Western Sub Regional RTEP:
AEP Supplemental Projects

November 17, 2023

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

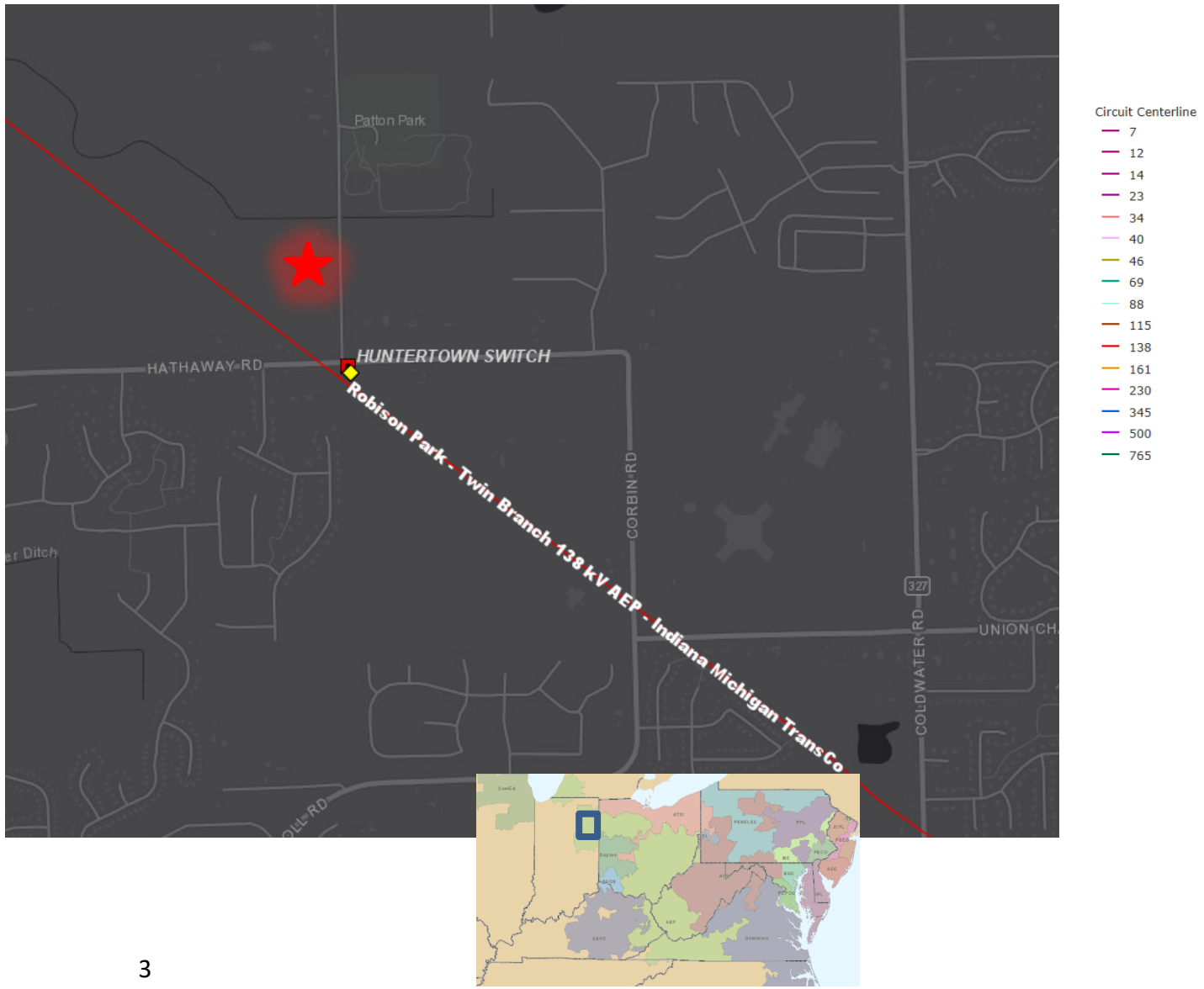
AEP Transmission Zone M-3 Process
Huntertown, Indiana

Need Number: AEP-2023-IM022
Process Stage: Needs Meeting: 11/17/2023
Supplemental Project Driver: Customer Need

Specific Assumption Reference: AEP Interconnection Guidelines (AEP Assumptions Slide 12)
Model: 2027 RTEP

Problem Statement:
NEREMC has requested a new delivery point for a peak load of 6MW in Huntertown, Indiana.

Requested ISD: 03/31/2025



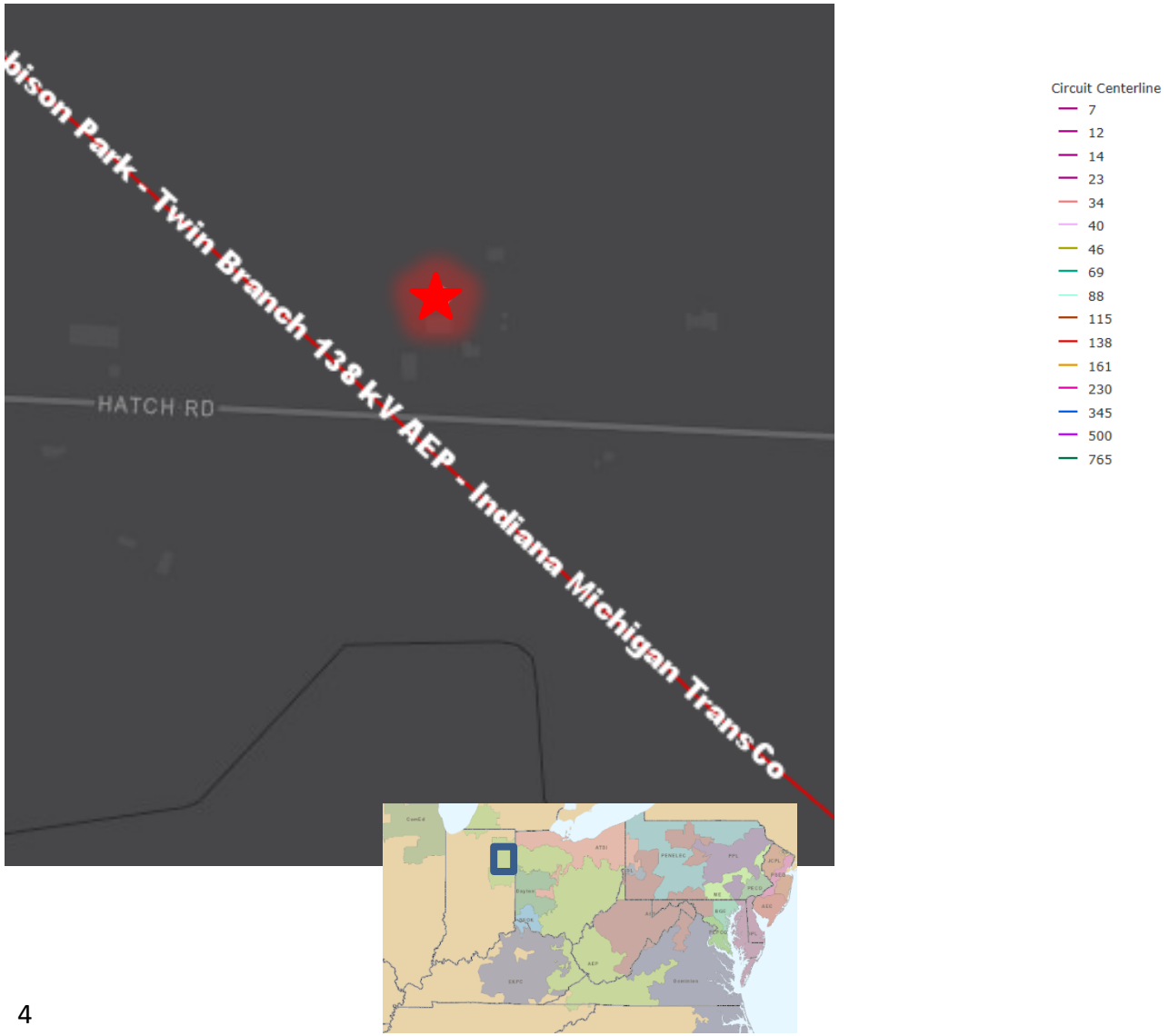
AEP Transmission Zone M-3 Process
Huntertown, Indiana

Need Number: AEP-2023-IM024
Process Stage: Needs Meeting: 11/17/2023
Supplemental Project Driver: Customer Need

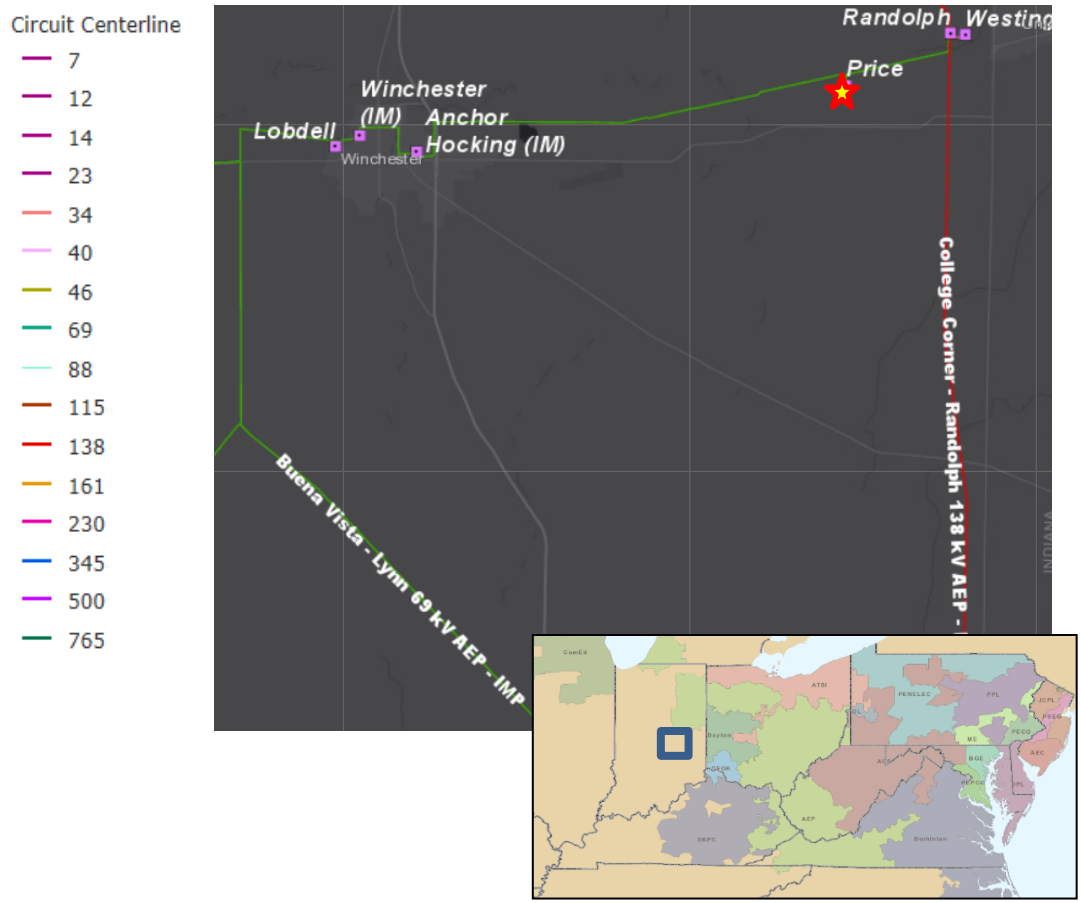
Specific Assumption Reference: AEP Interconnection Guidelines (AEP Assumptions Slide 12)
Model: 2027 RTEP

Problem Statement:
NEREMC has requested a new delivery point for a peak load of 6MW in Huntertown, Indiana.

Requested ISD: 03/31/2027



AEP Transmission Zone M-3 Process
Union City, IN



Need Number: AEP-2023-IM025

Process Stage: Need Meeting 11/17/2023

Project Driver: Customer Need

Specific Assumption Reference: AEP Interconnection Guidelines (AEP Assumptions Slide 12)

Problem Statement:

Indiana Michigan Power has requested a load increase of 14 MW at Price station. Total anticipated load to be served at the site is 28 MW.

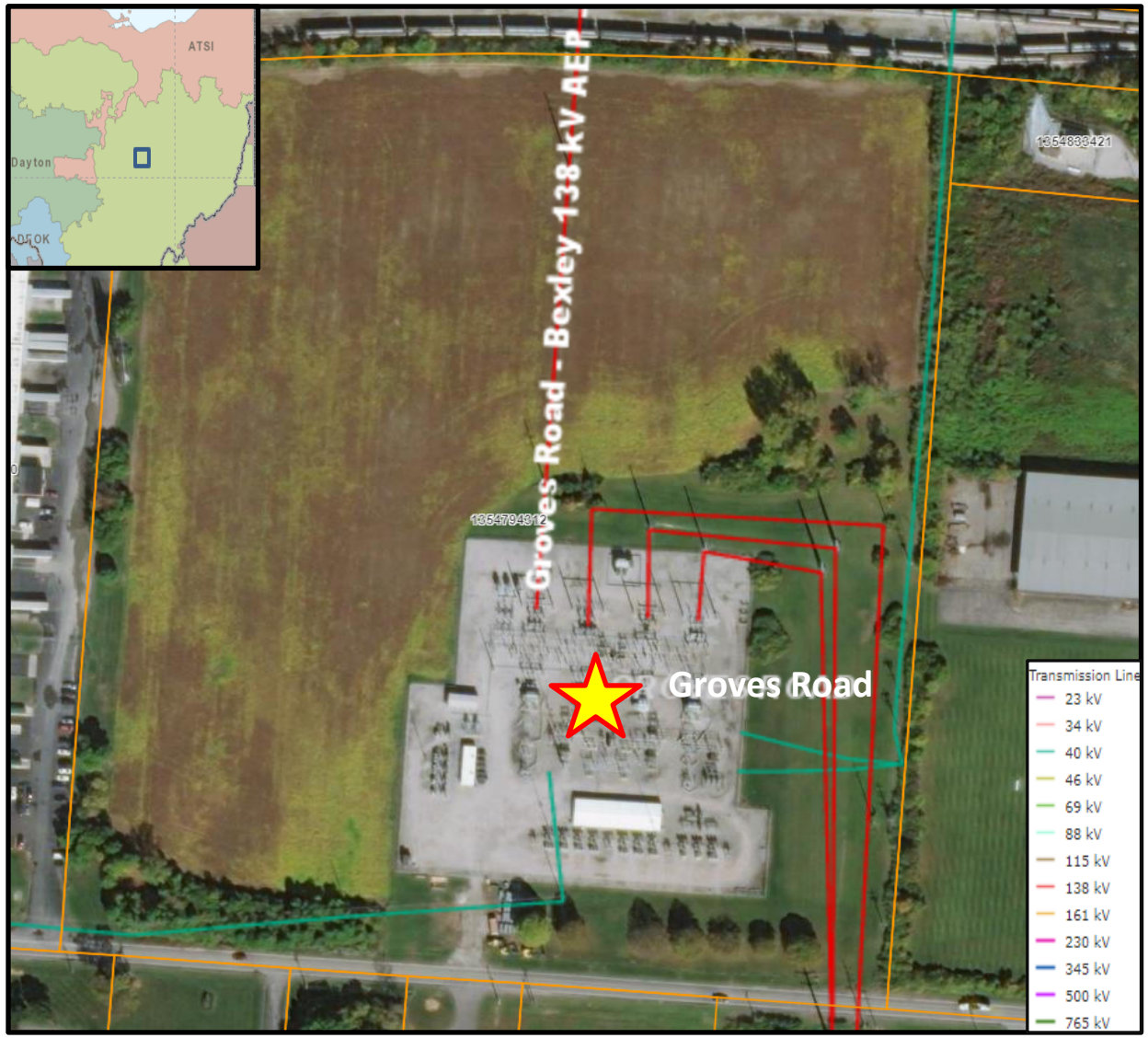
Requested ISD: 11/15/2024

AEP Transmission Zone M-3 Process
Columbus, OH

Need Number: AEP-2023-OH0038
Process Stage: Need Meeting 11/17/2023
Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Groves Road Station 138kV:

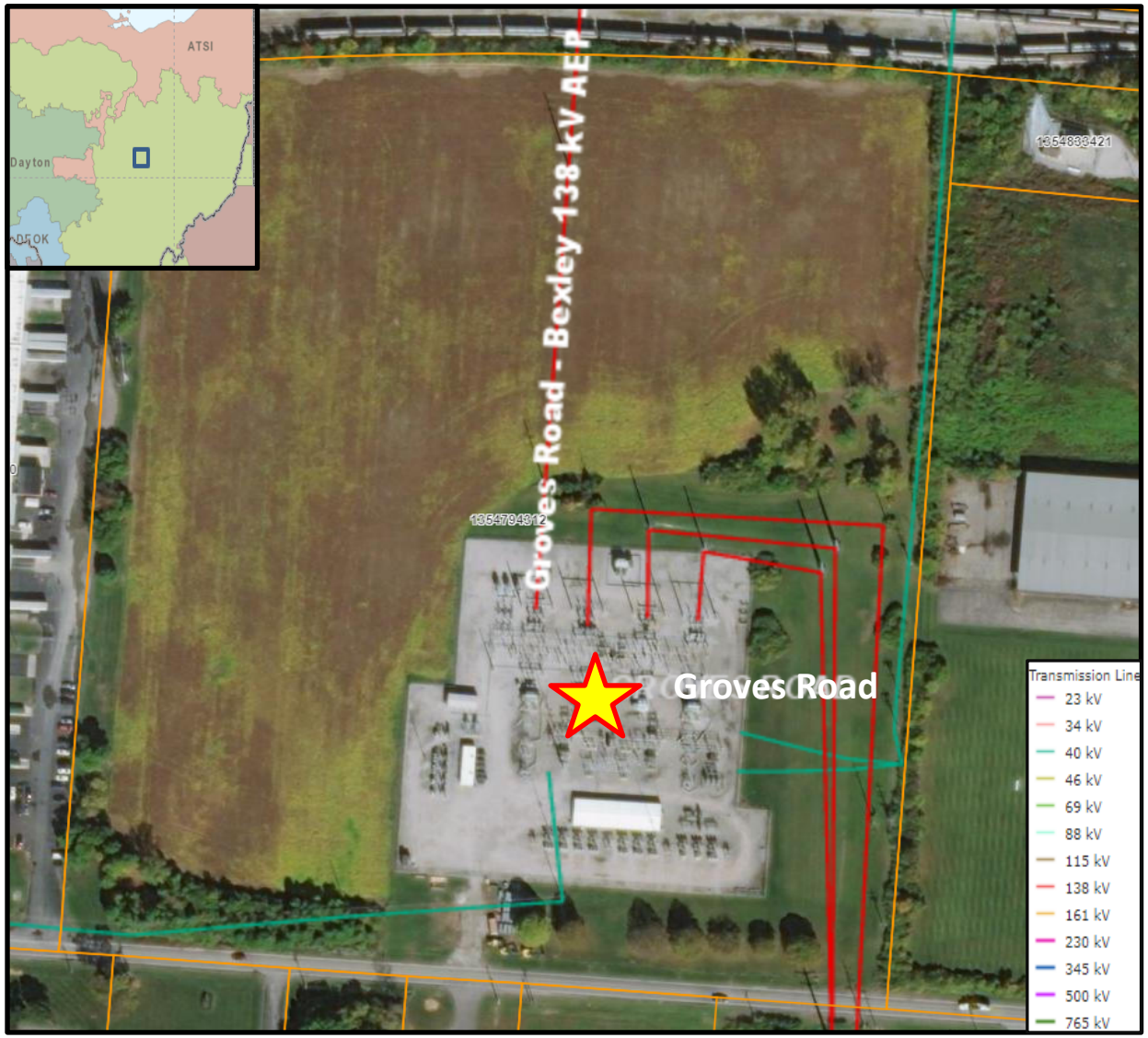
- AEP Ohio has indicated they have extensive equipment rehabilitation needs at the station as well as planned load growth.
- The station has experienced approximately 5 outages between 2018 – 2023 with a CMI of 538,923 related to Equipment Failure (3x) & Weather Related (2x).
- 138 kV Yard:
  - 138kV yard has cap-and-pin insulators and bus support insulators that are recommended for replacement
- 1-138 kV Circuit Switcher CS-AA:
  - Circuit Switcher age: 1999
  - Interrupting Medium: SF6
  - This vintage switcher type across the AEP system has had 110 malfunctions from May 2000 to August 2019. Failed operational components including high contact resistance, gas loss, and interrupter failure represent half of these malfunctions. Parts are expensive, especially because interrupters can only be replaced, not repaired, as they are hermetically sealed.



Need Number: AEP-2023-OH0038
Process Stage: Need Meeting 11/17/2023
Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Groves Road Station 138kV Continued:

- 138 kV Circuit Breaker CB-7:
  - Breaker age: 1966
  - Interrupting Medium: Oil
  - Number of Fault Operations: 15
  - Oil filled breakers have much more maintenance required due to oil handling than their modern SF6 counterparts do not require. The manufacturer provides no support for this fleet of circuit breakers and spare parts are increasingly 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 vacuum oil and oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.
- Relays:
  - Currently, T-RTU is outside of warranty period with limited to no spare parts availability and no vendor support. Electromechanical & static relays (80% of all station relays) are in need of replacement which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support.
- Control House:
  - Old Control house window caulking has asbestos and is breaking. Also, there are asbestos wrapped power cables.



AEP Transmission Zone M-3 Process
Licking County, Ohio

Need Number: AEP-2023-OH045

Previously Presented: Needs Meeting 11/17/2023

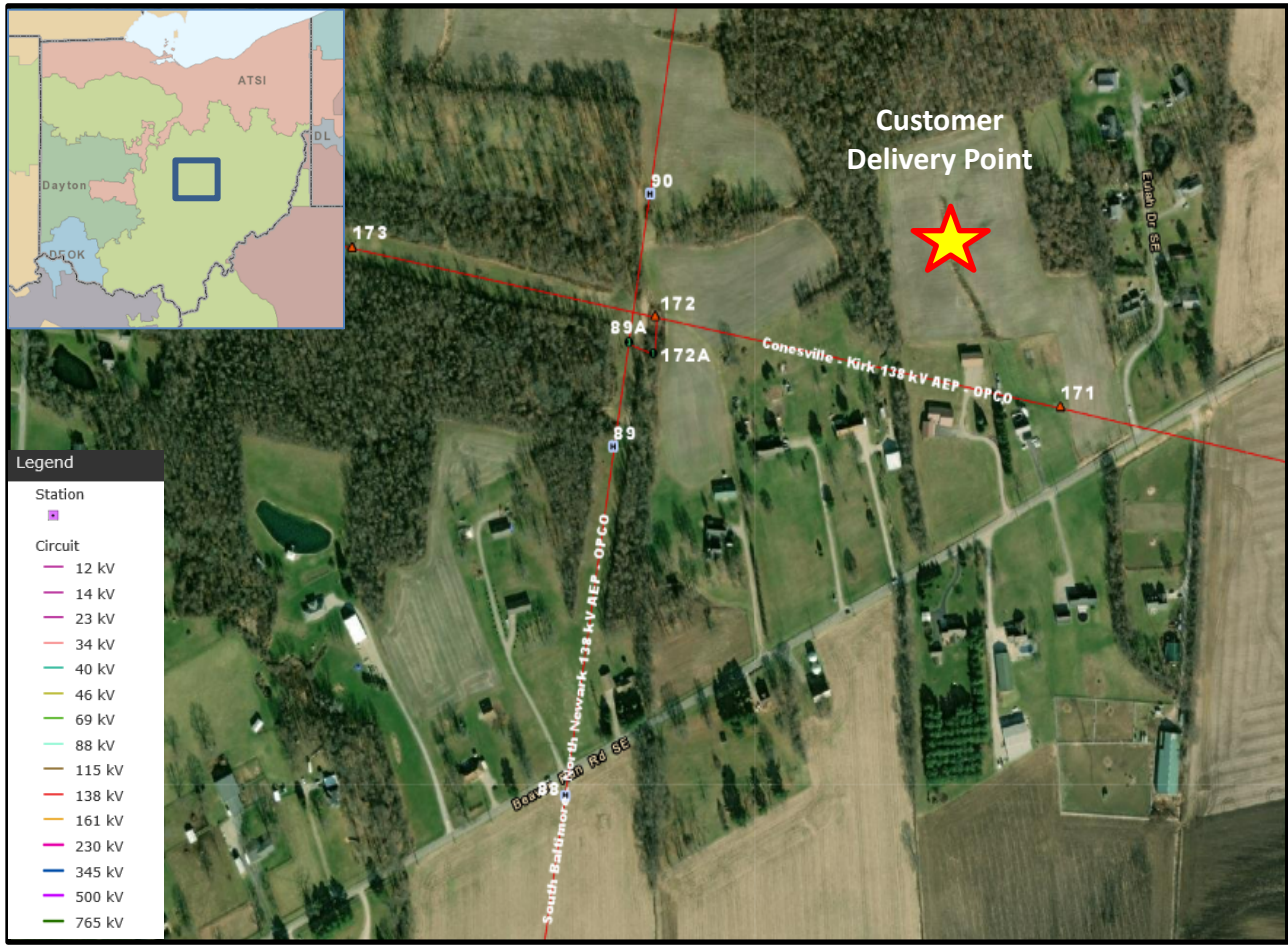
Project Driver: Customer Service

Specific Assumption Reference:

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

Problem Statement:

- A wholesale customer has requested service to a new delivery point in Licking County, Ohio.
- The projected demand for the site is projected to be 2 MW in 2024 with future growth of 2% expected per year.
- Service is requested by Spring 2024.



AEP Transmission Zone M-3 Process
Franklin County, OH

Need Number: AEP-2023-OH054

Process Stage: Need Meeting 11/17/2023

Project Driver: Equipment Material/Condition/Performance/Risk

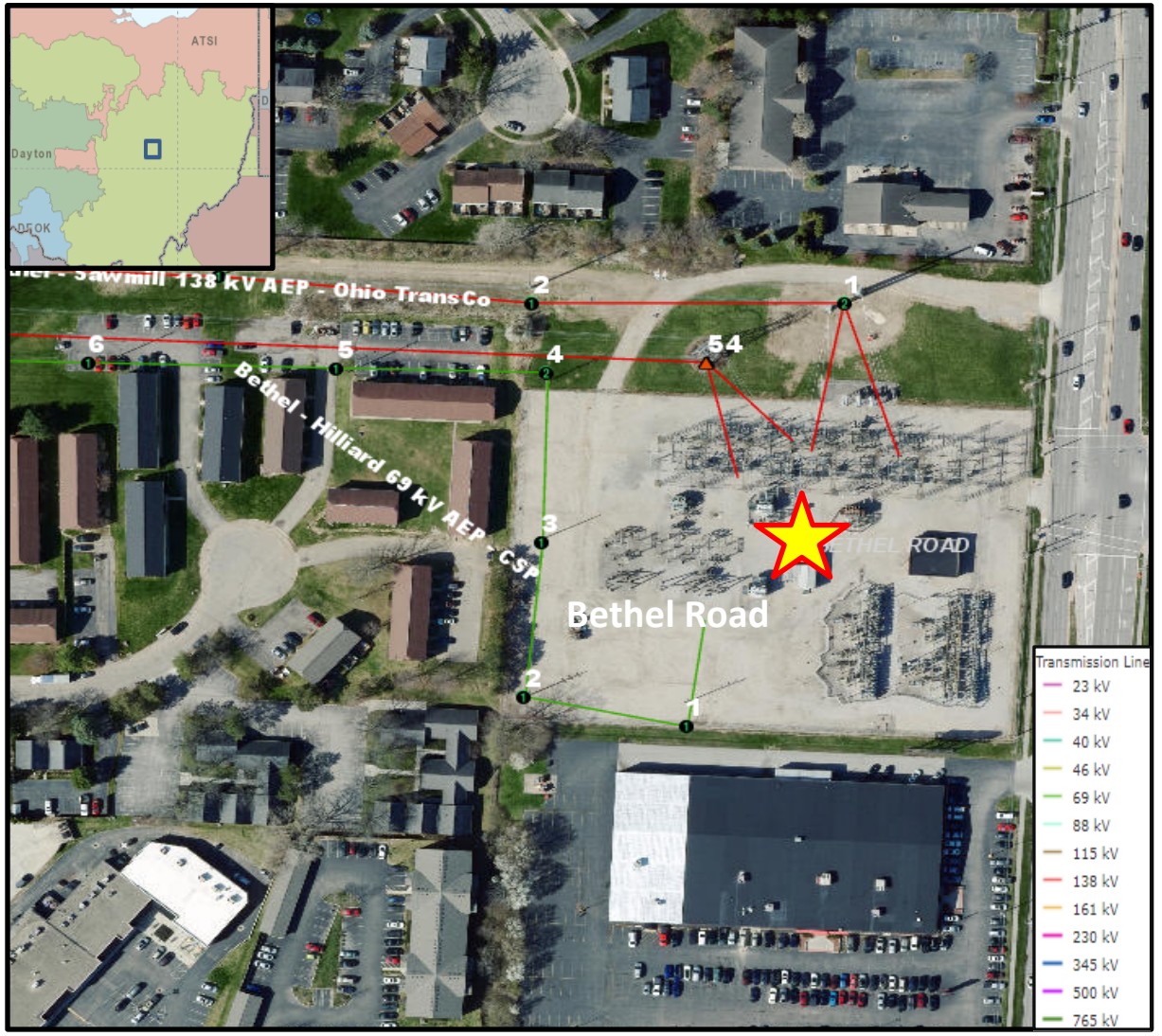
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

<u>69 kV Circuit Breakers CB – G & H:</u>

- Breaker age: 1967
- Interrupting Medium: (Oil)
- Number of Fault Operations: H=18
- 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. Circuit breaker CB-H has exceeded the manufacturer's designed number of full 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.

AEP Ohio has indicated additional needs on the 138/12kV Bethel Road distribution station.



AEP Transmission Zone M-3 Process
Franklin County, OH

Need Number: AEP-2023-OH054

Process Stage: Need Meeting 11/17/2023

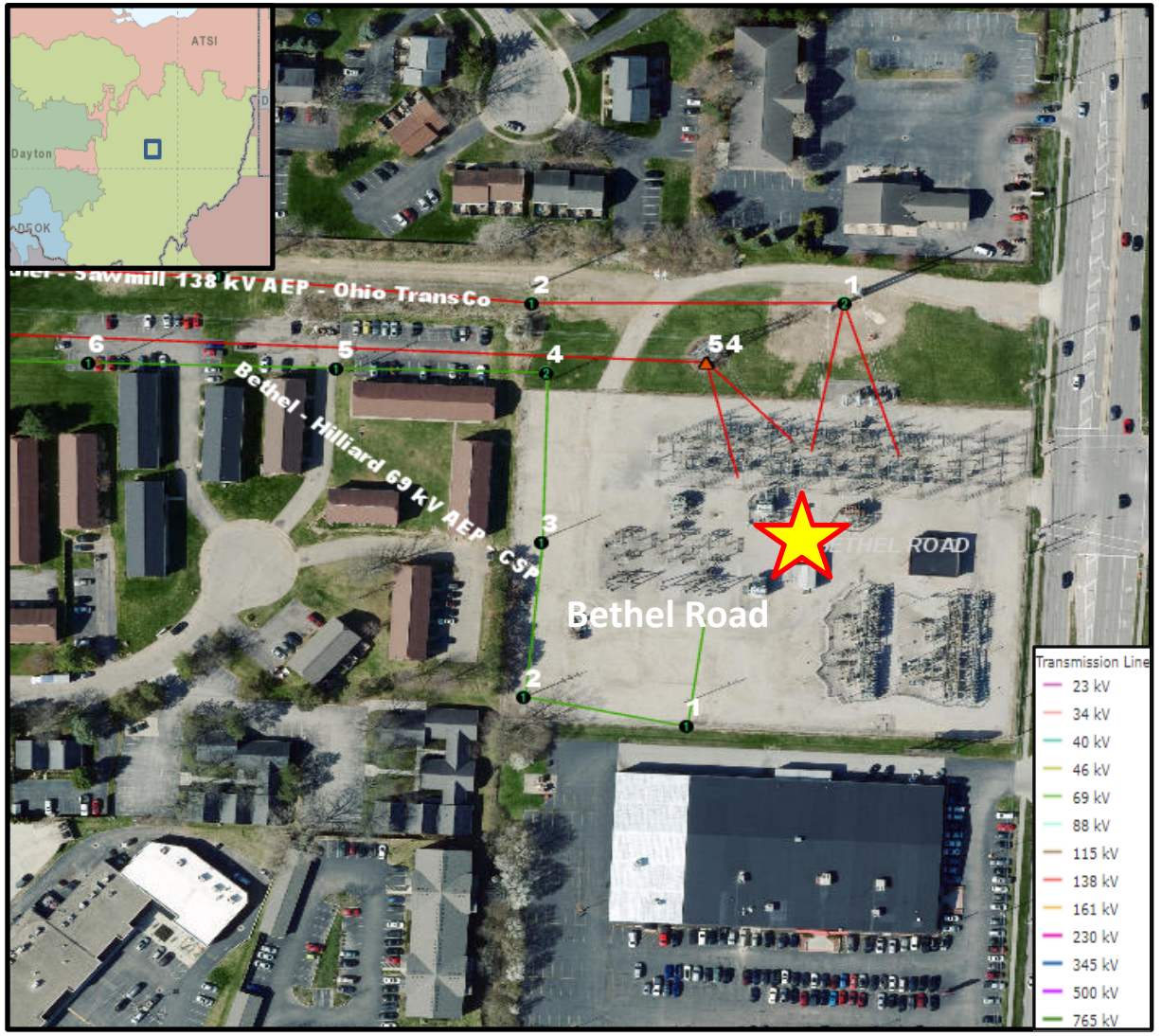
Problem Statement, continued:

<u>Transformer 3 - 138/69/12 kV:</u>

- Transformer Manufacture Date: 1963
- Additional Information:
    - Disolved gas analysis shows elevated levels of Acetylene in this unit. The presence of acetylene confirms the insulation system (oil and paper) is in poor condition and indicates electrical faults have occurred within the main tank causing an electrical breakdown of the unit. There are weld leaks, no oil containment, and the fans do not respond to cooling controls.

<u>Relays:</u>

- Currently, 98 of the 144 relays (68% of all station relays) are in need of replacement. 92 of these electromechanical type and 5 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
Columbus, Ohio

Need Number: AEP-2023-OH089

Process Stage: Need 10/20/2023

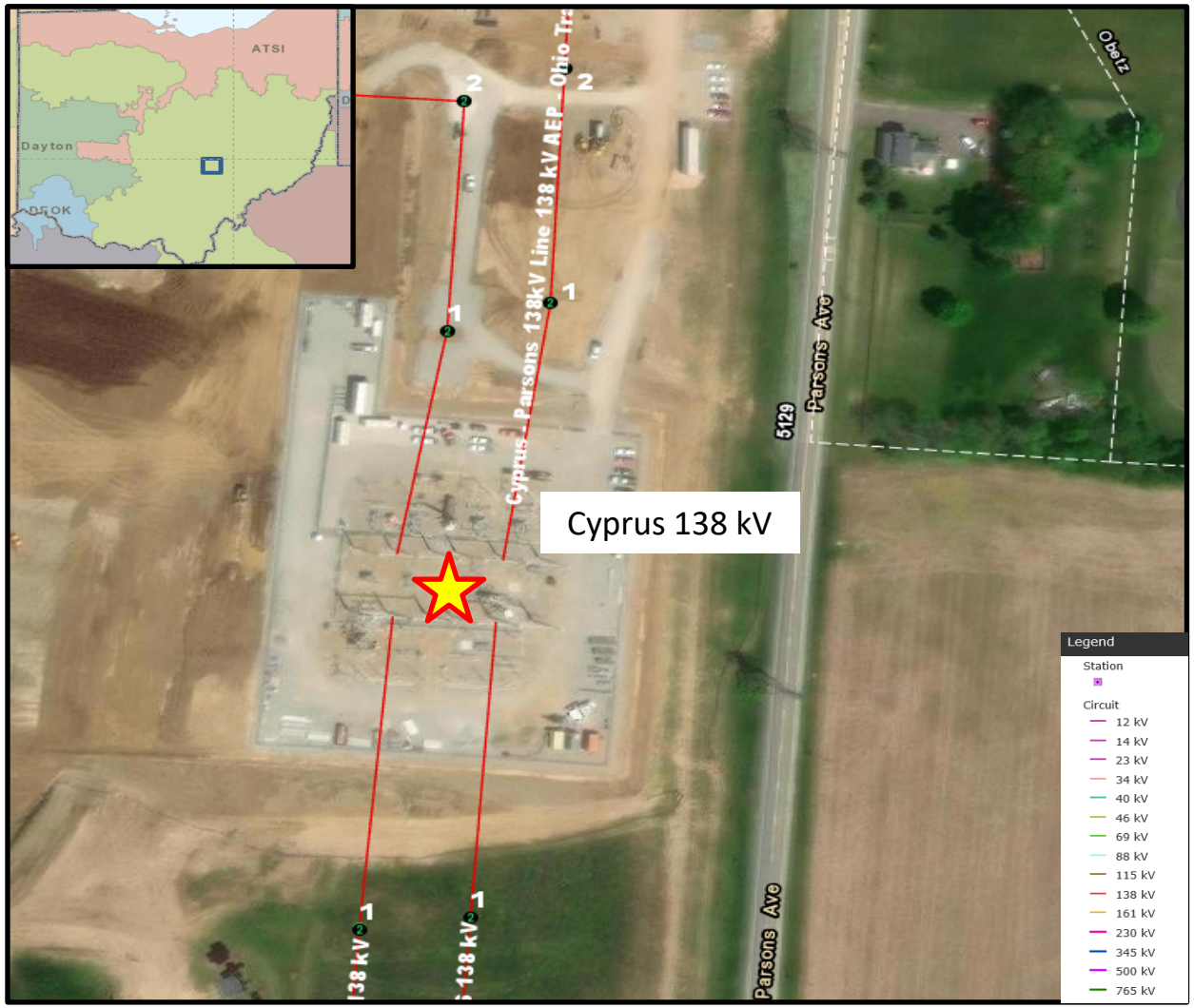
Project Driver: Customer Service

Specific Assumption Reference:

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

Problem Statement:

- A customer has requested additional 138 kV delivery points to their site in Columbus Ohio, just south of AEP's Cyprus station.
- The projected peak demand of the new delivery points will be approximately 96 MW, bringing the total load at the site to approximately 388 MW. The ultimate capacity of the customer remains the same at 675 MW.
- Customer requested in-service date of 04/30/2025.



AEP Transmission Zone M-3 Process
Scioto County, Ohio

Need Number: AEP-2023-OH094

Process Stage: Need Meeting 11/17/2023

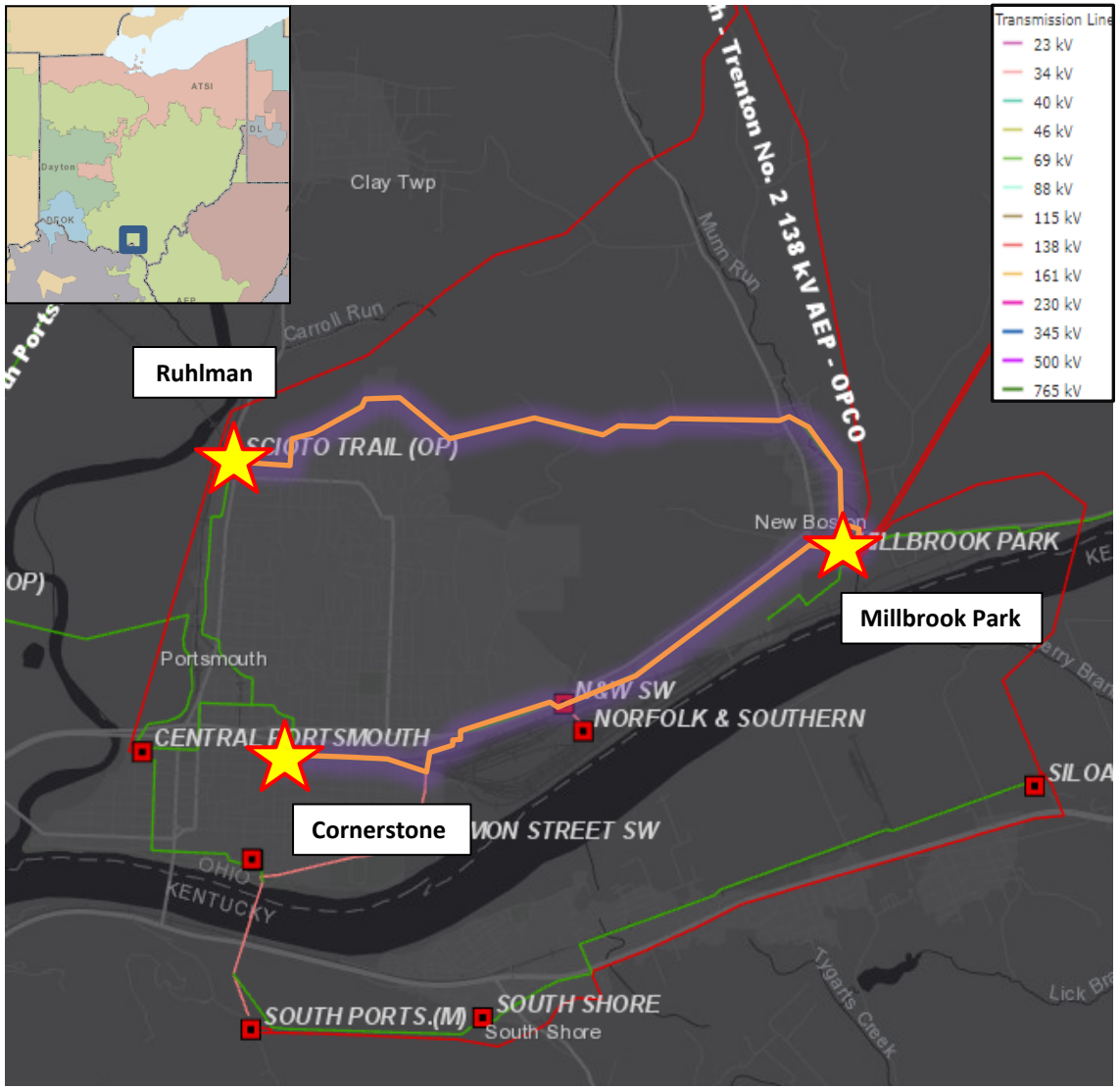
Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

<u>Millbrook Park – Scioto Trail 69 kV Line:</u>

- Original Install: 1937
- Total Length: ~4.29 Miles
- Conductor Types:
  - ~4.15 miles of 3/0 COPPER 7 (30COP) from 1937
  - ~0.08 miles of 336,400 CM ACSR 18/1 (Merlin) from 1937
- Total Structure Count: 109
  - 23 from 1930s, 2 from 1940s, 25 from 1960s, 19 from 1970s, 27 from 1980s, 11 from 1990s, 1 from 2013
- Open Conditions: There are 24 structures with at least one open condition, which relates to 22% of the structures on this line. There are currently 13 structure based open conditions consisting of rot top, split poles, woodpecker holes and a twisted crossarm. There are currently 4 grounding based open conditions consisting of broken ground lead wires. There are currently 8 hardware based open conditions consisting of burnt/broken insulators, broken shield wire hardware and a buried guy anchor.
- 6 structures were assessed by a ground crew. 100% of those structures had reported conditions, which includes the following: six structures have moderate deterioration of the pole, one structure had arms/braces moderately deteriorated, two structures are built to old standards, one structure had guy strain insulators moderately deteriorated, four structures have insulators and hardware with moderate deterioration, one structure had age cracks, one structure had significant deterioration to the pole topper, one structure had a split pole reported and one structure has two forestry open conditions reported.
- The representative structure on the Millbrook Park – Scioto Trail line does not meet 2017 NESC Grade B loading criteria.
- The line is insulated with porcelain post insulators which do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line is grounded with butt wraps which does not meet current AEP standards.

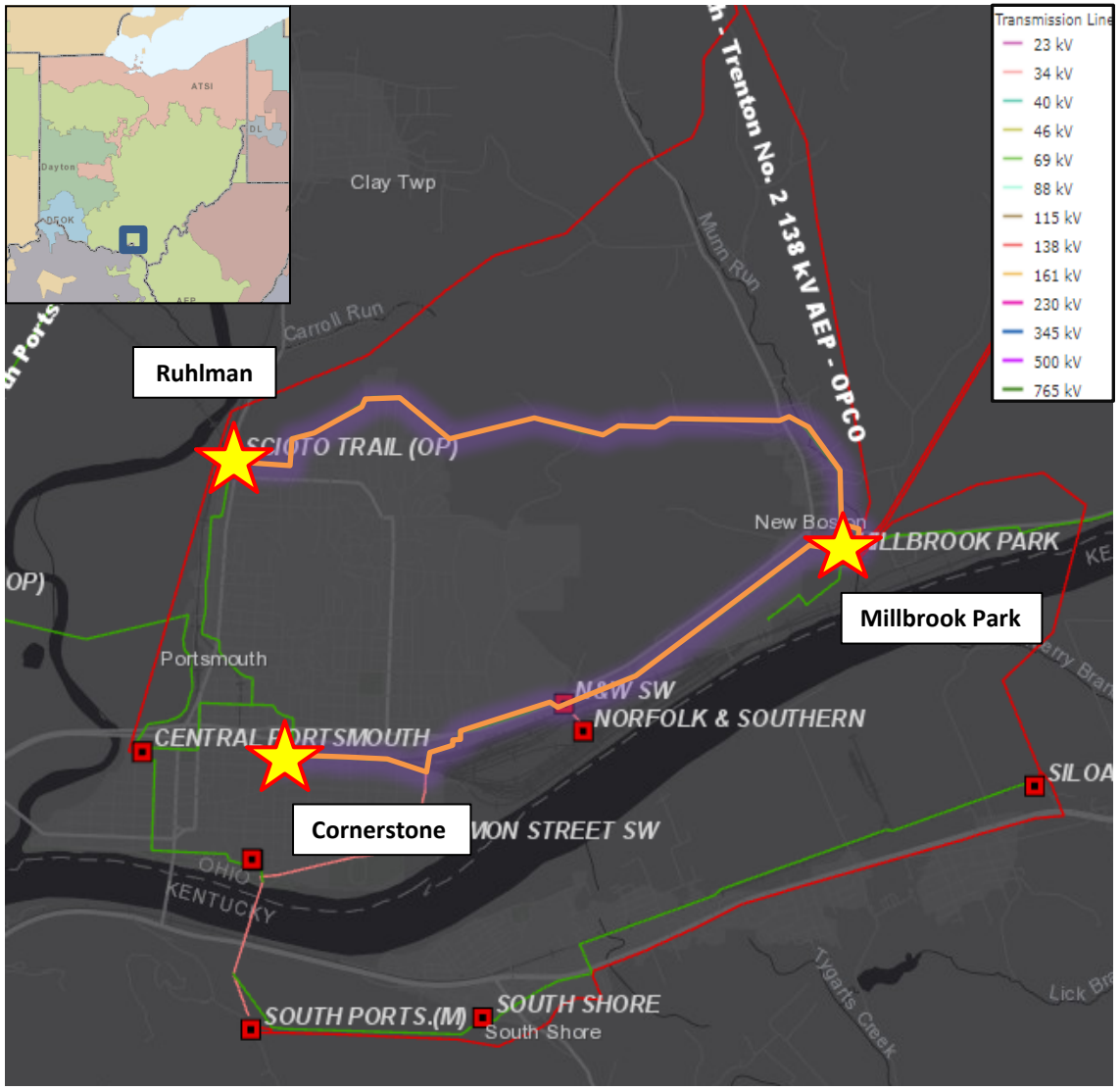


AEP Transmission Zone M-3 Process
Scioto County, Ohio

Problem Statement (continued):

Millbrook Park – Cornerstone 69 kV Line:

- Original Install: 1925
- Total Length: ~3.56 Miles
- Conductor Types:
  - ~3.43 miles of 3/0 COPPER 7 (30COP) from 1925
  - ~3.69 miles of 336,400 CM ACSR 18/1 (Merlin) from 1925
  - ~0.03 miles of 3/0 ACSR 6/1 (Pigeon) from 1950
- Total Structure Count: 119
  - 20 from 1920s, 2 from 1940s, 28 from 1950s, 57 from 1960s, 1 from 1970s, 5 from 1980s, 3 from 1990s, 2 from 2010s
- Open Conditions: there are 16 structures with at least one open condition, which relates to 13.4% of the structures on this line. There are currently 14 structure based open conditions consisting of rot top, rot heart and a split pole. There are currently 2 grounding based open conditions consisting of broken ground lead wires. There is currently 1 hardware based open condition consisting of a burnt insulator.
- 7 structures were assessed by a ground crew. 86% of those structures had reported conditions, which includes the following: one structure had the base of pole deteriorated, two structures have age cracks, two structure have moderate deterioration/rust on arms/braces, one structure had rusted guys, three structures have moderate deterioration/rust on the hardware, one structure had pulled insulators, one structure had significant deterioration/rot top to the topper, one structure had rot top reported on the crossarm and one structure had rot heart reported.
- The representative structure on Millbrook Park – Cornerstone 69kV line does meet 2017 NESC Grade B loading criteria.
- The line is insulated with porcelain vertical insulator posts which do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line is grounded with butt wraps which do not meet current AEP standards for CIFO and minimum leakage distance requirements.



Need Number: AEP-2023-OH096

Process Stage: Need Meeting 11/17/2023

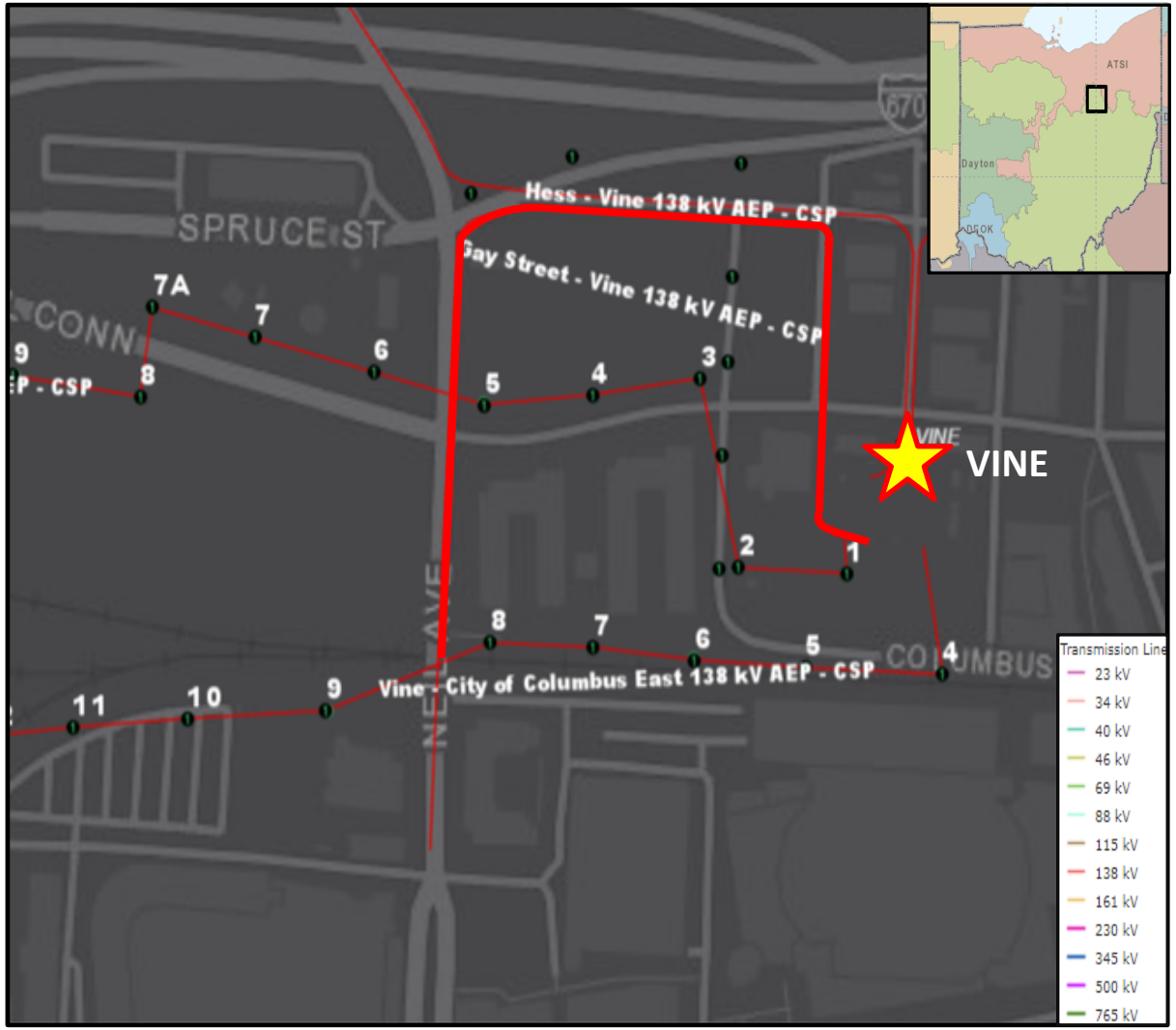
Supplemental Project Driver: Customer Service

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

Problem Statement:

Gay St. – Vine 138 kV:

- A customer has requested that AEP relocate a ~0.4-mile portion of the Gay St. - Vine 138 kV underground line to accommodate development in the area. This line was originally installed in the 1960s with an oil-filled pipe type cable design as described under the AEP-2020-OH033 need.
- Service is requested by 12/2024.

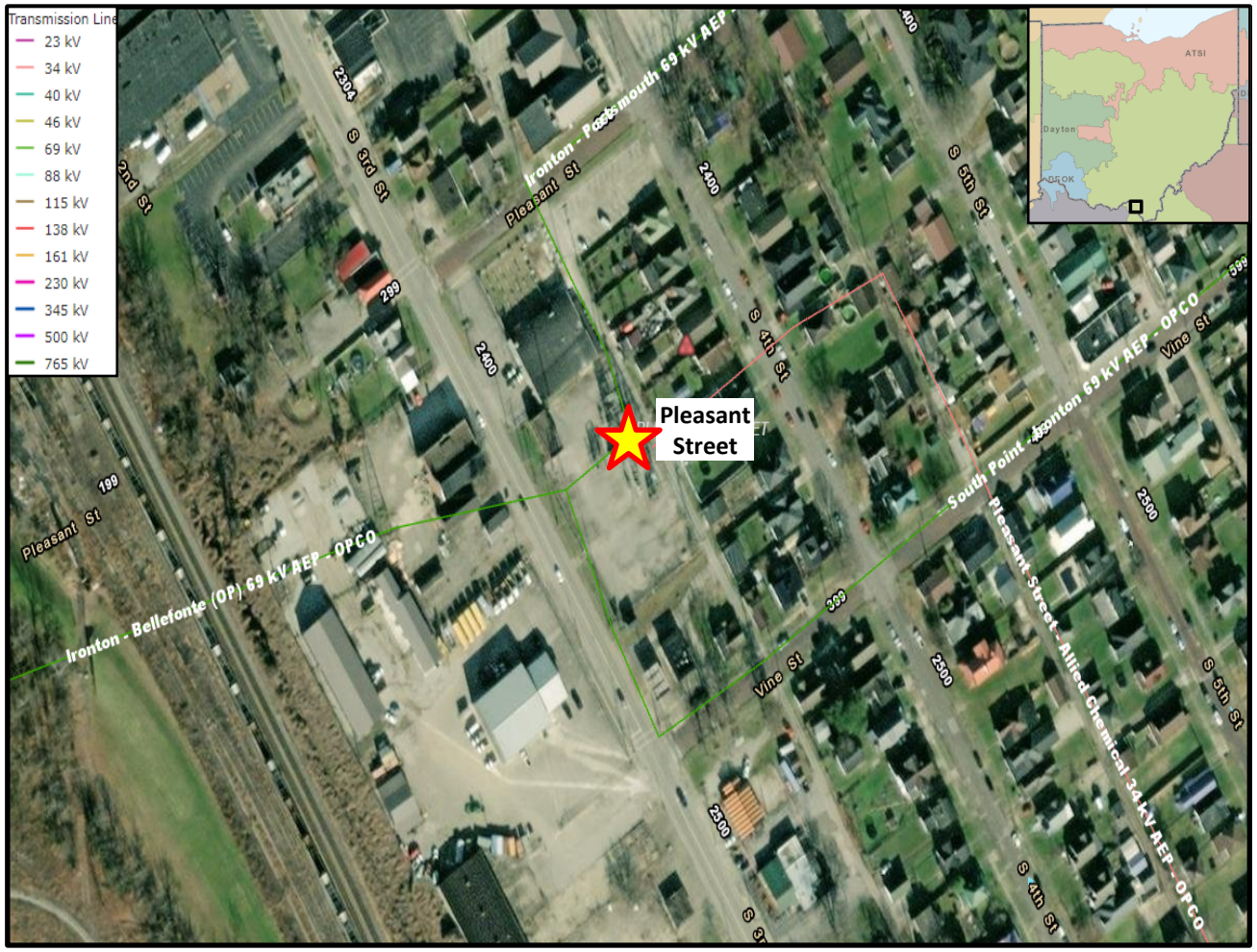


AEP Transmission Zone M-3 Process
Ironton, Ohio

Need Number: AEP-2023-OH097
Process Stage: Need Meeting 11/17/2023
Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Pleasant Street 69 kV:

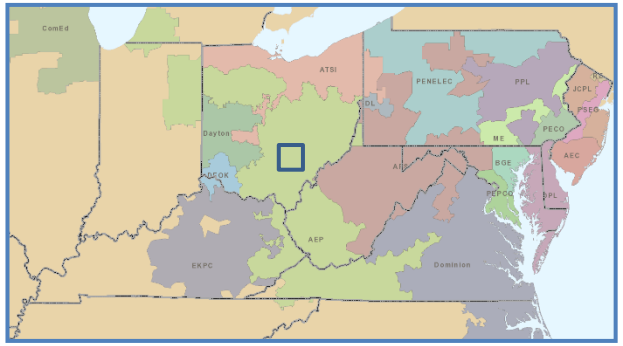
- CBs A & E
  - Age: 1971
  - Interrupting Medium: Oil
  - Fault Operations: CB E - 19
  - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require.
- CS AA
  - Age: 1990
  - Interrupting Medium: SF6
  - This model of circuit switcher has no gas monitor and currently in-service units on the AEP System have experienced 80 malfunctions from May 2002 to August 2019. The major malfunction events, which account for 80% of recorded malfunctions, include gas loss, interrupter failures, operating mechanism failures, and trip or reclose failures. Models manufactured at the same time as this unit have a high potential for broken spring carriers in the low-gas target assembly, which presents the possibility of an actual low gas situation going unnoticed due to the indicator not activating.
- Relays: Currently, 29 of the 40 relays (73% of all station relays) need replacement. 27 of these are of the electromechanical type and 2 are 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 Ohio has indicated that there are asset renewal and capacity issues tied to distribution equipment at the station.



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
Lancaster Area Improvements



Need Number: AEP-2020-OH026
Process Stage: Solutions Meeting 11/17/2023
Previously Presented: Need Meeting 04/20/2020
Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Ralston – North Logan 69 kV

- Original Install Date (Age): 1950's and 1960's
- Length of Line: 15.3 miles
- Total structure count: 148
- Original Line Construction Type: Wood
- Conductor Type: 336.4 ACSR 30/7
- Momentary/Permanent Outages and Duration: 13 Momentary and 5 Permanent outages
- CMI (last 5 years only): 1,496,000

Line Condition Summary:

Ralston – North Logan line section:

- 84 structures with at least one open condition.
- 59 structure related open conditions including broken crossarms, insect damage, rot heart, rot top, split poles and crossarms, and woodpecker holes
- 9 open conditions related to the conductor, including broken strands
- 7 open conditions related to the shielding wire and grounding, including broken shield wire strands
- 30 hardware related open conditions related to insulator, conductor hardware, or shield wire hardware, including broken, burnt, or chipped insulators

AEP Transmission Zone M-3 Process
Lancaster Area Improvements

Need Number: AEP-2021-OH026
Process Stage: Solutions Meeting 11/17/2023
Previously Presented: Need Meeting 05/21/2021
Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

<u>Section of the Lancaster Junction – Ralston 69kV Line, Single Circuit (Lancaster Junction – Str 273):</u>

- Age: 1955
- Length of Line Section: ~0.02 Miles
- Structure Count: 2
  - Structure Type: Wood
- Conductor Type: 556,500 CM ACSR 18/1 (Osprey)
- Outage History: 12 Momentary and 4 Permanent outages with a total CMI of 3,113,139.
- This is currently a three terminal line, which can cause miss-operations and over-tripping of the line.
- <u>Section of the South Lancaster – East Lancaster 69kV Line, Single Circuit (East Lancaster - Str 310):</u>
- Age: 1965
- Length of Line Section: ~0.01 Miles
- Structure Count: 1
  - Structure Type: Wood
- Conductor Type: 556,500 CM ACSR 18/1 (Osprey)
- Outage History: 8 Momentary and 2 Permanent outages
- This is currently a three terminal line, which can cause miss-operations and over-tripping of the line.

<u>Clouse – West Lancaster 138kV, Double Circuit:</u>

- Age: 1942
- Line Length: ~22.78 Miles
- Total Structures: 106
  - Structure Type: Steel Lattice
- Conductor Type: 397,500 CM ACSR 30/7 (Lark)
- Outage History: 6 momentary and 3 permanent outages with a total CMI of 208,134
- Open conditions: 60 total open conditions; 9 out of 106 structures have at least 1 open condition 8.5% of structures.
- Junction City Switch (2005): SCP has backup capability for Junction City, but only during light loading conditions. During peak loading, they cannot back feed their load.

AEP Transmission Zone M-3 Process
Lancaster Area Improvements

Need Number: AEP-2021-OH027
Process Stage: Solutions Meeting 11/17/2023
Previously Presented: Need Meeting 05/21/2021
Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

West Lancaster Station

Circuit Breakers: D & E (138 kV)

- Breaker Age: 1991: D & E
- Interrupting Medium: (SF6)
- Fault Ops: D: 40 & E: 8 (Manufactured recommended number of fault ops is 10)
- Additional Info: This type of breaker has had 411 malfunction records (mostly gas leaks and contact resistance concerns) and most problems reported with loss of SF6 and miss-operations.

Circuit Breakers: C & J (69 kV)

- Breaker Age: 1966: C & 1963: J
- Interrupting Medium: (Oil)
- Fault Ops: C: 87 & J: 5 (Manufactured recommended number of fault ops is 10)

Additional Info: . These breakers are McGraw-Edison CF/CG/CGH/CH family of oil filled breakers 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 mis-operations across the AEP fleet.

Circuit Switcher: BB (69 kV)

- Switcher Age: 1989
- Interrupting Medium: (SF6)
- Additional Info: This switcher is a Mark V type that has no gas monitor and currently in-service units on the AEP system have experienced 110 malfunctions from May 2000 to August 2019. Failed operational components including high contact resistance, gas loss, and interrupter failure represent half of these malfunctions. Two malfunctions of note were catastrophic equipment failures involving failures to trip.

AEP Transmission Zone M-3 Process
Lancaster Area Improvements

Need Number: AEP-2021-OH027
Process Stage: Solutions Meeting 11/17/2023

Problem Statement Continued:

West Lancaster - continued

138/69kV Transformer 2 (60 MVA)

- Age: 1966
- Overheating events indicate decomposition of the paper insulation that impairs the unit's ability to withstand future short circuit or through fault.
- No oil containment.
- High side disconnect switches need replaced.
- Additional Info.: Currently no sectionalizing on either side of Transformer 1 & 2, there are three dissimilar zones of protection (138 kV Bus, Transformer & 69 kV Bus) .

Relaying:

Currently, 40 of the 74 relays (54% of all station relays) are in need of replacement. There are 38 of the electromechanical type and 2 of the static type 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.

Control House:

- Asbestos on walls, roof and cables
- Structural Integrity is in question – this needs replaced as soon as possible.
- Relays systems are not set up for dual battery configuration
- Cable entrance is 100% full

AEP Transmission Zone M-3 Process
Lancaster Area Improvements

Need Number: AEP-2020-OH026, AEP-2021-OH026, AEP-2021-OH027
Process Stage: Solutions Meeting 11/17/2023

Proposed Solution:

Ralston - North Logan 69 kV Line : Retire the line section between North Logan – Geneva Switch (~9.0 miles) between Str. 70 – 147 and rebuild a portion as double circuit from Geneva Sw up to Str. 70/71 (~1.15 miles). Cost: $9.67M

East Logan – Shawnee 69 kV Line : Six-wire the 69 kV line between N. Logan – E. Logan (Str. 2-43) and terminate the E. Logan – New Lexington 69 kV circuit into the now vacated Ralston – N. Logan 69 kV line position at N. Logan station at/near structure 44 to form the new N. Logan – New Lex. 69 kV circuit. Remove sections between Str. 43 – 44 and Str. 2 – E. Logan (CB-L). Cost: $1.28M

Clouse - West Lancaster 138 kV: Rebuild ~23 miles of 138 kV line between West Lancaster and Clouse stations. The existing double circuit line will be rebuilt as double circuit between West Lancaster and just east of South Lancaster station along with the section between structure 96 and Clouse station. The remaining ~5.6 miles of the line will be rebuilt as single circuit. The section between structure 96 and Clouse will have one circuit of the double circuit operated at 69 kV to form the South Lancaster – Clouse circuit to allow for the retirement of the Ralston – North Logan line south. 69 kV and 138 kV line extensions will be installed into Clouse station, using 795 ACSR conductor SE 360 MVA. Cost: $65.81M

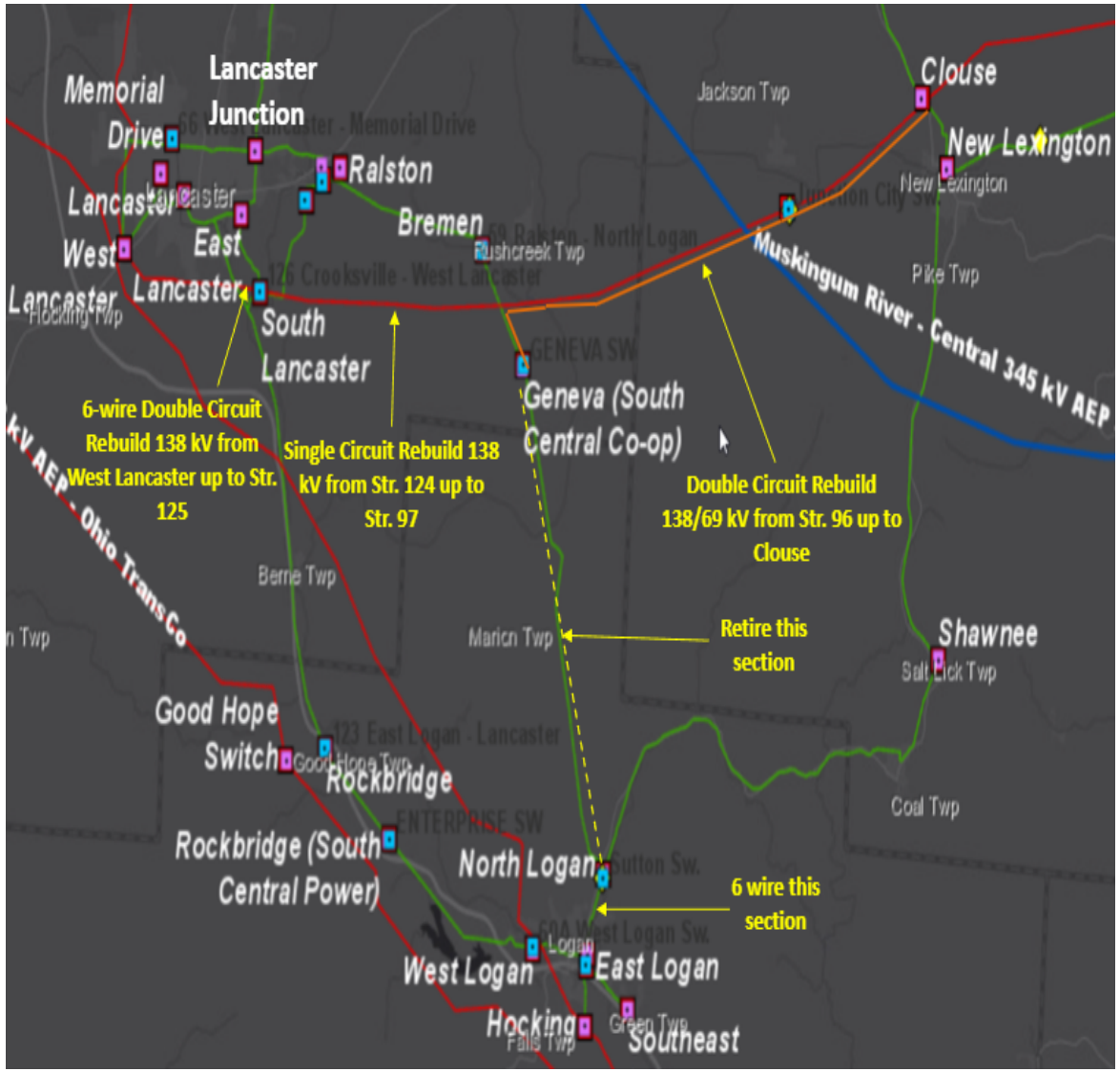
East Logan – South Lancaster 69 kV Line : Re-terminate this line at East Logan to utilize CB-P, which is a newer vintage breaker in better health than existing breaker M. Cost: $0.72M

East Logan 69 kV: Retire 69 kV CB-M and repurpose CB-P for re-terminating the South Lancaster circuit. Cost: $0.77M

Clouse 138 kV & 69 kV: Add a 138 kV, 3000 A, 63 kA breaker to accommodate the new 138 kV line from Crooksville. Add a 69 kV, 3000 A, 40 kA breaker to accommodate the new 69 kV line from South Lancaster (thru Geneva Sw). Install all associated attachment facilities. DICM expansion will likely be required. Cost: $1.67M

Geneva Sw 69 kV: Replace & relocate the existing PoP Switch with a 3-way 1200A PoP Switch. Cost: $0.95M

Junction City 138 kV: Replace the existing 2-way POP with a 3-way 2000A POP. Cost: $1.15M



AEP Transmission Zone M-3 Process
Lancaster Area Improvements

Need Number: AEP-2020-OH026, AEP-2021-OH026, AEP-2021-OH027
Process Stage: Solutions Meeting 11/17/2023

Proposed Solution Continued:

West Lancaster 138 kV & 69 kV: Replace T2 with a 90MVA bank. Replace 138 kV CB-D with 1 - 138 kV, 3000 A, 40 kA circuit breaker, 69 kV CB-C & CB-J with 2 – 69kV 3000 A, 40 kA circuit breakers, 69 kV CS-BB with 1 – 69 kV 2000A 31.5 kA circuit breaker and, the control building with DICM & new relays. Retire 138 kV CB-E. Replace 69 kV Bus 1 PT's. Cost: $10.83M. **Note: Work will be coordinated with previously proposed upgrades at station captured under S2857.9.**

South Lancaster 138 kV & 69 kV: Add 2 - 69 kV, 3000 A, 40 kA and 2- 138 kV, 3000 A, 40 kA circuit breakers to the low and high sides of T1 and T2. Upgrade transformers' protection. Cost: $3.22M

Lancaster – E. Lancaster – S. Lancaster 69 kV: In order to mitigate the 3-terminal line, 0.2 miles of 69 kV double circuit line, including several dead end and turning structures, will be constructed to loop the circuit into East Lancaster station. Cost: $2.39M

East Lancaster 69 kV: Extend the bus to accommodate a new line. Install one new 69 kV, 3000 A, 40 kA breaker and all associated attachment facilities (relays, bus work, risers, and switches). Retire the 69 kV cap bank. Cost: $1.04M

Lancaster Jct – E. Lancaster – Ralson 69 kV : In order to mitigate the 3-terminal line, 0.2 miles of 69 kV double circuit line will be constructed to loop the circuit into Lancaster Junction station. There will be associated telecom work performed as well. Cost: $1.65M

Lancaster Junction 69 kV: Add three 69 kV, 3000 A, 40 kA line breakers at Lancaster Junction and all associated attachment facilities (relays, bus work, risers, and switches). Expand the Station to include two box bays. Retire 69 kV Line & Bus tie switches. Cost: $5.03M

Anchor Hocking, Lancaster, North Logan, New Lexington 69 kV: Remote end PCE work will be performed to accommodate project in area. Cost: $0.69M

Total Estimated Transmission Cost: $108.77

Alternatives Considered:

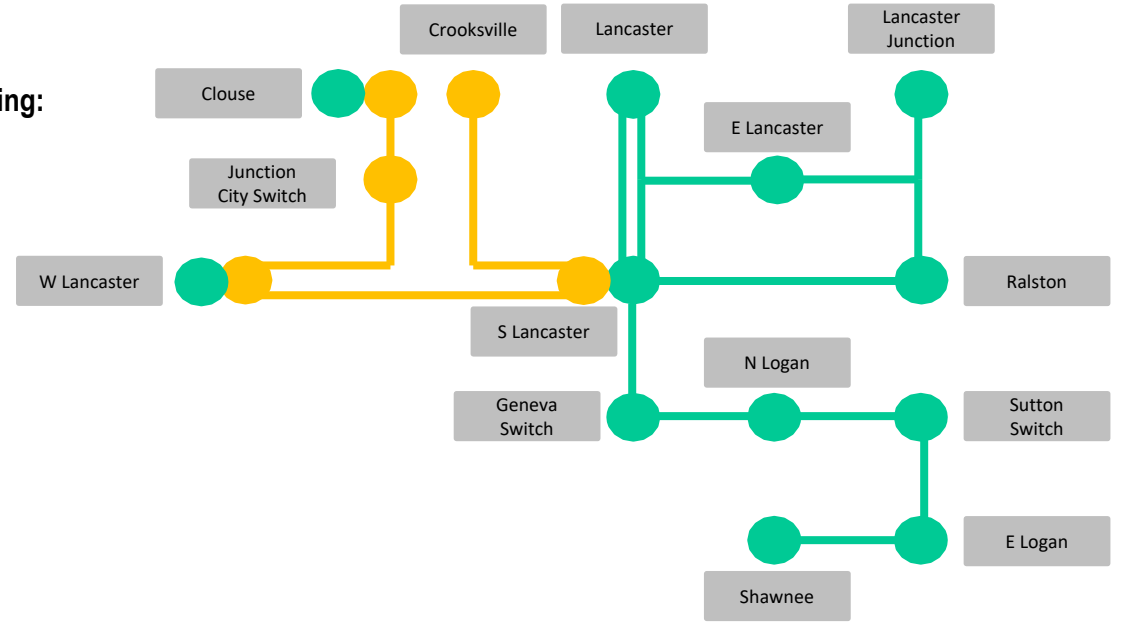
- Rebuild the existing assets as they exist today, including the 9 miles of proposed 69 kV retirement. After discussing needs in the area with AEP Ohio and South Central Power, it was determined that the reconfiguration of the lines still served the needs of the loads and resulted in a lower cost solution. Estimated Cost: $150M

Projected In-Service: 3/1/2029

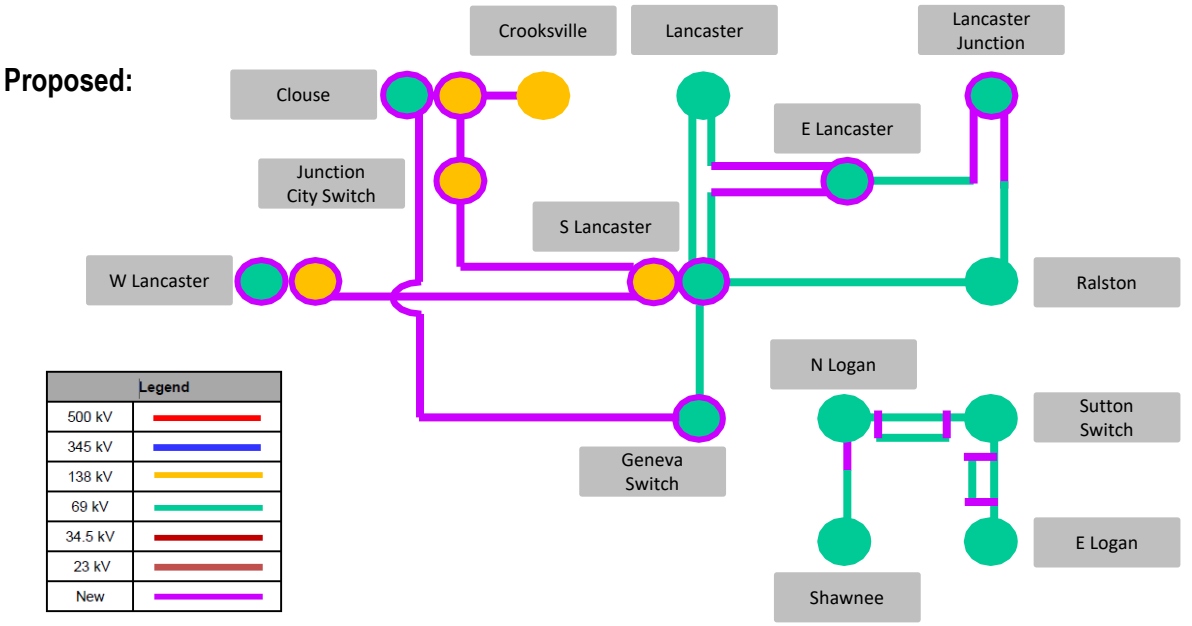
Project Status: Engineering

Model: 2028 RTEP

Existing:



Proposed:



Need Number: AEP-2021-AP009

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 3/19/2021

Supplemental Project Driver: Customer Request

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

Problem Statement:

- A customer has requested service for the establishment of a new distribution station located at the Wildwood Commerce Park site in Hillsville, VA.
- This station is the result of VA House Bill 1840 (HB1840) (Electric Utilities: Pilot Programs for Transmission Facilities Serving Business Parks).

Need Number(s): AEP-2021-AP009

Process Stage: Solutions Meeting 11/17/23

Proposed Solution:

Wildwood 138 kV Station ($0 M - Distribution)

- Construct a 138 kV straight bus with 2 MOABs that are SCADA controlled
- Install a 138/34.5 kV, 30 MVA Distribution transformer with two 34.5kV circuit breakers

Wildwood 138 kV Extension ($20.8M)

- Install a new 138kV 3 pole custom tap structure on the Jacksons Ferry – Huffman 138 kV circuit. Construct approximately 4.0 miles of new double circuit 138 kV line with OPGW from the tap location to the new Wildwood substation. The higher cost is due to access road and restoration costs in the state of Virginia. The right of way for this 138kV extension travels in different directions due to hard to obtain easements causing higher line cost. Install ADSS fiber along existing Huffman-Jacksons Ferry line.

Estimated Total Transmission Cost: $20.8 M

Ancillary Benefits:
Establishing a new 138 kV station near the Wildwood Commerce Park will allow for future interconnection opportunities and economic development in the area. This project is the result of VA House Bill 1840 (HB1840) (Electric Utilities: Pilot Programs for Transmission Facilities Serving Business Parks).
At present, AEP/APCO economic development and partners are supporting requests from prospective business inquiries to Wildwood Commerce Park. The Blue Ridge Crossroads Economic Development Authority is in late-stage negotiations with a prospective customer seeking to locate to Wildwood Commerce Park. This project is a confidential/unannounced prospective business opportunity, with initial demand needs forecasted to exceed available distribution system capacity upon completion/full buildout. This prospect is anticipated to make a public announcement in 2024; date for public announcement is pending completion of formal/final stage project review processes.

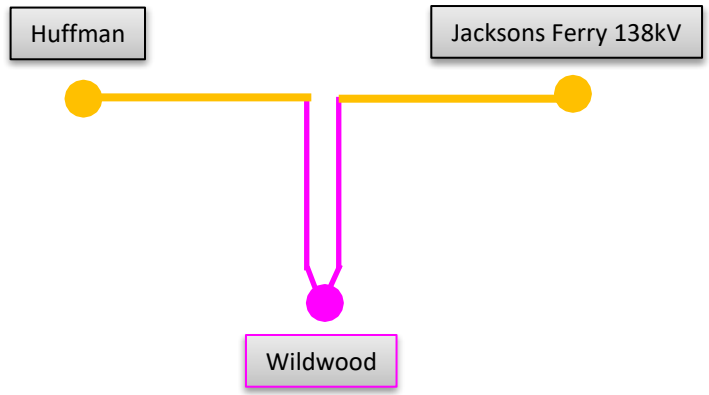
Alternatives Considered: Other 138kV lines were looked at but the Jacksons Ferry – Huffman 138kV circuit was picked due to its proximity to the Wildwood site.

Projected In-Service: 11/15/2024

Project Status: Engineering

Existing

Proposed



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

Need Number: AEP-2021-AP014

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 03/19/2021

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

Specific Assumption References: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12, 14)

Problem Statement:

Line Name: Garden Creek – Skeggs Branch – Richlands 69kV

Original Install Date (Age): 1935,1962,1970

Length of Line: ~21 mi

Total structure count: 180

Original Line Construction Type: Wood and Lattice Steel

Conductor Type: 3/0 ACSR 6/1 (Pigeon), 556,500 CM ACSR 26/7 (Dove), and 336,400 CM ACSR 30/7 (Oriole)

Momentary/Permanent Outages: 26 Momentary and 6 permanent Outages

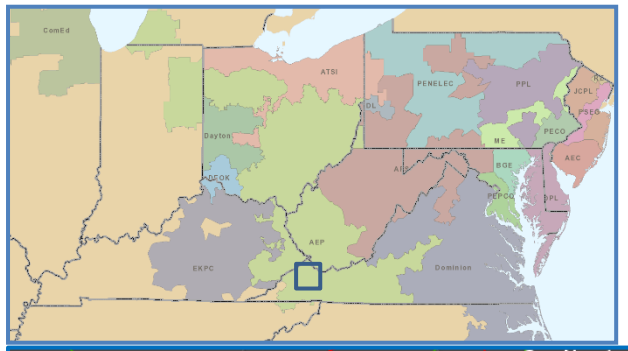
CMI (last 5 years only): 0

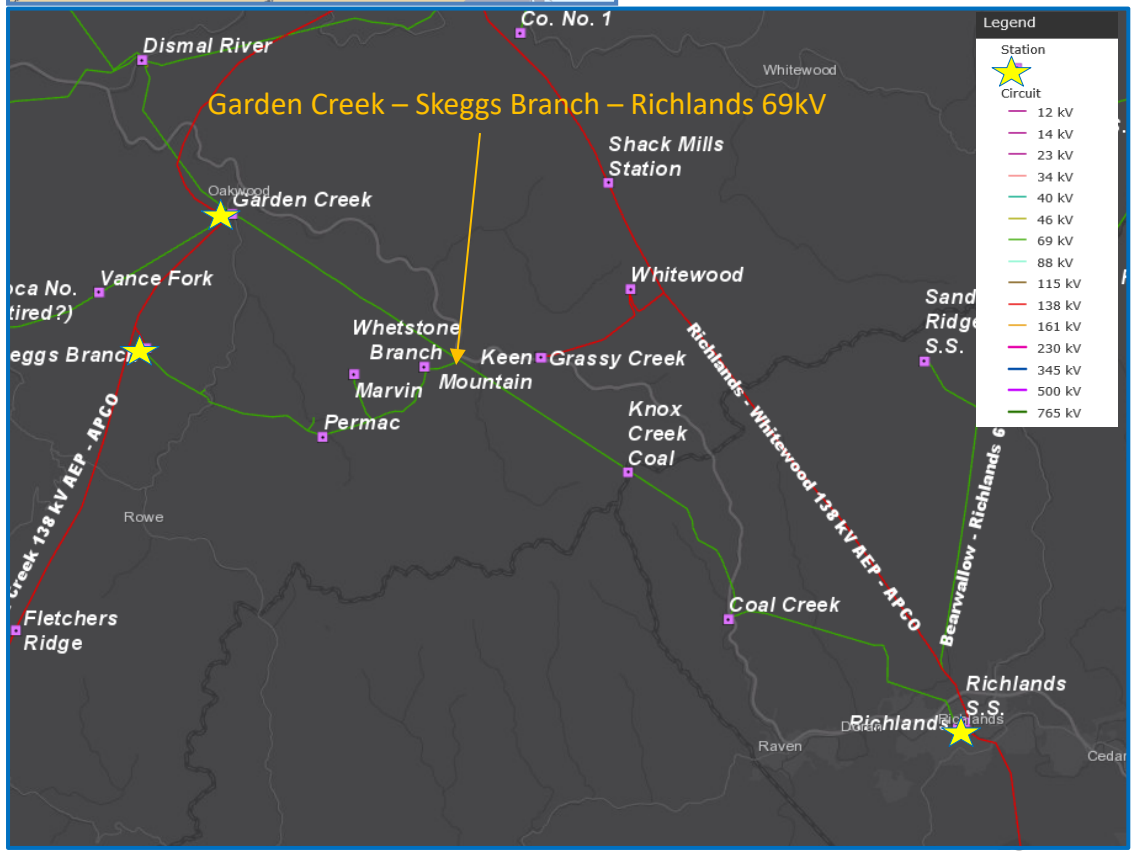
Line conditions:

- 42 structures with at least one open structural condition, 23% of the structures on this circuit.
- 73 structure related open conditions impacting wooden poles, lattice steel towers, crossarms, braces, and filler blocks including rot, bowing, woodpecker holes, insect damage, cracked, split, and heavy rust/corrosion.
- 1 open conditions related to broken strands
- 8 hardware related open conditions related to broken or chipped insulators and a buried guy.

Other:

- This circuit is operated normally open at Permac station
- Lack of sectionalizing capability due to multiple stations (Twin Valley SS, Marvin, Clell) being hard tapped to 69kV Line or operated radially
- Whetstone Branch is a 3 terminal switching station with no 69 kV line breakers.
- Only 11.6 miles of this line are currently shielded.





Need Number: AEP-2021-AP014

Process Stage: Solutions Meeting 11/17/2023

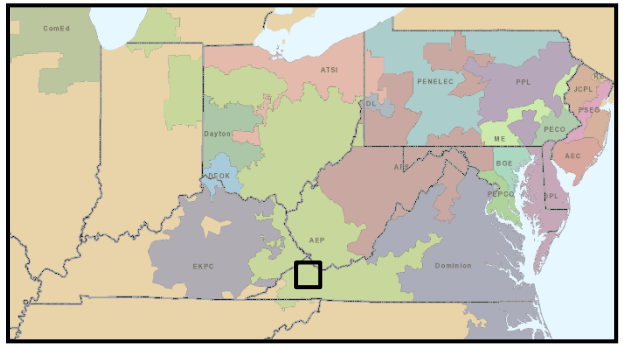
Previously Presented: Needs Meeting 03/19/2021

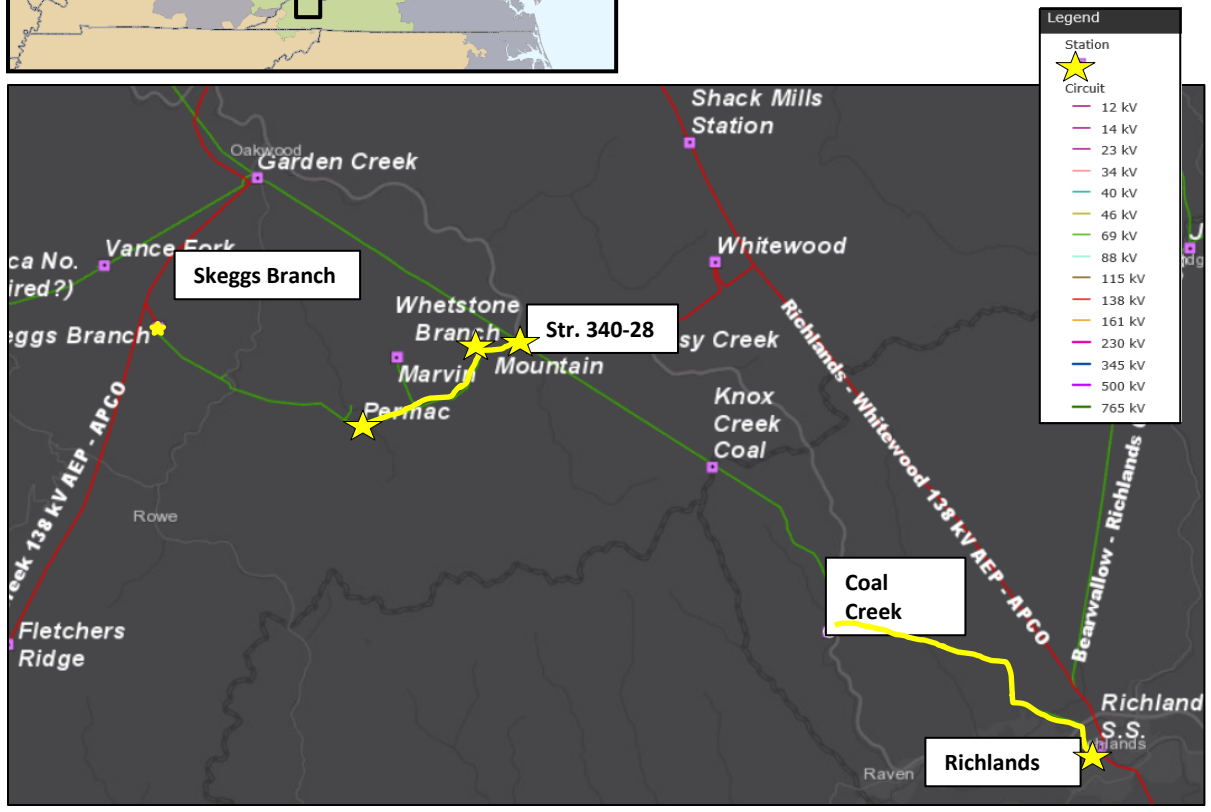
Supplemental Project Driver: Equipment Condition/Performance/Risk

Proposed Solution:

- Rebuild ~2.6 mi portion of the existing Garden Creek - Richlands - Skeggs Branch 69kV Line from the existing Permac station to the existing tap structure 340-28 on the Garden Creek – Skeggs Branch - Richlands. Rebuild ~4.6 mi of the existing Garden Creek - Richlands - Skeggs Branch 69kV Line from the existing Coal Creek to Richlands substation. **Estimated Transmission Cost: $27.2 M**
- At Whetstone Branch Station, replace circuit switcher "AA" with a new, standard, 69kV circuit switcher, replace all metering CTs and PTs with CT/PT combo metering units, and replace the existing single phase CCVT with a new standard three phase CCVT. **Estimated Transmission Cost: $1.55 M**
- At Coal Creek substation, reconductor the 69kV bus, replace 600A Switchers with new MOAB switches on new steel structures. Switch "33" towards the customer will be replaced to allow for the new structure to fit into the existing station footprint. **Estimated Transmission Cost: $0 M**
- Remote end work at Richlands substation. **Estimated Transmission Cost: $0.05 M**
- Provide transition fiber on the Garden Creek - Richlands - Skeggs Branch 69kV Line for connectivity at Mount Heron Station and at Whetstone Branch Station to support CES networking and SCADA connectivity. **Estimated Transmission Cost: $0.40 M**

Total Estimated Transmission Cost: $29.2 M





Need Number: AEP-2021-AP014

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 03/19/2021

Supplemental Project Driver: Equipment Condition/Performance/Risk

Proposed Solution:

Ancillary Benefit:

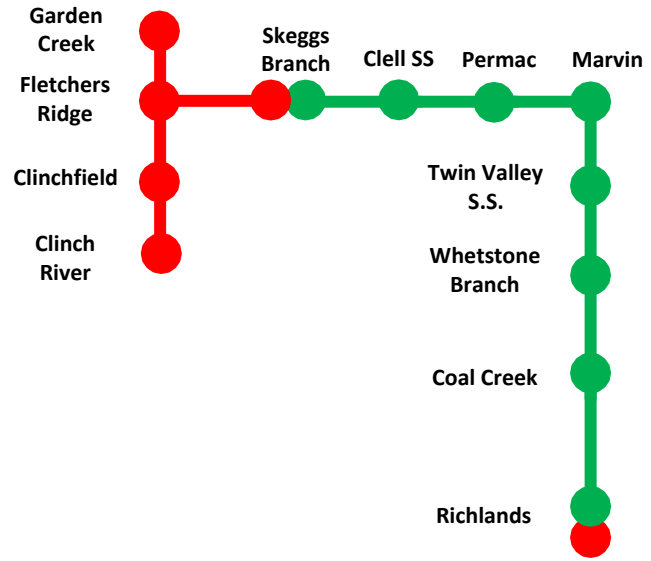
In conjunction with B3333, which proposes to rebuild sections of Garden Creek - Skeggs Branch – Coal Creek line and retire part of the line, this project proposes to rebuild rest of the 69kV line and thus addressing remaining needs of AEP-2021-AP014.

Alternatives Considered:

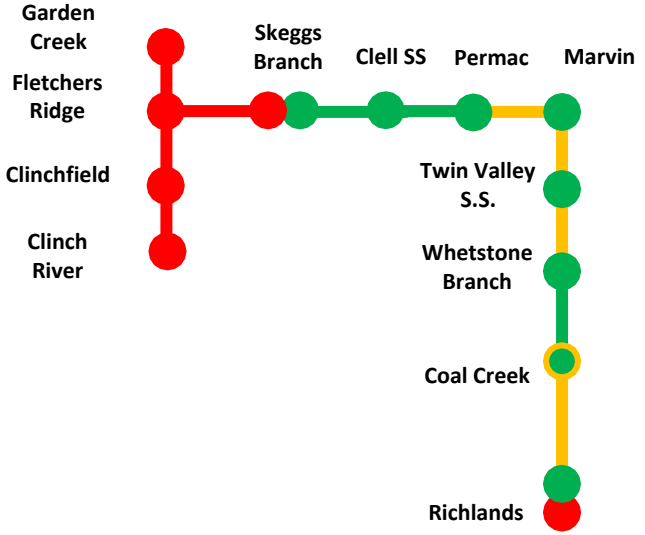
- An alternative of converting the Skeggs Branch – Richlands – Garden Creek line to 138kV was considered. However, this alternative would warrant all the delivery points on the line to be converted to 138kV. This alternative would also amend the baseline line work under B3333. The cost of the 138kV conversion and the challenge of outages, finding properties for the new facilities under the aggressive timeline for the baseline work this alternative was not deemed prudent.

Projected In-Service: 10/30/2027

Bubble Diagram (Existing)



Bubble Diagram (Proposed)



Legend	
345 kV	
138 kV	
69 kV	
46 kV	
New	

AEP Transmission Zone M-3 Process
Rothadew Area Improvements

Need Number: AEP-2022-IM013

Process Stage: Solution Meeting 11/17/2023

Previously Presented: Need meeting 6/15/2022

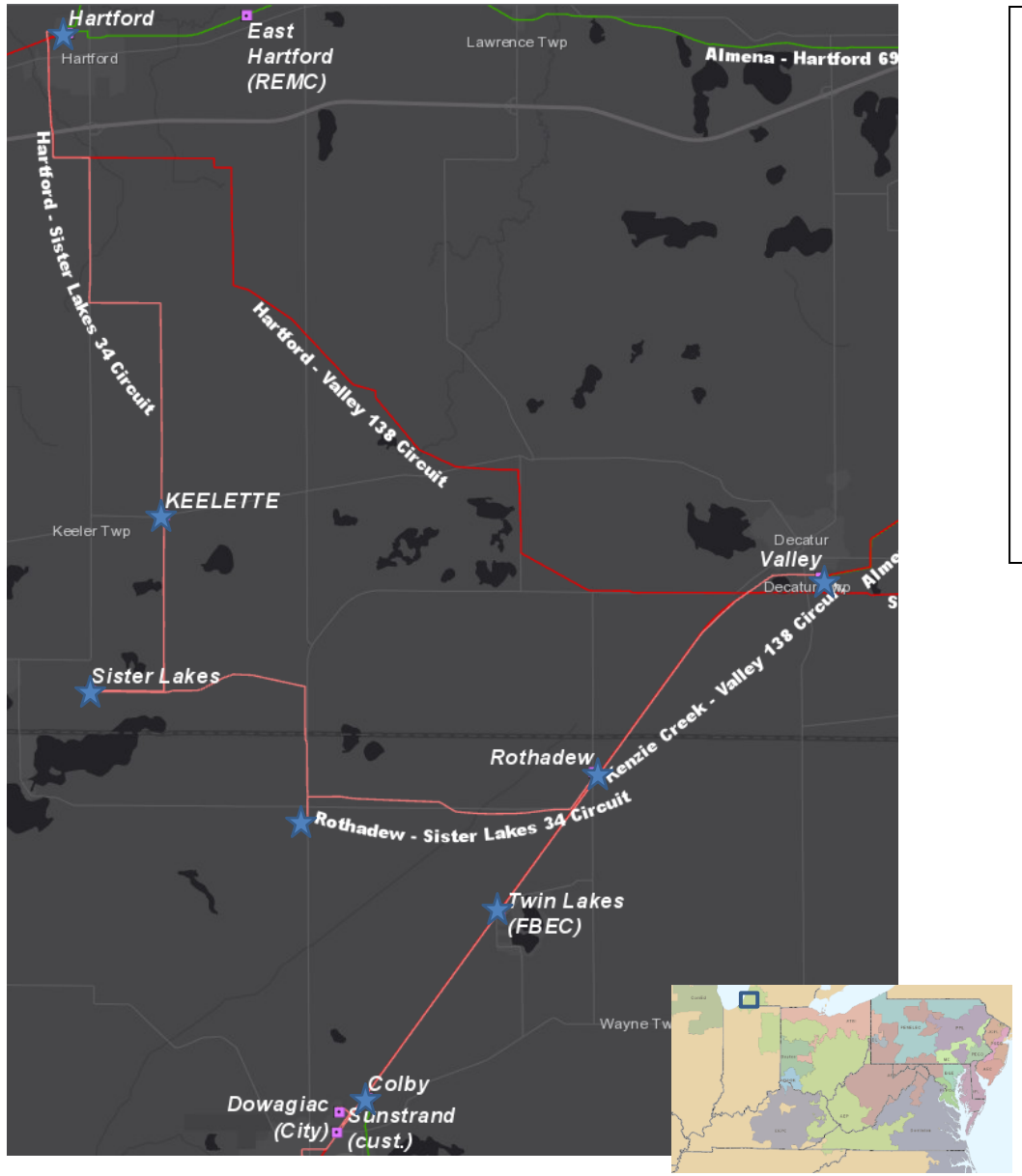
Project Driver: Equipment Material Condition, Performance and Risk

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

Problem Statement:

Dowagiac Customer Growth

- The customer served from Rudy Tap 34.5kV Sw has requested a load increase.
- The customer has indicated a demand of 28MW at their existing delivery point with plans to expand and increase load significantly



AEP Transmission Zone M-3 Process
Rothadew Area Improvements

Need Number: AEP-2022-IM013

Process Stage: Solution Meeting 11/17/2023

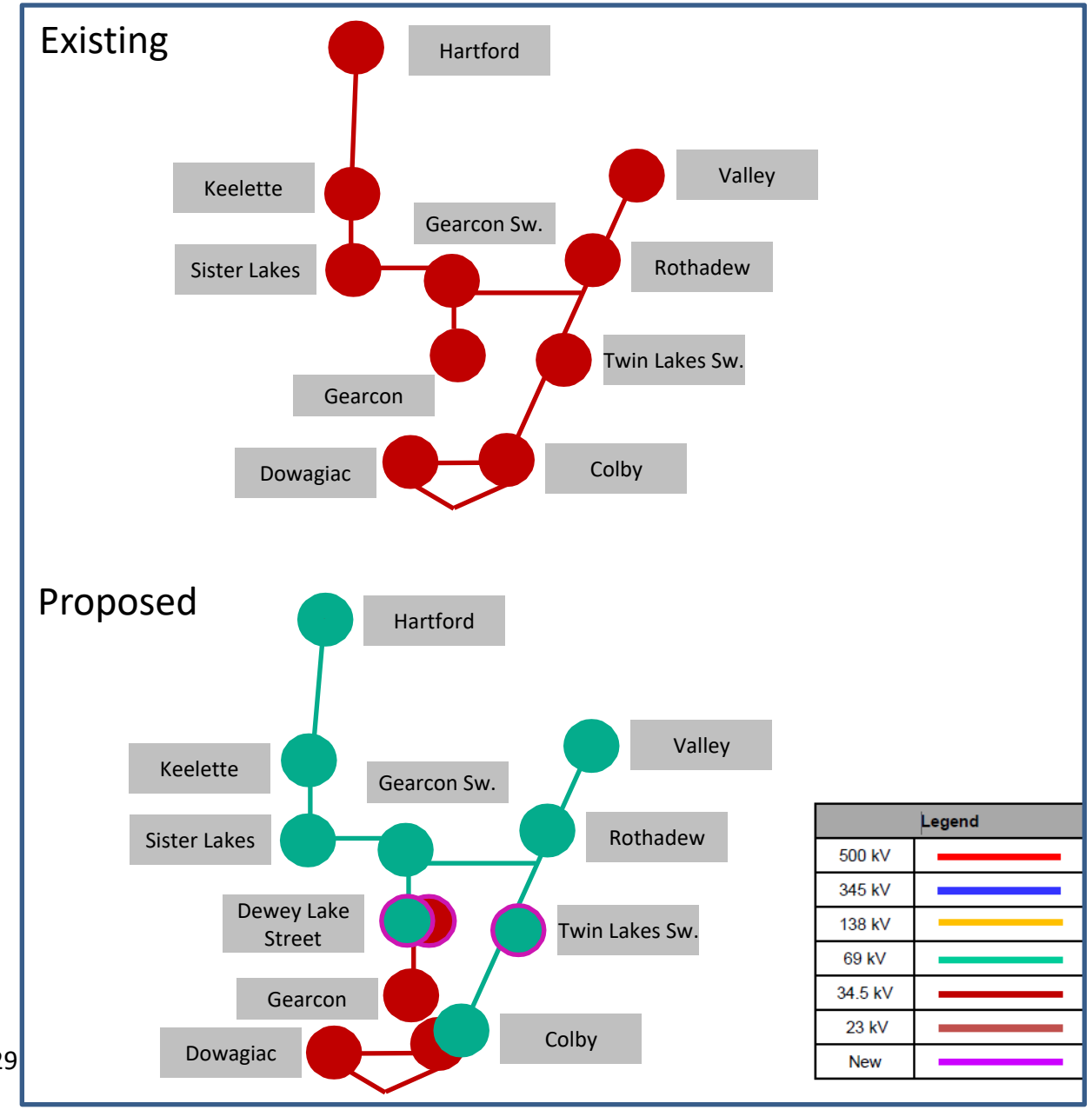
Previously Presented: 6/15/2022

Project Summary: With the 28MW load increase request at Dowagiac, there are several issues that arise on the existing 34.5 kV system under N-1-1 loss of both the transformers at Colby station that include the following:

- Rothadew – Twin Lakes 34.5kV loads to 123% of its summer emergency rating
- Colby – Twin Lakes 34.5kV loads to 121% of its summer emergency rating
- Hartford 138/69/34.5kV transformer loads to 203% of its summer emergency rating
- The 34.5kV area experiences low voltages at Keelette, Sister Lakes, Gearcon, Valley, Twin Lakes, Dowagiac, and Sunstrand with the lowest being 0.42 per unit

In order to address the issues listed above with the increased load, the best path forward would be to convert the area to 69kV. The majority of the lines in the area are already constructed to 69 kV standards; therefore, the scope of work required to convert to 69 kV is limited. The delivery point at Dowagiac is already configured to accommodate the 28 MW request.

Further, AEP is moving away from the 34.5kV transmission voltage class where there are issues with drop and pick operations. The 34.5kV voltage delivery points are out of phase from delivery at 69kV or 138kV and switching load from one 34.5kV source to another, higher voltage source requires the customers to be dropped and then picked up from the new source. Utilizing 69 or 138 kV as a standard delivery voltage eliminates the initial drop requirement for the load.



AEP Transmission Zone M-3 Process
Rothadew Area Improvements

Need Number: AEP-2022-IM013

Process Stage: Solution Meeting 11/17/2023

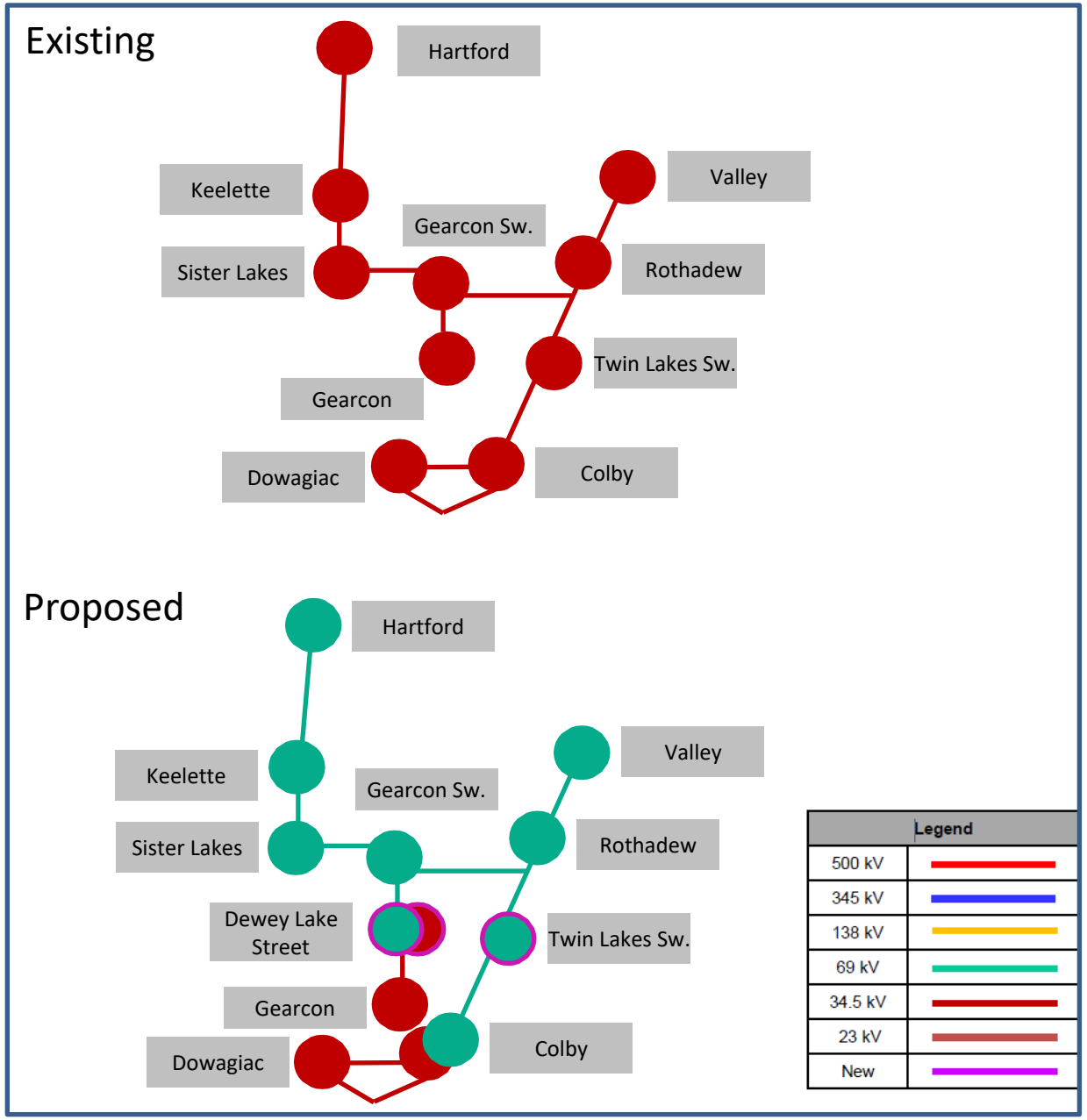
Previously Presented: 6/15/2022

Proposed Solution:

- **Hartford Station:** Install a 69kV breaker and remove the 34.5kV equipment. Station Service will be relocated closer to the transformer. **Estimated Transmission Cost: $0.59M**
- **Sister Lakes:** Replace both transformers with 9.375MVA 69/12kV units and install a high side switcher on transformer 1. **Estimated Transmission Cost: $0M**
- **Dewey Lake Street:** Install a new 7.5 MVA 69/34.5kV transformer with low side breaker and high side fuse. This will be located close to Gearcon Switch. **Estimated Transmission Cost: $1.72M**
- **Valley:** Install a 69/34.5kV 12.5MVA transformer and retermniate the Rothadew line to the 69kV bus. **Estimated Transmission Cost: $3.63M**
- **Colby:** Move the Rothadew line to the 69kV bus. **Estimated Transmission Cost: $0.11M**
- **Twin Lakes Sw.:** Replace Switch. **Estimated Transmission Cost: $0.83M**
- **Keelette, Sister Lakes, Gearcon Sw., Rothadew,:** Energize to 69kV. **Estimated Transmission Cost: $1.01M**

Total Estimated Transmission Cost: $7.89M

Ancillary Benefits: Moving to 69kV will improve operational flexibility and eliminate the problem of the drop and pick issues that the 34.5kV voltage class experiences. Scope of work is limited due to lines already constructed to 69 kV design.



AEP Transmission Zone M-3 Process
Rothadew Area Improvements

Need Number: AEP-2022-IM013

Process Stage: Solution Meeting 11/17/2023

Previously Presented: 6/15/2022

Alternative considered:

Serve the customer at the 138kV voltage.

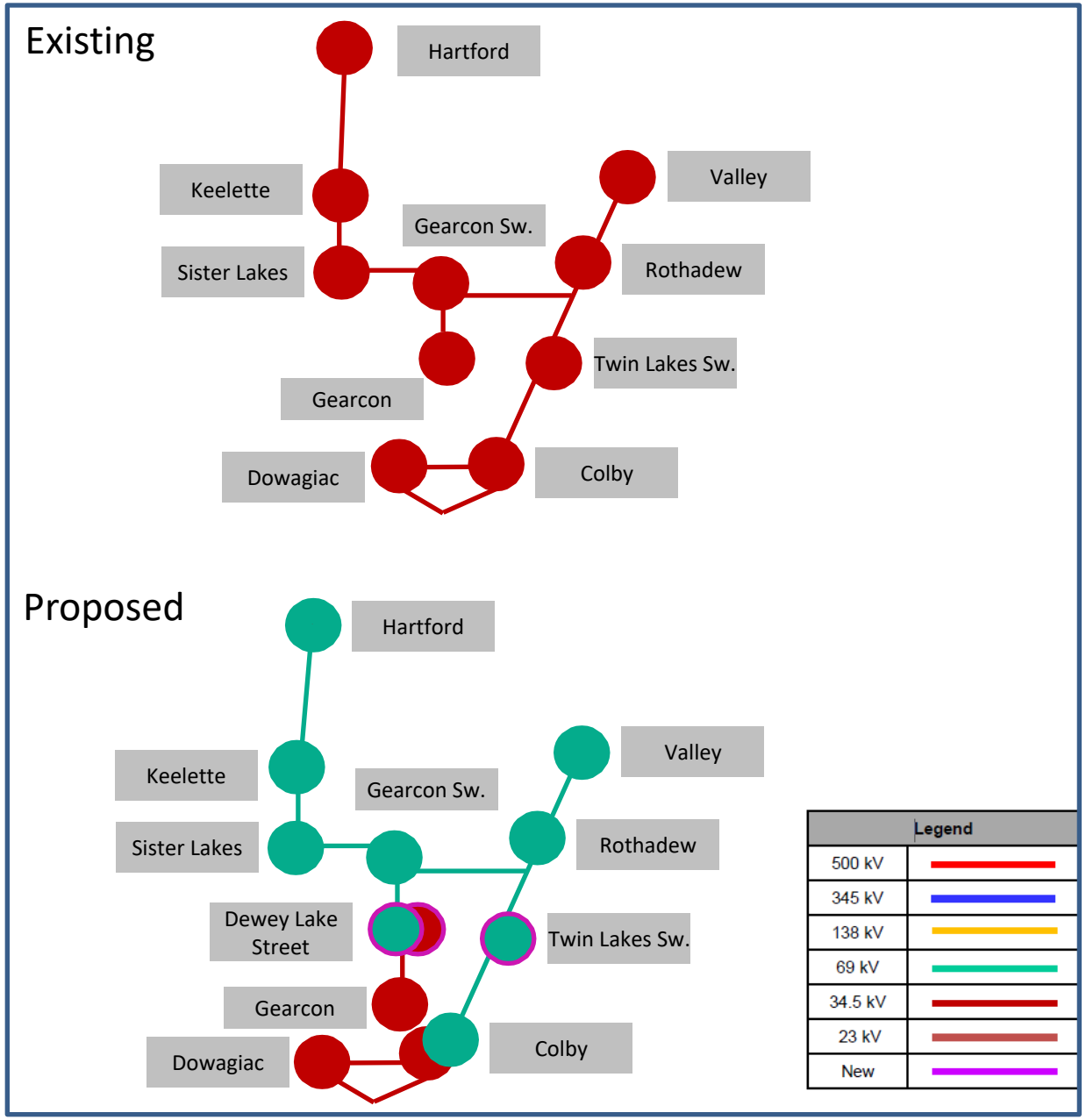
This would require a 0.75 mile 138kV radial feed served from Colby and a dedicated 138/34.5kV drop down station to serve the customer at their existing delivery. This new feed would require a railroad crossing along with forested and wetland areas. Previous work in this area has also uncovered endangered habitats. With all these risks, the feed would likely not be able to be in serviced in time to meet the customer's timeline.

The existing 34.5kV network being proposed for upgrade to 69kV operation is ready for conversion. The conversion to 69kV will remove the drop and pick operating procedure which heavily impacts the local customers. The related PJM project IDs that have previously completed this work are b2345 and s1297. b2345 rebuilds from Rothadew to Keelette and constructs Hartford – Keelette to 69kV standards. S1297 rebuilds Rothadew – Valley to 69kV standards. Colby – Rothadew was constructed to 69kV standards in 1993.

Estimated Alternate Cost: $10M

Projected In-Service: 7/27/2027

Project Status: Scoping



Need Number: AEP-2023-AP021

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 8/18/2023

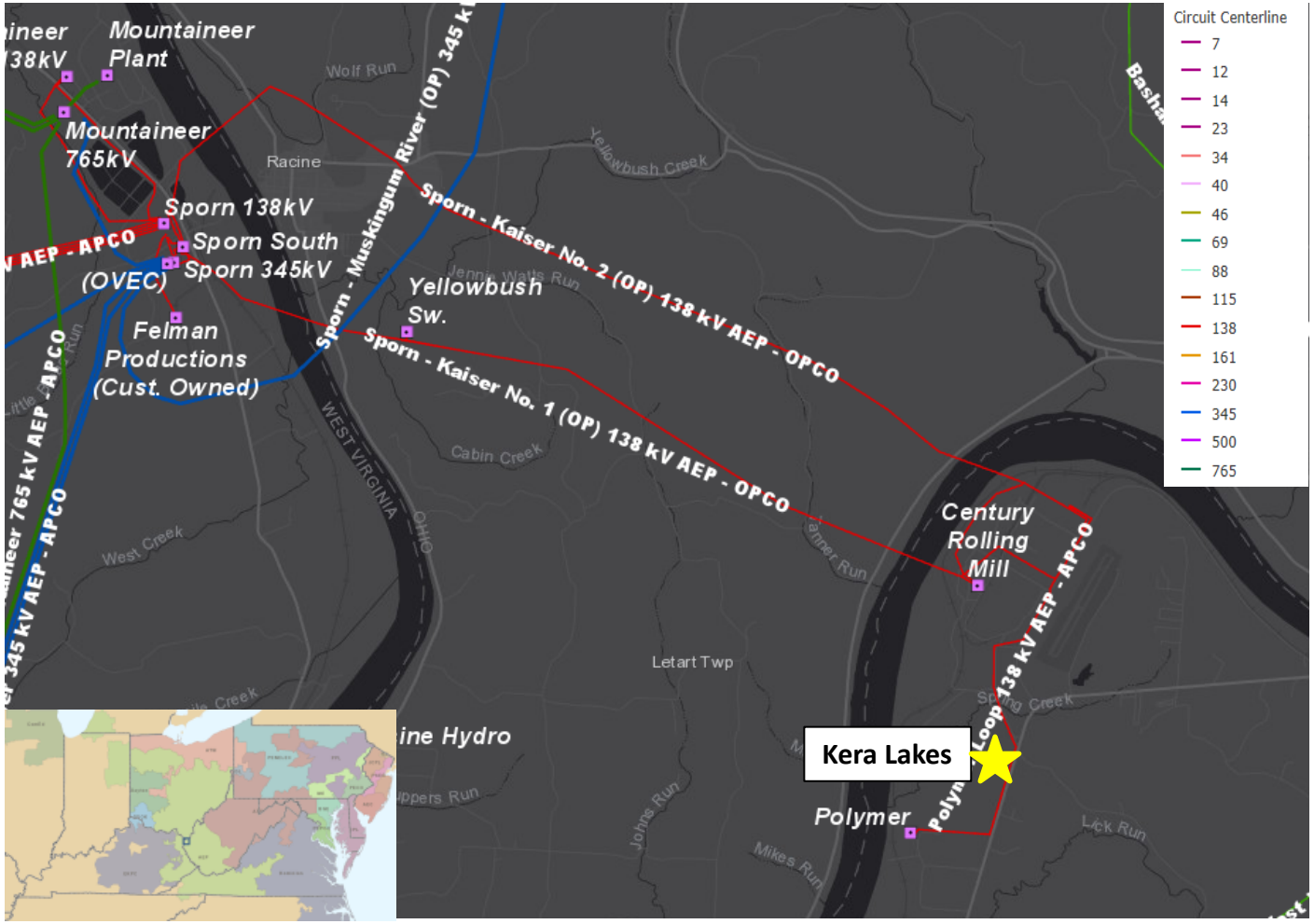
Supplemental Project Driver: Customer Service

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

Problem Statement:

A new industrial customer has requested service in Jackson County, WV by the end of 2024.

Projected load: 30 MVA initial load, upwards to a maximum of 80 MVA



Need Number: AEP-2023-AP021

Process Stage: Solutions Meeting 11/17/2023

Proposed Solution:

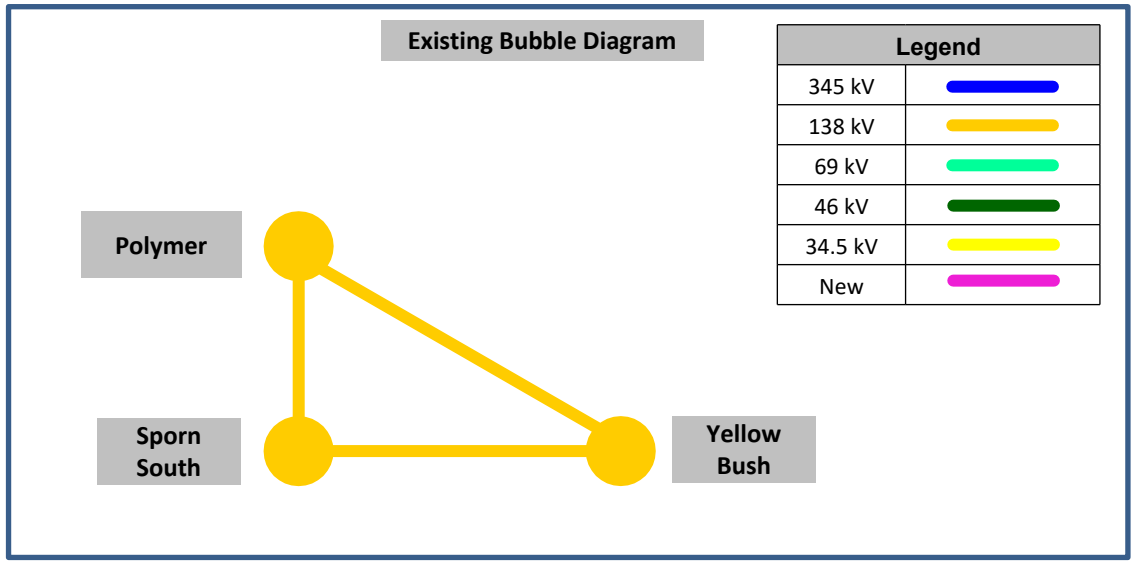
- Cut in/out of the existing Yellow Bush – Polymer 138 kV line, install a new double circuit 138 kV 0.1 mile line to the new 138 kV station (Kera Lakes). **Estimated Trans. Cost: $0**
- Construct a new 138 kV station (Kera Lakes) with 4 – 3000A, 40 kA circuit breakers in a ring bus configuration with two feeds to the customer. **Estimated Trans. Cost: $0**
- Network fiber support work at Cottageville Station. **Estimated Trans. Cost: $0**

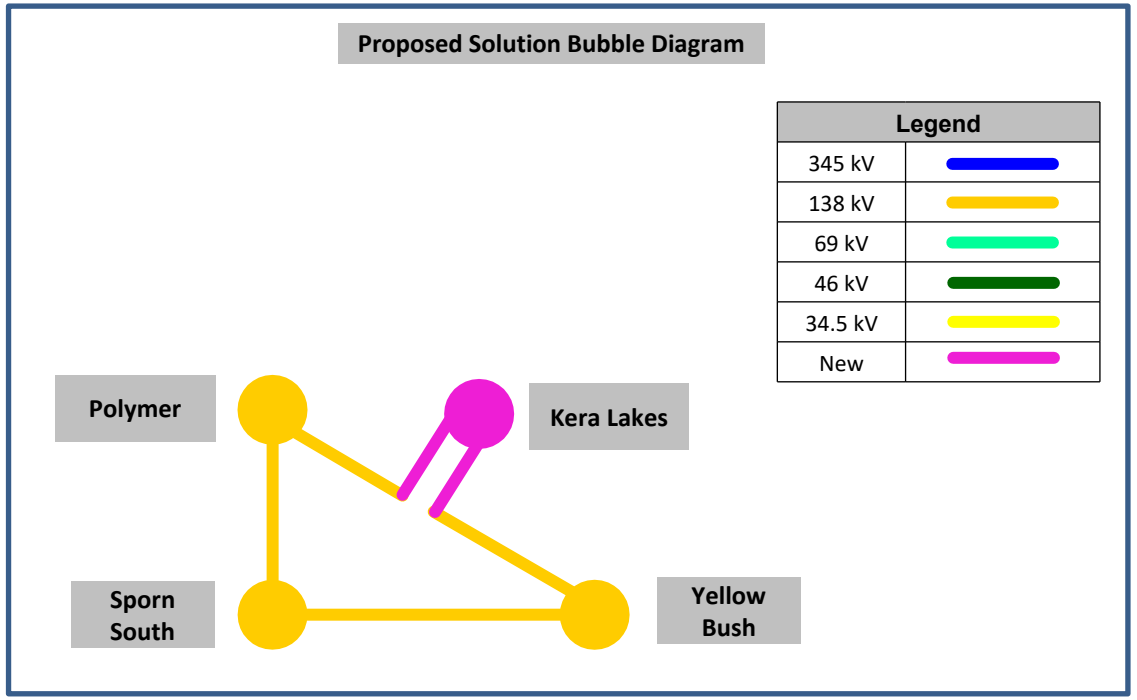
Total Estimated Transmission Cost: $0

Projected In-Service: 12/13/2024

Project Status: Scoping

Model: 2028 RTEP





AEP Transmission Zone M-3 Process
Licking County, OH

Need Number: AEP-2023-OH012

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 1/20/2023

Project Driver:

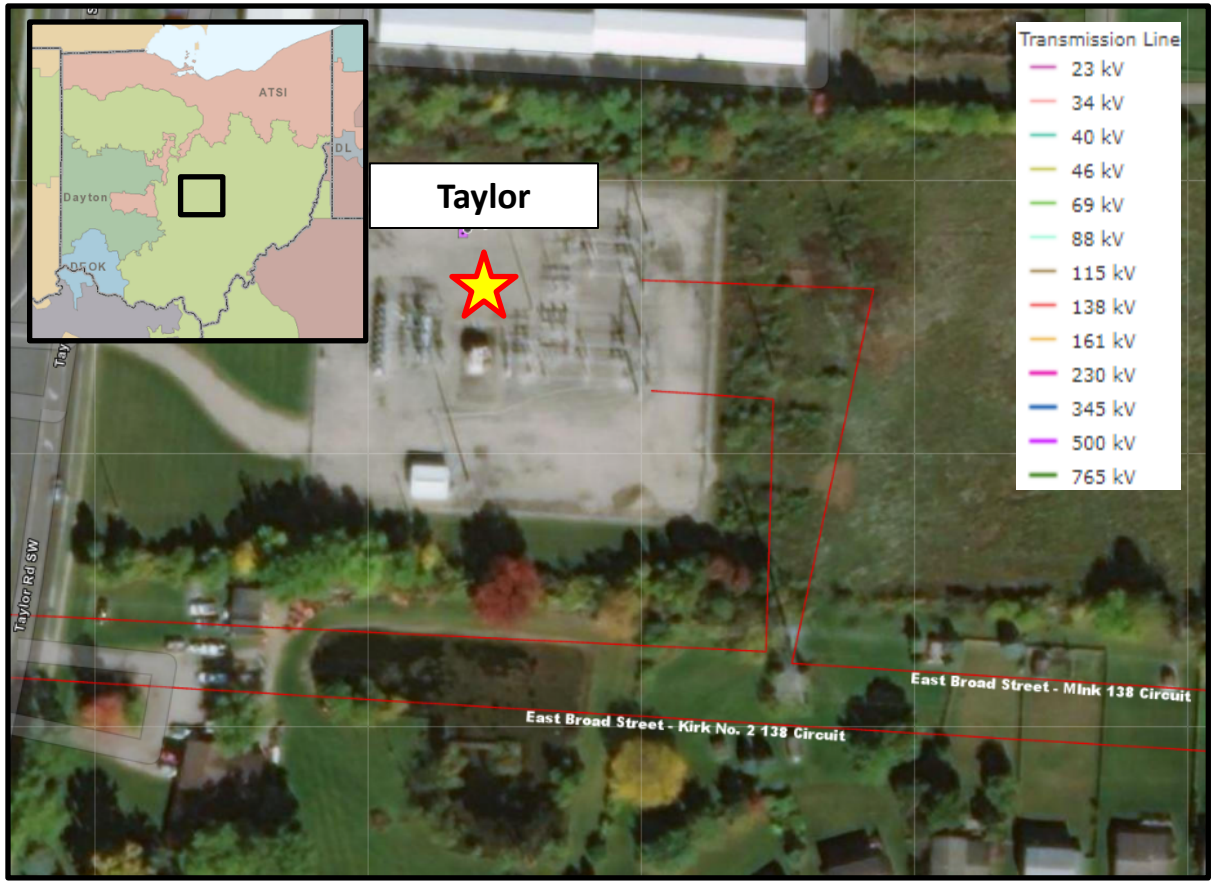
Customer Service

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

Problem Statement:

AEP Ohio has requested to add capacity at Taylor station, due to continuous load growth in the area and to address concerns AEP Ohio has about reliability and contingency constraints. The anticipated peak load is approximately 42 MVA. The requested in-service date is December 2024.

Model: 2027 RTEP



AEP Transmission Zone M-3 Process
Taylor Station

Need Number: AEP-2023-OH012

Process Stage: Solutions Meeting 11/17/2023

Proposed Solution:

- At Taylor station, install 1-138 kV 40 kA 3000 A bus tie circuit breaker and 1-138 kV 3000 A 40 kA GOAB beaker disconnect switch to accommodate a new distribution transformer. Estimated Transmission Cost: $ 1.26M.

Alternatives Considered:

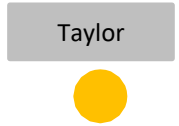
- No cost-effective alternatives identified considering the location and timing of the request.

Projected In-Service: 12/31/2024

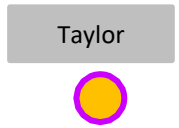
Project Status: Engineering

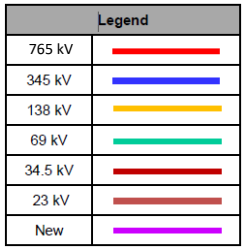
Model: 2027 RTEP

Existing:



Proposed:





AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP015

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

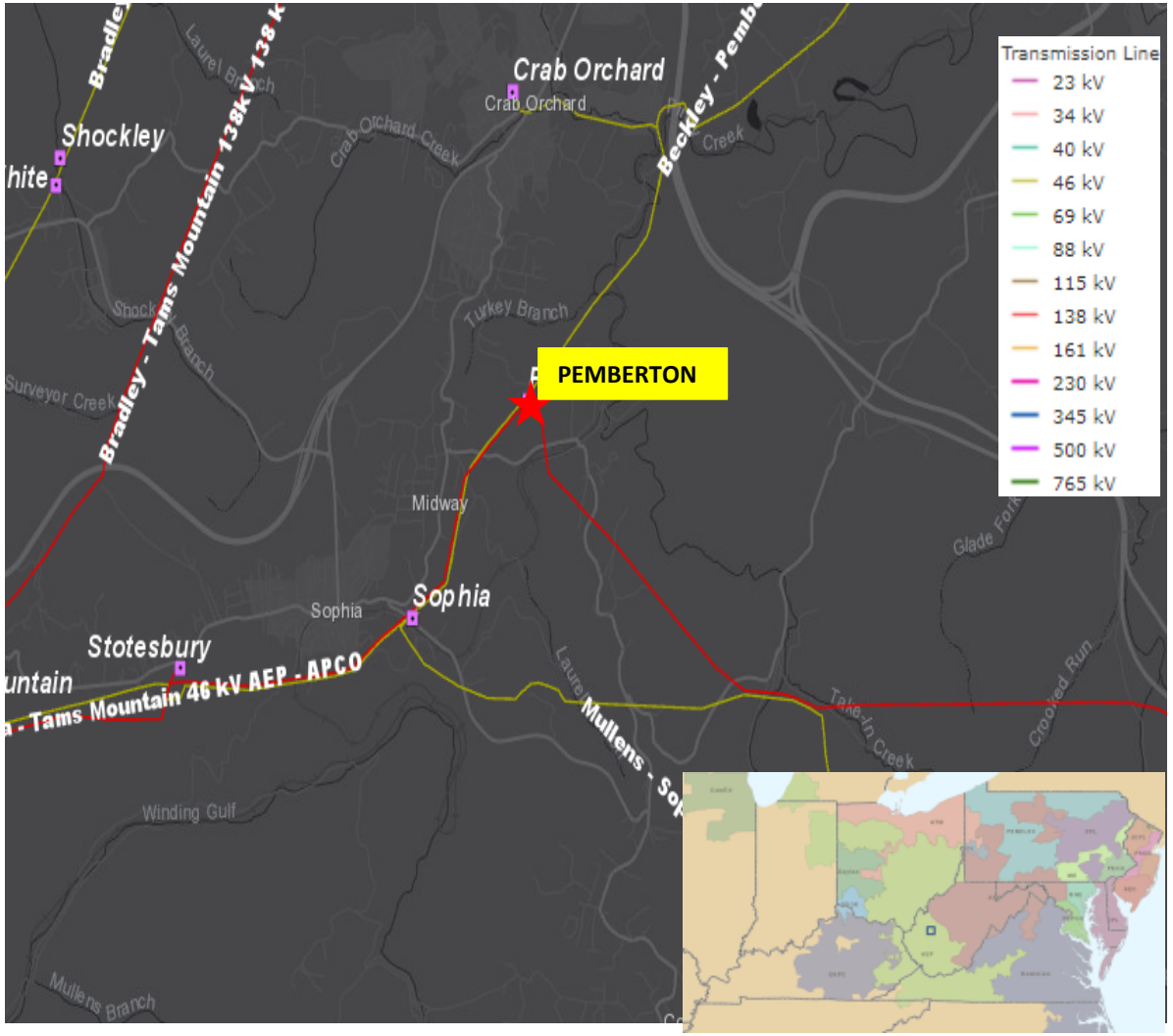
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Pemberton Station

- 46kV circuit breakers B and C are an CG type oil filled breaker, without oil containment.
  - 1984 vintage
  - Oil filled breakers need more maintenance due to the oil handling required
  - These breakers have exceeded the manufacturer's recommended number of fault operations
  - The manufacturer does not provide support for this type of breaker and spare parts are not available.
  - Oil spills can result in significant mitigation costs.
- 138/46 kV XFR
  - 1984 vintage
  - Multiple oil and nitrogen leaks
  - Bushings are in poor physical condition
  - Cooling controls, cooling fans and internal wiring are obsolete and in need of replacement
  - No secondary oil containment installed on the unit
- 11 of the 25 relays at the station are in need of replacement
  - 4 relays are electromechanical type which have significant limitations with regards to fault data collection and retention.
  - 7 microprocessor relays with legacy firmware



AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP016

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

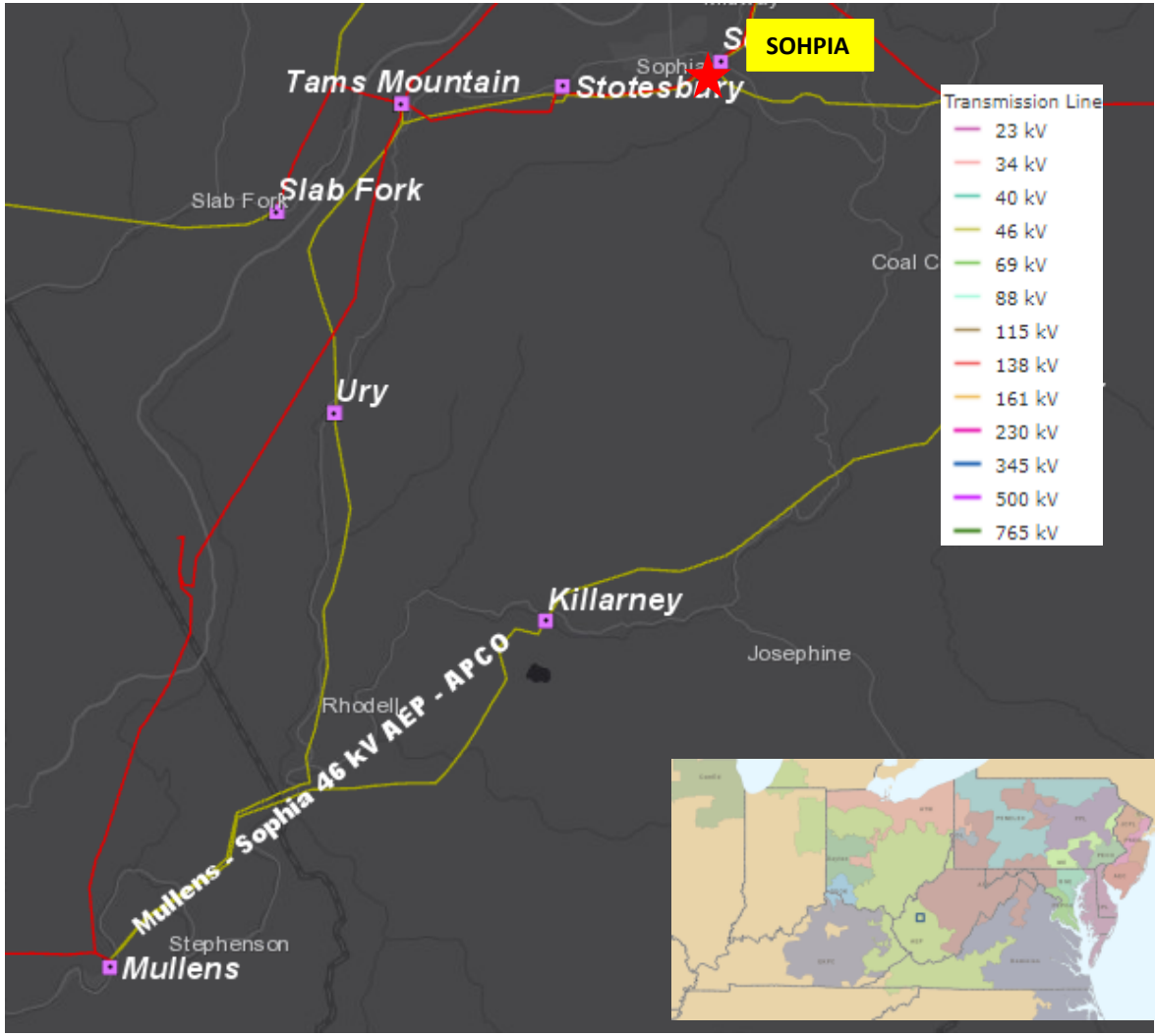
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Sophia Station

- 46kV circuit breakers B, C and D are FK type oil filled breaker, without oil containment.
  - 1965 vintage
  - Oil filled breakers need more maintenance due to the oil handling required
  - These breakers have exceeded the manufacturer's recommended number of fault operations
  - The manufacturer does not provide support for this type of breaker and spare parts are not available.
  - Oil spills can result in significant mitigation costs.
- 23 of the 33 relays at the station are in need of replacement
  - 16 relays are electromechanical type which have significant limitations with regards to fault data collection and retention.
  - 7 microprocessor relays with unsupported firmware.



AEP Transmission Zone: Supplemental Beckley, WV

Need Number: AEP-2022-AP017

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

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

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

Problem Statement:

Mullens – Sophia 46 kV (~18 miles)

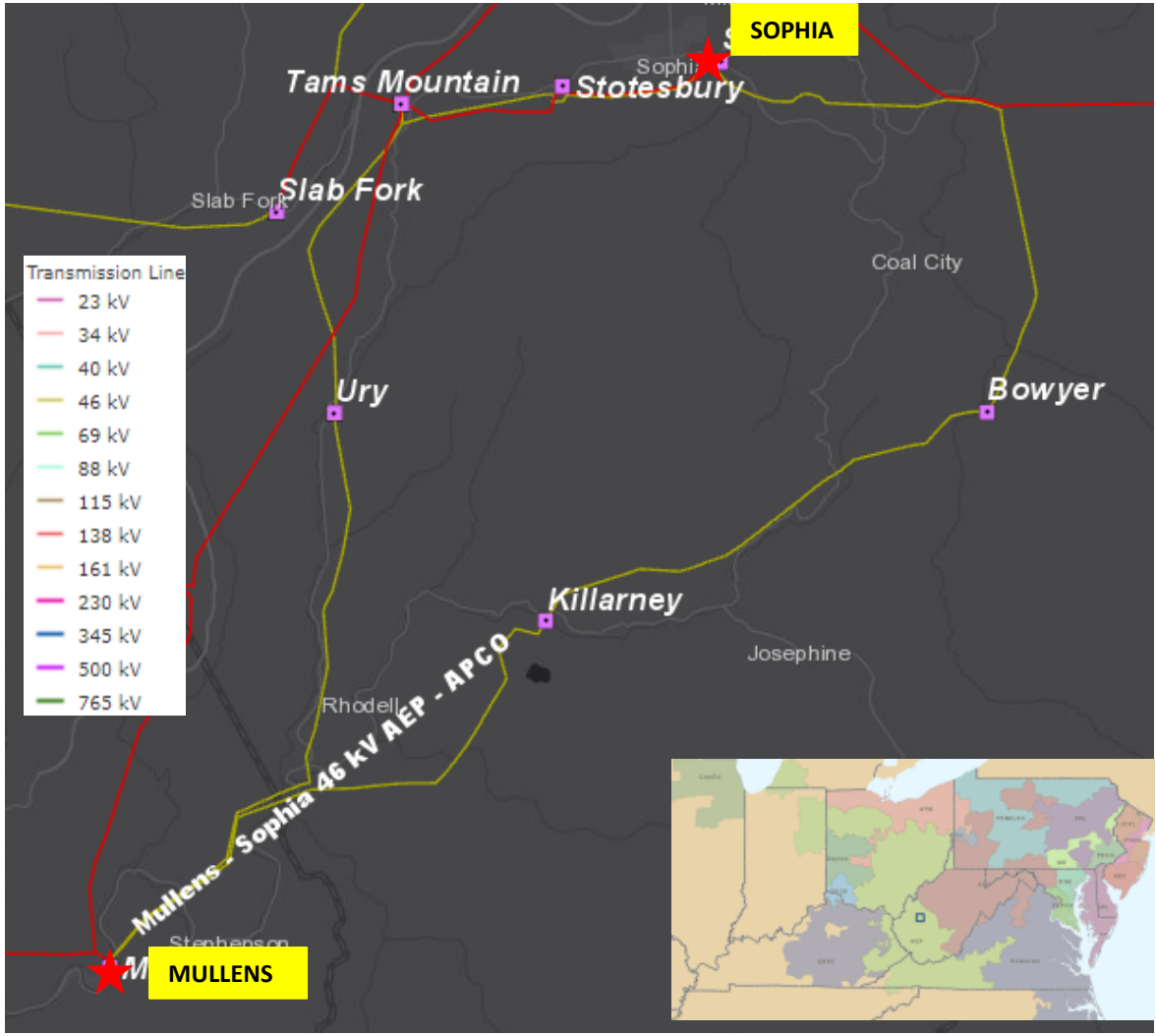
- Originally constructed in 1914
- Primarily consists of 1914 vintage wood poles (79%) and lattice steel structures (4%)
- Conductor primarily consists of 1951 vintage copper conductor and 1951 vintage 3/0 ACSR conductor
- Since 2015, there have been 19 momentary and 8 permanent outages on the Mullens – Sophia 46 kV circuit.
  - Momentary outages due to lightning, wind, ice/snow, vegetation fall-in outside AEP ROW.
  - Permanent outages due to vegetation fall-in outside AEP ROW, ice/snow, crossarm failure and distribution
  - Outages resulted in 348k CMI
- Currently there are 50 structures (30% of the line) with at least one open structural condition
  - Currently 77 structural open conditions including rotted poles, crossarms, brace, insect damaged poles, crossarms, brace and woodpecker damaged poles.

Condition & Impacts of the Degraded pre-1930s Era System

- These transmission line assets are clearly in the accelerated deterioration phase of their life.
- 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

Conditions of System for the Pre 1930s Lattice Line

- Towers: Typical life of galvanizing is 70 years. The towers are all supported by steel grillage foundations buried in the ground. The tower leg is subject to significant risk of corrosion where it enters the ground. 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.
- Insulator & Hardware Corrosion: The connecting elements including the tower attachment hole and the insulator hook have experienced serious section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection. The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or is significantly compromised, the bare steel corrodes at an accelerated rate.
- Broken Insulators: Broken, cracked and otherwise damaged insulators lead to premature flashover causing permanent outages. When the insulator assembly breaks, the wire falls to the ground potentially damaging other conductors, and presents an increased public safety concern.
- Conductor: Aluminum Conductor Steel Reinforced (ACSR) conductor consists of aluminum strands wrapped around a core of galvanized steel strands. The steel provides the structural strength. Like other steel elements, the strands of the core have also lost the galvanized coating and steel section. The degraded state results in significant loss of tensile strength and potential risk to the public if the conductor was to fail and fall to the ground. Conductor damage is usually not visible in a field inspection. Specific conductor samples, from the belly of the sag (lowest point) and/or inside the clamps at the insulators, have confirmed significant corrosion. During the restoration or construction activities, conductors often break at adjacent locations due to handling, introducing a potential safety risk and increase public safety concern.



AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP018

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

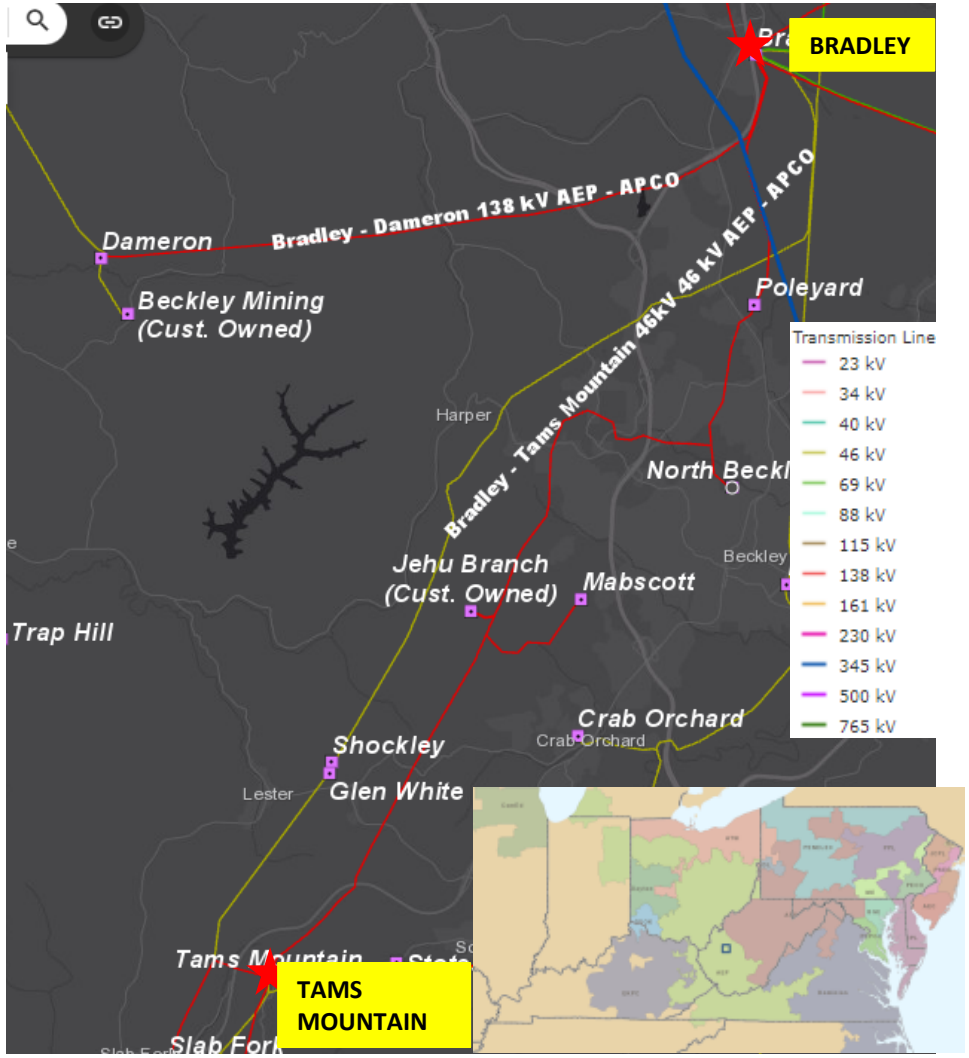
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Bradley – Tams Mountain 46 kV (~15 miles)

- Originally constructed in 1920
- Consists primarily of wood pole structures of 1920 (42%), 1950s (13%) and 2002 (20%) vintages
- Conductor consists primarily of 1920 #2 Copper, 336 ACSR, 4/0 ACSR, and 3/0 ACSR
- Since 2015, there have been 13 momentary and 13 permanent outages on the Bradley – Tams Mountain 46 kV circuit.
  - Momentary outages due to lightning, wind, ice/snow, distribution and wind
  - Permanent outages due to vegetation fall-in outside AEP ROW, lightning, ice/snow, non-AEP tree removal, splice failure and vandalism
  - Outages resulted in a total of 980k CMI
- Currently there are 30 structures (19% of the line) with at least one open condition
  - 64 Open conditions affecting poles, crossarms, knee braces, woodpecker holes, insect damage, rot
  - 4 hardware conditions related to broken insulators



AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP019

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

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

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

Problem Statement:

Beckley – Pemberton 46 kV (~6 miles)
- Originally constructed in 1913
- Consists of 1913 vintage steel lattice towers (74%) and 1913 wood poles (23%)
- Conductor consists of 1913 vintage 2/0 Copper, 3/0 Copper, 3/0 ACSR and 556 ACSR

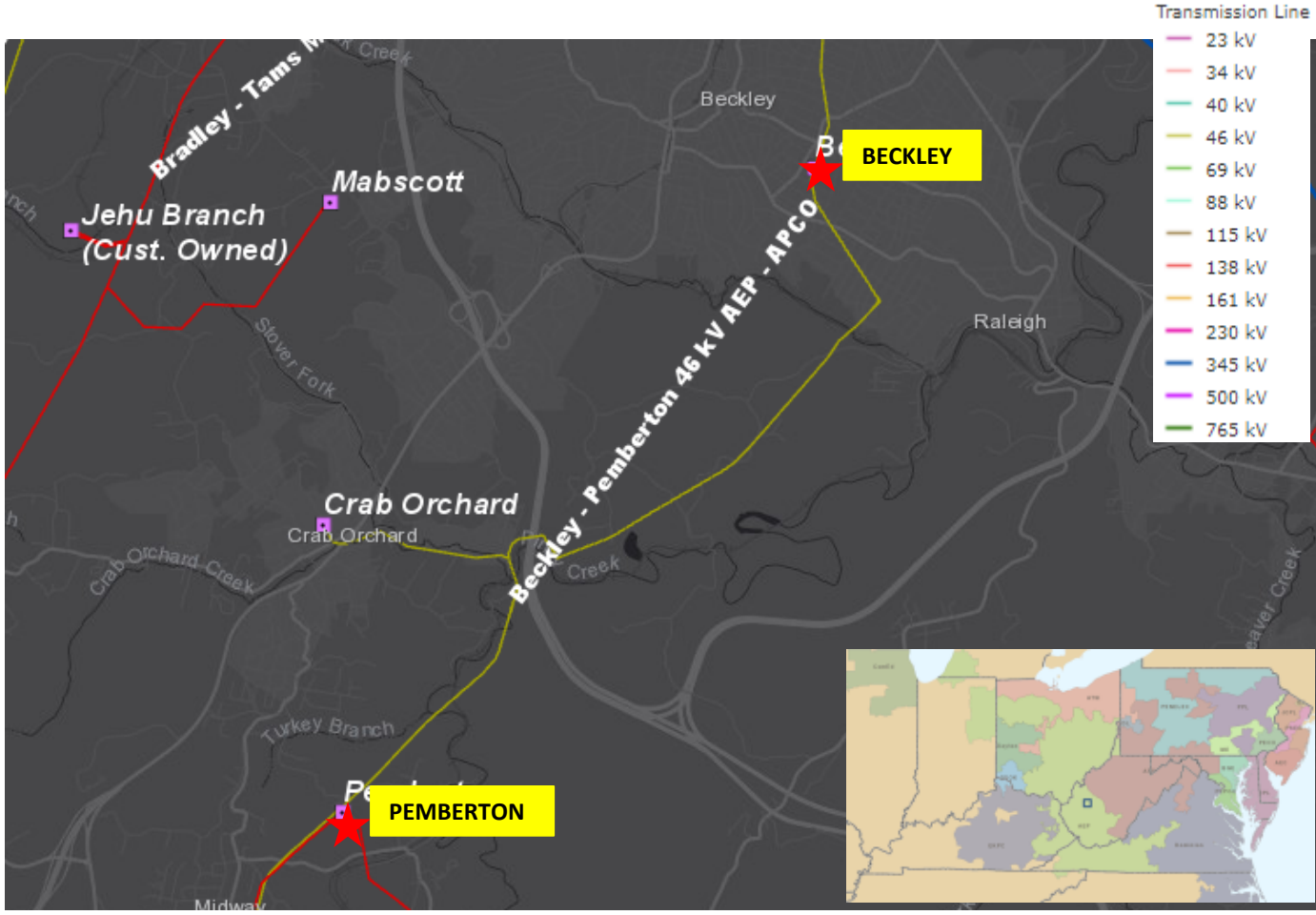
Condition & Impacts of the Degraded pre-1930s Era System
- These transmission line assets are clearly in the accelerated deterioration phase of their life.
- Significant deterioration results in loss of strength and performance posing a significant risk of failure under conditions the assets should be able to withstand.
  - May cause frequent and extended outages
  - May create significant economic losses
  - May endanger public safety

Conditions of System for the Pre 1930s Lattice Line
- Towers: Typical life of galvanizing is 70 years. The towers are all supported by steel grillage foundations buried in the ground. The tower leg is subject to significant risk of corrosion where it enters the ground. 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.
- Insulator & Hardware Corrosion: The connecting elements including the tower attachment hole and the insulator hook have experienced serious section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection. The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or is significantly compromised, the bare steel corrodes at an accelerated rate.
- Broken Insulators: Broken, cracked and otherwise damaged insulators lead to premature flashover causing permanent outages. When the insulator assembly breaks, the wire falls to the ground potentially damaging other conductors, and presents an increased public safety concern.
- Conductor: Aluminum Conductor Steel Reinforced (ACSR) conductor consists of aluminum strands wrapped around a core of galvanized steel strands. The steel provides the structural strength. Like other steel elements, the strands of the core have also lost the galvanized coating and steel section. The degraded state results in significant loss of tensile strength and potential risk to the public if the conductor was to fail and fall to the ground. Conductor damage is usually not visible in a field inspection. Specific conductor samples, from the belly of the sag (lowest point) and/or inside the clamps at the insulators, have confirmed significant corrosion. During the restoration or construction activities, conductors often break at adjacent locations due to handling, introducing a potential safety risk and increase public safety concern.

Crab Orchard 46 kV Tap (~1 mile)
- Originally constructed in 1946
- Consists primarily of wood pole structures of 1946 vintage (94%)
- Conductor consists of 1946 3/0 ACSR

Since 2014, there have been 6 momentary and 3 permanent outages on the Beckley – Pemberton 46 kV circuit (includes Crab Orchard Tap).
- Momentary outages due to lightning, wind, ice/snow, distribution,
- Permanent outage due to vegetation fall-in outside AEP ROW and lightning.
- Outages resulted in a total of 248k CMI

Currently there are 7 structures (10% of the line) with at least one open condition
- 2 conditions related to rust on lacing and leg, 1 condition affecting broken strand on conductor, 5 conditions related broken insulators and 2 forestry related conditions



AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP020

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

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

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

Problem Statement:

Sophia – Tams Mountain 46 kV (~4 miles)

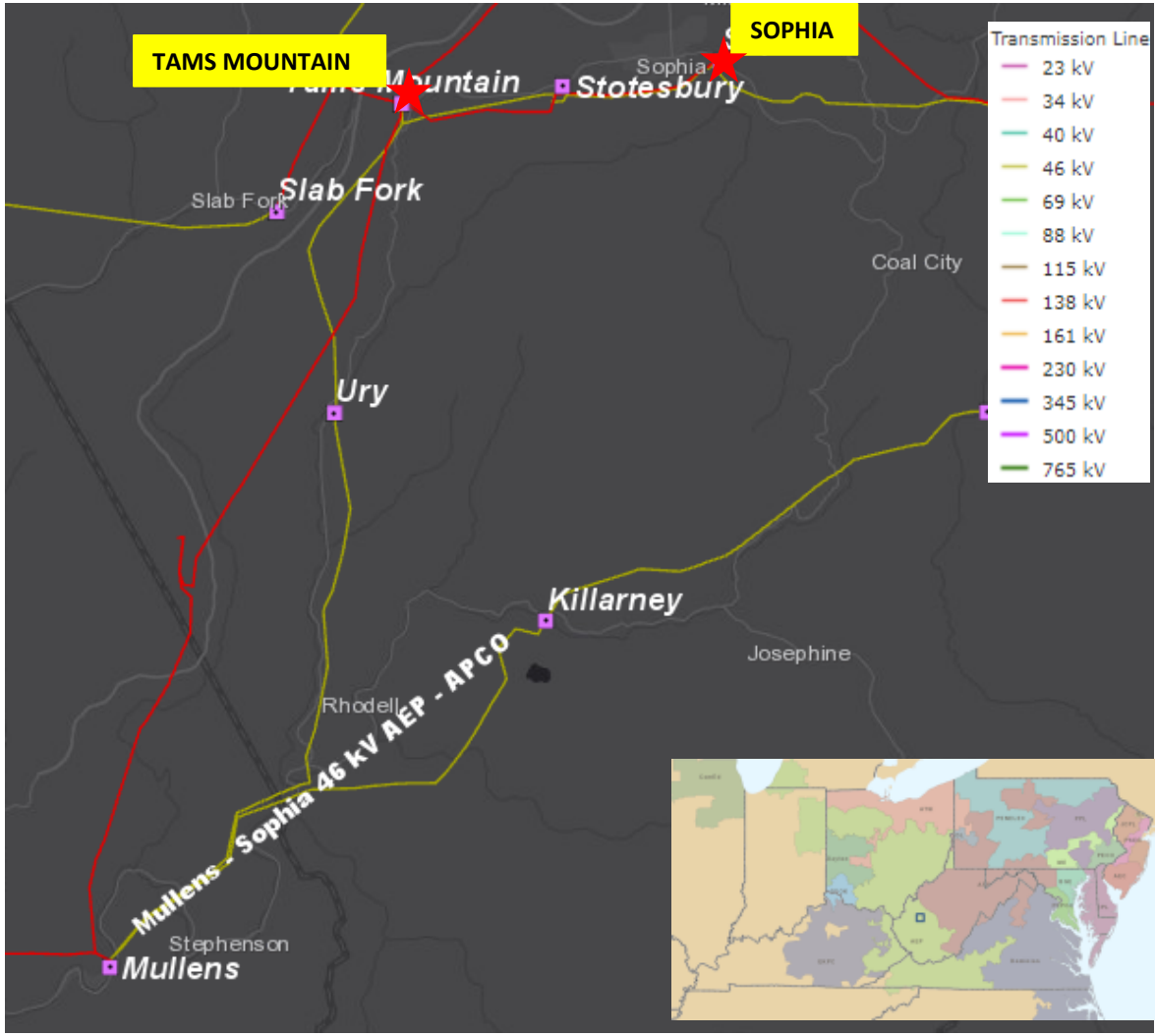
- Originally constructed in 1915
- Consists of 1915 vintage wood (65%) and steel lattice structures (33%)
- Conductor consists of 1915 vintage copper conductor and 556 ACSR
- Since 2014, there have been 2 momentary and 1 permanent outages on the Sophia – Tams Mountain 46 kV circuit.
  - Momentary outages due to ice/snow
  - Permanent outage due to lightning
- Currently there are 6 structures (15% of the line) with at least one open structural condition
  - 6 structural open conditions affecting pole, knee/vee brace and crossarms including corroded, broke, split and rot top

Condition & Impacts of the Degraded pre-1930s Era System

- These transmission line assets are clearly in the accelerated deterioration phase of their life.
- 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

Conditions of System for the Pre 1930s Lattice Line

- Towers: Typical life of galvanizing is 70 years. The towers are all supported by steel grillage foundations buried in the ground. The tower leg is subject to significant risk of corrosion where it enters the ground. 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.
- Insulator & Hardware Corrosion: The connecting elements including the tower attachment hole and the insulator hook have experienced serious section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection. The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or is significantly compromised, the bare steel corrodes at an accelerated rate.
- Broken Insulators: Broken, cracked and otherwise damaged insulators lead to premature flashover causing permanent outages. When the insulator assembly breaks, the wire falls to the ground potentially damaging other conductors, and presents an increased public safety concern.
- Conductor: Aluminum Conductor Steel Reinforced (ACSR) conductor consists of aluminum strands wrapped around a core of galvanized steel strands. The steel provides the structural strength. Like other steel elements, the strands of the core have also lost the galvanized coating and steel section. The degraded state results in significant loss of tensile strength and potential risk to the public if the conductor was to fail and fall to the ground. Conductor damage is usually not visible in a field inspection. Specific conductor samples, from the belly of the sag (lowest point) and/or inside the clamps at the insulators, have confirmed significant corrosion. During the restoration or construction activities, conductors often break at adjacent locations due to handling, introducing a potential safety risk and increase public safety concern.



AEP Transmission Zone: Supplemental
Beckley, WV

Need Number: AEP-2022-AP021

Process Stage: Solutions Meeting 11/17/2023

Previously Presented: Needs Meeting 2/18/2022

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

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

Problem Statement:

Beckley – Bradley 46 kV (~7 miles)

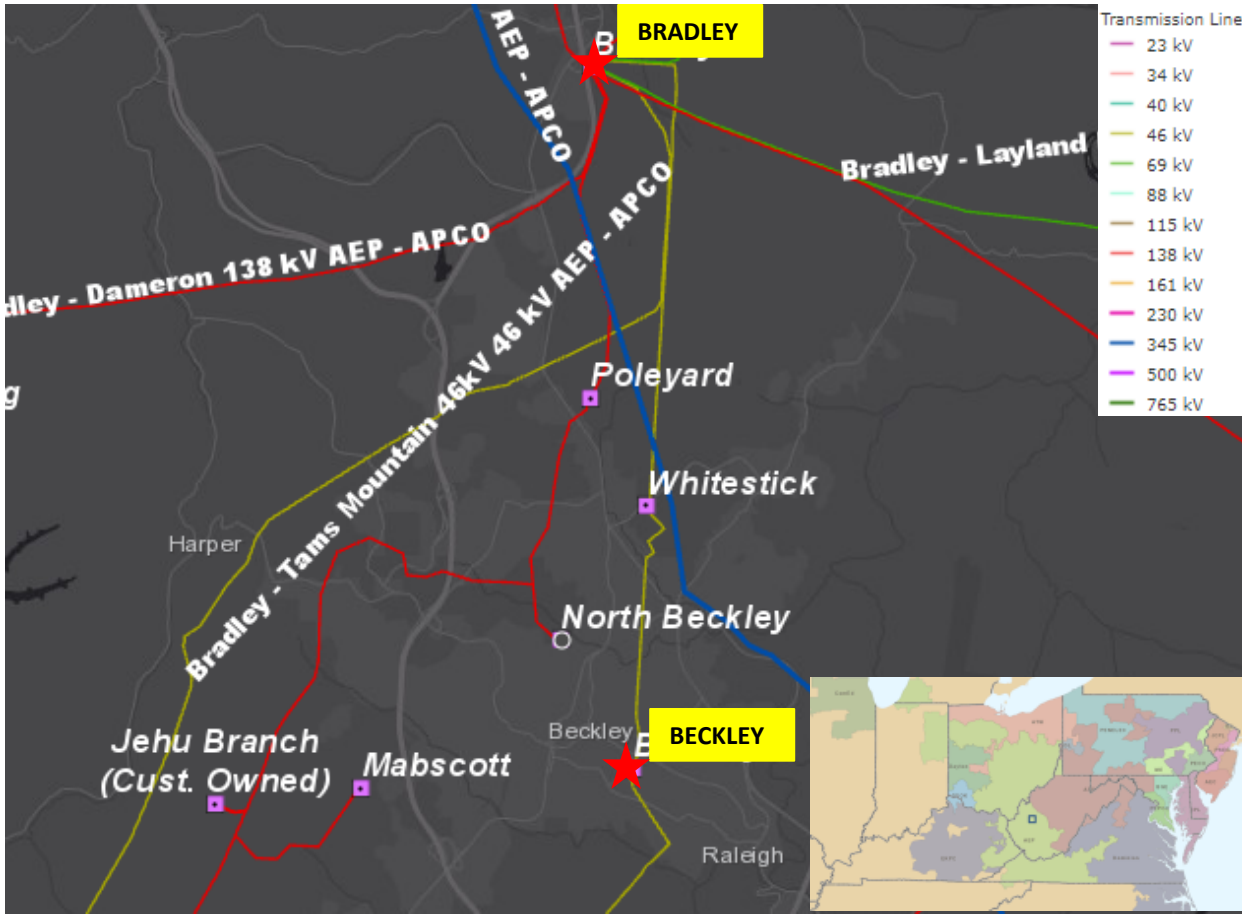
- Originally constructed in 1913
- Consists of 1913 vintage steel lattice towers and wood poles (40%) and 2002 wood poles (56%)
- Conductor consists of 1913 vintage 3/0 Copper (92%) and some 2005 vintage 556 ACSR
- Since 2015, there have been 43 momentary and 1 permanent outages on the Beckley – Bradley 46 kV circuit.
  - Momentary outages due to lightning, wind, ice/snow, distribution, relay misoperation, vegetation fall-in outside AEP ROW.
  - Permanent outage due to Distribution
  - Peak Load Impact: 21.68 MVA

Condition & Impacts of the Degraded pre-1930s Era System

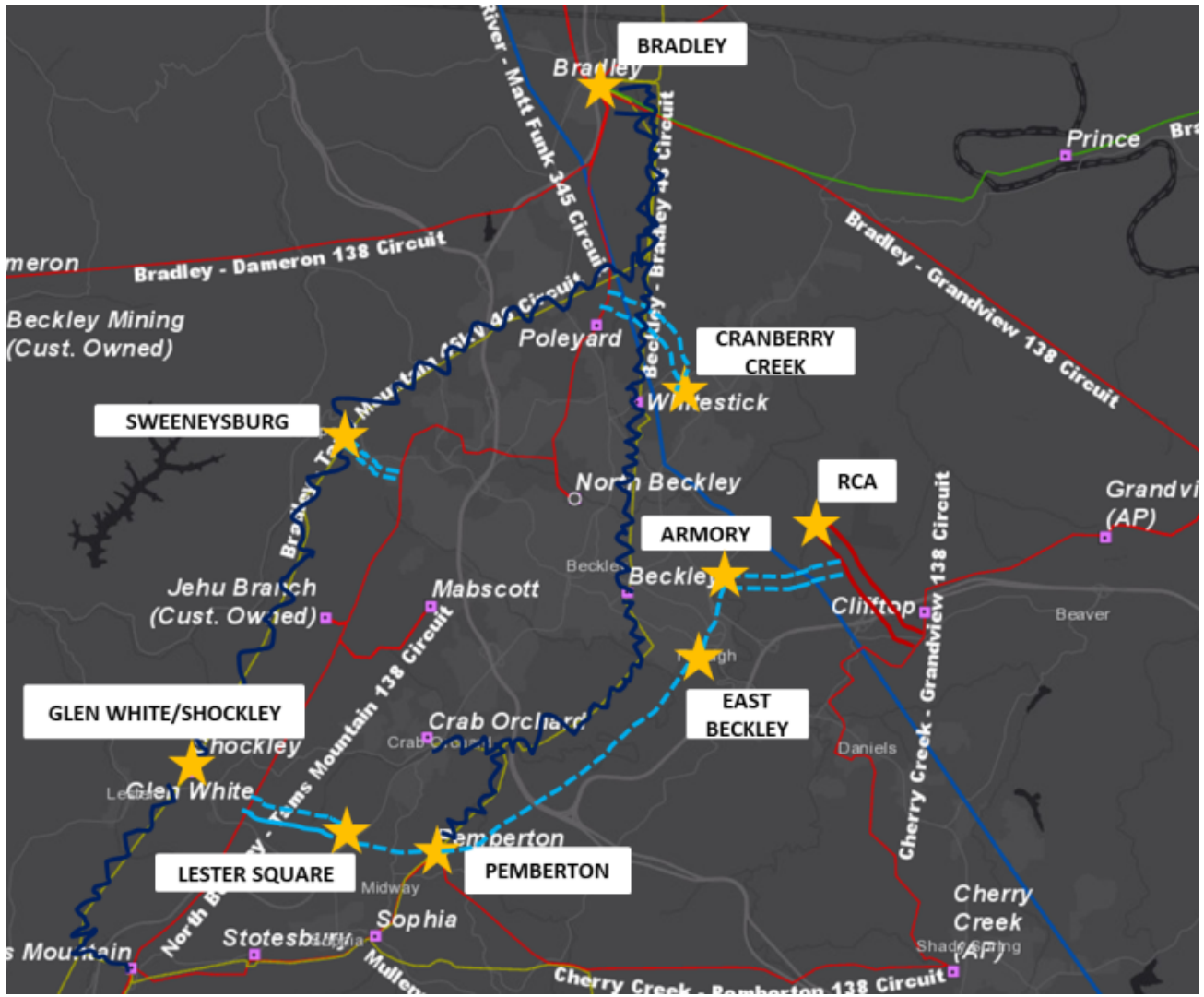
- These transmission line assets are clearly in the accelerated deterioration phase of their life.
- Significant deterioration results in loss of strength and performance posing a significant risk of failure under conditions the assets should be able to withstand.
  - May cause frequent and extended outages
  - May create significant economic losses
  - May endanger public safety

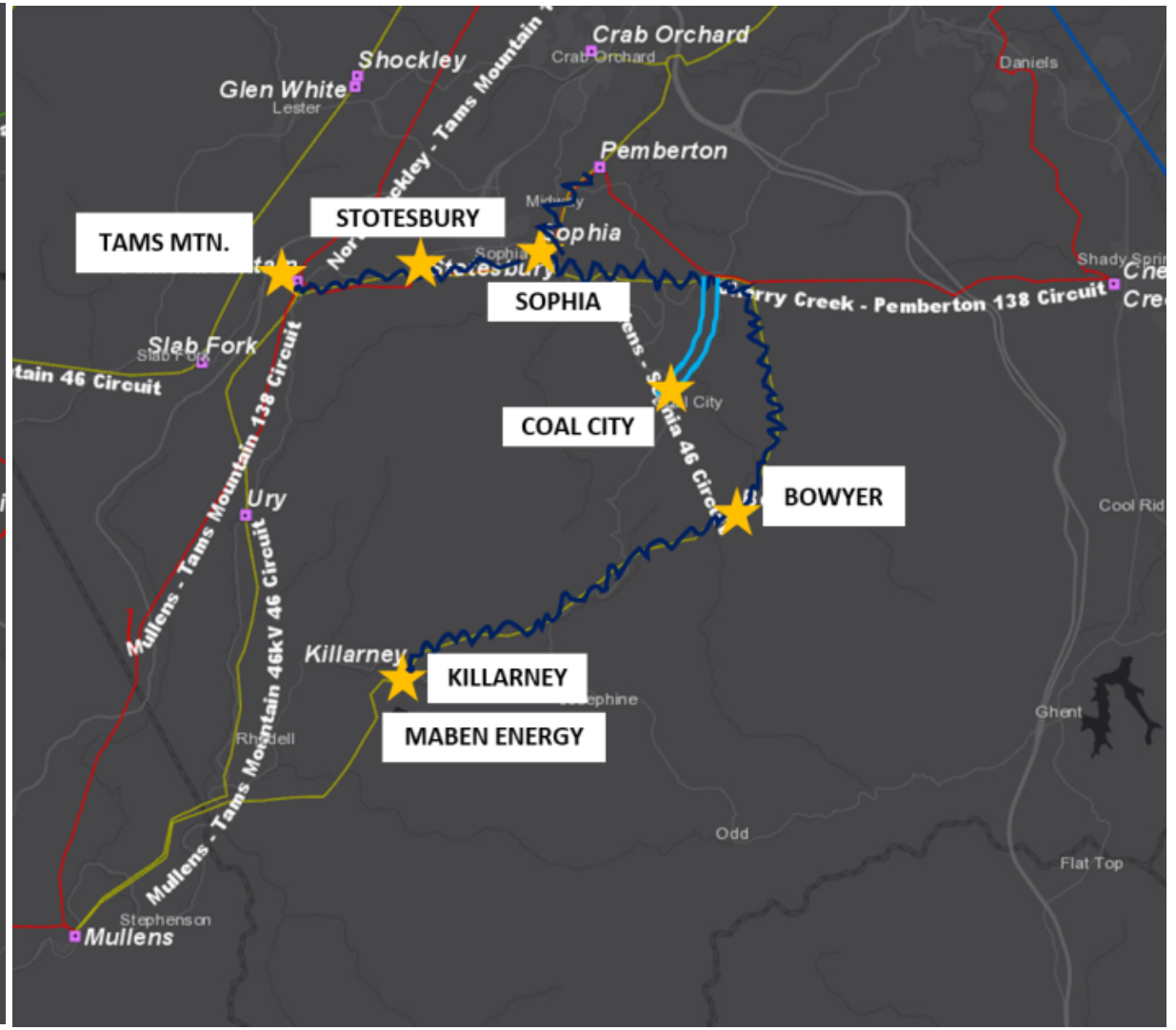
Conditions of System for the Pre 1930s Lattice Line

- Towers: Typical life of galvanizing is 70 years. The towers are all supported by steel grillage foundations buried in the ground. The tower leg is subject to significant risk of corrosion where it enters the ground. 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.
- Insulator & Hardware Corrosion: The connecting elements including the tower attachment hole and the insulator hook have experienced serious section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection. The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or is significantly compromised, the bare steel corrodes at an accelerated rate.
- Broken Insulators: Broken, cracked and otherwise damaged insulators lead to premature flashover causing permanent outages. When the insulator assembly breaks, the wire falls to the ground potentially damaging other conductors, and presents an increased public safety concern.
- Conductor: Aluminum Conductor Steel Reinforced (ACSR) conductor consists of aluminum strands wrapped around a core of galvanized steel strands. The steel provides the structural strength. Like other steel elements, the strands of the core have also lost the galvanized coating and steel section. The degraded state results in significant loss of tensile strength and potential risk to the public if the conductor was to fail and fall to the ground. Conductor damage is usually not visible in a field inspection. Specific conductor samples, from the belly of the sag (lowest point) and/or inside the clamps at the insulators, have confirmed significant corrosion. During the restoration or construction activities, conductors often break at adjacent locations due to handling, introducing a potential safety risk and increase public safety concern.

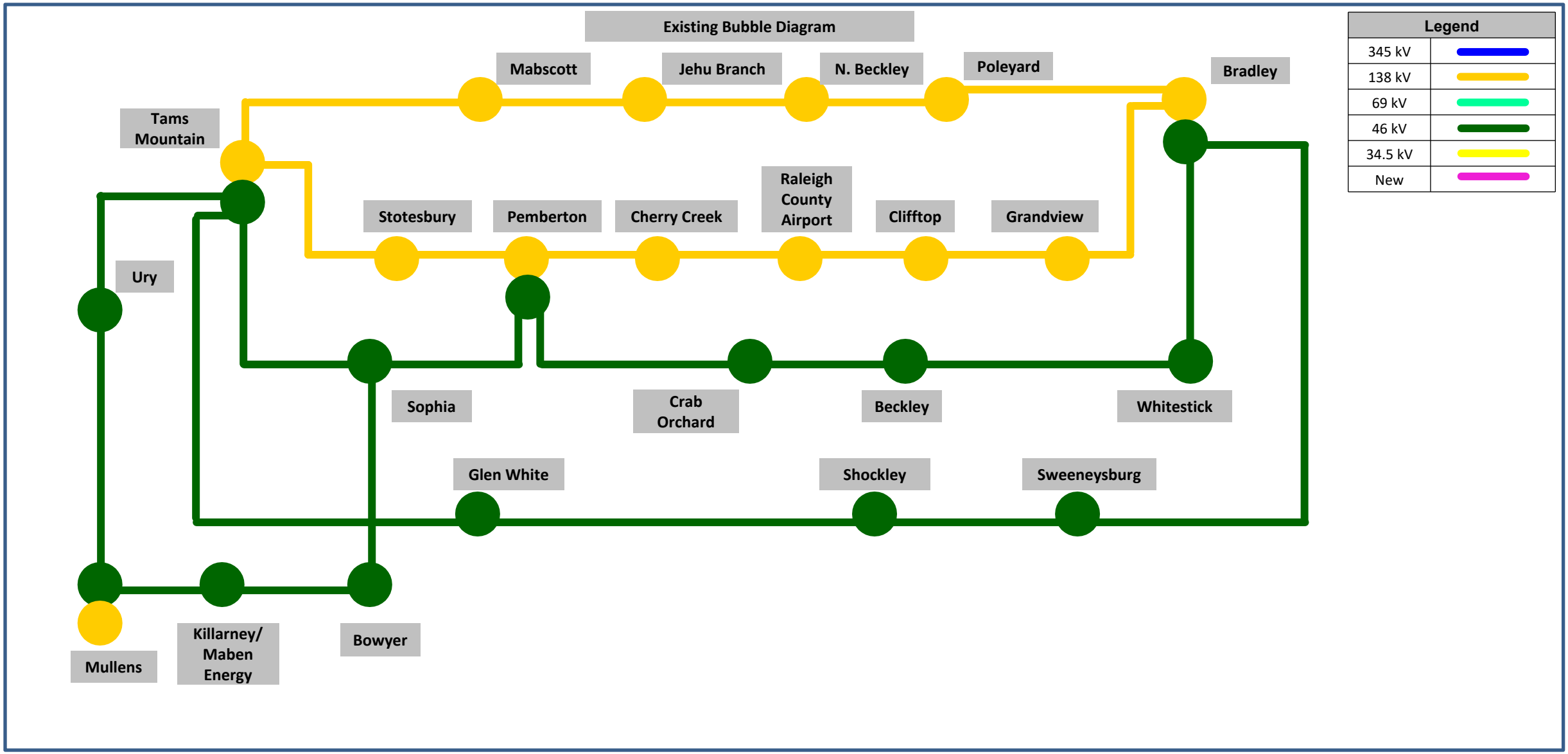


AEP Transmission Zone: Supplemental
Beckley , WV

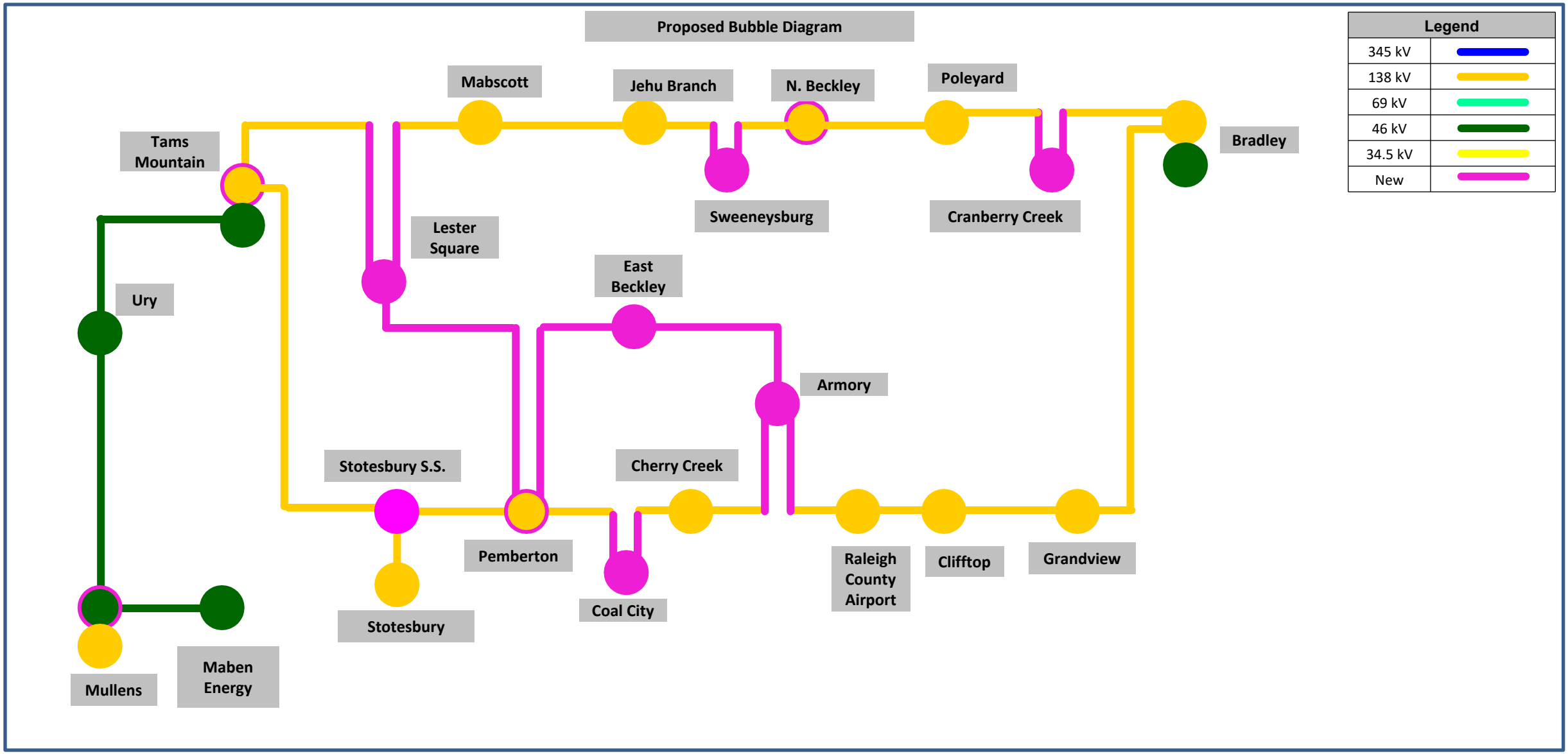




AEP Transmission Zone: Supplemental
Beckley , WV



AEP Transmission Zone: Supplemental
Beckley , WV



AEP Transmission Zone: Supplemental
Beckley , WV

Need Number: AEP-2022-AP015, AEP-2022-AP016, AEP-2022-AP017, AEP-2022-AP018, AEP-2022-AP019, AEP-2022-AP020, AEP-2022-AP021

Process Stage: Solutions Meeting 11/17/2023

Proposed Solution

- Construct a new double circuit 138 kV line (approx. 1 miles) by tapping the existing Cherry Creek – Pemberton 138 kV and building in/out to a new 138 kV station near Coal City. **Estimated Trans. Cost: $5.4M**
    - Retire existing 46 kV line from Sophia – Maben Energy. **Estimated Trans. Cost: $11.5M**
    - Retire existing Sophia – Tams Mountain 46 kV line **Estimated Trans. Cost: $4.7M**
    - Retire existing Pemberton – Sophia 46 kV line. **Estimated Trans. Cost: $3.3M**
- New Coal City Station: Install two 138 kV line MOABs, one 138/12 kV 20 MVA XFR with high side circuit switcher and two 12 kV feeders **Estimated Trans. Cost: $1.0M**
- Retire Sophia 46 kV Station **Estimated Trans. Cost: $1.4M**
- Pemberton Station: Install a new 138/46 kV XFR with a high side circuit switcher and new metering. This will feed the customer currently served out of Sophia Station. Construct a new 1 mile 46 kV line from Pemberton to the customer. Install two new 138 kV circuit breakers . Retire 138/46 kV XFR, 46 kV CB-A, 46 kV CB-C and 4 kV distribution equipment. Install one new 138 kV circuit breaker. Retire 46 kV CB-B **Estimated Trans. Cost: $10.7M**
- Stotesbury: Replace existing hard tap with a new 3-way phase over phase switch **Estimated Trans. Cost: $1.8M**
- Retire Killarney 46 kV Station **Estimated Trans. Cost: $0.0M**
- Retire Bowyer 46 kV Station **Estimated Trans. Cost: $0.0M**
- Tams Mountain: Remove 46 kV CB-N2 and 46 kV CB M **Estimated Trans. Cost: $1.1M**

Proposed Solution Bubble Diagram

SEE PREVIOUS SLIDES

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

AEP Transmission Zone: Supplemental
Beckley , WV

Need Number: AEP-2022-AP015, AEP-2022-AP016, AEP-2022-AP017, AEP-2022-AP018, AEP-2022-AP019, AEP-2022-AP020, AEP-2022-AP021

Process Stage: Solutions Meeting 11/17/2023

Proposed Solution

- Construct a new double circuit 138 kV line in/out (approx. 1 mile) to the existing Sweeneysburg Switch Station **Estimated Trans. Cost: $3.8M**
- Construct a new 138 kV double circuit line (approx. 2 miles) by tapping the existing North Beckley – Tams Mountain 138 kV line and building in/out to a new 138 kV station (Lester Square Station) **Estimated Trans. Cost: $9.9M**
- Construct a new 138 kV single circuit line (approx. 1.2 miles) from the new Lester Square Station to the existing Pemberton 138 kV station. **Estimated Trans. Cost: $6.6M**
- Retire Glen White Station **Estimated Trans. Cost: $0.0M**
- Retire Shockley Station **Estimated Trans. Cost: $0.1M**
- Retire Bradley – Tams Mountain 46 kV line: **Estimated Trans. Cost: $20.3M**
- Sweeneysburg Switch: Convert to 138 kV **Estimated Trans. Cost: $0.1M**
- Lester Square: Install five 138 kV CBs in a ring configuration, install one 23 MVAR capacitor bank with a circuit switcher, install a new 138/12 kV 20 MVA XFR with two 12 kV feeders. Install a new 138/46 kV XFR to feed the customer previously served from Shockley Station. Construct a new 46 kV line from Lester Square to the customer previously served at Shockley Station. **Estimated Trans. Cost: $5.9M**
- North Beckley Station: Remote End work required due to the new line cut in to Lester Square Station. **Estimated Trans. Cost: $0.6M**
- Bradley Station: Remove 46 kV CB-F, Retire 46 kV CB-J **Estimated Trans. Cost: $0.8M**

Proposed Solution Bubble Diagram

SEE PREVIOUS SLIDES

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

AEP Transmission Zone: Supplemental
Beckley , WV

Need Number: AEP-2022-AP015, AEP-2022-AP016, AEP-2022-AP017, AEP-2022-AP018, AEP-2022-AP019, AEP-2022-AP020, AEP-2022-AP021

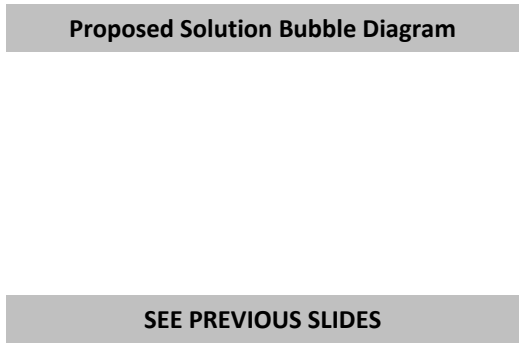
Process Stage: Solutions Meeting 11/17/2023

Proposed Solution

- Construct a new 138 kV double circuit line (approx. 1.5 miles) tapping the existing Bradley – North Beckley 138 kV line and building in/out to a new 138 kV station (Cranberry Creek) **Estimated Trans. Cost: $7.9M**
- Construct a new single circuit 138 kV line (approx. 5.1 miles) from Pemberton to a new 138 kV station (East Beckley) **Estimated Trans. Cost: $15.7M**
- Construct a new single circuit 138 kV line (approx. 1.7 mile) from the new East Beckley 138 kV Station to a new 138 kV station (Armory Station) **Estimated Trans. Cost: $8.0M**
- Construct a new double circuit 138 kV line (approx. 1.0 miles) by tapping the Raleigh County 138 kV Extension line and building in/out to the new Armory 138 kV Station. **Estimated Trans. Cost: $4.5M**
- Retire Bradley – Beckley 46 kV line **Estimated Trans. Cost: $9.6M**
- Retire Beckley – Pemberton 46 kV line and Crab Orchard 46 kV tap line **Estimated Trans. Cost: $7.0M**
- Retire Whitestick 46 kV Station **Estimated Trans. Cost: $0.0M**
- Retire Beckley 46 kV Station **Estimated Trans. Cost: $0.0M**
- Retire Crab Orchard 46 kV Station: **Estimated Trans. Cost: $0.0M**
- Armory Station: Install three 138 kV circuit breakers, 23 MVAR capacitor bank with circuit switcher, install one new 138/12 kV 25 MVA XFR with high side circuit switcher and three 12 kV feeders **Estimated Trans. Cost: $4.2M**
- East Beckley: Install two 138 kV MOABs, install one new 138/12 kV 25 MVA XFR with a high side circuit switcher and three 12 kV feeders **Estimated Trans. Cost: $1.2M**
- Cranberry Creek: Install one 138 kV circuit breaker, one 138 kV line MOAB, one 138/12 kV 25 MVA XFR with a high side circuit switcher and three 12 kV feeders **Estimated Trans. Cost: $2.2M**
- Cherry Creek Station: Remote end work due to the the Armory Extension cut-in. **Estimated Trans. Cost: $0.0M**
- North Beckley Station: Install one 138/12 kV 25 MVA XFR with three 12 kV feeders. Install one new 138 kV circuit breaker, replace existing ground switch MOAB on XFR #1 with a new 138 kV circuit switcher. Replace existing ground switch MOAB on 138/34.5 kV XFR #2 and replace existing 34.5 kV circuit breakers G and H. **Estimated Trans. Cost: $1.6M**

Total Combined Estimated Trans. Cost: $150.9M

Proposed Solution Bubble Diagram



SEE PREVIOUS SLIDES

Need Number: AEP-2022-AP015, AEP-2022-AP016, AEP-2022-AP017, AEP-2022-AP018, AEP-2022-AP019, AEP-2022-AP020, AEP-2022-AP021

Process Stage: Solutions Meeting 11/17/2023

Alternate:

- Rebuild the existing Mullens – Sophia 46 kV line (approx. 17 miles), Rebuild the existing Sophia – Tams Mountain 46 kV line (approx. 4 miles). Replace three 46 kV circuit breakers and one 46 kV circuit switcher at Sophia Station. **Estimated Cost: 88.7M**
- Rebuild existing Bradley – Tams Mountain 46 kV line (approx. 16 miles). **Estimated Cost: 67.2M**
- Rebuild existing Bradley – Beckley 46 kV line (approx. 8 miles), rebuild existing Beckley – Pemberton 46 kV line (approx. 5 miles), rebuild existing Crab Orchard 46 kV tap line (approx. 1 mile). Replace one existing 46 kV circuit breaker and the existing 138/46 kV transformer at Pemberton Station. **Estimated Cost: 63.7**
- Total Alternate Estimated Cost: $219.6M

Ancillary Benefits: Alternate consists of 51 total miles of line needing to be rebuilt. The proposed solution consists of a total of 14.5 miles of greenfield line. Additionally, as part of the proposed solution the following deteriorating Distribution station equipment will be retired: Beckley Station 3 – 12 kV CBs, 2 – 46/12 kV XFRs, 25 EM relays, 1 RTU. Whitestick Station 3 – 12 kV CBs, 1 – 46/12 kV XFR, 18 EM relays. Crab Orchard Station 1 – 46/12 kV XFR, 1 RTU. Pemberton Station 1 – 46/4 kV XFR. Killarney Station 1 – 46/7.2 kV XFR. Bowyer Station 1 – 46/12 kV XFR. Glen White Station 1 – 46/12 kV XFR, 4 EM Relays

Projected In-Service: 6/10/2031

Project Status: Scoping

Model: 2028 RTEP

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

11/7/2023– V1 – Original version posted to pjm.com

11/13/2023– V2 – Slide #5, Added requested ISD

11/14/2023– V3 – Slide #45, Updated bubble diagram