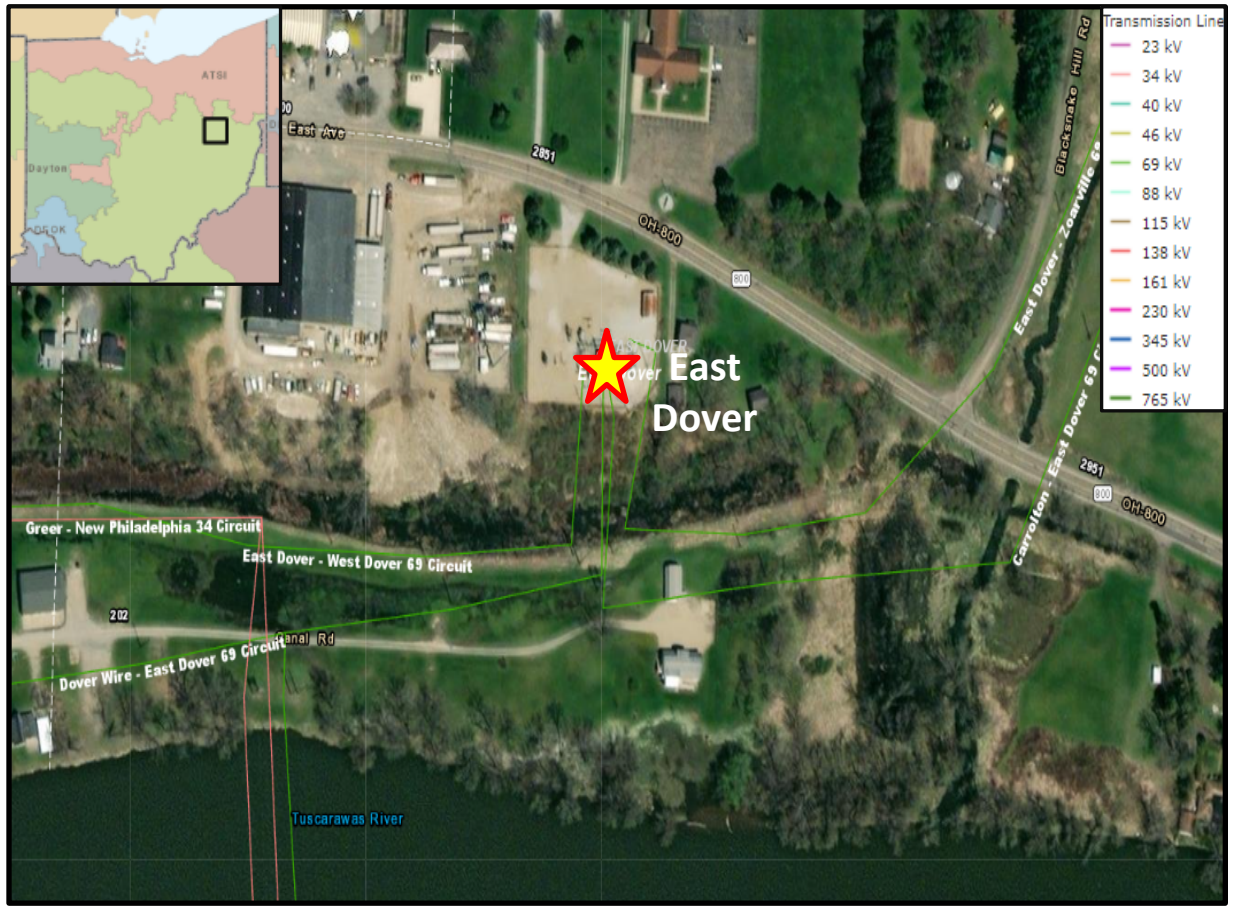
Additional Information: These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. The manufacturer provides no support for the CG family of circuit breakers and spare parts are not available. 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.

<u>Relays:</u>

Currently, 30 of the 42 relays (71% of all station relays) are in need of replacement. 28 of these are of the electromechanical and static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition,

these relays lack of vendor support.

The 69kV electromechanical bus protection relays have no redundancy and would require the tripping of all remote-end 69kV station breakers in the event of a failure.



AEP Transmission Zone M-3 Process
Dover, Ohio

Need Number: AEP-2022-OH053

Process Stage: Need Meeting 9/16/2022

Project Driver: Equipment Material/Condition/Performance/Risk

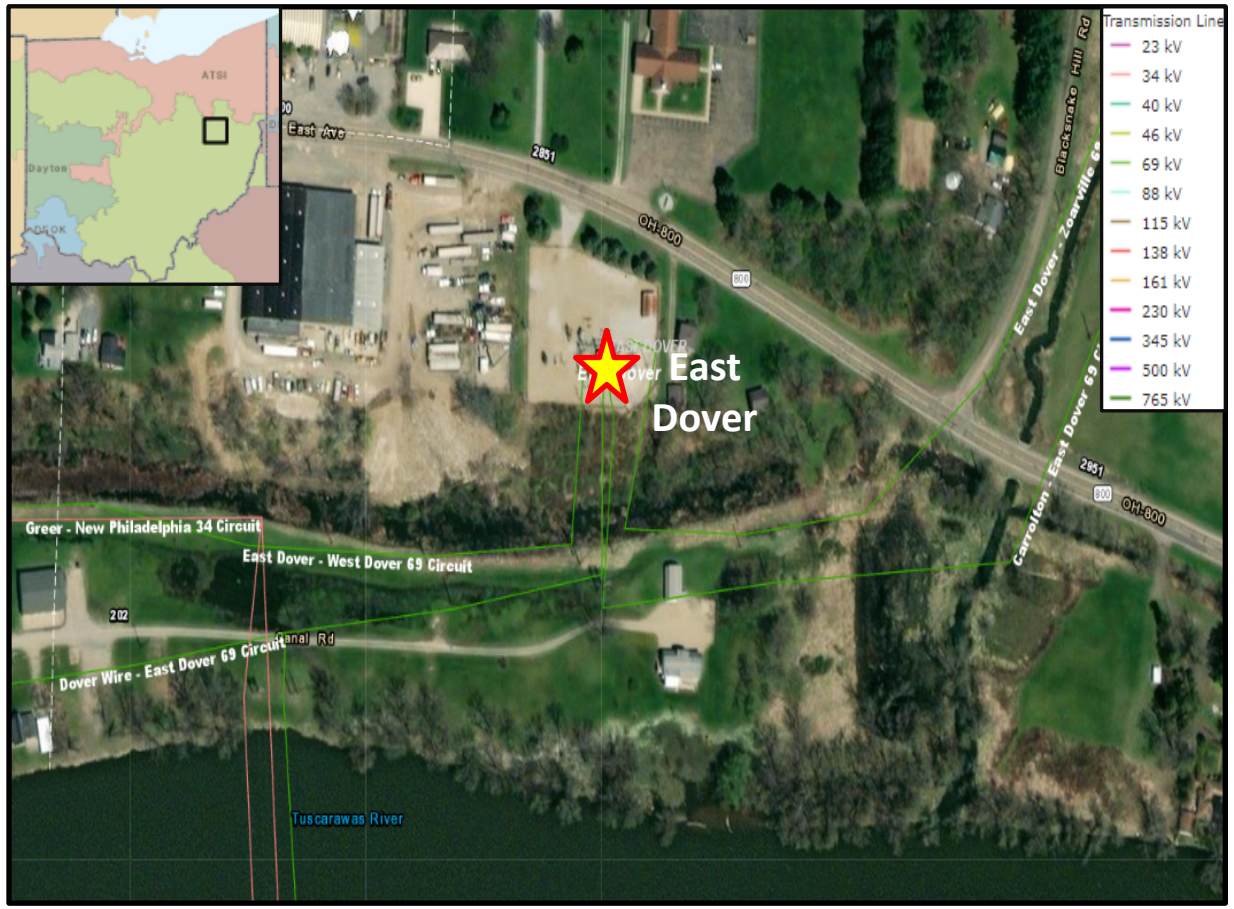
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement, Continued:

The station control house has many issues of concern, including: rusting, lead paint, and asbestos, and the direct-buried-cable trench is full. The perimeter fence and entry gate are substandard and there are safety concerns with the driveway. Station service is corner-grounded which is a safety concern and there is no backup station service. Over the past 5 years, distribution customers at the station experienced 213,000 minutes of CMI due to station equipment failures.

The 69kV circuit to Greer/Dover Wire uses a legacy pilot wire communications channel. Pilot wire cables have been increasing prone to failure and downtime across the AEP system.

The 69-12kV distribution transformer lacks a high-side fault-interrupting device, which requires taking out the 69kV bus for a transformer fault.



AEP Transmission Zone M-3 Process
Hammansburg - Buckeye Pipe

Need Number: AEP-2022-OH058

Process Stage: Need Meeting 09-16-2022

Project Driver:

Equipment Material/Condition/Performance/Risk, Operational Flexibility

Specific Assumption Reference:

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

Problem Statement:

Hammansburg - Buckeye Pipe 34kV Line:

- Length of Line: 1.8 Miles
- Total Structure Count: 49
    - Wooden Monopoles
- Conductor Types: 4/0 ACSR 6/1 (Penguin)
- Open Conditions: 20 open conditions on 18 unique structures

2 open conditions related to the ground lead wire including broken and stolen

4 structure related open conditions specifically affecting the push pole, crossarm, or pole including rot heart, elongated bolt holes and loose conditions

13 open conditions related to the insulator

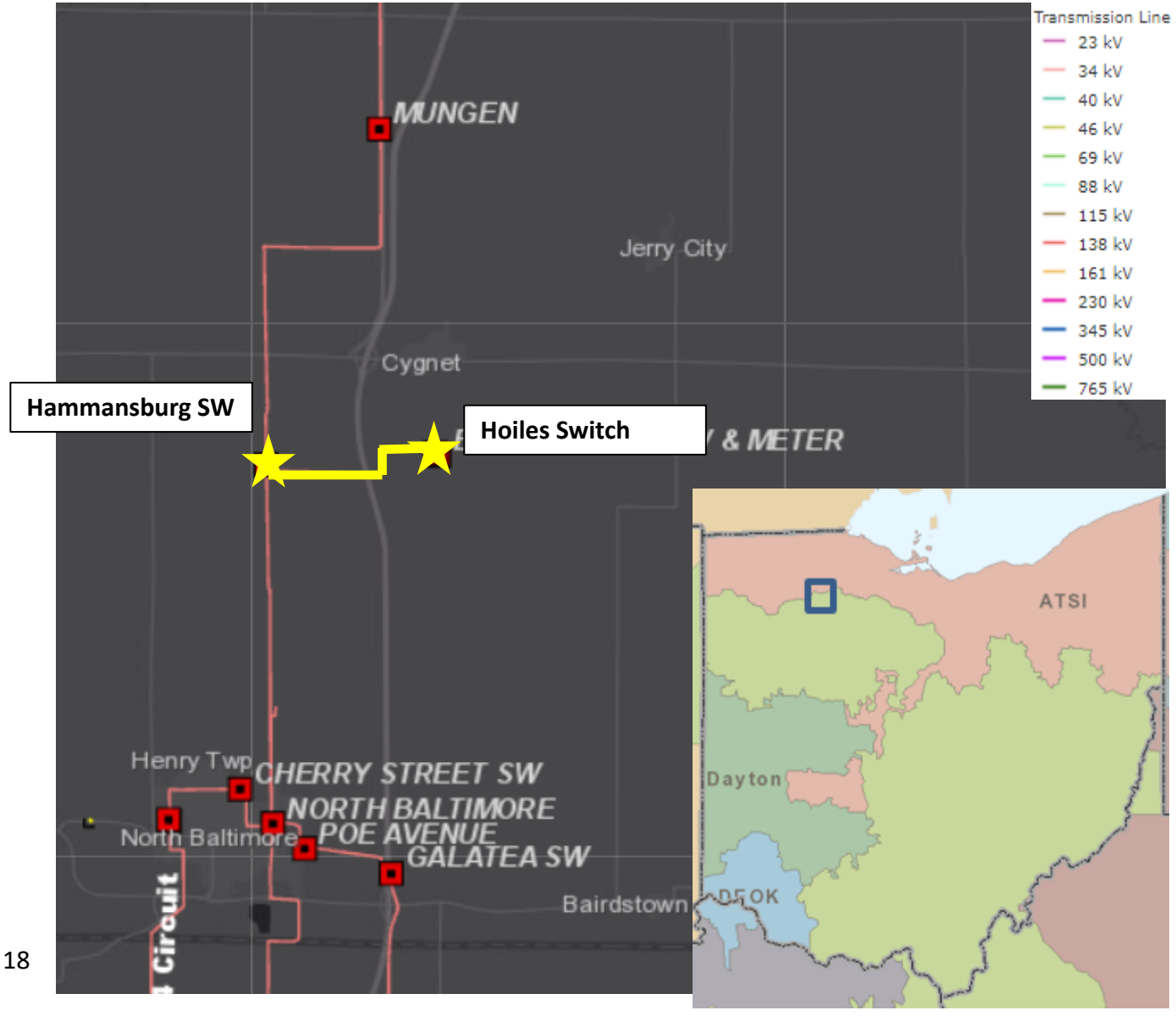
1 related to bonding on a conductor

This line was constructed in 1953. 93% of the line and 88% of the structure assets are the original vintage.

Additional Information:

The Hammansburg - Buckeye Pipe line is a radial line hard tapped off the North Baltimore - Portage line limiting operational flexibility. The North Baltimore - Portage line was previously submitted as AEP-2019-OH052.

The Hoiles switch MOAB U has defective insulators. The switched cannot be operated while energized, including picking up or dropping energized line.



AEP Transmission Zone M-3 Process
Fairfield, Ohio

Need Number: AEP-2022-OH059

Process Stage: Need Meeting 9/16/2022

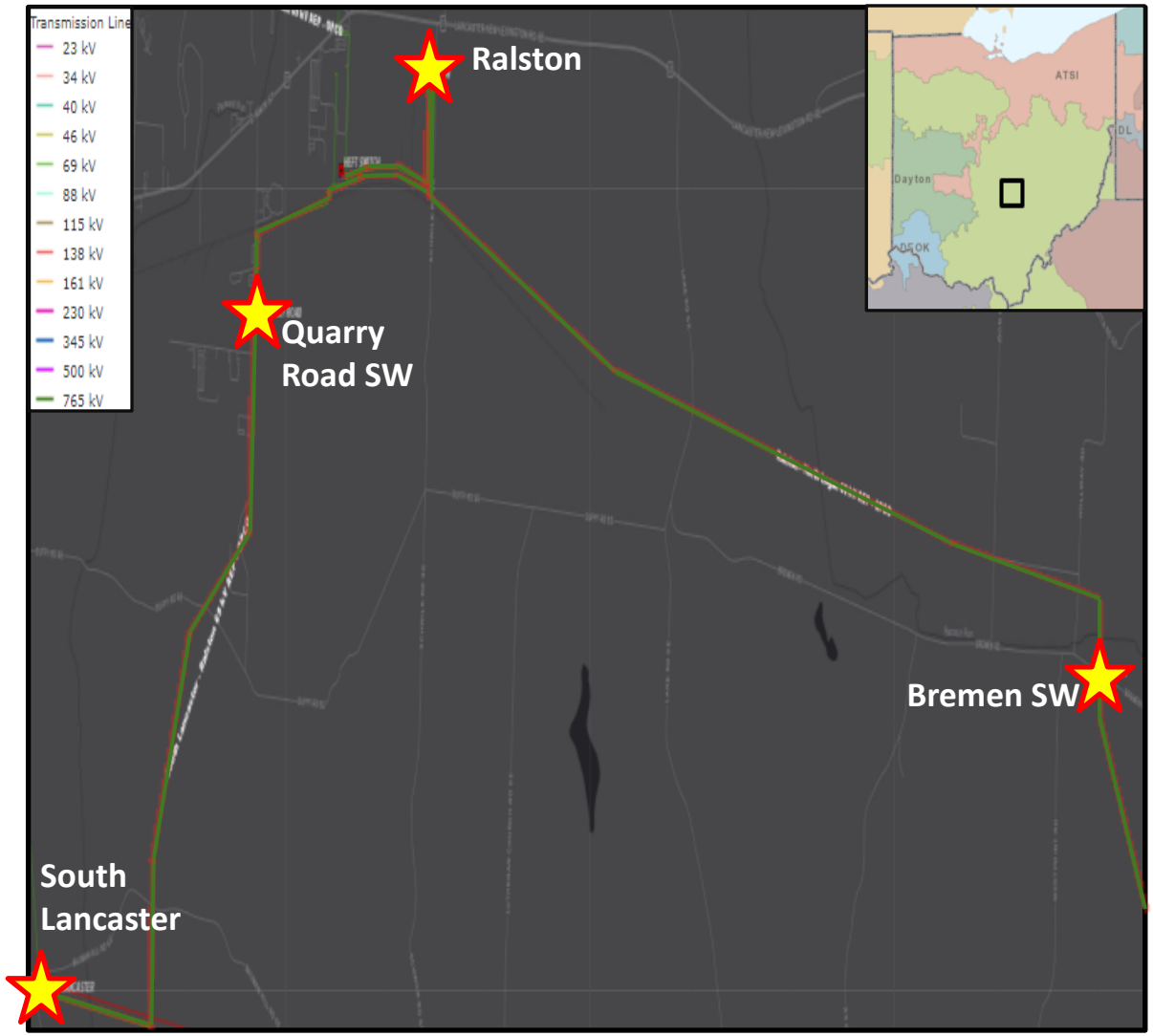
Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

South Lancaster – Ralston 69 kV (1966)

- Length of Line: 4.37 Miles
- Total Structure Count: 86
    - Wood 84 (81 from the 1960s, 1 from 1974, 1 from 1987)
    - Steel: 2 from 2018
- Conductor Types: 556,500 CM ACSR 18/1 (Osprey)
    - 7.43 miles from 1966 & 0.21 miles from 2018
- Five Year Outage History:
    - CMI: 3,281,048
    - 22 Momentary and 8 Permanent
- Open Conditions: There are 30 structures with at least one open condition, which relates to 34% of the structures on this line. There are 12 structure based open conditions consisting of insect damage, rot top, a split pole and woodpecker holes, 10 conductor based open conditions consisting of damaged and improper installation of plp splic/dead ends, 7 shielding /grounding based open conditions consisting of broken and missing ground lead wires and broken strands of a shield wire, and 13 hardware based open conditions consisting of a broken insulator, burnt insulators, a damaged guy guard, missing guy guards and vines on a guy wire.
- The representative structures on the line fails to meet 2017 NESC Grade B loading criteria, fails to meet current AEP and current ASCE structural strength requirements. The insulators do not meet current AEP standards for CIFO and minimum leakage distance requirements. The grounding is inadequate for current AEP Standards. The line shielding angle on the typical tangent structure is measured at 47 degrees, which is inadequate for AEP current shield angle requirements



AEP Transmission Zone M-3 Process
Fairfield, Ohio

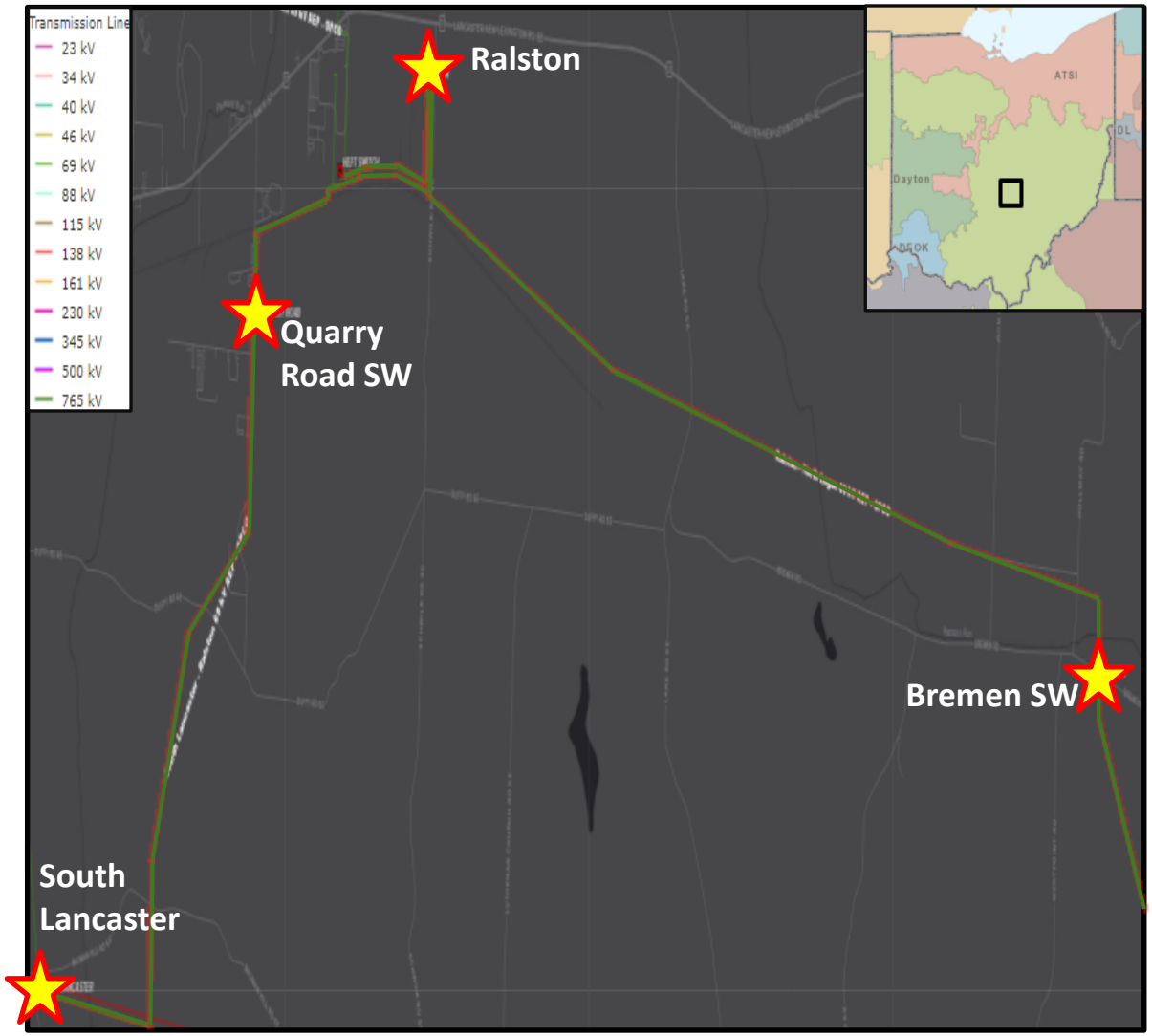
Need Number: AEP-2022-OH059

Process Stage: Need Meeting 9/16/2022

Problem Statement:

Lancaster Junction – Ralston 69 kV Section Str. 58 – Str. 73 (1955)

- Length of Line: ~0.74 Miles
- Total Structure Count: 16
    - Wood from 1960s
- Conductor Types: 556,500 CM ACSR 18/1 (Osprey) from 1955
- Five Year Outage History:
    - CMI: 3,113,139
    - 13 Momentary
    - 4 Permanent
- Open Conditions: there are 10 structures with at least one open condition, which relates to 62% of the structures on this section of line. There are currently 2 structure based open conditions consisting of rot heart, rot top, insect damage of poles and a split knee/vee brace. There are currently 2 conductor based open conditions consisting of a broken bond and improper installation of plp splice/dead ends. There are currently 2 grounding based open conditions consisting of broken ground lead wires. There are currently 4 hardware based open conditions consisting of missing guy guards, burnt/chipped insulators and broken/damaged/missing moldings.
- Additional Information: The line shielding angle on the typical tangent structure is measured at 41.6° degrees, for crossarm structures, which is inadequate for AEP current shielding angle requirements.



AEP Transmission Zone M-3 Process
Fairfield, Ohio

Need Number: AEP-2022-OH059

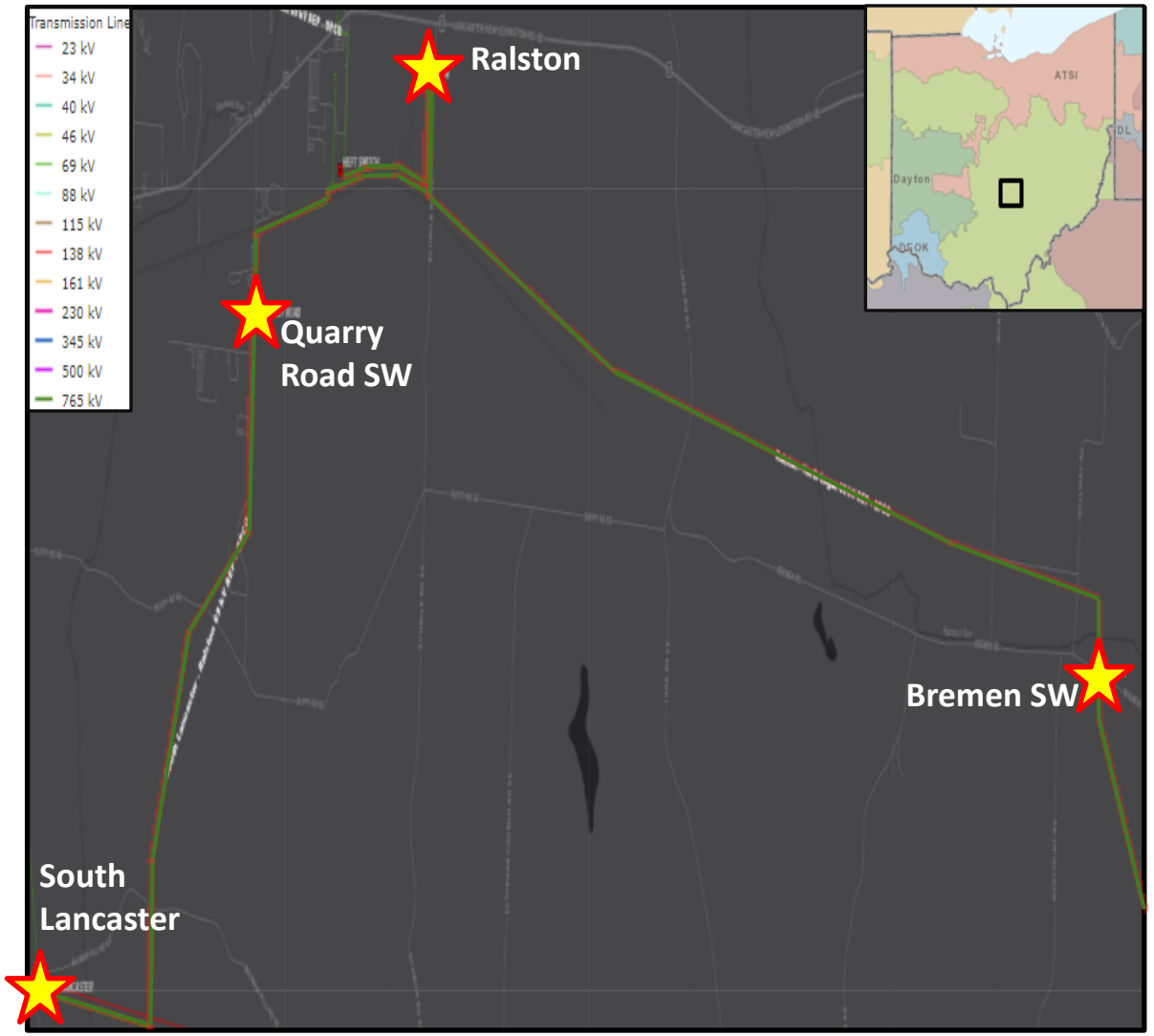
Process Stage: Need Meeting 9/16/2022

Problem Statement:

Ralston 69 kV Circuit Breaker "A"

- Breaker Age: 1965 & Interrupting Medium: (Oil)
- Number Fault Operations: 72
- Additional Information: 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. This circuit breaker has exceeded the manufacturer's designed number of fault operations. Each of these fault operations is likely not at the full fault current rating of the circuit breakers, but with each fault operation of any magnitude comes accelerated aging. The manufacturer provides no support for the CF/CG/CGH/CH family of circuit breakers and spare parts are not available. 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.

Ralston Relays: Currently, 29 of the 36 relays (81% of all station relays) are in need of replacement. Of these, 28 are of the electromechanical type and 1 of the static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support.



AEP Transmission Zone M-3 Process
Franklin County, OH

Need Number: AEP-2022-OH064

Process Stage: Need Meeting 9/16/2022

Project Driver:

Customer Service; Operational Flexibility and Efficiency

Specific Assumption Reference:

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

Problem Statement:

<u>Astor Station 138kV:</u>

- AEP Ohio has indicated they have extensive equipment rehabilitation needs at the station.
- The station utilizes a single 138kV bus tie breaker configuration which lacks line breakers. The result is a complete loss of the distribution sources at the station in the event of a breaker failure. Lack of automatic switching devices on the high side of the transformers also result in overlapping zones of protection between the bus, line, and transformer on each side of the bus tie breaker.
- The station utilizes legacy electromechanical relays and the existing Transmission RTU exceeds capacity to install new IEDs.
- The station has experienced 9 outages between 2014 – 2020 with a CMI of 6.53M due primary to equipment failure & animal incidents.

AEP Transmission Zone M-3 Process
Findlay, Ohio

Need Number: AEP-2022-OH065

Process Stage: Need Meeting 09/16/2022

Supplemental Project Driver:

Customer Service

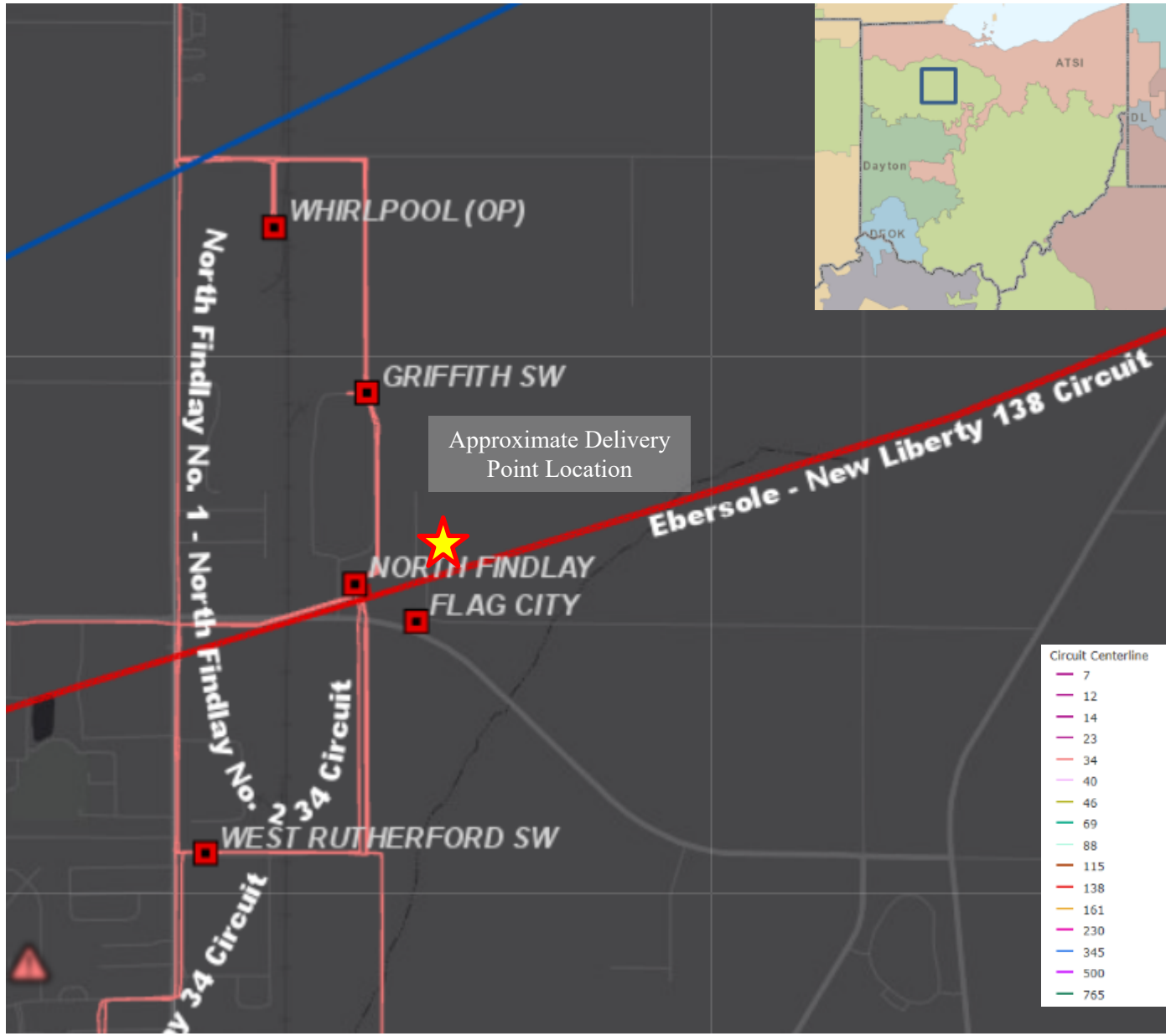
Specific Assumption Reference:

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

Problem Statement:

Customer Service:

- A customer has requested transmission service at a site east of AEP's North Findlay site in Findlay, Ohio
- The customer has indicated an initial load of 30 MVA with future service up to 150 MVA.
- The customer has requested an ISD of December 2022.



AEP Transmission Zone M-3 Process
Jackson & Gallia Counties Ohio

Need Number: AEP-2022-OH067

Process Stage: Need Meeting 09/16/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

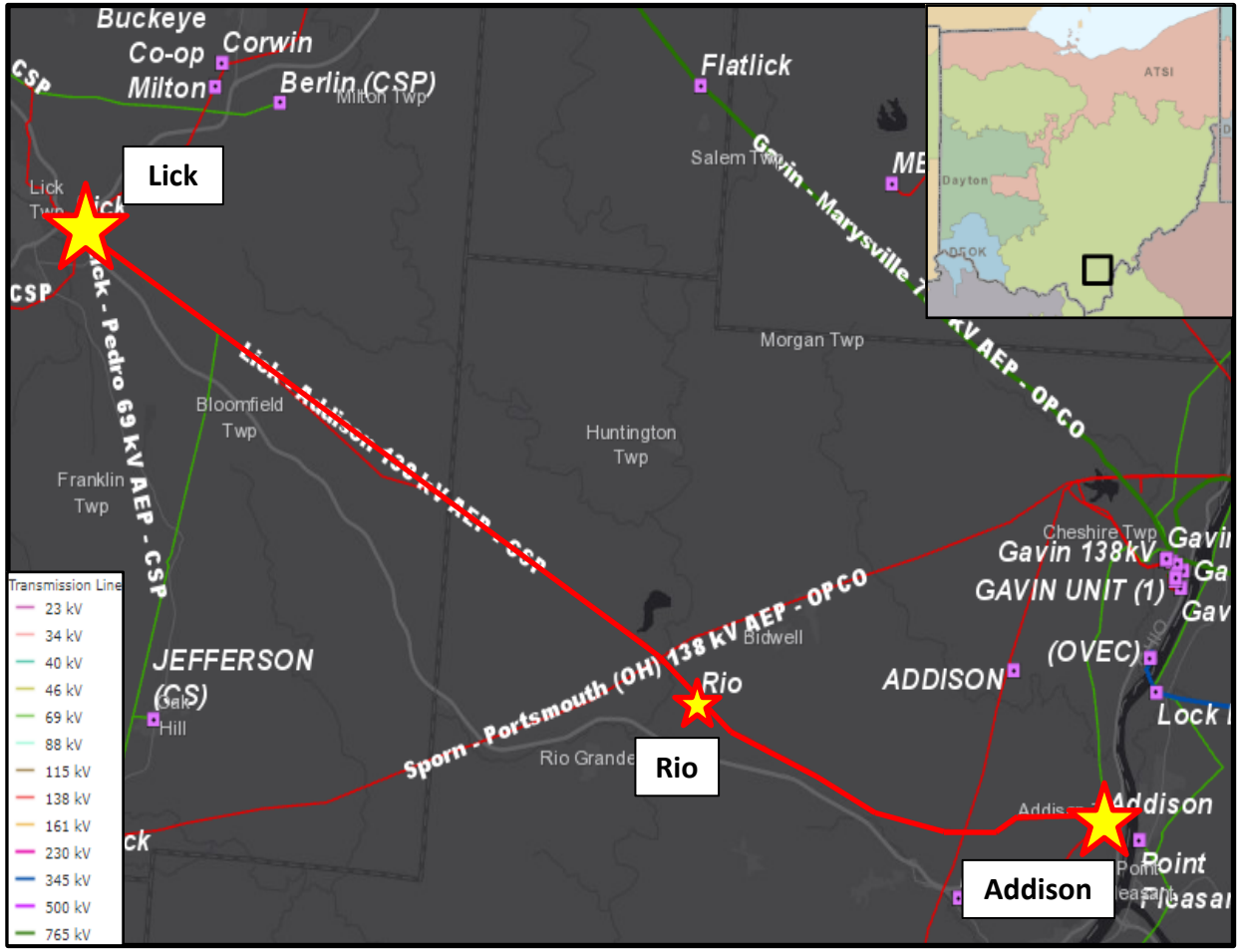
Specific Assumption Reference:

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

Problem Statement:

Addison – Lick 138 kV:

- Original Install: 1953
- Total Length: ~28.98 Miles
- Conductor Types:
  - ~28.97 miles of 336,400 CM ACSR 30/7 (Oriole) from 1953
  - ~0.01 miles of 336,400 CM ACSR 18.1 (Merlin) from 2004
- Total Structure Count: 174
  - Wooden Structure:
    - 116 from 1950s, 9 from 1970s, 2 from 1980s, & 14 from 1990
  - Steel Structure:
    - 2 from 1997, 1 from 2004, & 30 from 2016
- Outage History:
  - 13 momentary & 1 permanent outage
  - CMI from permanent outage 1,242,742
- Open Conditions: there are 74 structures with at least one open condition, which relates to 42.5% of the structures on the line. There are currently 90 structure related open conditions dealing with broken and split crossarms, rot heat crossarms, rot top crossarms, many wood pecker holes, broken knee/vee braces, broken poles, rot top on poles and broken x-braces. There are currently 4 shielding and grounding related open conditions dealing with missing ground lead wires or ground rods. There are currently 23 hardware related open conditions dealing with missing guy guards, burnt insulators, guy wire in vines, loose guys, broken damper, rusty guy wire and broken insulators.
- Additional Information: There is currently a hard tap near structure 100 of the line that creates a three terminal point between Addison, Lick, and Sporn stations.



AEP Transmission Zone M-3 Process
Scioto County, Ohio

Need Number: AEP-2022-OH068

Process Stage: Need Meeting 09/16/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

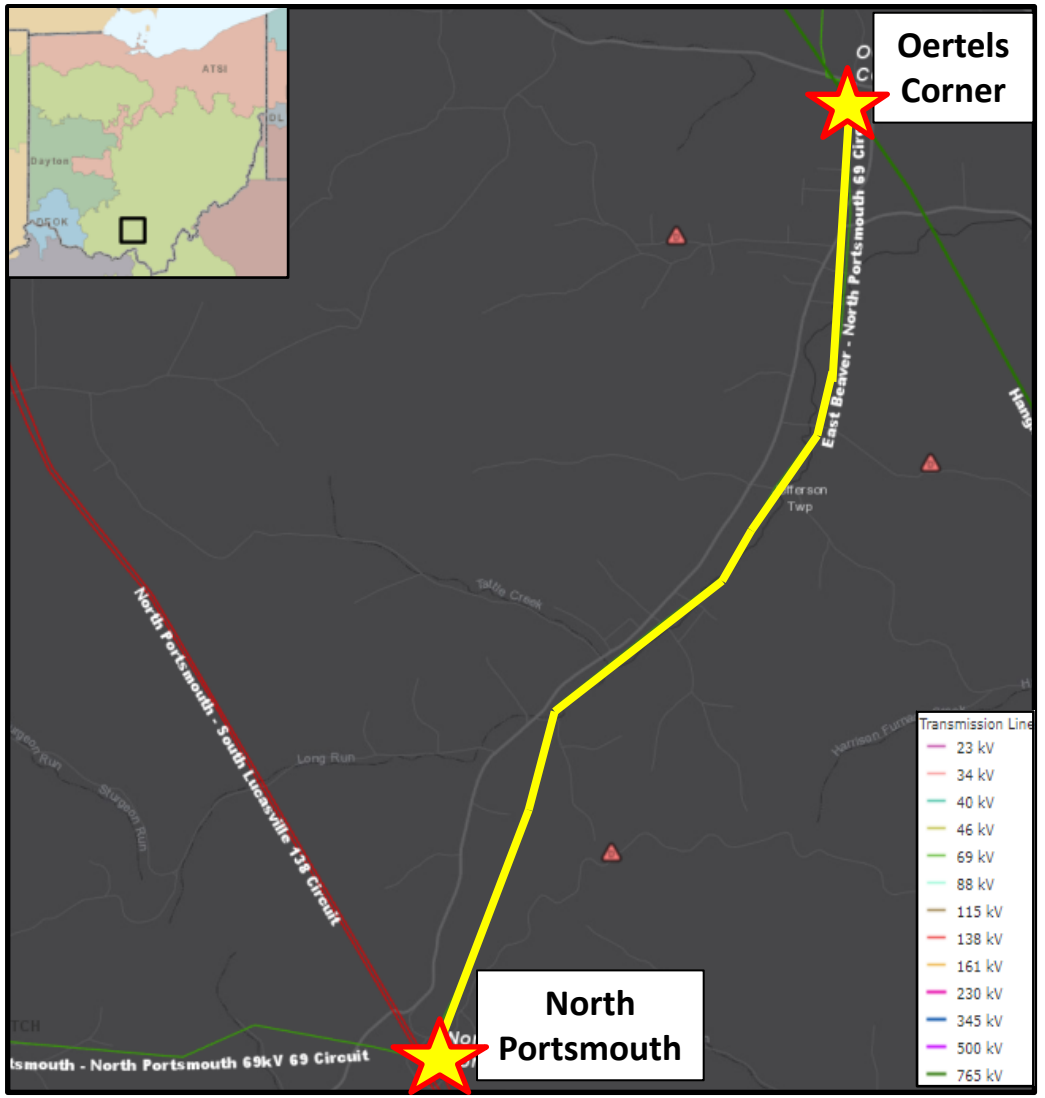
Specific Assumption Reference:

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

Problem Statement:

<u>Oertels – North Portsmouth 69 kV:</u>

- Original Install: 1947
- Total Length: ~4.7 Miles
- Conductor Types:
  - ~3.05 miles of 1/0 ACSR 6/1 (Raven) from 1947
  - ~1.65 miles of 3/0 ACSR 6/1 (Pigeon) from 1947
- Outage History:
  - 13 momentary & 10 permanent outages
  - Total CMI of 4,619,162
- Total Structure Count: 80 Wooden
  - 32 from 1940's, 7 from 1960s, 1 from 1970's 32 from 1980's 4 from 1990's 4 from 2010s
- Open Conditions: There are 36 structures with at least one open condition which relates to 45% of the structures on this line. There are 41 structure related open conditions dealing with broken and split crossarms, burnt crossarm, rot on crossarms, woodpecker holes, and rot top on poles. 3 hardware related open conditions dealing with missing ground lead wires & broken or burnt insulators. 9 forestry related open conditions.
- Additional Information: 3.1 miles of the line is already being rebuilt under b3362.



AEP Transmission Zone M-3 Process
Gallia County, Ohio

Need Number: AEP-2022-OH069

Process Stage: Need Meeting 09/16/2022

Project Driver: Customer Service & Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12 & 13)

Problem Statement:

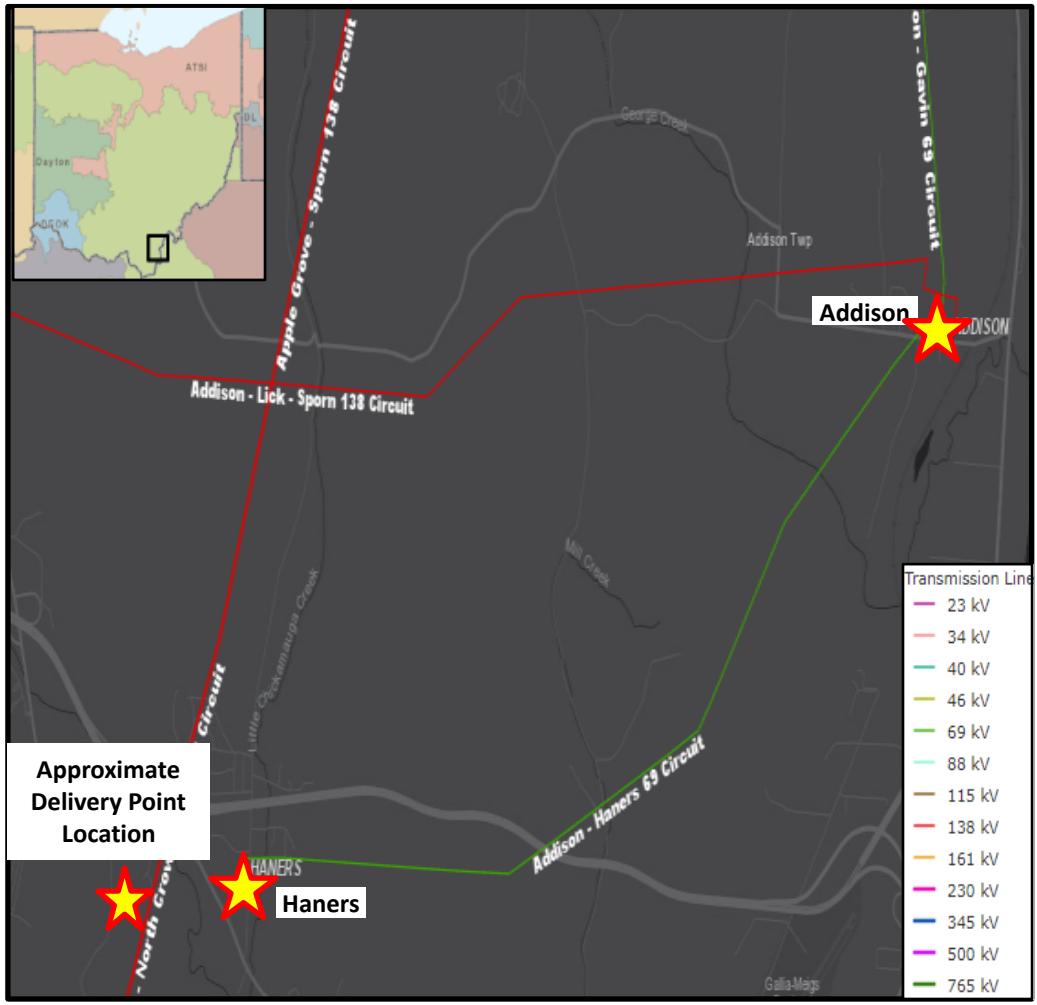
Customer Service:

- AEP Ohio has requested to add capacity at Addison station by June 2026, due to load growth in the area. The anticipated peak load is approximately 18.3 MVA.
- AEP Ohio has requested service to a new 138kV delivery point near AEP's Haners 69kV station by June 2026. Anticipated load is approximately 20.6 MVA.

Equipment Material/Condition/Performance/Risk:

Addison – Haners 69 kV:

- Original Install: 1967
- Total Length: ~4.23 Miles
- Conductor Types:
    - ~4.17 miles of 336,400 CM ACSR 30/7 (Oriole) from 1967
    - ~0.05 miles of 336,400 CM ACSR 30/7 (Oriole) from 2011
    - ~0.01 miles of 336,400 CM ACSR 30/7 (Oriole) from 2006
- Total Structure Count: 29 (Wood)
    - 14 from 1950s, 5 from 1960s, 2 from 1970s 1 from 1990s 4 from 2000s 3 from 2010.
- Open Conditions: there are 18 structures with at least one open condition, which relates to 62% of the structures on the circuit. There are currently 57 structure related open conditions specifically affecting the crossarm or pole including rot, split, insect damage, and woodpecker conditions. There is currently 1 conductor related open condition affecting improper installation of a conductor. There are currently 7 open conditions related to the ground lead wire, including broken, missing, and damaged. This could lead to the poor lightning performance. There is currently 4 hardware related open condition specifically affecting broken, damaged, or burnt insulators and guy anchors
- Additional info: The existing Haners station is radially fed from this line. Haners feeds the city of Gallipolis, a regional hospital along with the areas emergencies services and utilities; transfer options are very limited due to capacity concerns and no other sources in the area. The radial line is 4.2 miles with approximately 20 MW of load served from the station.

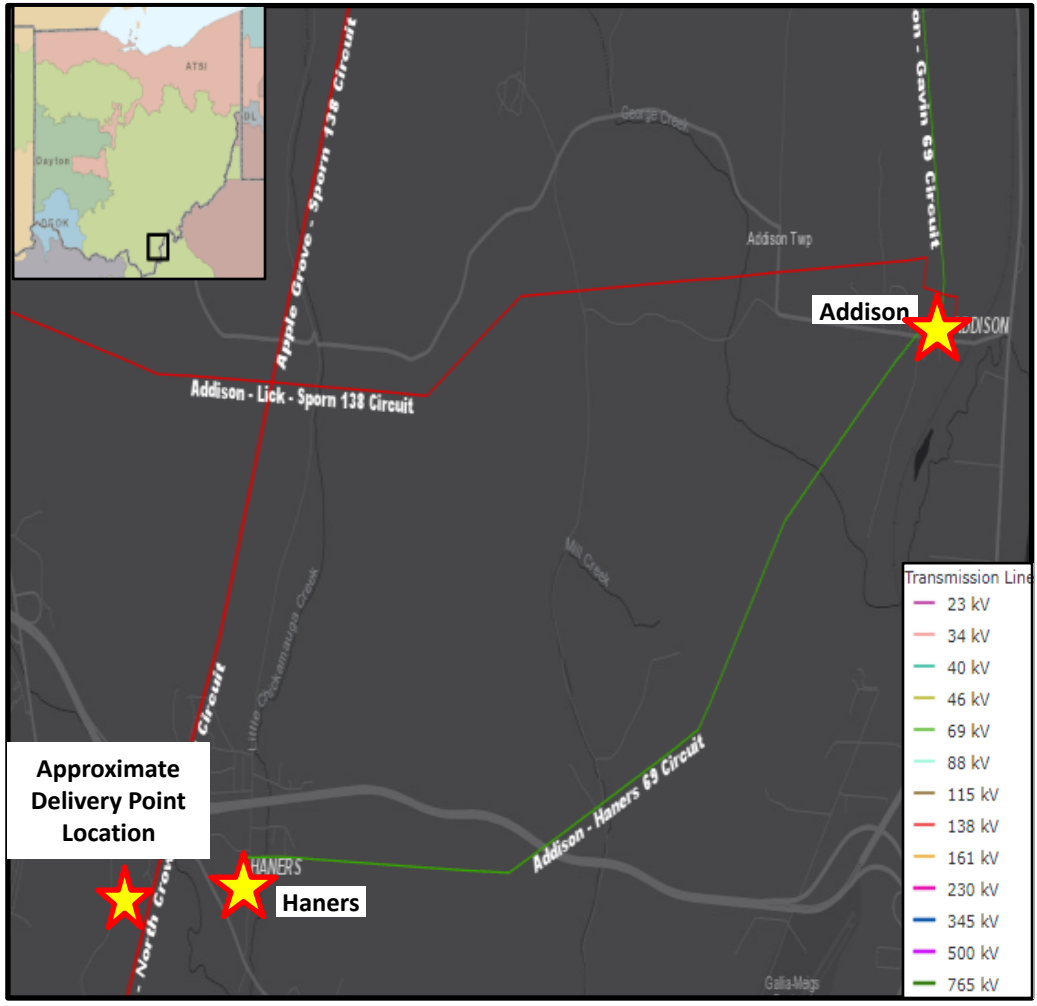


AEP Transmission Zone M-3 Process
Gallia County, Ohio

Need Number: AEP-2022-OH069
Process Stage: Need Meeting 09/16/2022
Problem Statement Continued:

Addison Station:

- 69kV CBs 3 & 62
    - Age: CB 3 is from 1967 & CB 62 is from 1975
    - Interrupting Medium: Oil
    - Fault Ops: CB 3 has 0 & CB 62 has 46
    - 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.
- Transformer 3 138/69/12 kV
    - Age: 1976
    - Elevated moisture levels, indicating gasket leaks or breakdown in oil or paper/pressboard insulation. Low dielectric strength, which indicates an increase in particles within the oil, decreasing the capability of the oil to withstand fault events, which can damage the paper insulation. There is also an upward trend in insulation power factor, which also indicates an increase in particles within the oil. The values of dielectric strength, moisture and power factor indicate the dielectric strength of the insulation system (oil and paper) are in poor condition, which impairs the unit's ability to withstand electrical faults.
- Relays: Currently, 29 of the 42 relays (69% of all station relays) need replacement. 26 of these are of the electromechanical and static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support. There are also 2 DPU type units. Out of the 431 relays of this family in the AEP system, 129 of them have had at least one malfunction record documented. This relates to 30% of the DPU fleet. There is 1 microprocessor based relay commissioned in 2004 that has firmware that is unsupported.



Need Number: AEP-2022-OH070

Process Stage: Need Meeting 9/16/2022

Supplemental Project Driver:

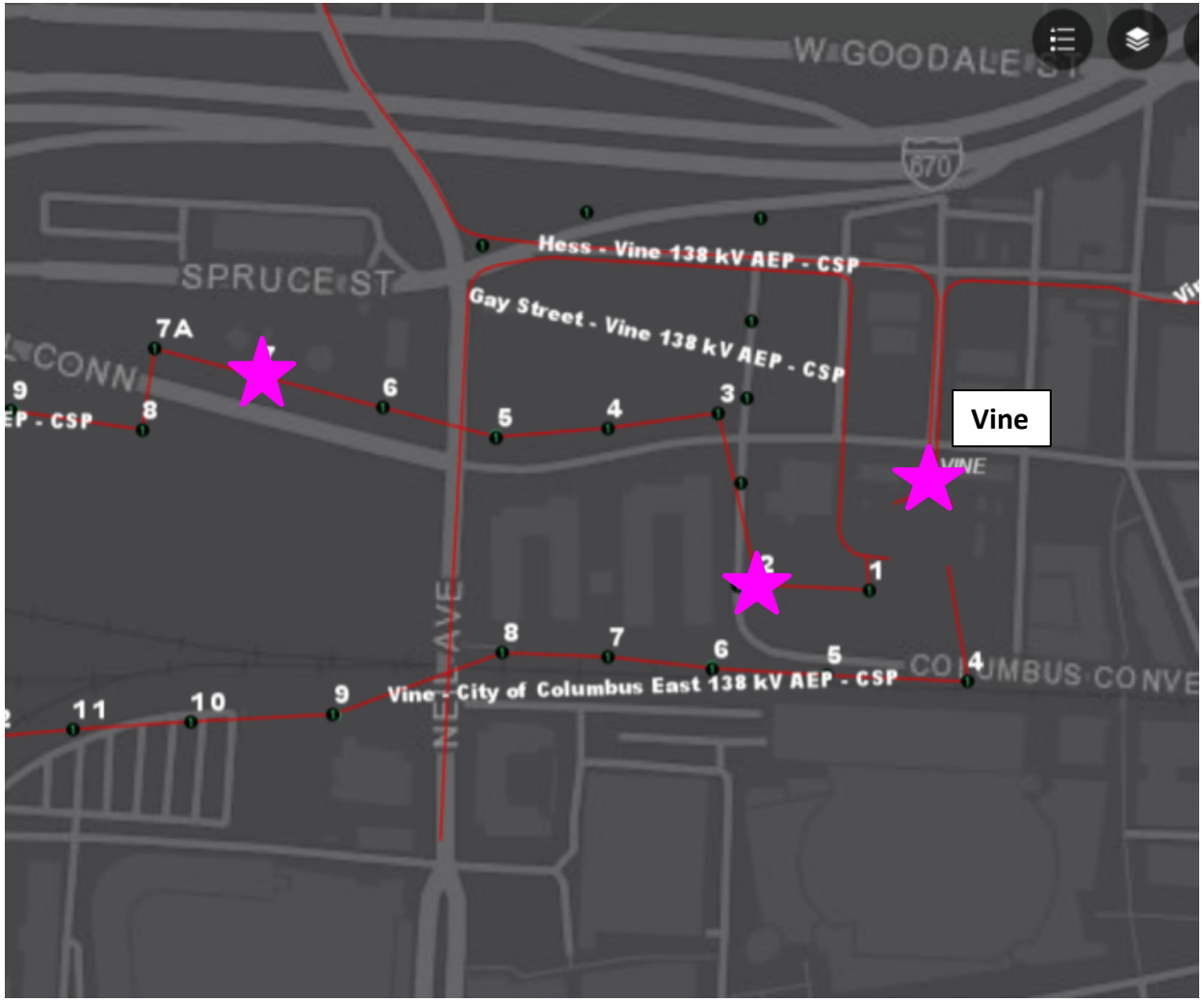
Customer Service

Specific Assumption Reference:

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

Problem Statement:

- A customer has requested that AEP relocate the section from structures 2 to 7 of the Vine - City of Columbus West 138kV line from overhead to underground to accommodate development in the area. The customer has requested this work to be in service by June 2023.



Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

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

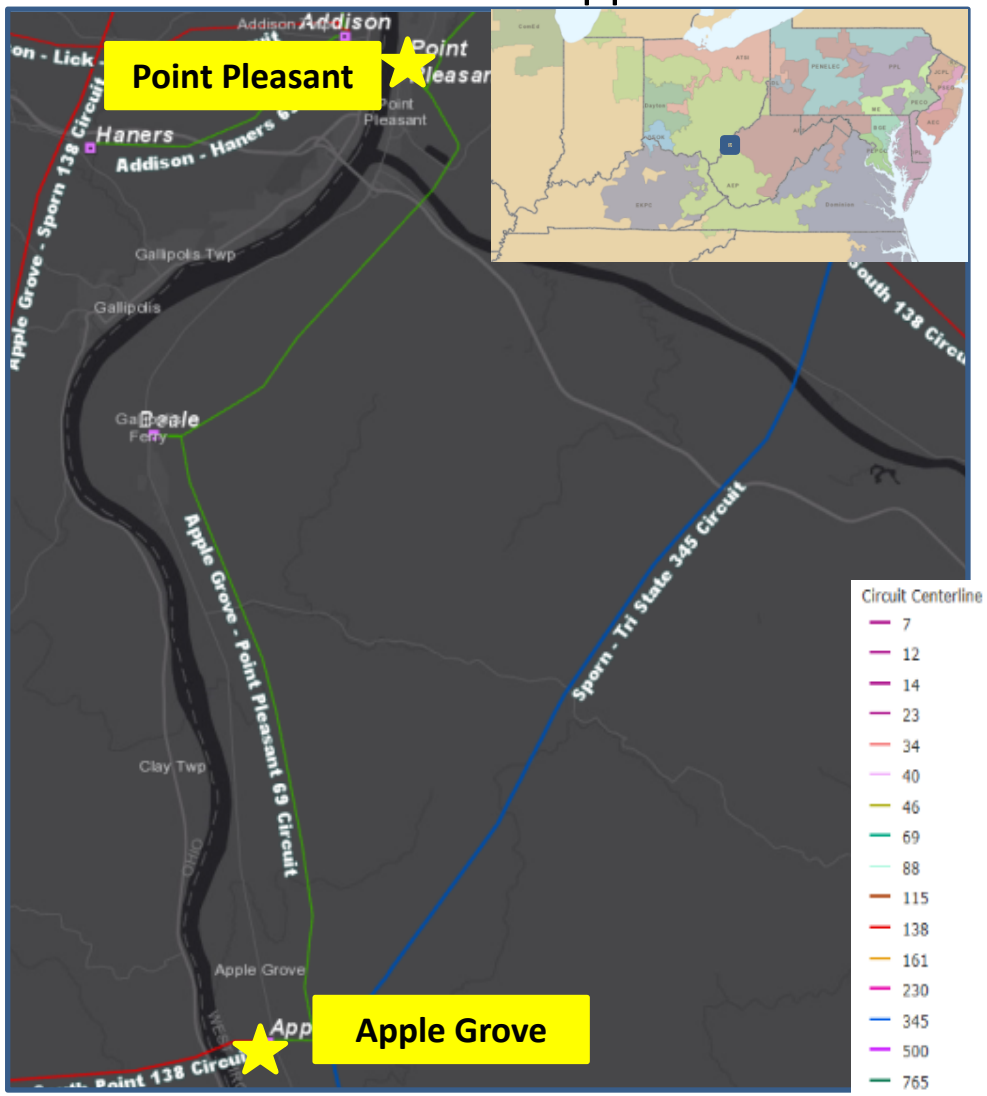
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

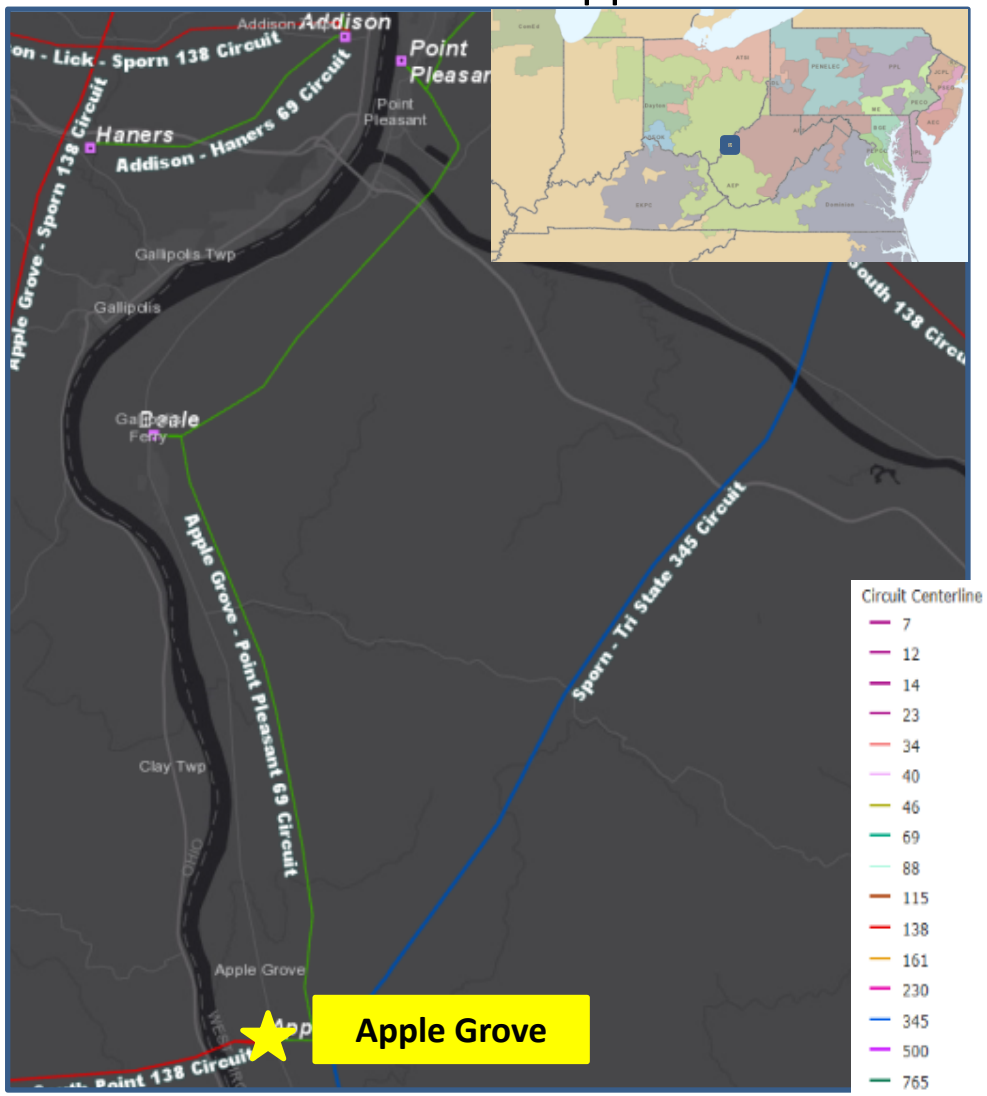
Supplemental Project Driver: Equipment Condition/Performance/Risk

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.

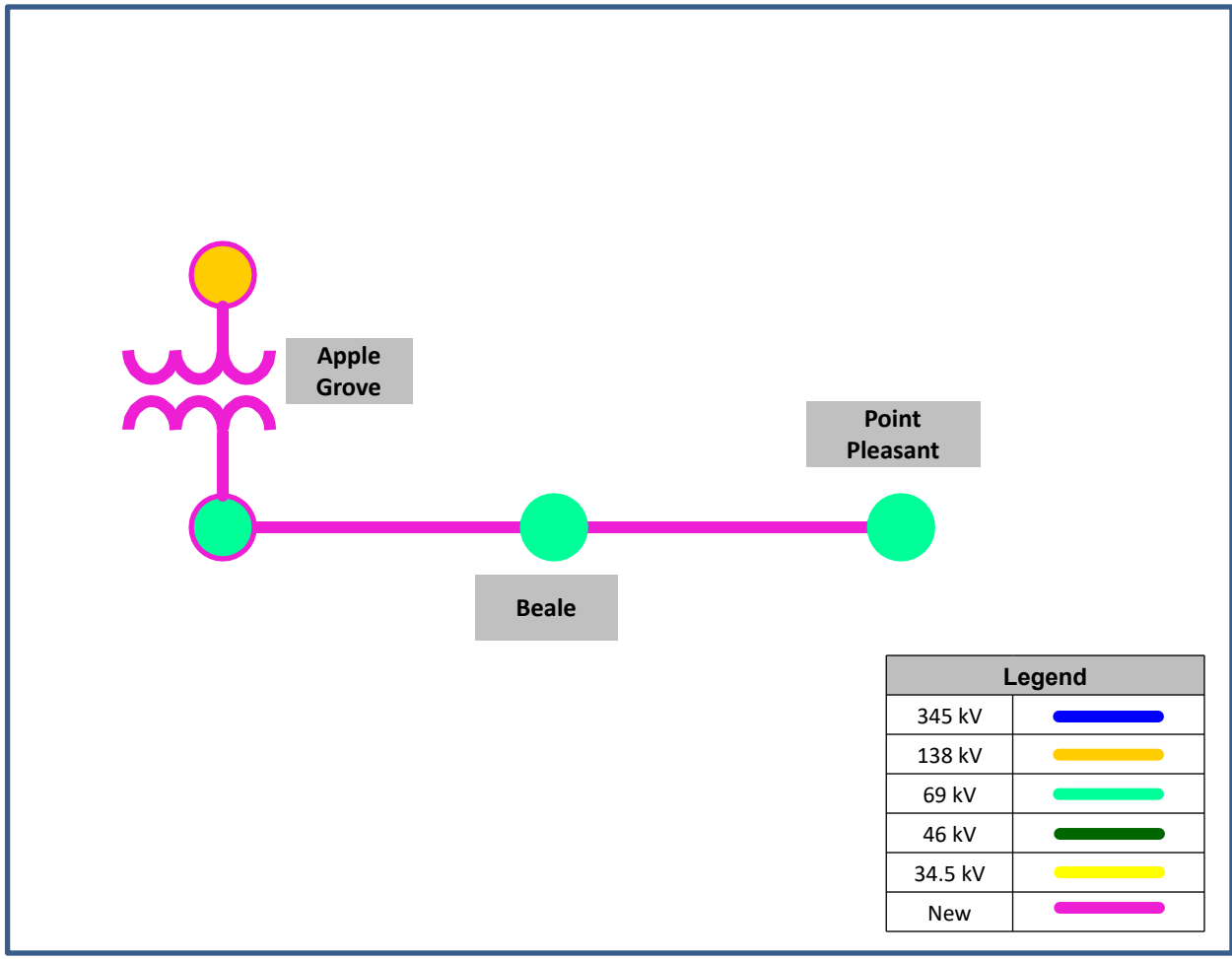
Alternatives Considered:

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
Stark & Tuscarawas Counties, Ohio

Need Number: AEP-2020-OH053 (split from AEP-2020-OH050)

Process Stage: Solution Meeting 9/16/2022

Previously Presented: Need Meeting 3/19/2020

Supplemental Project Driver:

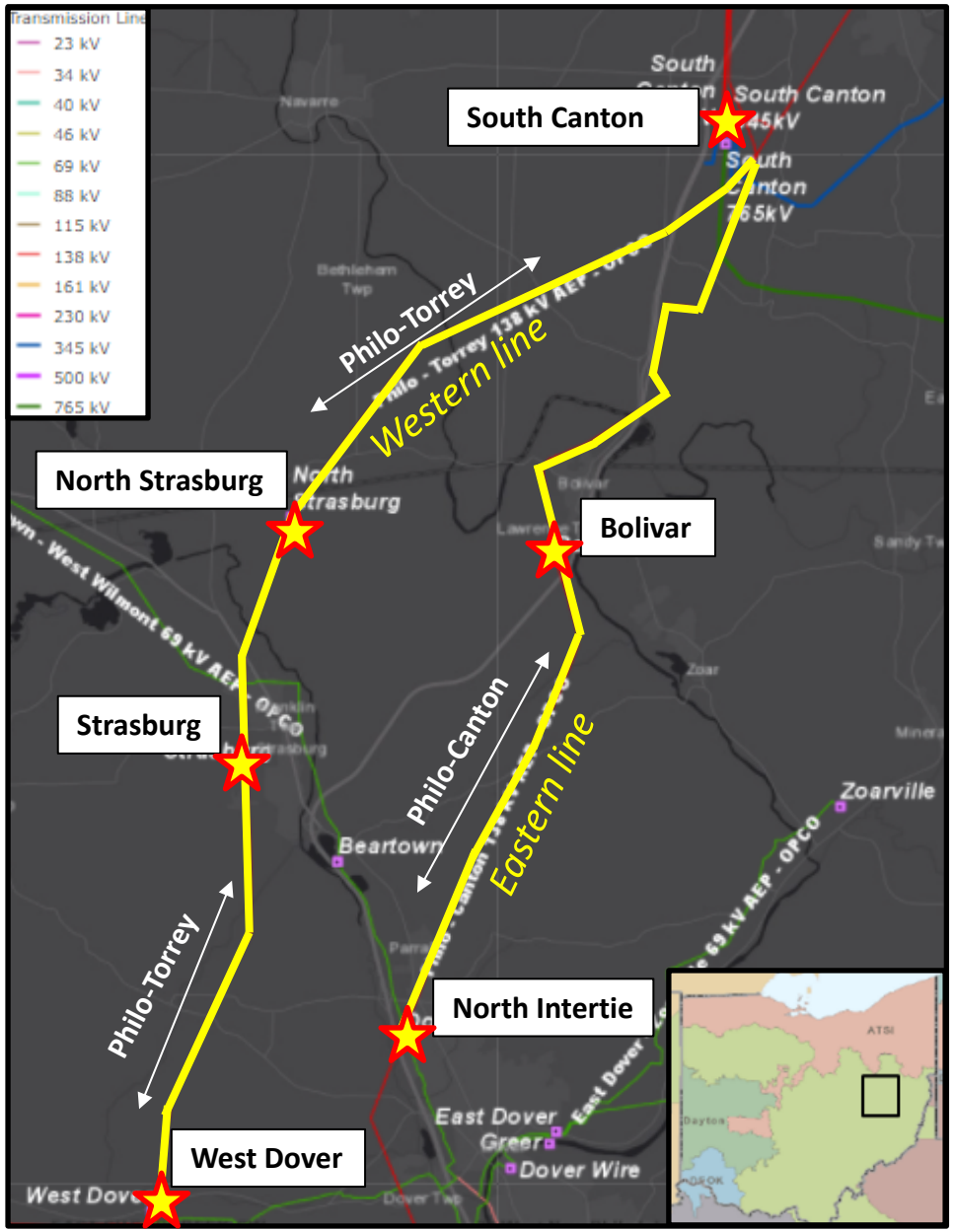
Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

Specific Assumption Reference:

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

Problem Statement:

- The South Canton – North Intertie eastern 138kV transmission line is 14.6 miles long, originally constructed in 1923. The vast majority of the structures are still original, as well as the six-wired 336 ACSR conductor, insulators, and hardware. This line is made up of several circuits connected between South Canton and Sunnyside stations.
- Insulator assemblies are showing corrosion and deterioration, which could lead to additional failures and safety concerns.
- This line has experienced 12 momentary outages and 2 sustained outages over the past 10 years (2008/2018).



AEP Transmission Zone M-3 Process
Stark & Tuscarawas Counties, Ohio

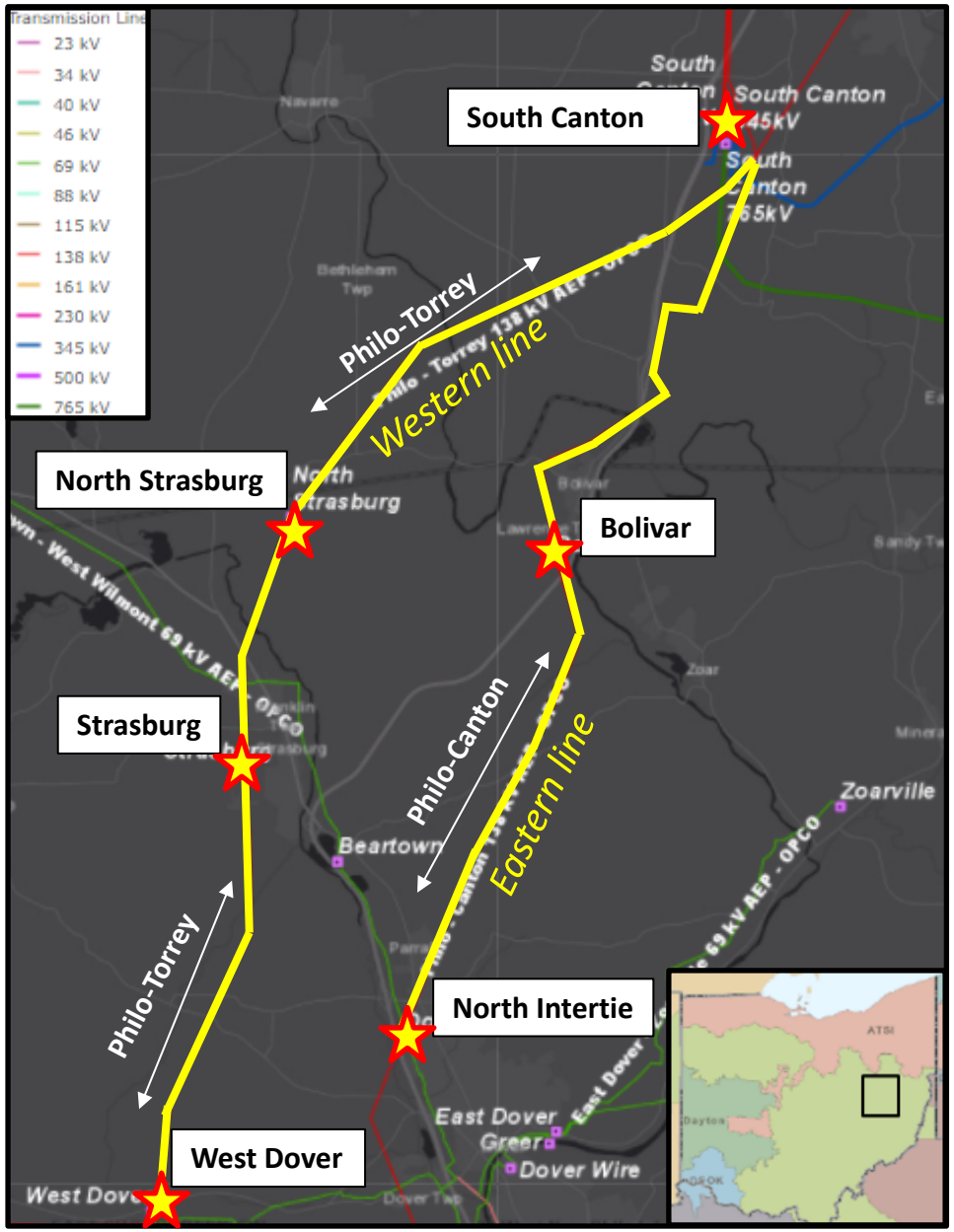
Need Number: AEP-2020-OH053 (split from AEP-2020-OH050)

Process Stage: Solution Meeting 9/16/2022

Previously Presented: Need Meeting 3/19/2020

Problem Statement:

- The South Canton-West Dover western 138kV transmission line is 18.0 miles long and is part of the 75.2-mile-long circuit Philo-South Canton. The line was originally built in 1942 with steel lattice towers. The conductor is 6-wired single-circuit, with one side installed in 1942 (397 ACSR) and the other side installed in 1954 (477 ACSR). The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP's 1930's steel lattice tower line presentation.
- The Philo-South Canton 138kV circuit has experienced 18 momentary outages over the past 5 years and 4 sustained outages, resulting in 437,567 minutes of CMI. There are currently 18 open conditions on the circuit. Examples of the conditions include: burnt insulators, worn hardware, rusting towers, damaged shield wire, and severe rusting of the tower steel.



AEP Transmission Zone M-3 Process
Dover to South Canton Line Rebuilds

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

Need Number: AEP-2020-OH053

Process Stage: Solution Meeting 9/16/2022

Proposed Solution:

Rebuild the "Philo-Torrey" 138kV transmission line between West Dover and South Canton stations (18.0 miles). The circuit affected is South West Dover 138kV. Remove the existing lattice towers and supplemental the right-of-way as needed. **Estimated Cost: $46.74 Million**

Rebuild the "Philo-Canton" 138kV transmission line between North Intertie and South Canton (14.6 miles). The circuit affected is North Intertie-South Canton 138kV. Remove the existing lattice towers and supplemental the right-of-way as needed. **Estimated Cost: $42.84 Million**

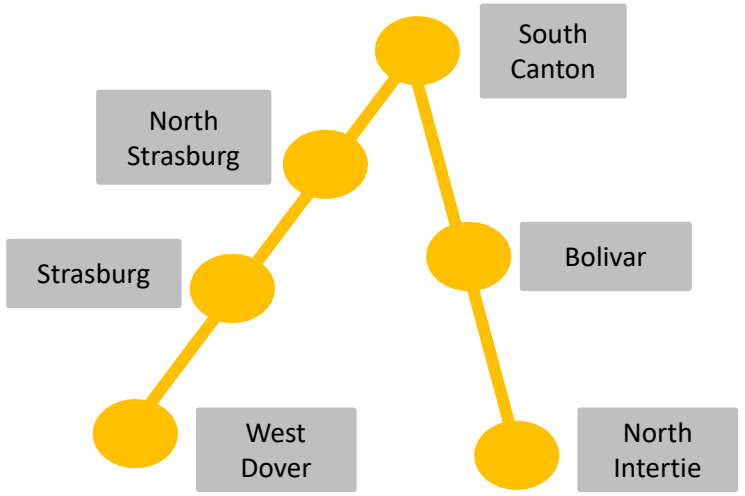
Total Estimated Transmission Cost: $89.58 Million

Alternatives Considered: A number of alternatives were evaluated in order to upgrade the two 138kV transmission lines. Options to consolidate the lines as a double-circuit and retire some segments were ultimately ruled out due to: the physical separation of the 6 stations connected between the 2 circuits, making it infeasible for significant line consolidation; the large amount of new greenfield 138kV line construction that would have been required to connect the two lines (approximately 4 miles, depending on location); the higher cost of greenfield transmission line construction and associated siting and outreach challenges, which would have resulted in greater public impacts. In the end, rebuilding the two 138kV lines on their existing routes was the optimal plan for this area, from a customer service and cost-effective standpoint.

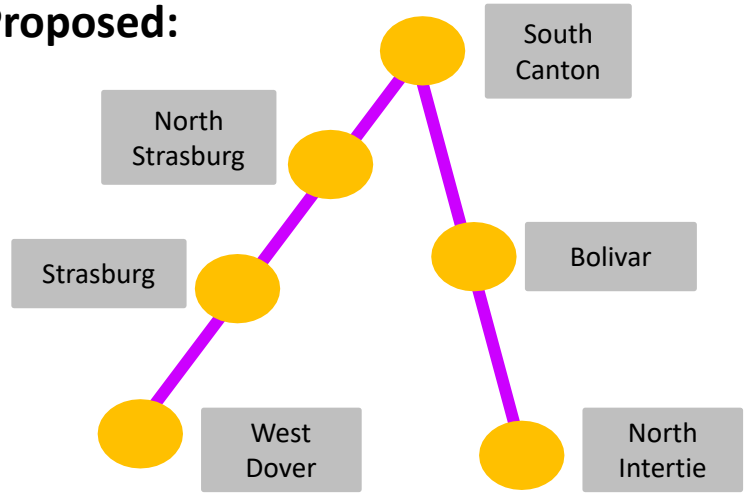
Projected In-Service: 12/1/2026

Project Status: Scoping

Existing:



Proposed:

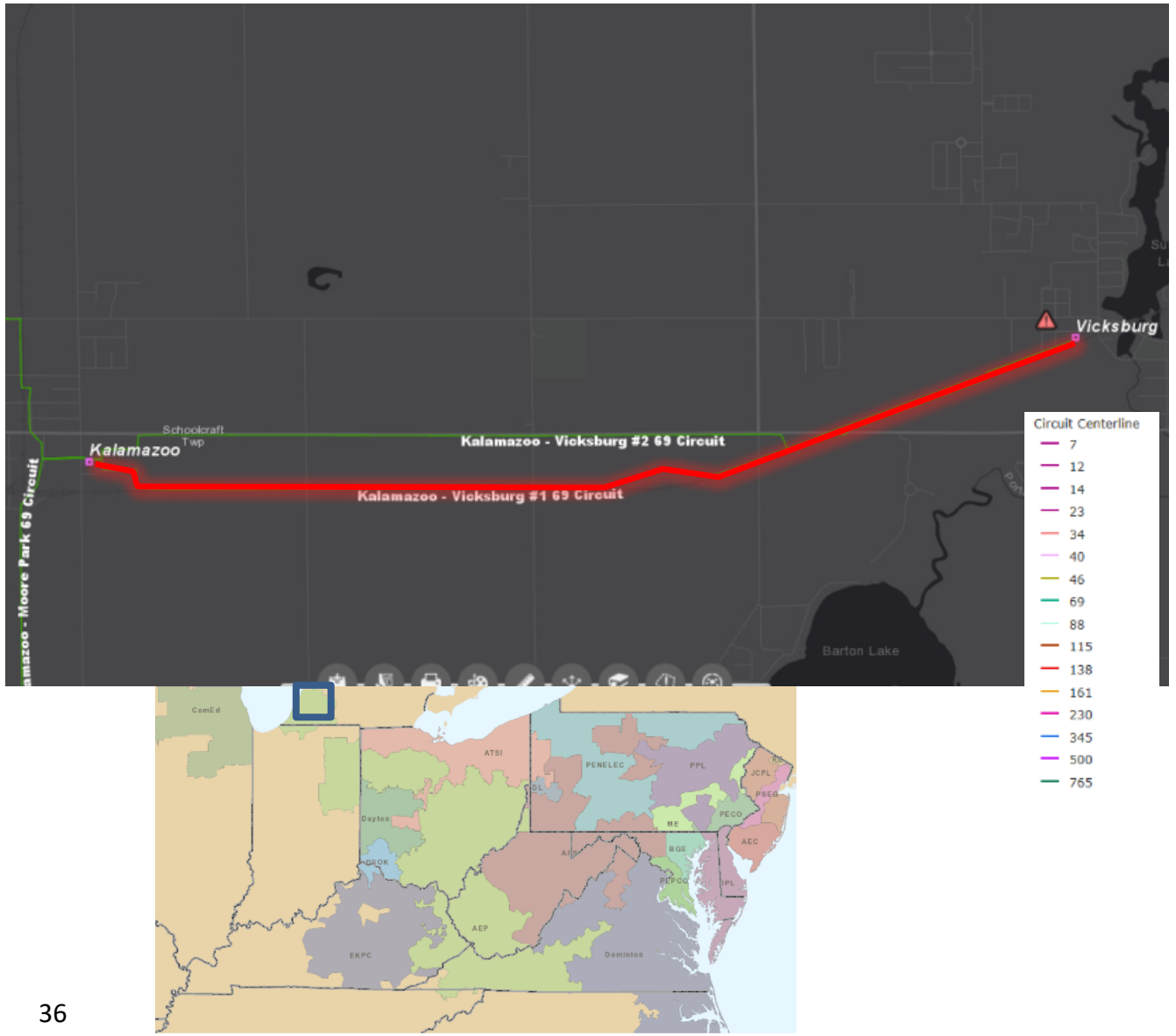


AEP Transmission Zone M-3 Process
Kalamazoo – Vicksburg 69kV Rebuild

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:

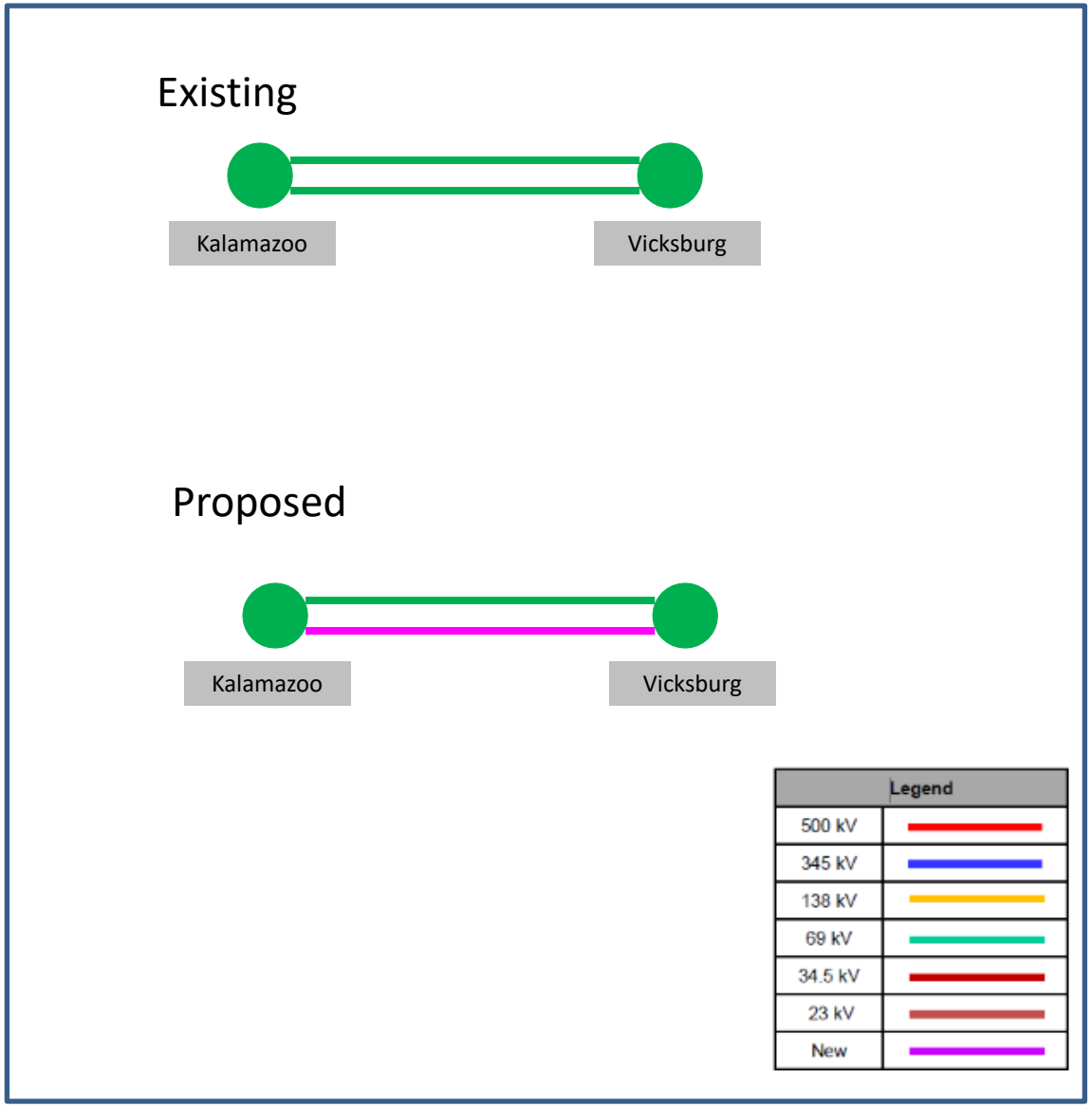
Kalamazoo – Vicksburg 69kV line:
Rebuild the 4.72 Kalamazoo – Vicksburg #1 69kV line with 336 30/7 ACSR Oriole and eliminate line crossings with Kalamazoo – Vicksburg #2 69kV.
Estimated Cost: $8.45M

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
Canton, Ohio

Need Number: AEP-2021-OH041

Process Stage: Solution Meeting 09/16/2022

Previously Presented: Need Meeting 08/16/2021

Project Driver: Equipment Material/Condition/Performance/Risk; Customer Service

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs; AEP Connection Requirements (AEP Assumptions Slides 12-13)

Problem Statement:

<u>Gambrinus Road Station 69kV:</u>

<u>Equipment Material/Condition/Performance/Risk:</u>

Circuit Breaker: T (69 kV)

- Breaker Age: 1978
- 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.

<u>Relays:</u> 42 of the 44 relays (95% of all station relays) are in need of replacement. All 42 of these are of the electromechanical type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support.

AEP Transmission Zone M-3 Process
Canton, Ohio

Need Number: AEP-2021-OH041

Process Stage: Solution Meeting 09/16/2022

Previously Presented: Need Meeting 08/16/2021

Problem Statement Continued:

The control house has asbestos and various maintenance issues. The station entry is in a congested industrial area, along with minimal drive-path width, resulting in labor constraints and safety issues for field personnel. The station fence is not built to current AEP standards. Station cables are direct-buried in the ground, leaving them more vulnerable to failure over time.

The 69kV revenue metering is a legacy 2-element style, not the current 3-element metering. All of the 69kV connections use a legacy pilot wire communications channel.

<u>Customer Service:</u>

The Gambrinus Road station serves an oil refinery customer with a peak demand of 44 MW. The station is served by only two remote 69kV sources, leaving it vulnerable to outages when maintenance must be performed on either of the two sources.

AEP Transmission Zone M-3 Process
Canton, Ohio

Need Number: AEP-2021-OH052

Process Stage: Solution Meeting 09/16/2022

Previously Presented: Need Meeting 10/15/2021

Project Driver: Equipment Material/Condition/Performance/Risk; Operational Flexibility & Efficiency

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slides 13-14)

Problem Statement:

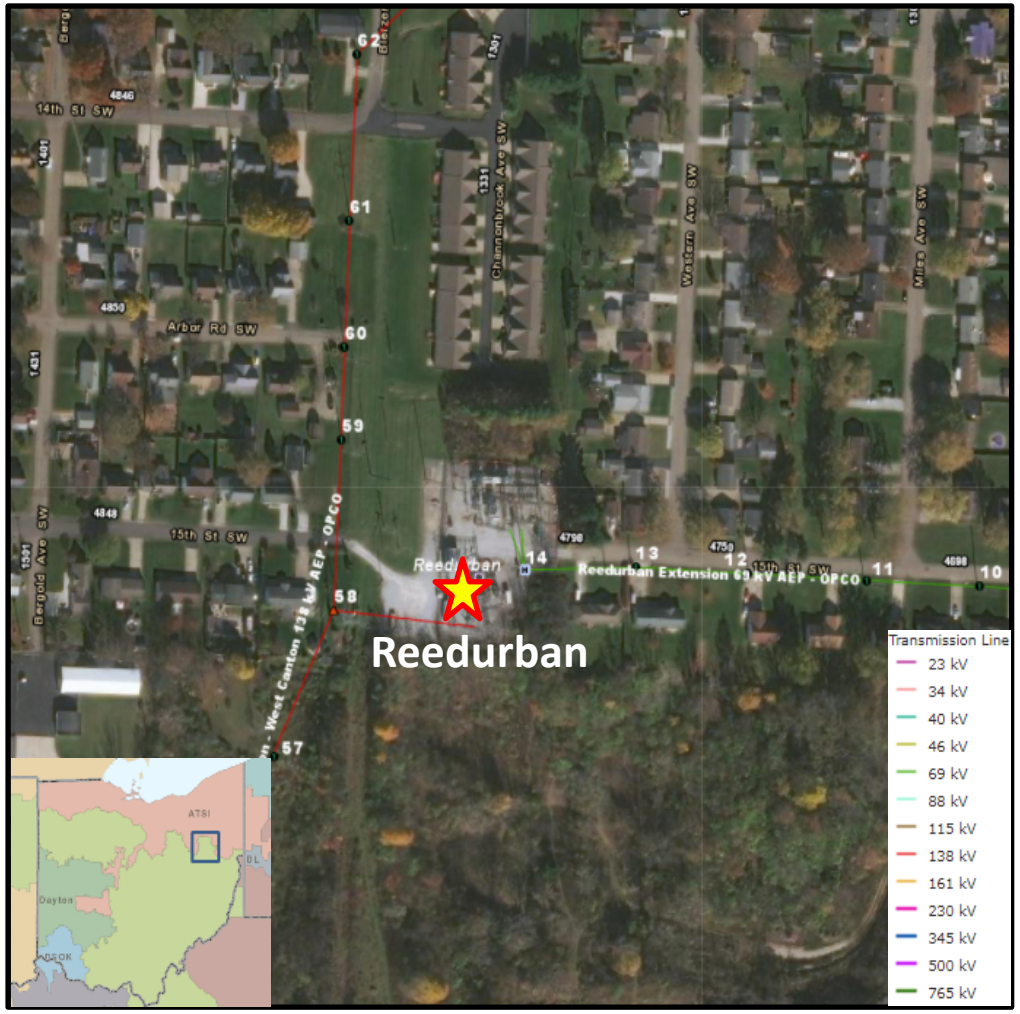
<u>Reedurban Station:</u>

Circuit Breaker: R (69 kV)

- Breaker Age: 1979
- Fault Operations: 10
- 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.
- 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 misoperations across the AEP fleet.
- The manufacturer provides no support for this family of circuit breakers and spare parts are not available.

Relays: 8 of the 25 relays (21% of all station relays) are in need of replacement. All 8 of these are of the electromechanical type which have significant limitations with regards to spare part availability and fault data collection and retention. The 69kV circuit to Gambrinus used an obsolete pilot wire communications channel.

The control house has a number of concerns: poor ventilation, rusting roof, lead-based paint, and physical security issues. Portions of the perimeter are not built to current standards. All station cables are direct-buried without a cable trench, leading to increased probability of failure. The station service is an obsolete design (delta configuration, with corner ground, which is a safety concern).



AEP Transmission Zone M-3 Process
Canton, Ohio

Need Number: AEP-2021-OH052

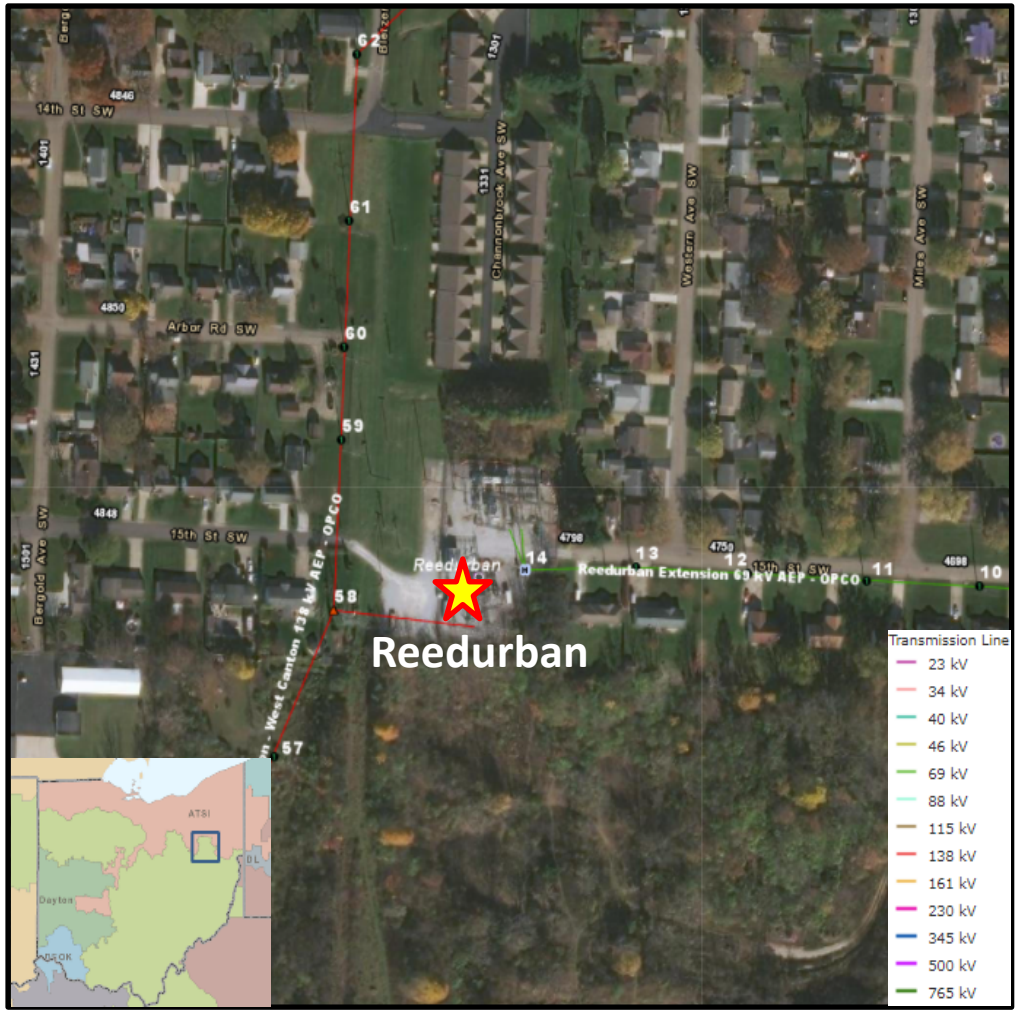
Process Stage: Solution Meeting 09/16/2022

Previously Presented: Need Meeting 10/15/2021

Problem Statement:

Operational Flexibility & Efficiency

The Miles Avenue-Reedurban-South Canton 138kV circuit is a 3-terminal line, due to the 138-69kV transformer source at Reedurban, and the lack of 138kV line breakers at Reedurban (contains motor-operated switches today, requiring remote-end breaker operation). Three-terminal lines are more difficult to reliably protect and are a risk for overtripping and misoperations.



AEP Transmission Zone M-3 Process
Gambrinus & Reedurban Station Upgrades

Need Number: AEP-2021-OH041 and AEP-2021-OH052

Process Stage: Solution Meeting 09/16/2022

Proposed Solution:

Rebuild Gambrinus station as Nolan station approximately 0.2 miles away as a 4-breaker 69kV ring bus. **Estimated Cost: $7.07 million**

Retire Gambrinus station and remove all equipment. **Estimated Cost: $1.04 million**

Extend the Gambrinus-Reedurban and Gambrinus-Torrey 69kV transmission lines 0.2 mile northward, to connect to Nolan station. **Estimated Cost: $1.36 million**

From Nolan station, construct a span of 69kV transmission line and a structure, for each of the two feeds to the customer. This will connect to the customer's 69kV loop. **Estimated Cost: $0.67 million**

At the 69kV remote-end of Torrey, upgrade line relays to coordinate with Nolan station. **Estimated Cost: $0.47 million**

At the 69kV remote-end of Reedurban, upgrade line relays to coordinate with Nolan and also replace the 69kV oil-filled breaker "R". Convert the 69kV pilot wire system to fiber. Eliminate the 138kV 3-terminal configuration by installing 2- 138kV breakers on the incoming 138kV circuits. **Estimated Cost: $3.61 million**

At Reedurban station, reconfigure the South Canton-Reedurban-Miles Avenue 138kV transmission line going into the station, to connect to the new breakers and bus. **Estimated Cost: $0.66 million**

At Reedurban station, replace and relocate a structure on the Nolan 69kV transmission line, to accommodate the station improvements and distribution scope. **Estimated Cost: $0.33 million**

Total Estimated Transmission Cost: $15.21 million

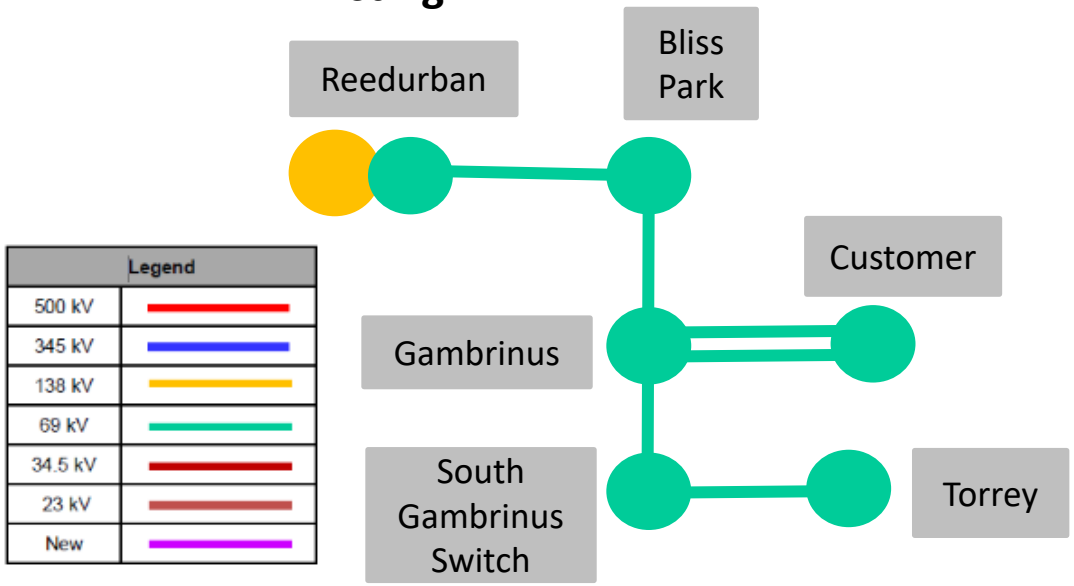
Alternatives Considered: No viable alternatives to upgrade Gambrinus station, due to the small station property size, customer outage constraints, and high-traffic area adjacent to the oil refinery.

Projected In-Service: 12/1/2025

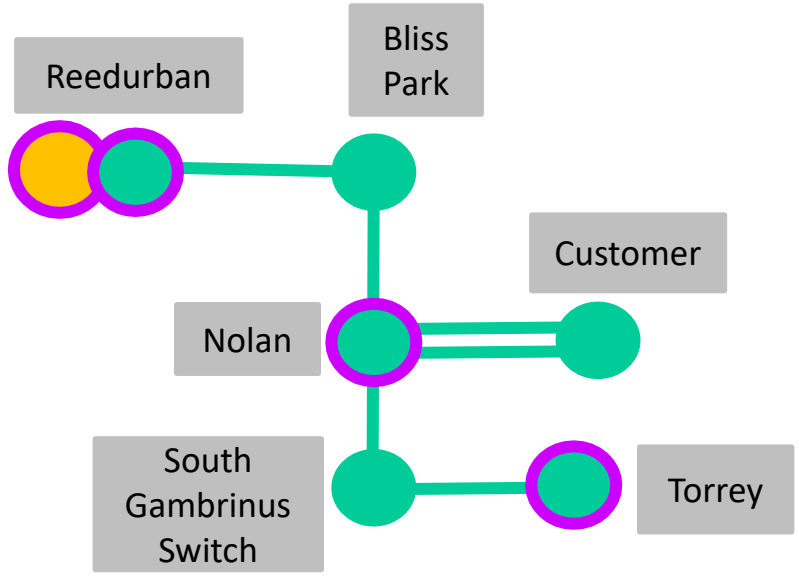
Project Status: Scoping

Model: 2026 PJM RTEP

Existing:



Proposed:



Appendix

High Level M-3 Meeting Schedule

Assumptions

Activity	Timing
Posting of TO Assumptions Meeting information	20 days before Assumptions Meeting
Stakeholder comments	10 days after Assumptions Meeting

Needs

Activity	Timing
TOs and Stakeholders Post Needs Meeting slides	10 days before Needs Meeting
Stakeholder comments	10 days after Needs Meeting

Solutions

Activity	Timing
TOs and Stakeholders Post Solutions Meeting slides	10 days before Solutions Meeting
Stakeholder comments	10 days after Solutions Meeting

Submission of Supplemental Projects & Local Plan

Activity	Timing
Do No Harm (DNH) analysis for selected solution	Prior to posting selected solution
Post selected solution(s)	Following completion of DNH analysis
Stakeholder comments	10 days prior to Local Plan Submission for integration into RTEP
Local Plan submitted to PJM for integration into RTEP	Following review and consideration of comments received after posting of selected solutions

Revision History

9/6/2022 – V1 – Original version posted to pjm.com