Sub Regional RTEP Committee: Western
AEP Supplemental Projects

February 18, 2022

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
Johnson County, Kentucky

Need Number: AEP-2022-AP004

Process Stage: Needs Meeting 02/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

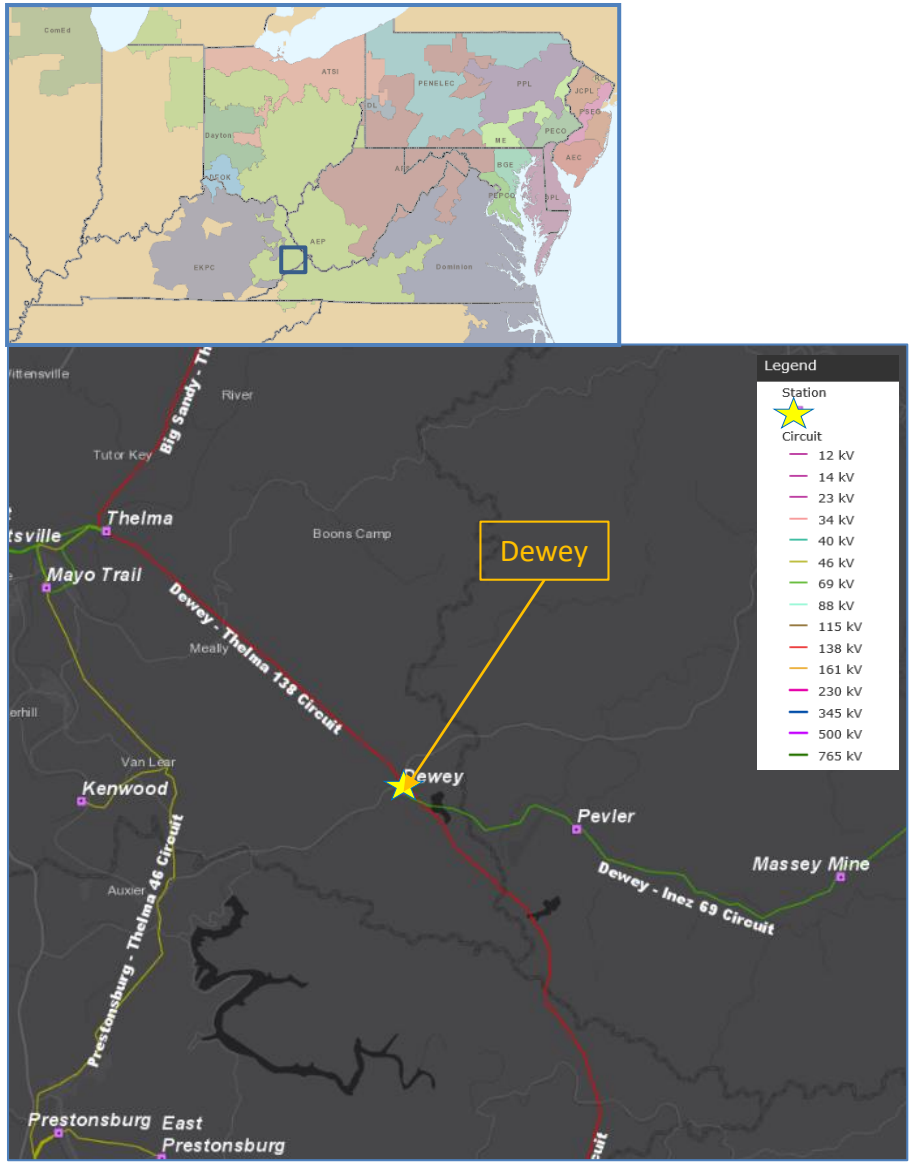
Specific Assumption Reference:

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

Problem Statement:

Dewey substation Needs:

- 138kV Circuit Breaker B:
  - 1992 Vintage, number of fault ops: 55
  - The 138kV transmission owned circuit breaker, CB-B, is a 145-PA-40-20B type, SF6 filled breaker. As of May 11, 2020, there have been 437 recorded malfunctions of this 145-PA model family on the AEP System. The most common issues are related to loss of SF6 gas and mis-operations. The expected life of the bushing gaskets and door inspection port seals is 25 years; this unit has reached this age. Seals that are no longer adequate cause SF6 leaks to become more frequent. SF6 leaks impact the environment. The manufacturer provides no support for this family of circuit breakers and spare parts are not available.
- Relaying
  - Currently, 21 of the 34 relays (62% of all station relays) are in need of replacement. 21 of these are of the electromechanical type which have significant limitations with regards to spare part availability and fault data collection and retention.



AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Need Number: AEP-2022-AP005

Process Stage: Needs Meeting 02/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

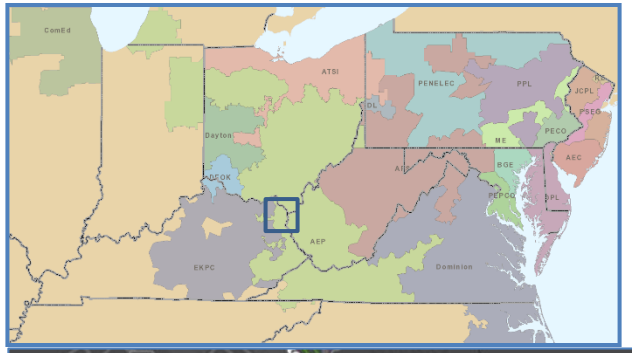
Specific Assumption Reference:

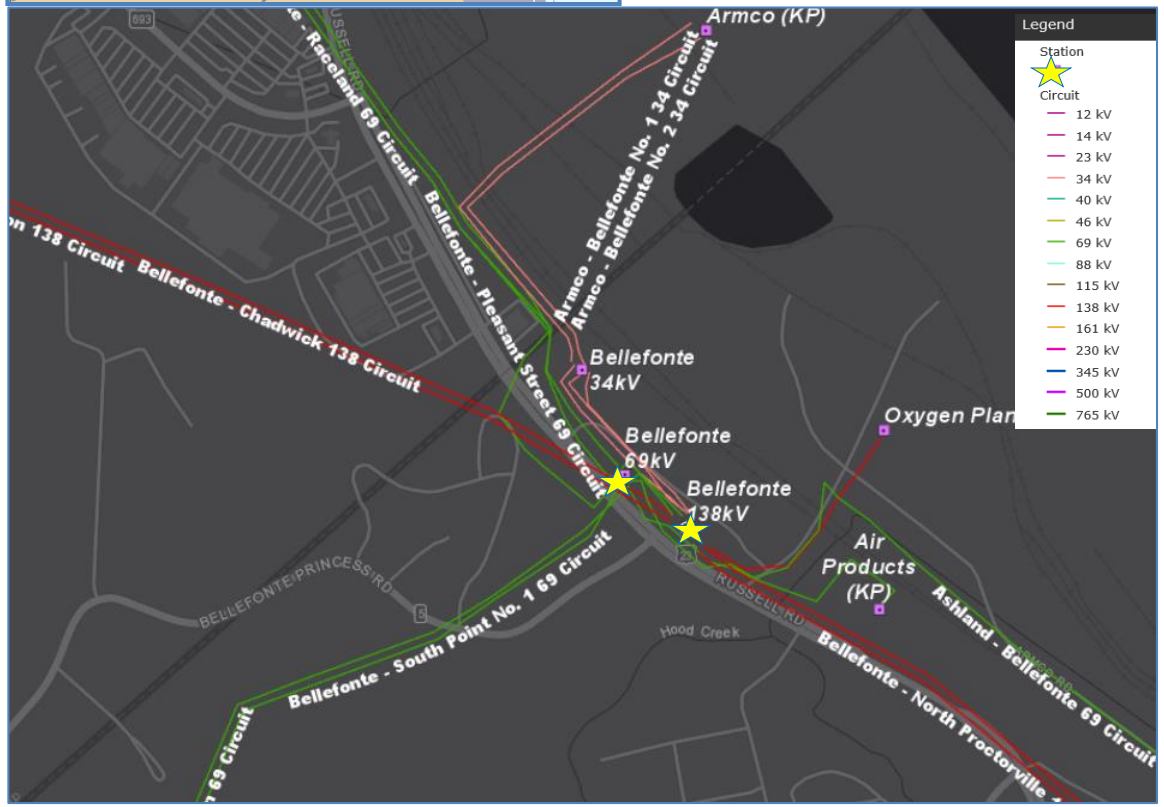
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Bellefonte 138kV Yard:

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

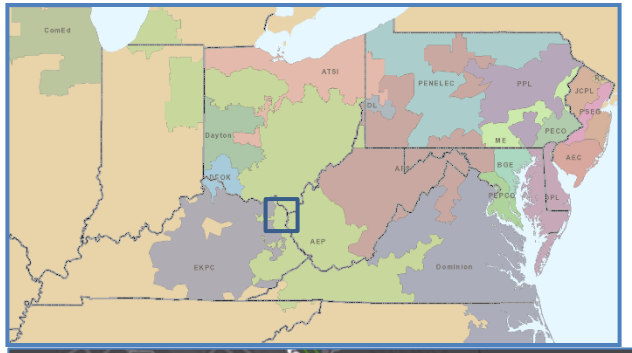


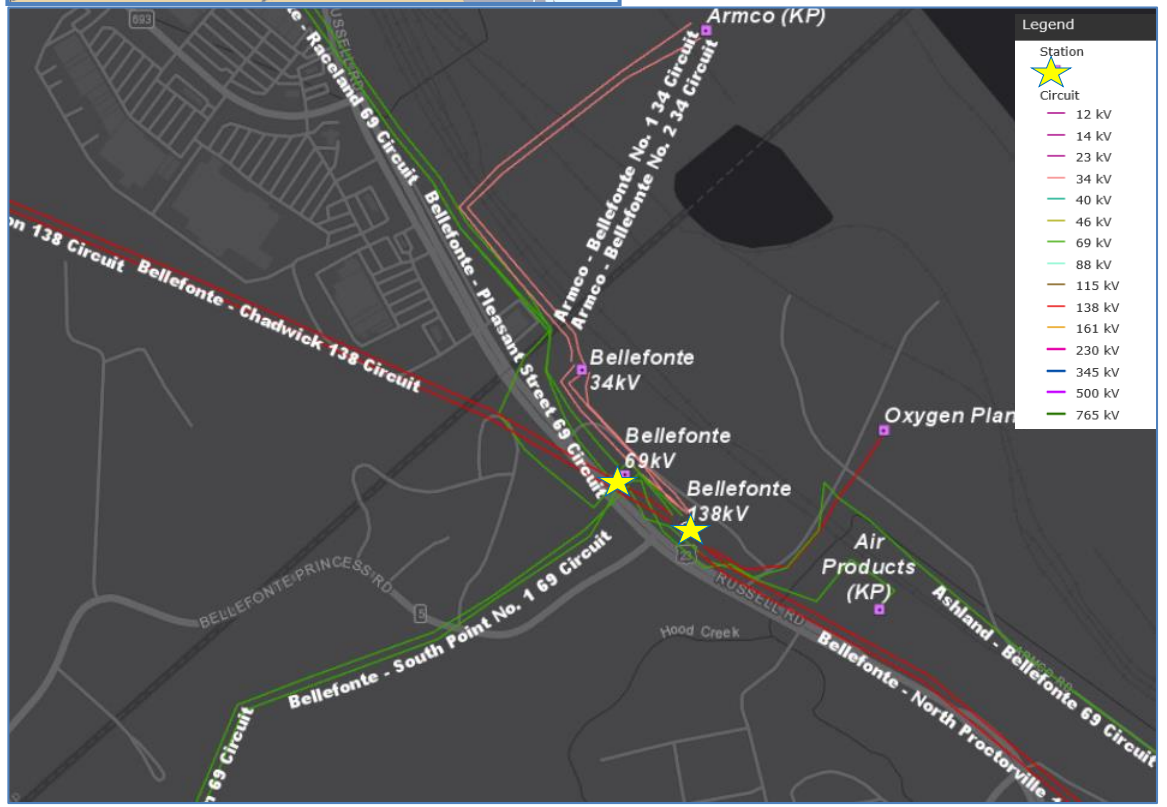


AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 138kV Yard (cont):

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





AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 69kV Yard:

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

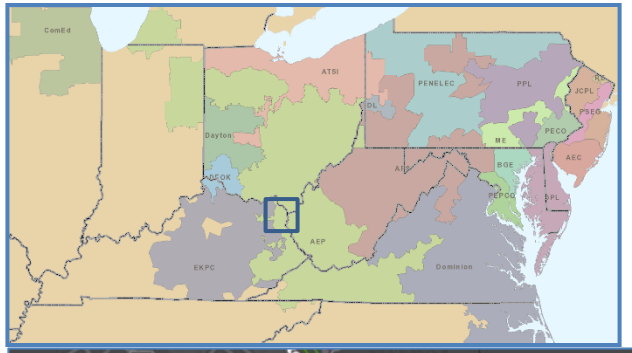
- As of May 25, 2021, there are 20 remaining FK-72.5-27000-10 circuit breakers on the AEP System, including the 6 at this station. GE provides no support for this fleet of circuit breakers and spare parts are increasingly more difficult to obtain; components are often taken from out of service units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

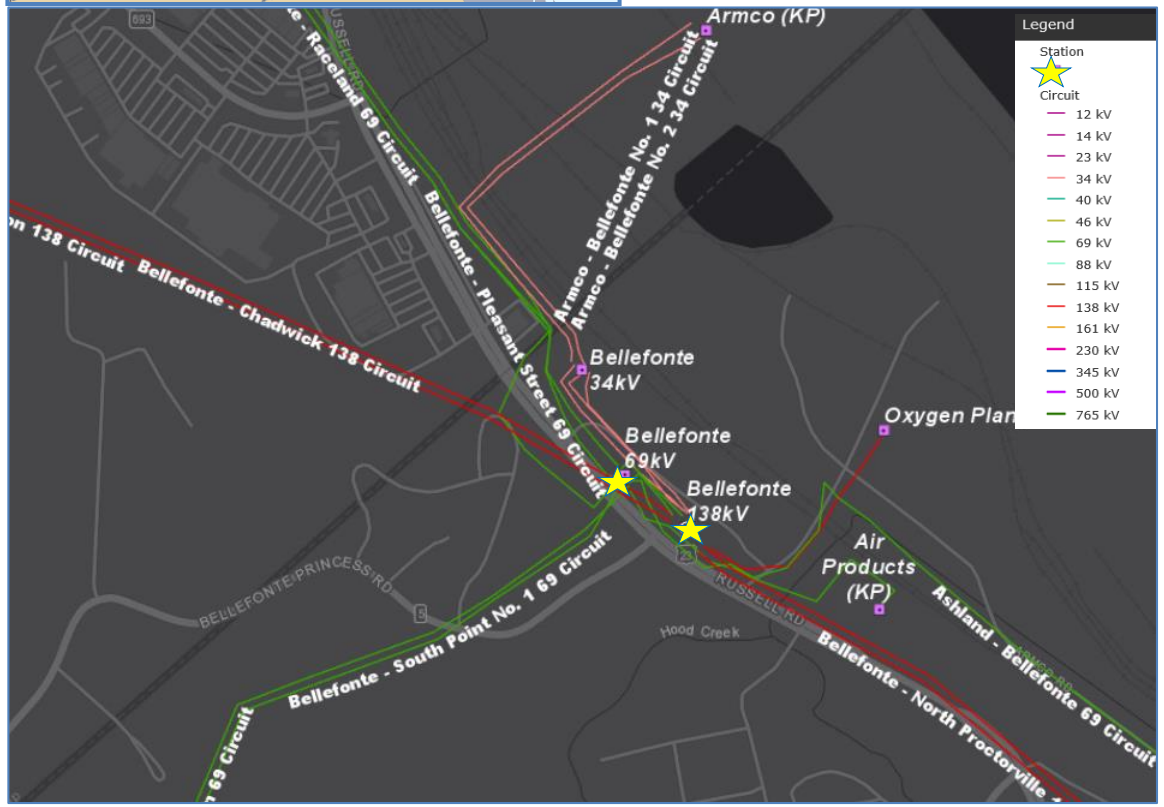
69kV circuit breakers H and T CF-48-69-2500 type oil filled breaker, without oil containment.

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

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

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





AEP Transmission Zone M-3 Process
Johnson County, Kentucky

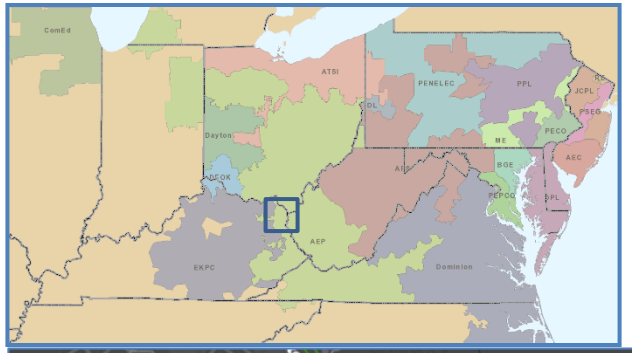
Bellefonte 69kV Yard (cont):

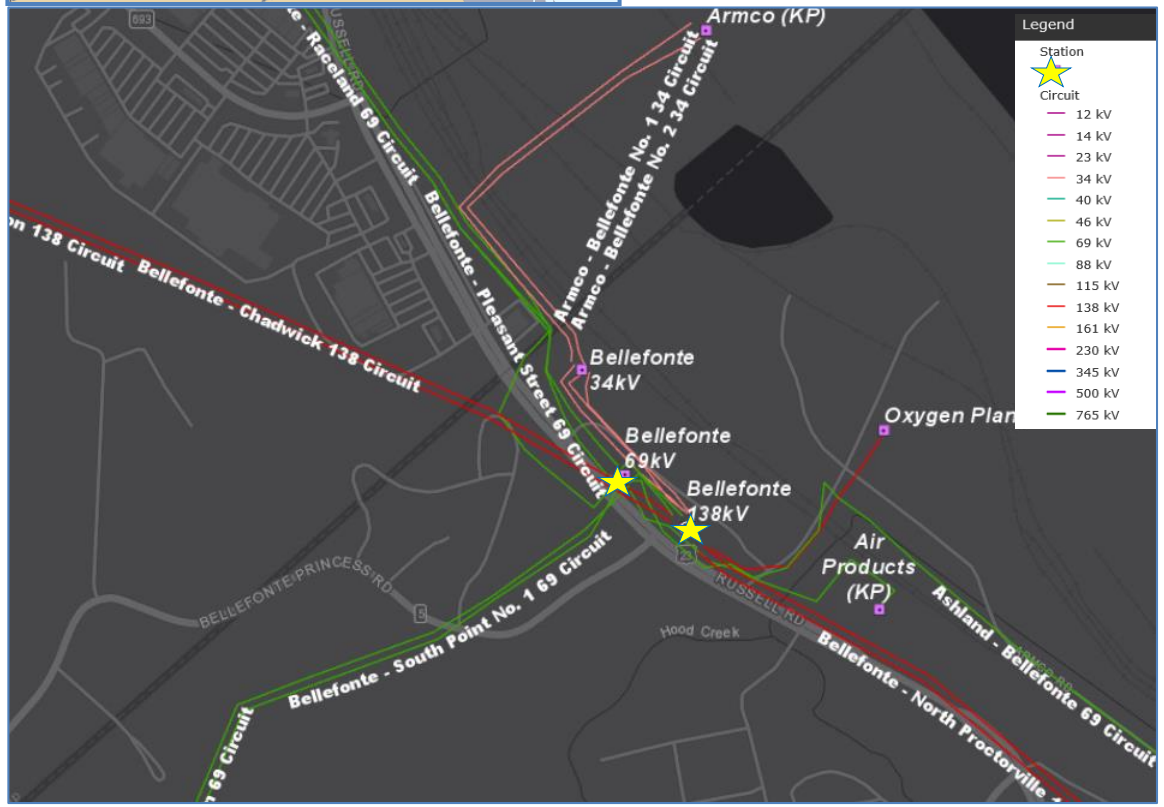
Relaying:

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

Others:

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

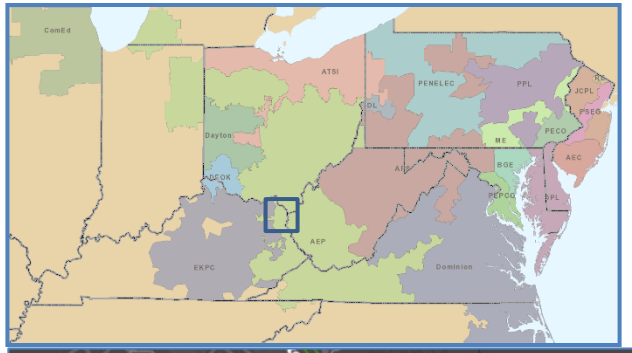


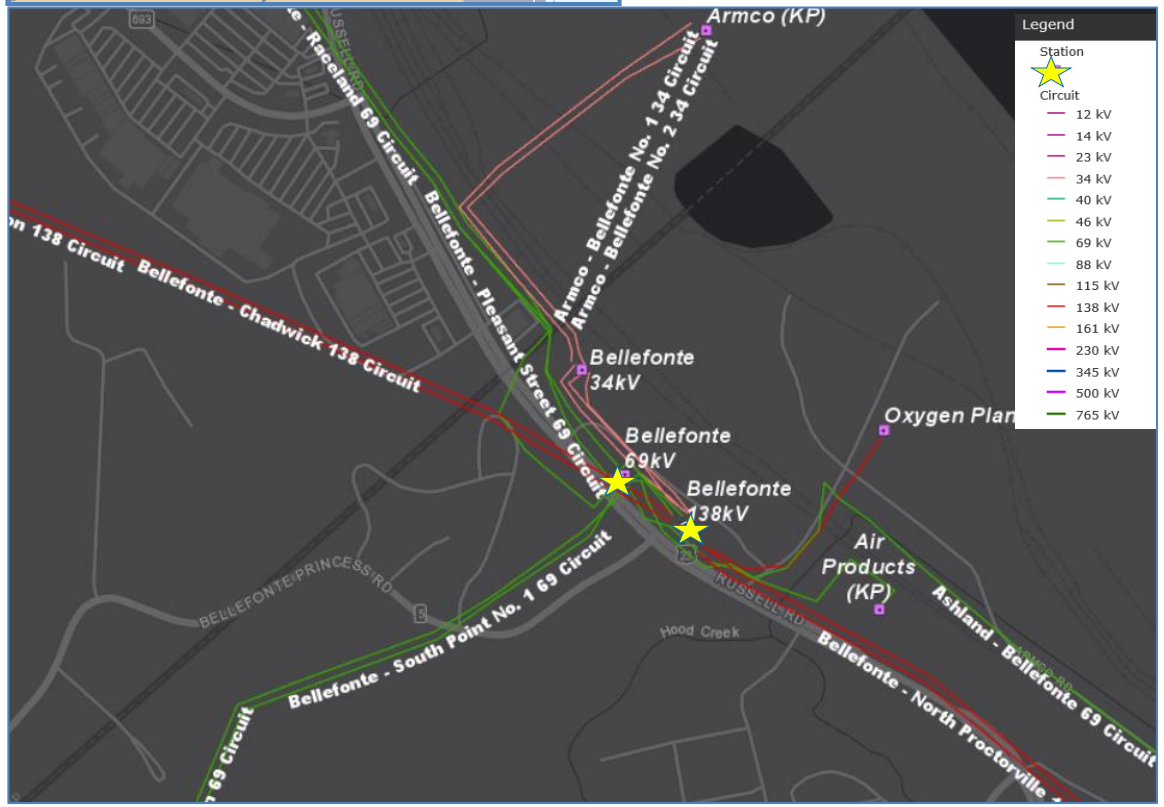


AEP Transmission Zone M-3 Process
Johnson County, Kentucky

Bellefonte 34kV Yard:

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





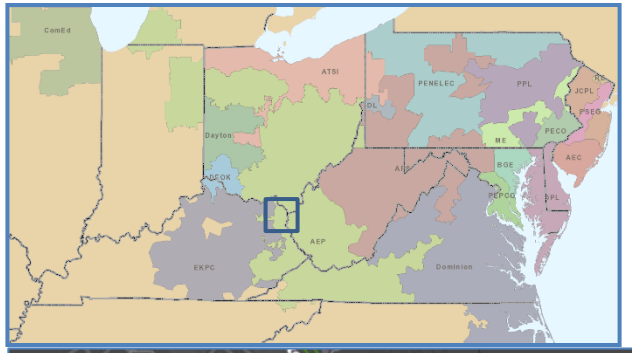
AEP Transmission Zone M-3 Process
Johnson County, Kentucky

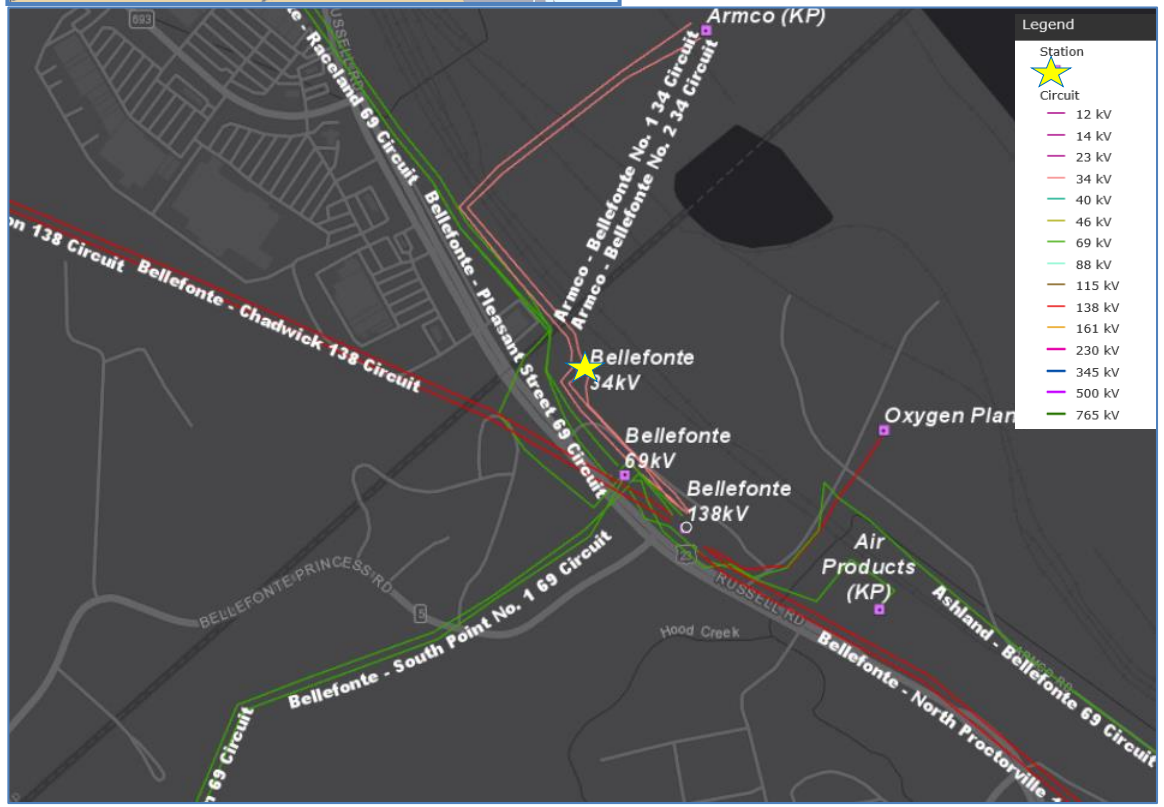
Bellefonte 34kV Yard (cont):

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

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

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





AEP Transmission Zone M-3 Process
Pike County, Kentucky

Need Number: AEP-2022-AP007

Process Stage: Need Meeting 2/18/2022

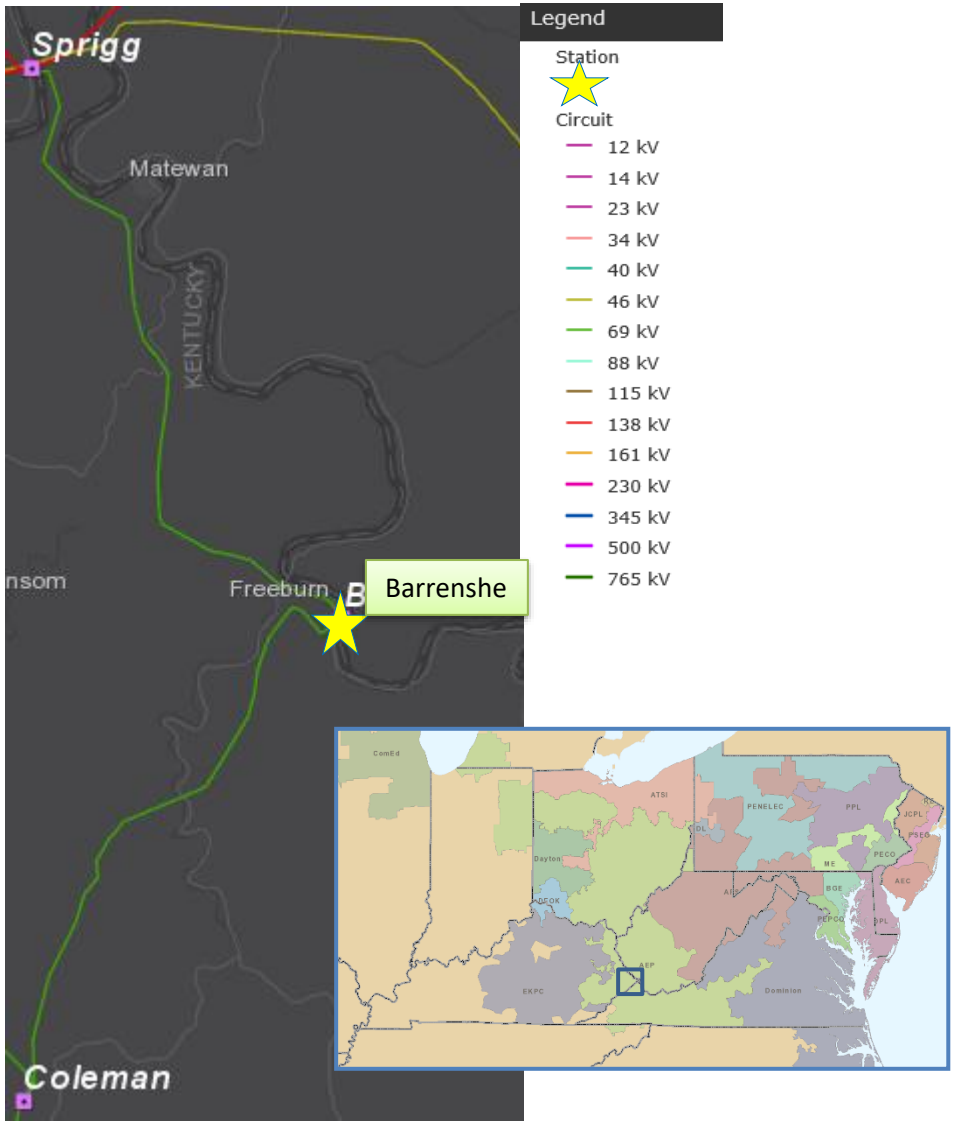
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Barrenshe Station:

- All 15 relays at Barrenshe station are in need of replacement. There are 11 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. Also, the remaining 4 microprocessor relays were commissioned from 2006-2007 and are at the end of their useful life.
- The station bay was constructed using wood poles that were installed in 1953. The poles are very rotten and there is concern that any type of stress on the poles could cause the station to fail completely. The poles closest to the transformer are leaning and have twisted the bus.
- In 1977, flood waters were over 3/4 up the control cabinet. There has been repeated wash out in the rear of the station causing the fence post foundations to wash away. The station lies in the 100 year flood plain between mountainous terrain and highway 194 making expansion at the existing site extremely difficult.
- 69 kV MOAB W is 1973 vintage and needs replaced due to wear and lack of available parts.



AEP Transmission Zone M-3 Process
Pike County, Kentucky

Need Number: AEP-2022-AP008

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Coleman – Sprigg 69 kV:

Original Install Date: 1926

Length of Line: ~13 mi

Total structure count: 101

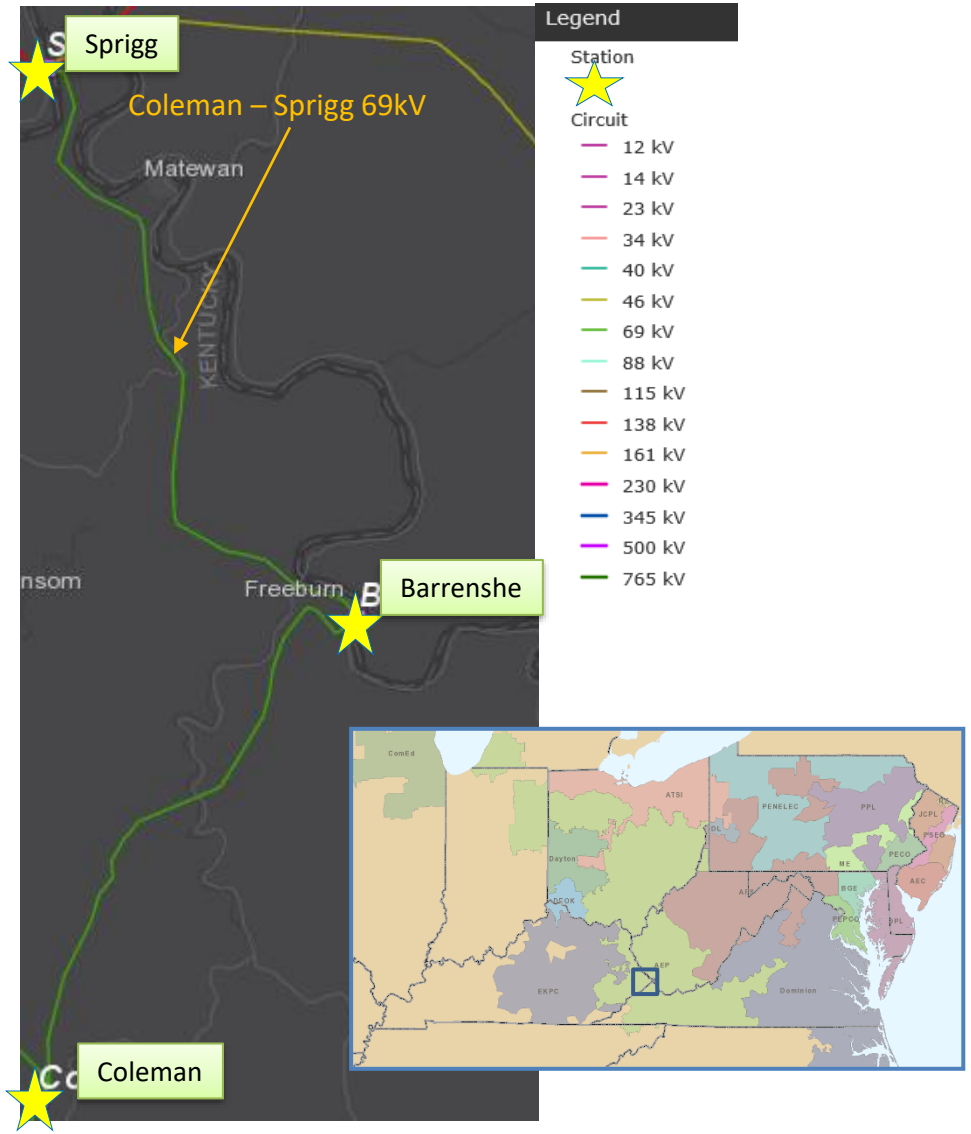
Original Line Construction Type: Wood

Conductor Type: 2/0 Copper, 176,900 ACSR, 556,500 ACSR, 795,000 ACSR

Momentary/Permanent Outages: 11 Momentary and 10 Permanent

Line Conditions:

- The 10 permanent outages caused 2.6M minutes of interruption for distribution customers
- The line structures fail to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements.
- Currently, there are 44 structures with at least one open condition, which relates to 43% of the structures on the circuit specifically affecting the crossarm, knee/ vee brace, or pole including rot, damaged, insect damage, and bowed conditions.
- 39 of 101 (39%) structures are 1920s vintage
- 53 of 101 (52%) are 1970s vintage. The Barrenshe – Coleman segment was rebuilt in the early 1970s. On the Sprigg – Barrenshe segment, 17 structures were also rebuilt in the 1970s. These 1970s structures are also showing signs of pole cracking, weathering, rot, and woodpecker damage. The crossarms and braces show signs of mold as well as signs of rot, cracking, splitting, bowing, and weathering.



AEP Transmission Zone M-3 Process
Pike County, Kentucky

Need Number: AEP-2022-AP008

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

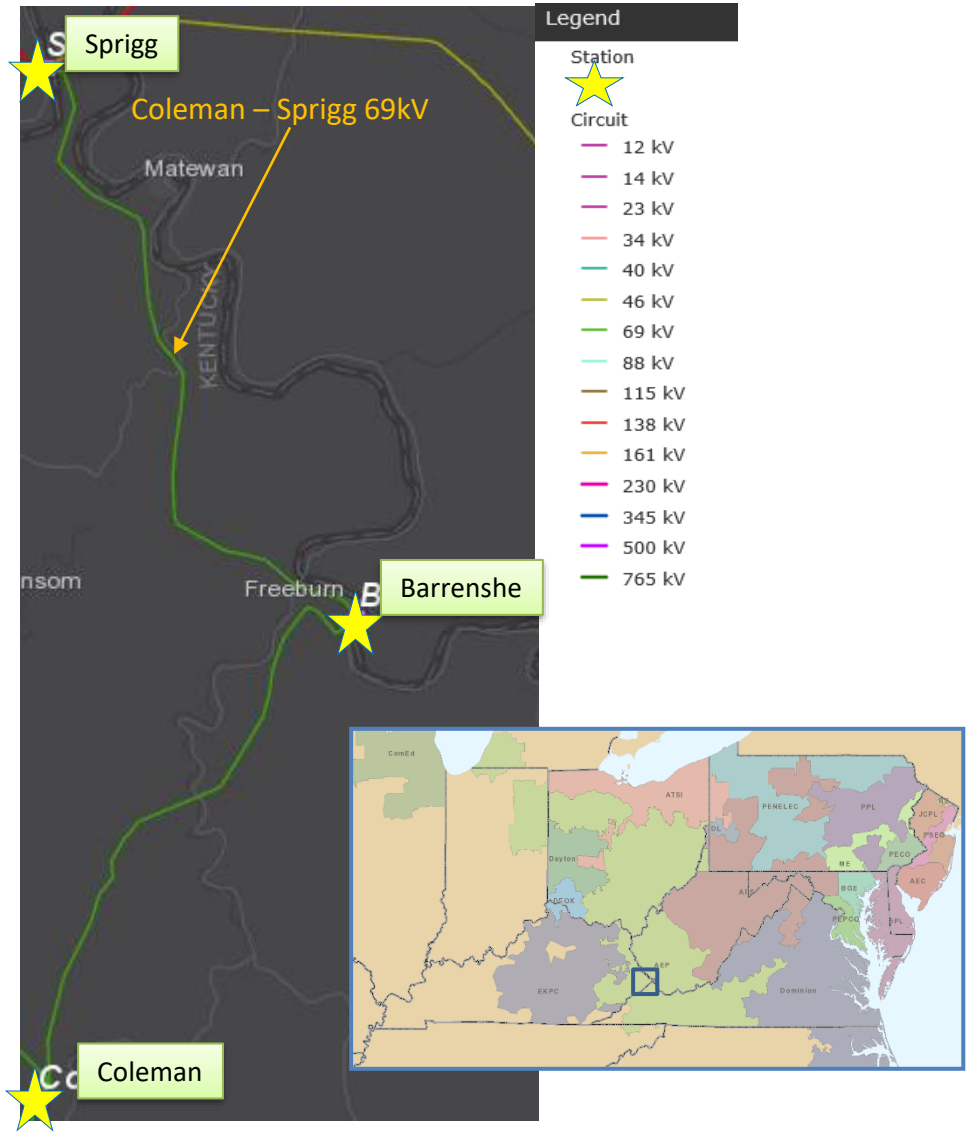
Specific Assumption Reference:

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

Coleman – Sprigg 69 kV Continued:

Line Conditions Con't:

- The 4-bell porcelain insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- There is no shielding present on the Sprigg – Barrenshe segment, which is inadequate for AEP's current shielding requirements and leads to poor lightening performance for the circuit.
- The butt wrap grounding is inadequate per current AEP Standards and causes poor lightning performance. The current grounding system, poor shielding angle, and the electrical strength of the insulators do not meet current AEP and industry accepted criteria, making the line susceptible momentary and permanent outages, affecting customer reliability.
    - The inadequate grounding limits the available path to ground during any type of line fault, increasing the intensity the conductor and related hardware have to withstand during the fault. The reduced electrical strength of the insulators could lead to electrical damage to structures and hardware during a fault if the insulator were to fail from elevated electrical stresses.
    - The line serves a peak load of 12.5 MVA at Barrenshe station.



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

Need Number: AEP-2022-AP009

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Sprigg – Wharncliffe 46 kV:

Original Install Date (Age): 1929

Length of Line: ~18 mi

Total structure count: 120

Original Line Construction Type: Wood

Conductor Type: 1/0 Copper, 176,900 ACSR, 336,400 ACSR, 556,500 ACSR

Momentary/Permanent Outages: 27 Momentary and 10 Permanent

Line Conditions:

- The 10 permanent outages caused 481k minutes of interruption for distribution customers
- The line structures fail to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements.
- Currently, there are 39 structures with at least one open condition, which relates to 33% of the structures on the circuit specifically affecting the crossarm, knee/ vee brace, or pole including rot, damaged, insect damage, woodpecker holes, and bowed conditions.
- 32 of the 120 structures are 1930s vintage or older accounting for 27% of the structures. Another 33 of the 120 structures are split almost evenly between 1940s, 50s, and 60s vintage, accounting for 28% of the structures. An additional 22 of 120 structures are spread between the 1970s and 90s (18%). The described structures, including 11% more are all wood structures, with only 16% of the line made up of steel structures.

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

Need Number: AEP-2022-AP009

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Sprigg – Wharncliffe 46 kV Continued:

Line Conditions Con't:

- The 4-bell porcelain insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- The majority of the line has no static wire, making it inadequate for AEP current shielding angle requirements and results in poor lightening performance.
- The butt wrap grounding and typical shield angle is inadequate per current AEP Standards and can cause poor lightning performance. The current grounding system, poor shielding angle, and the electrical strength of the insulators do not meet current AEP and industry accepted criteria, making the line susceptible momentary and permanent outages, affecting customer reliability.
    - The inadequate grounding limits the available path to ground during any type of line fault, increasing the intensity the conductor and related hardware have to withstand during the fault. The reduced electrical strength of the insulators could lead to electrical damage to structures and hardware during a fault if the insulator were to fail from elevated electrical stresses.
    - The line serves a peak load of 6 MVA at Grapevine, Briar Mountain, and Bens Creek stations.

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

Need Number: AEP-2022-AP010

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Jim Branch – Wharncliffe 46 kV:

Original Install Date (Age): 1925 and 1930

Length of Line: ~25 mi

Total structure count: 162

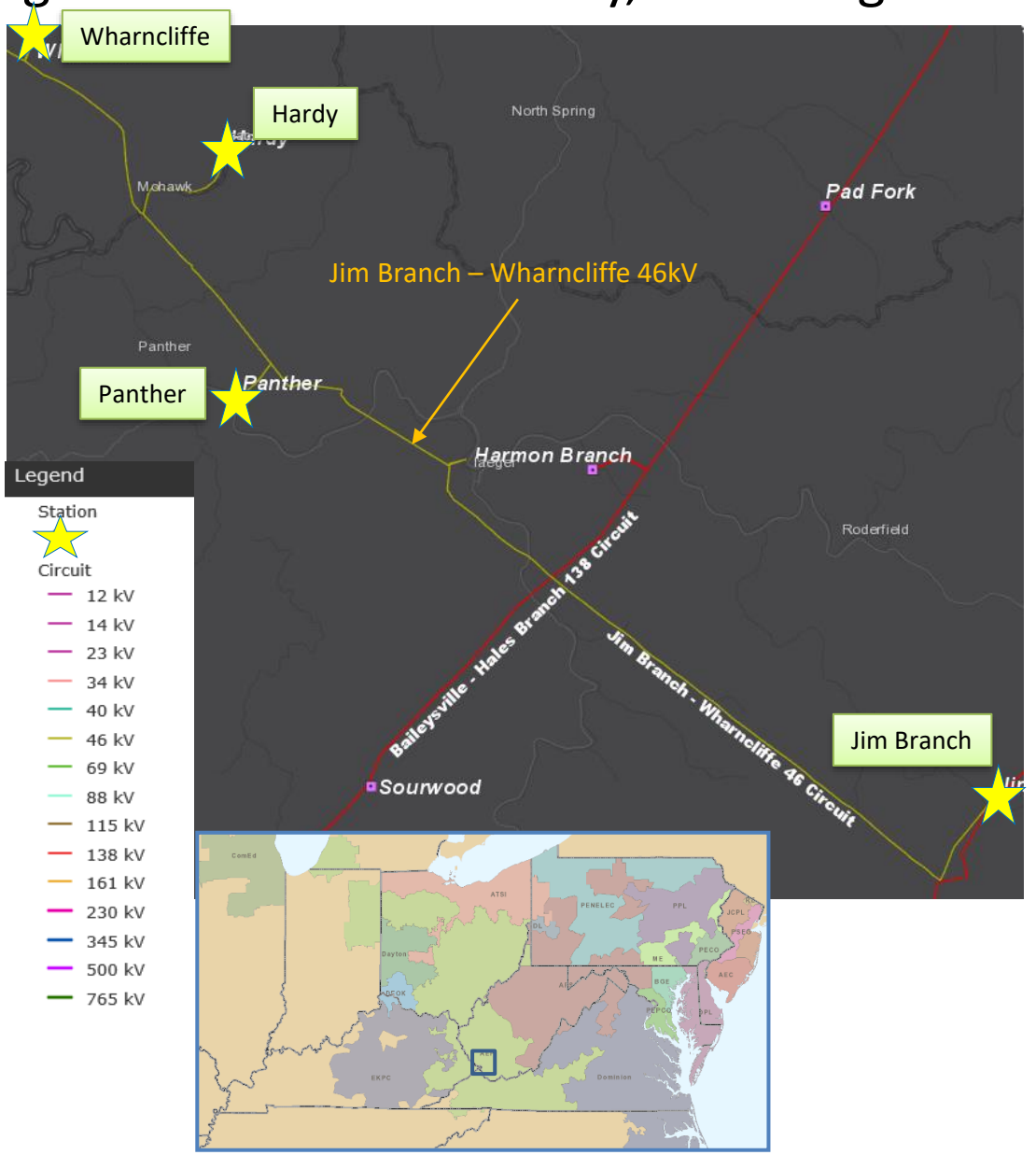
Original Line Construction Type: Wood

Conductor Type: 1/0 Copper, 2/0 Copper, #2 ACSR, 4/0 ACSR, 176,900 ACSR, 556,500 ACSR

Momentary/Permanent Outages: 29 Momentary and 20 Permanent

Line Conditions:

- The momentary outages were attributed to lightning (24), wind (3), relay mis-operation (1), unknown (1), and distribution (1) causes. The permanent outages attributed to vegetation contacts from outside the AEP ROW (12), lightning (4), pole failure (1), failed insulator (1), ice/snow (1), and relay mis-operation (1) causes. The large number of lightning caused outages is due to 65% of the circuit lacking shield wire.
- The permanent outages caused 2.62M minutes of interruption for 11,744 customers at Panther and Hardy substations.
- The line structures fail to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements.
- 134 of the 162 structures are 1930s vintage or older accounting for 83% of the structures. These structures have conditions like top rot, Woodpecker damage, split top, heart rot, base rot, bowing, and corroded hardware.



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

Need Number: AEP-2022-AP010

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

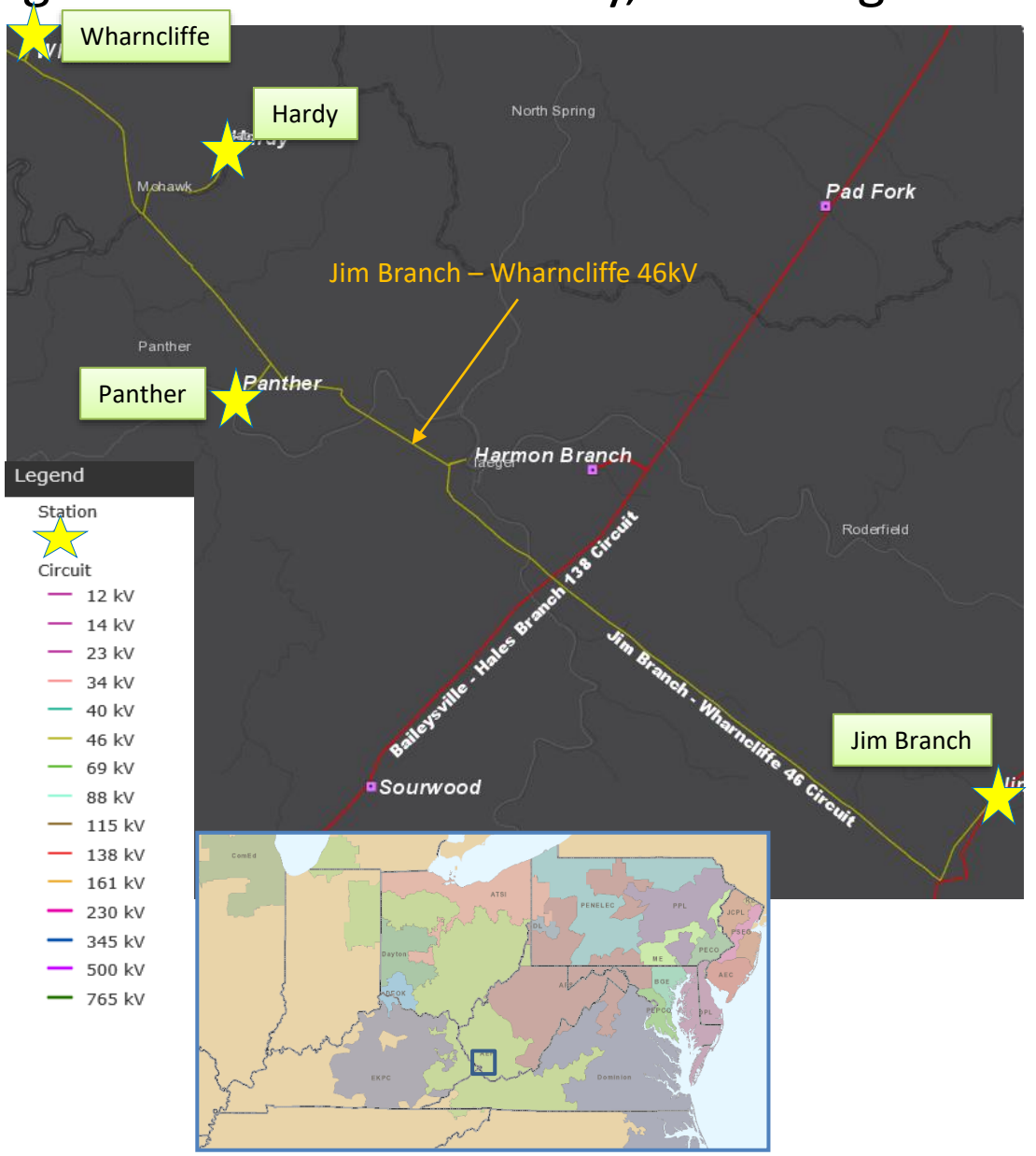
Specific Assumption Reference:

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

Jim Branch – Wharncliffe 46 kV Continued:

Line Conditions Con't:

- The majority of the line has no static wire, making it inadequate for AEP current shielding angle requirements.
- The butt wrap grounding and typical shield angle is inadequate per current AEP Standards and can cause poor lightning performance. The current grounding system, poor shielding angle, and the electrical strength of the insulators do not meet current AEP and industry accepted criteria, making the line susceptible momentary and permanent outages, affecting customer reliability.
    - The inadequate grounding limits the available path to ground during any type of line fault, increasing the intensity the conductor and related hardware have to withstand during the fault. The reduced electrical strength of the insulators could lead to electrical damage to structures and hardware during a fault if the insulator were to fail from elevated electrical stresses.
    - The line serves a peak load of 7 MVA at Hardy and Panther stations.



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

Need Number: AEP-2022-AP011

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Sprigg Station:

138/69 – 46kV Transformer #1

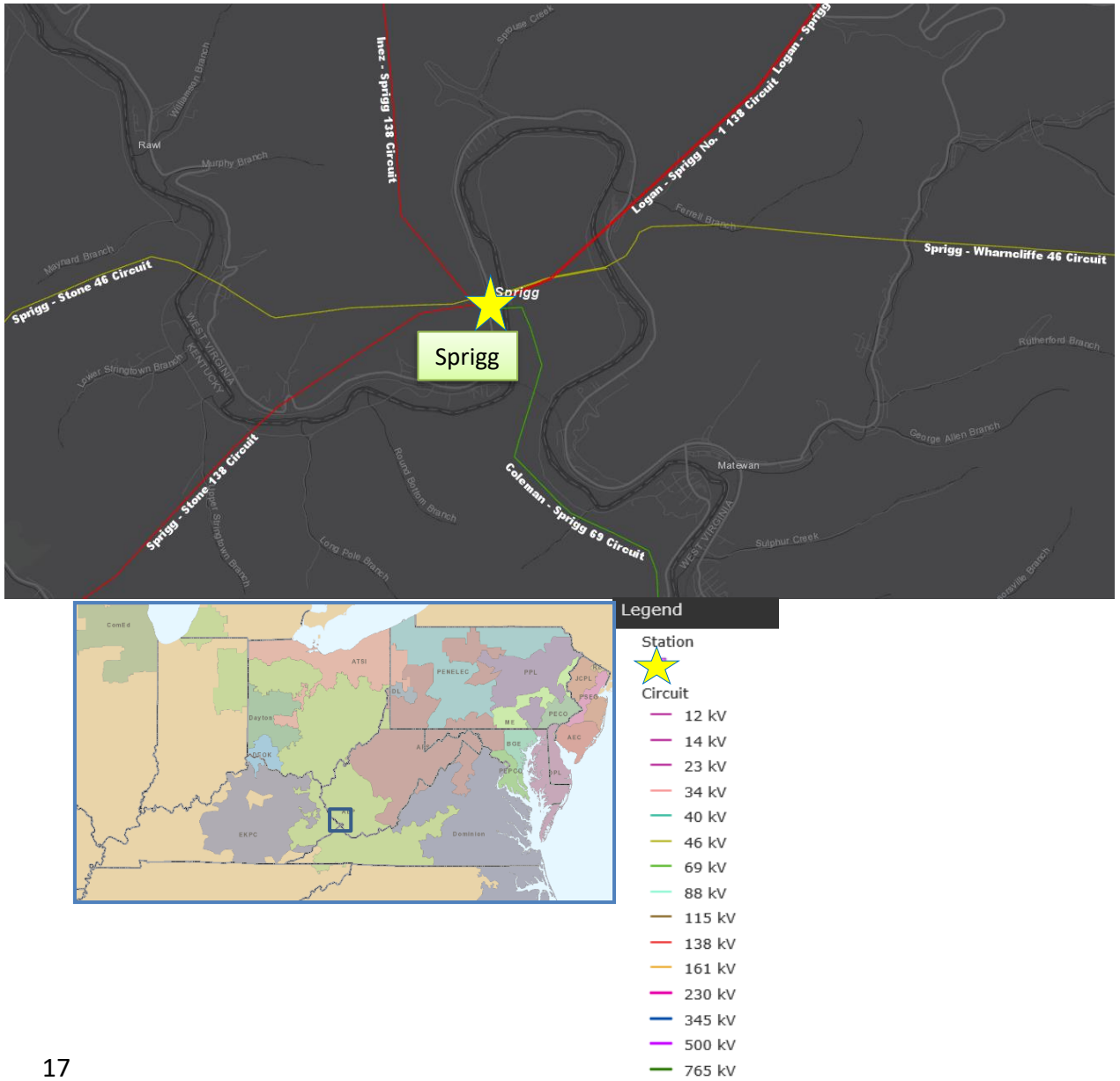
- 1971 Vintage Transformer
- The presence of Ethane, along with the indication of overheating faults, indicates decomposition of the paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
- The dielectric is driven by the upward trend in insulation power factor, which indicates an increase in particles within the oil.
- The transformer has elevated moisture levels that are a result of gasket leaks or breakdown in oil or paper/pressboard insulation.

46/7.2kV GND Bank

- 1972 Vintage Transformer
- The elevated levels of Acetylene indicate increased decomposition of the paper insulating materials. The dielectric is driven by the upward trend in insulation power factor, which indicates an increase in particles within the oil.
- The transformer has elevated moisture levels that are a result of gasket leaks or breakdown in oil or paper/pressboard insulation.

Relays

- There are 82 electromechanical and 3 static 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.



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

Need Number: AEP-2022-AP011

Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Sprigg Station Continued:

138kV Circuit Breakers A, B, C, D, and S

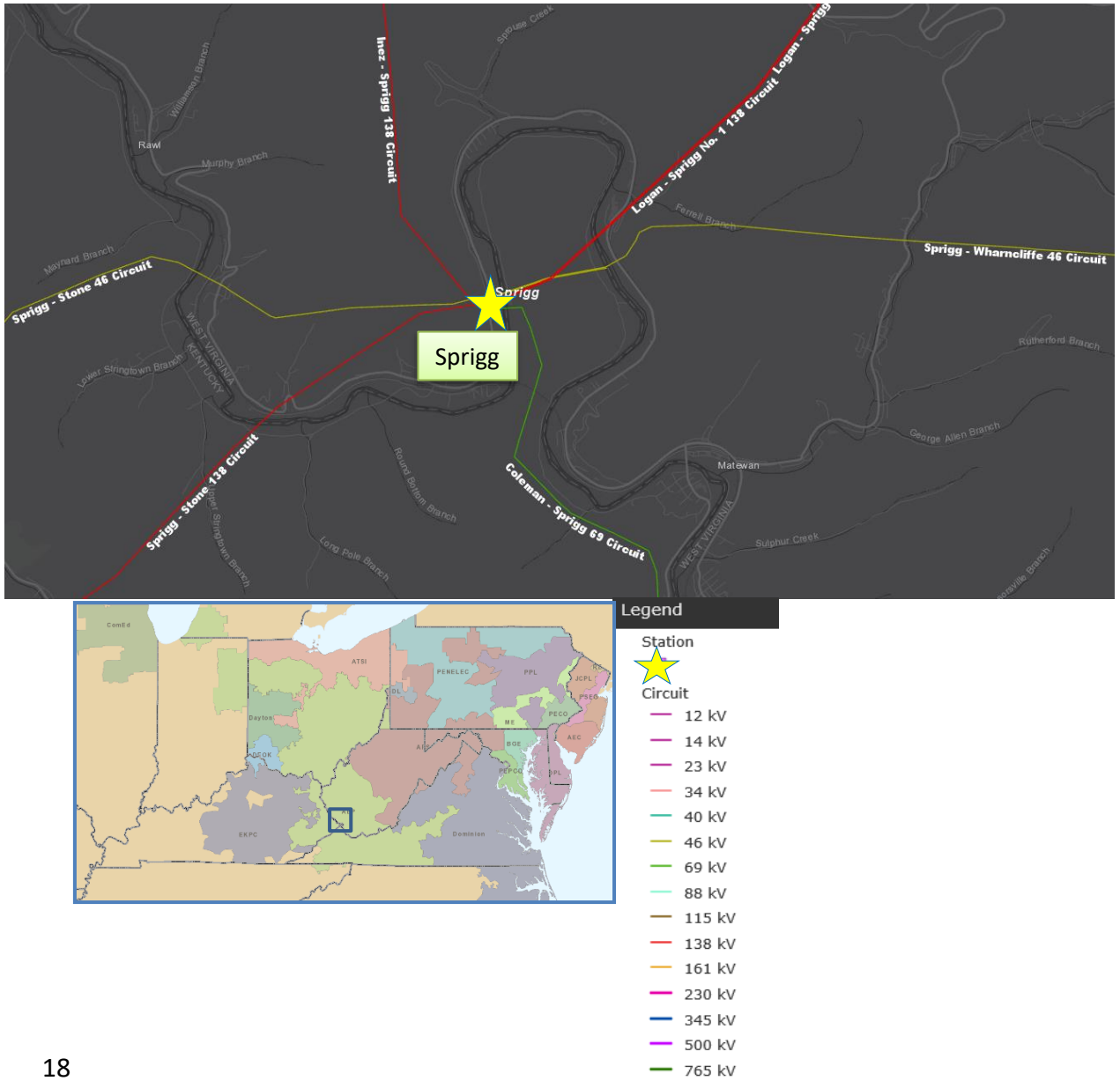
- A, B, C, and D are 1987 vintage and S is 1990 vintage SF6 filled circuit breakers.
- The manufacturer provides no support for these types of breakers and there are no spare parts available for these breakers.
- Circuit Breaker A, B, C, & D, have each exceeded the manufacturer's recommended number of fault operations. Circuit Breaker S has experienced 6 low gas level malfunctions since December 2013. The age of the seals are causing the SF6 leaks to happen more frequently.

46kV Circuit Breakers H and N, 69kV Circuit Breaker T

- Circuit breaker H is 1960 vintage and N and T are 1972 vintage with all being oil filled without containment. The manufacturer provides no support for this fleet of circuit breakers and spare parts are not available. The breakers have oil contamination from aging gaskets allowing moisture and other particles to ingress.
- Circuit Breaker H, N and T have each exceeded the manufacturer's recommended number of fault operations.

Station conditions and Flooding

- The Station and Control House has experienced many floods in the past (1957, 1963, 1977 and 2002).
- Foundations are crumbling in the 46kV yard and the 138kV yard.



AEP Transmission Zone M-3 Process
Smith Mountain, VA Area

Need Number: AEP-2022-AP012

Process Stage: Needs Meeting 2/18/2022

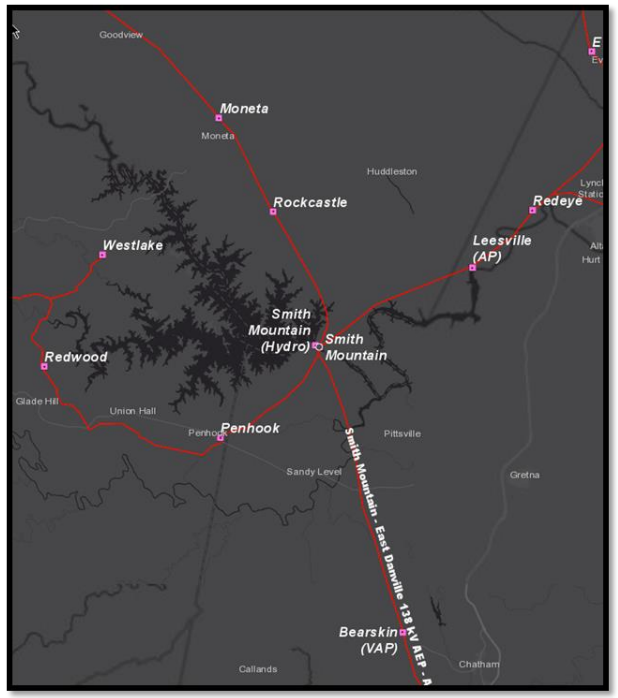
Supplemental Project Driver: Equipment Condition/Performance/Risk, Operational flexibility

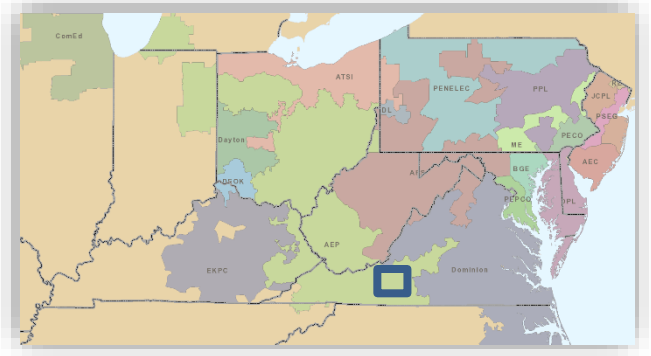
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13, 14)

Problem Statement:

Smith Mountain Station:

- **138 kV Circuit Breakers (A, A1, A2, B, B1, B2, C, C1, C2, and D2)**
  - Smith Mountain Station has ten 138 kV transmission owned circuit breakers (A, A1, A2, B, B1, B2, C, C1, C2, and D2) which are HVB145 type, SF6 filled breakers. These breakers are of 1990's or 2000's vintage. Most of these circuit breakers (A, A2, B, B2, C, C1, C2, and D2) have exceeded the manufacturer's recommended number of fault operations.
  - The HVB145 model family has the propensity to mechanically pump close instead of locking open as it awaits an electrical close command from the relaying. This presents a high mis-operation risk on the system. The mechanisms have been a significant source of trouble during recent cold weather events. Also, this model family has a high occurrence of SF6 gas leaks.
  - At Smith Mountain Substation, there have been over 40 malfunction records in IPS indicating low gas or gas being added to these circuit breakers. This is an environmental concern since SF6 is a potent greenhouse gas with a high climate change potential, and its concentration in the earth's atmosphere is rapidly increasing. In addition, low SF6 causes operational issues with the breaker which can lead to excessive maintenance of closing contacts or failure. The HVB breakers have had some failures due to slow tripping with the breakers not reclosing faster than 20 cycles.
- **Relaying**
  - Smith Mountain Substation currently deploys 50 relays, implemented to ensure the adequate protection and operation of the substation. Currently, 39 of the 50 relays (78% of all station relays) are in need of replacement. There are currently 25 electromechanical type and 6 static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. In addition, there are 8 microprocessor relays that utilize legacy firmware.
- **Operational flexibility**
  - Currently, hydro generators #1 and #5 are connected directly to the 138 kV Bus #2 via a motor operated air-break switch (MOAB). Today, 138 kV breakers A2, B2, C2 and D2 are required to operate until the MOAB is able to sectionalize the fault. Every time Generation needs to be isolated by the 138kV MOAB X2, 138 kV Bus #2 must have a momentary outage to allow the MOAB to be opened.





AEP Transmission Zone M-3 Process
Wythe County, Virginia

Need Number: AEP-2022-AP013

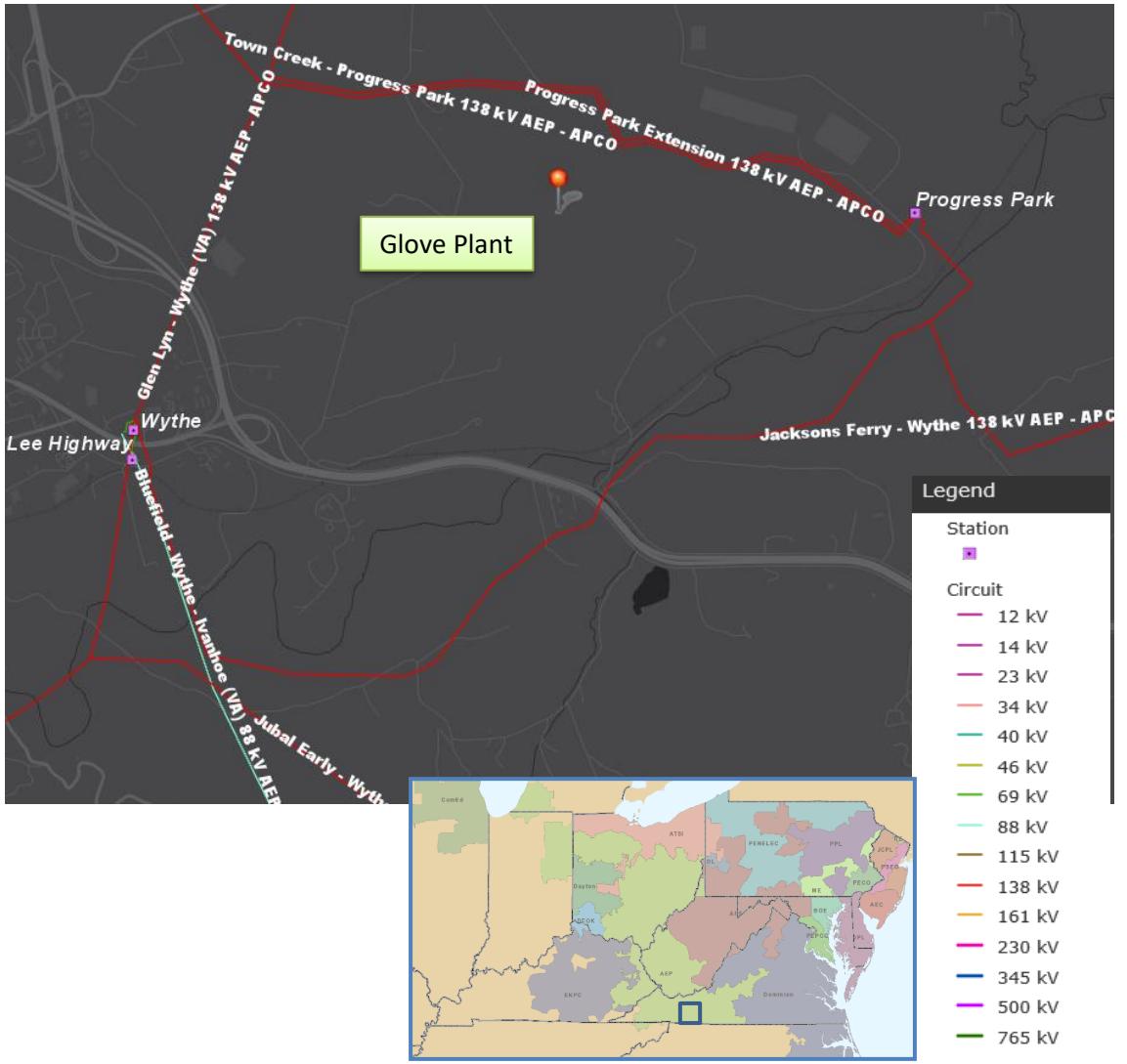
Process Stage: Need Meeting 2/18/2022

Supplemental Project Driver: Customer Service

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

Problem Statement:

- AEP Distribution has requested a new delivery point (Glove Plant).
- A customer is constructing a manufacturing facility which will bring on a load that is projected to grow to 59.5MW by May 2026.



Need Number: AEP-2022-AP014

Process Stage: Needs Meeting 2/18/2022

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 near Apple Grove, WV by the end of 2024.

Projected load: 450 MVA

AEP Transmission Zone M-3 Process
Beckley, WV

Need Number: AEP-2022-AP015

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

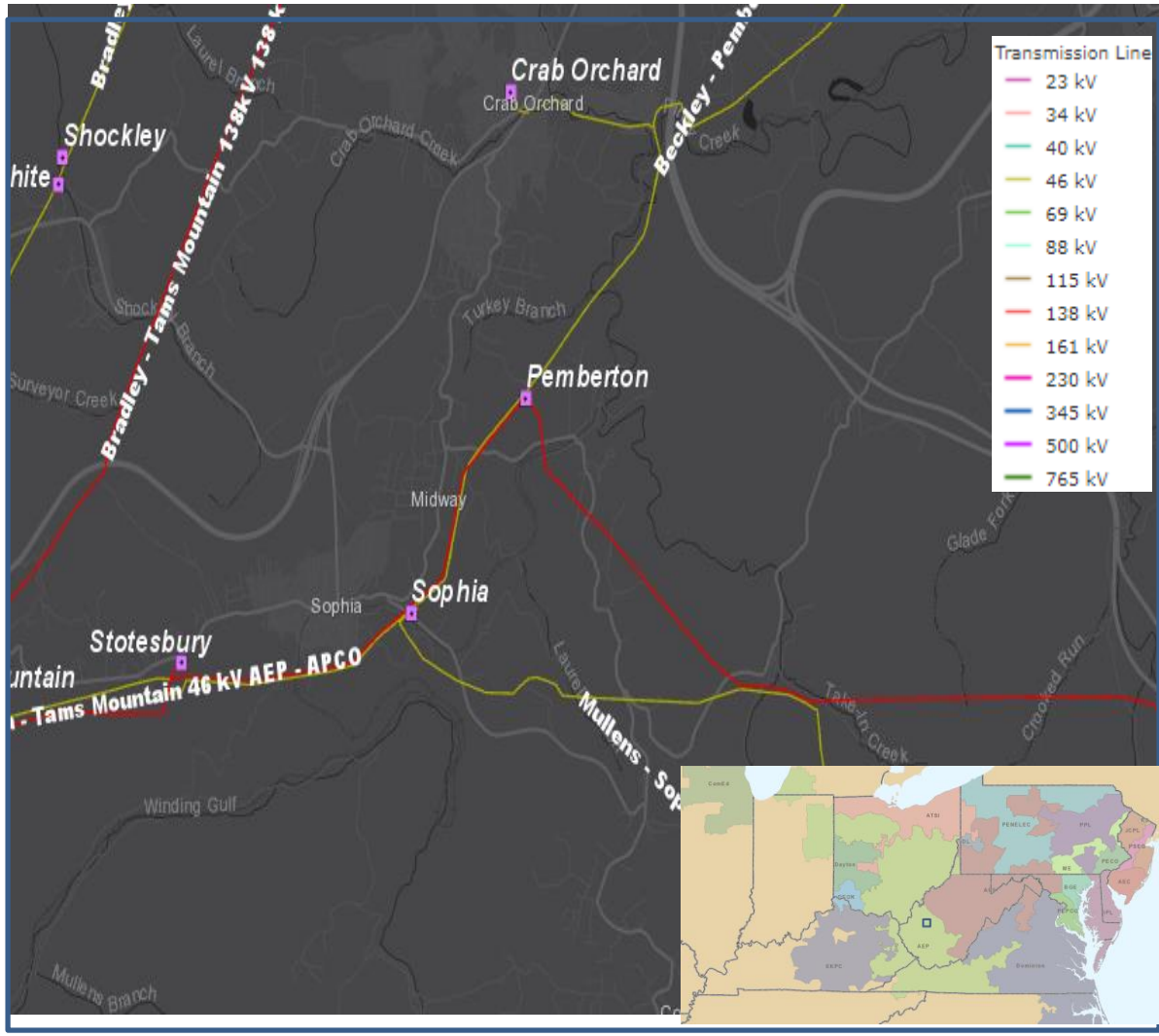
Specific Assumption Reference:

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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP016

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

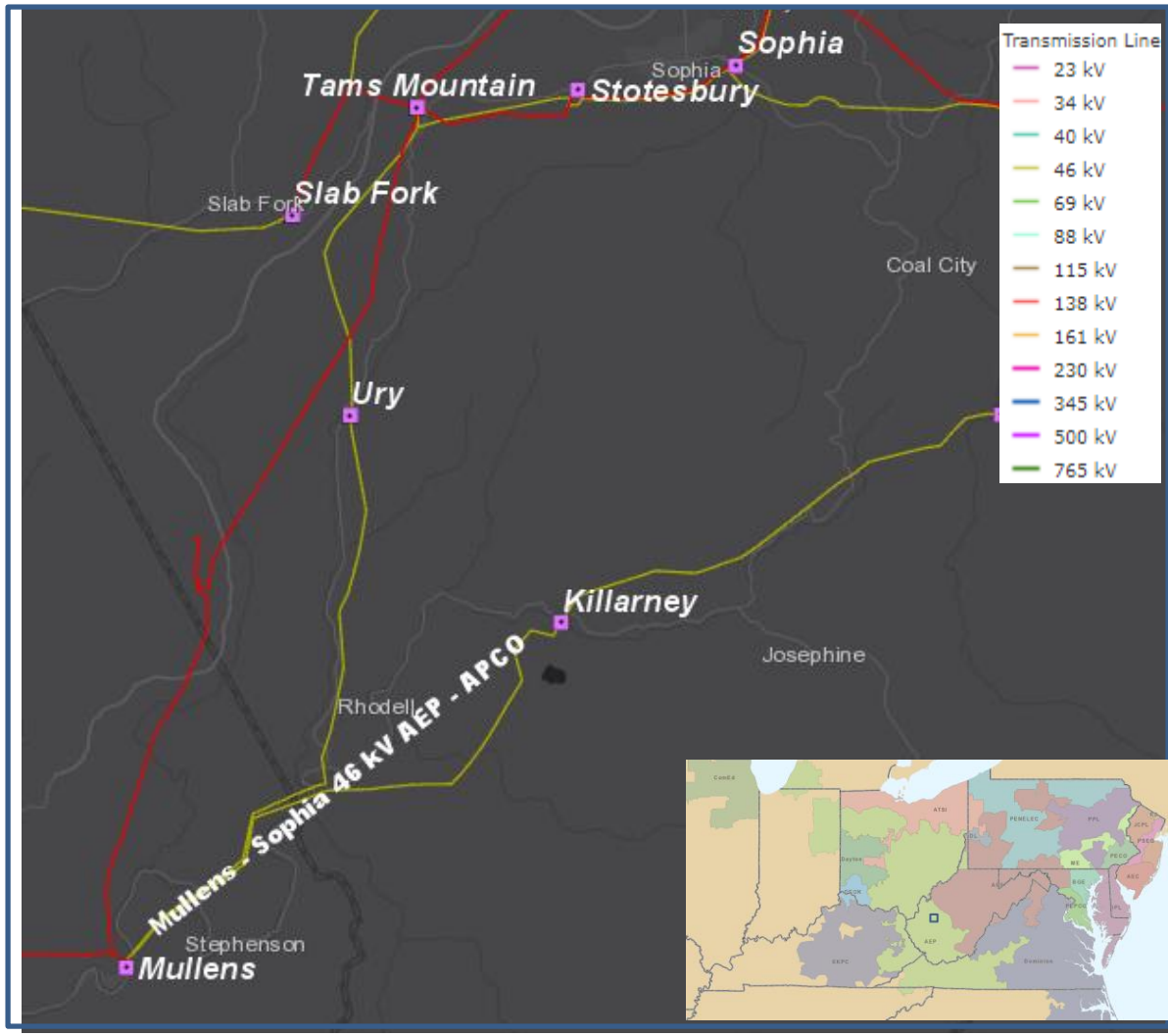
Specific Assumption Reference:

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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP017

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Mullens – Sophia 46 kV (~18 miles)

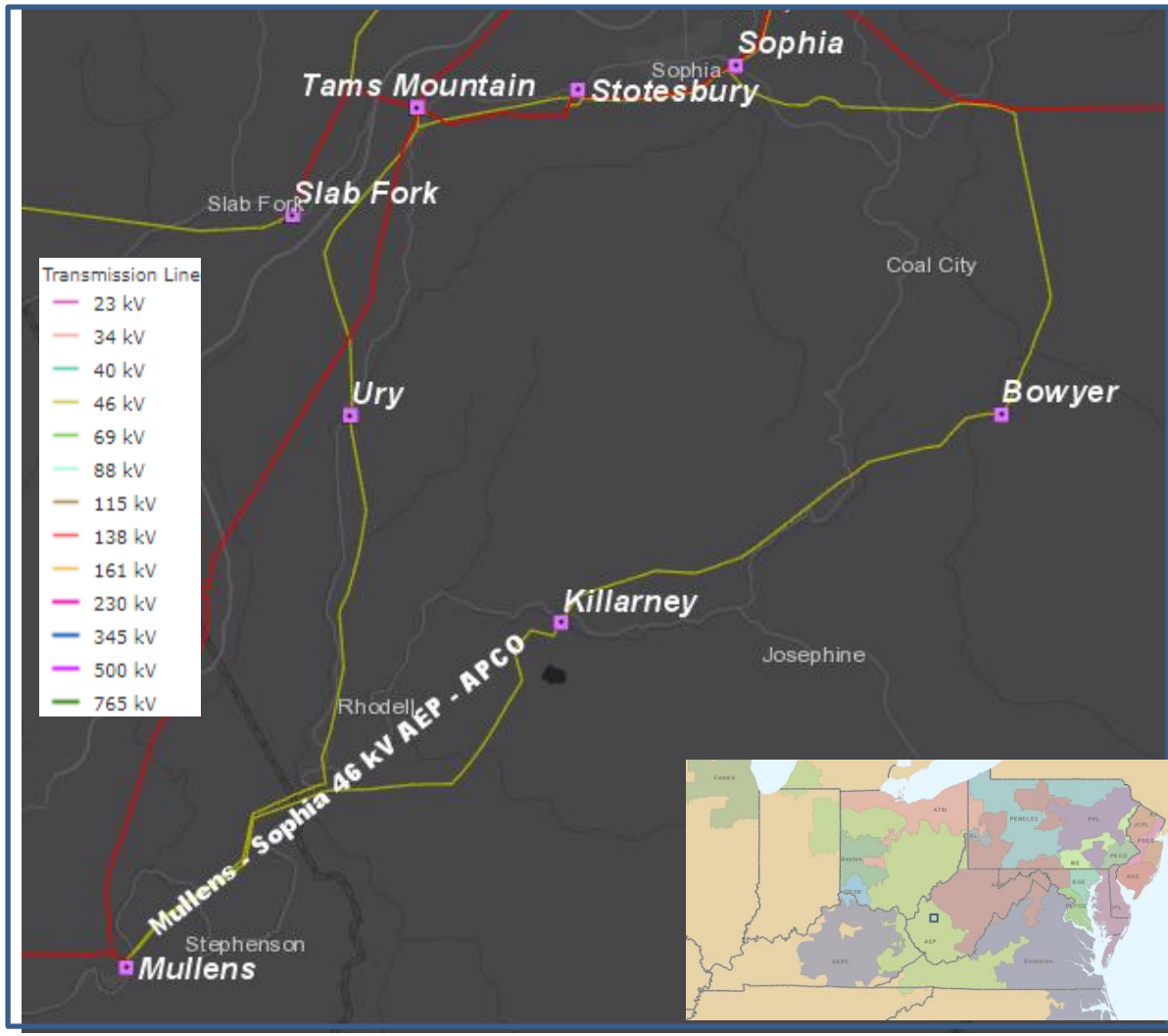
- Originally constructed in 1914
- Primarily consists of 1914 vintage wood poles (79%) and lattice steel structures (4%)
- Conductor primarily consists of 1951 vintage copper conductor and 1951 vintage 3/0 ACSR conductor
- Since 2015, there have been 19 momentary and 8 permanent outages on the Mullens – 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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP018

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

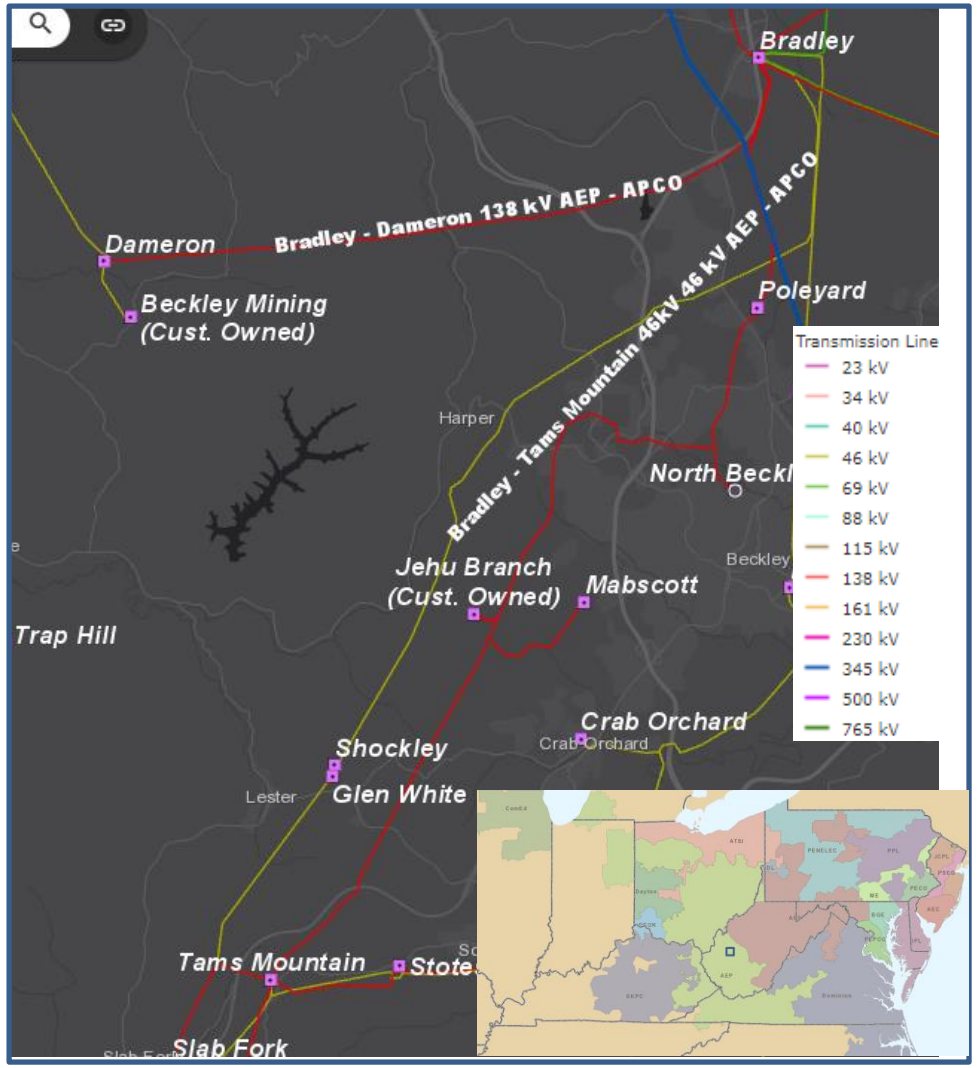
Specific Assumption Reference:

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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP019

Process Stage: Need Meeting 2/18/2022

Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP020

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Sophia – Tams Mountain 46 kV (~4 miles)

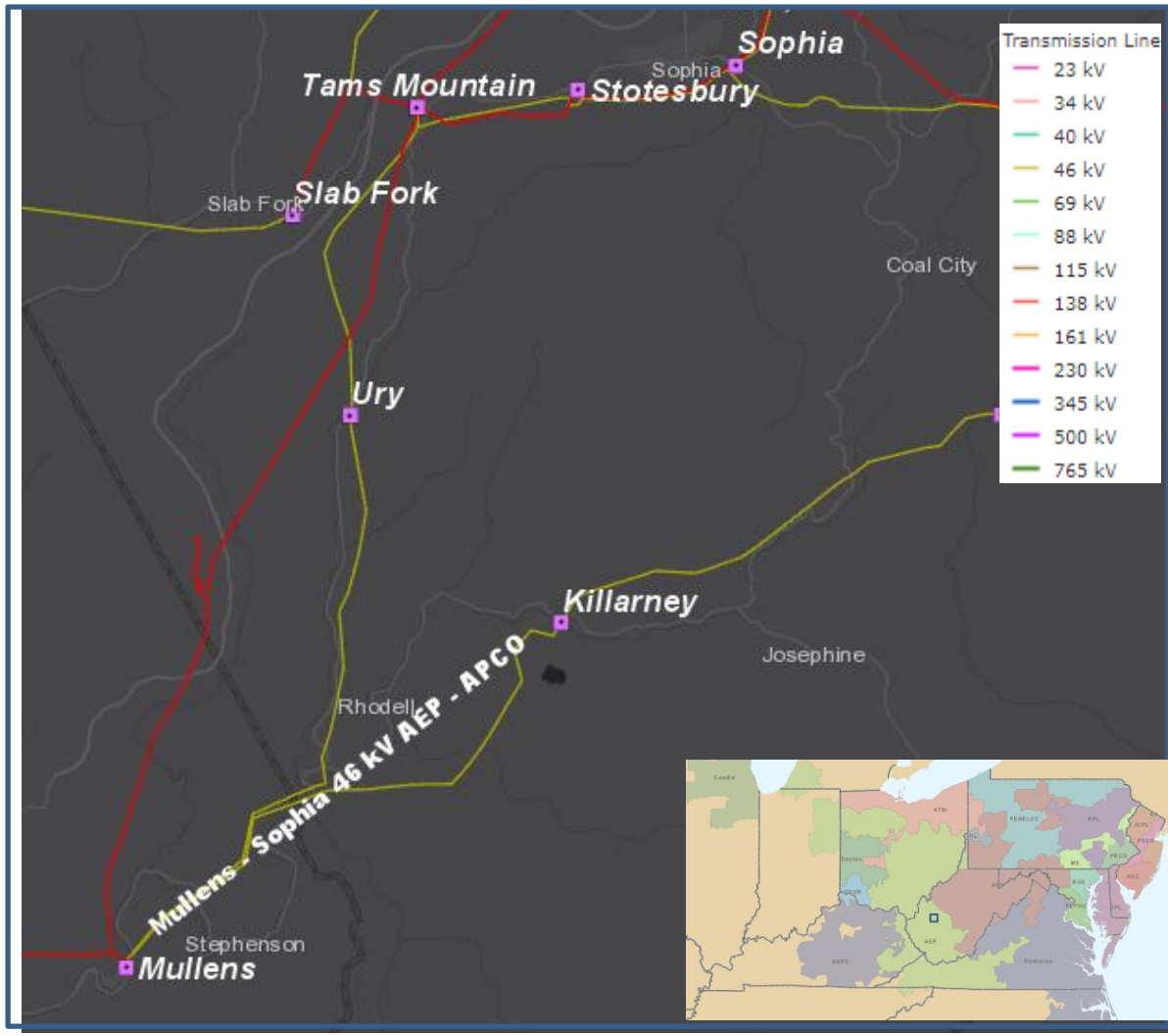
- Originally constructed in 1915
- Consists of 1915 vintage wood (65%) and steel lattice structures (33%)
- Conductor consists of 1915 vintage copper conductor and 556 ACSR
- Since 2014, there have been 2 momentary and 1 permanent outages on the Sophia – Tams Mountain 46 kV circuit.
    - Momentary outages 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 M-3 Process
Beckley, WV

Need Number: AEP-2022-AP021

Process Stage: Need Meeting 2/18/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Beckley – Bradley 46 kV (~7 miles)

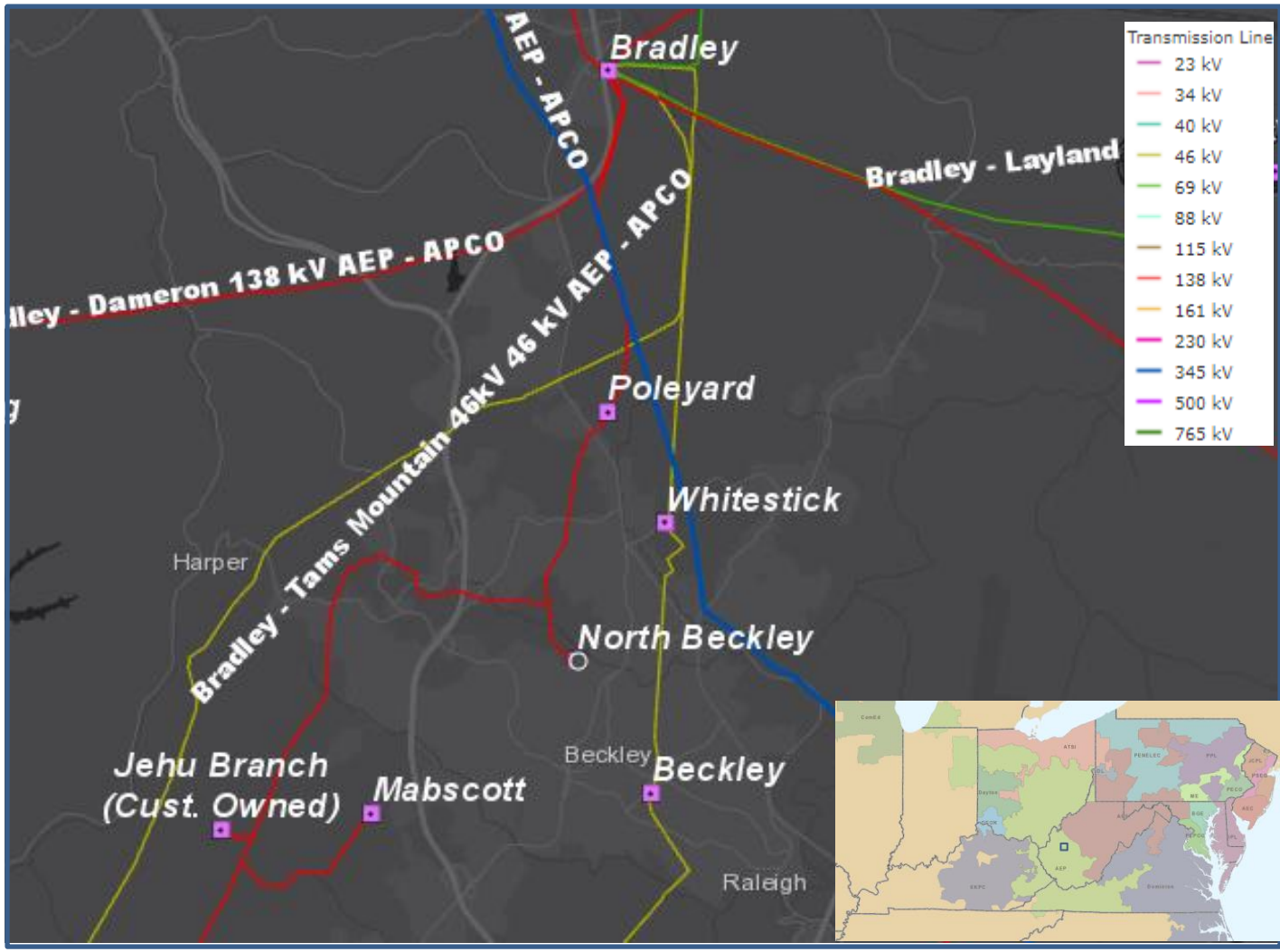
- Originally constructed in 1913
- Consists of 1913 vintage steel lattice towers and wood poles (40%) and 2002 wood poles (56%)
- Conductor consists of 1913 vintage 3/0 Copper (92%) and some 2005 vintage 556 ACSR
- Since 2015, there have been 43 momentary and 1 permanent outages on the Beckley – Bradley 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 M-3 Process
Muncie, IN

Need Number: AEP-2022-IM006

Process Stage: Need Meeting 2/18/2022

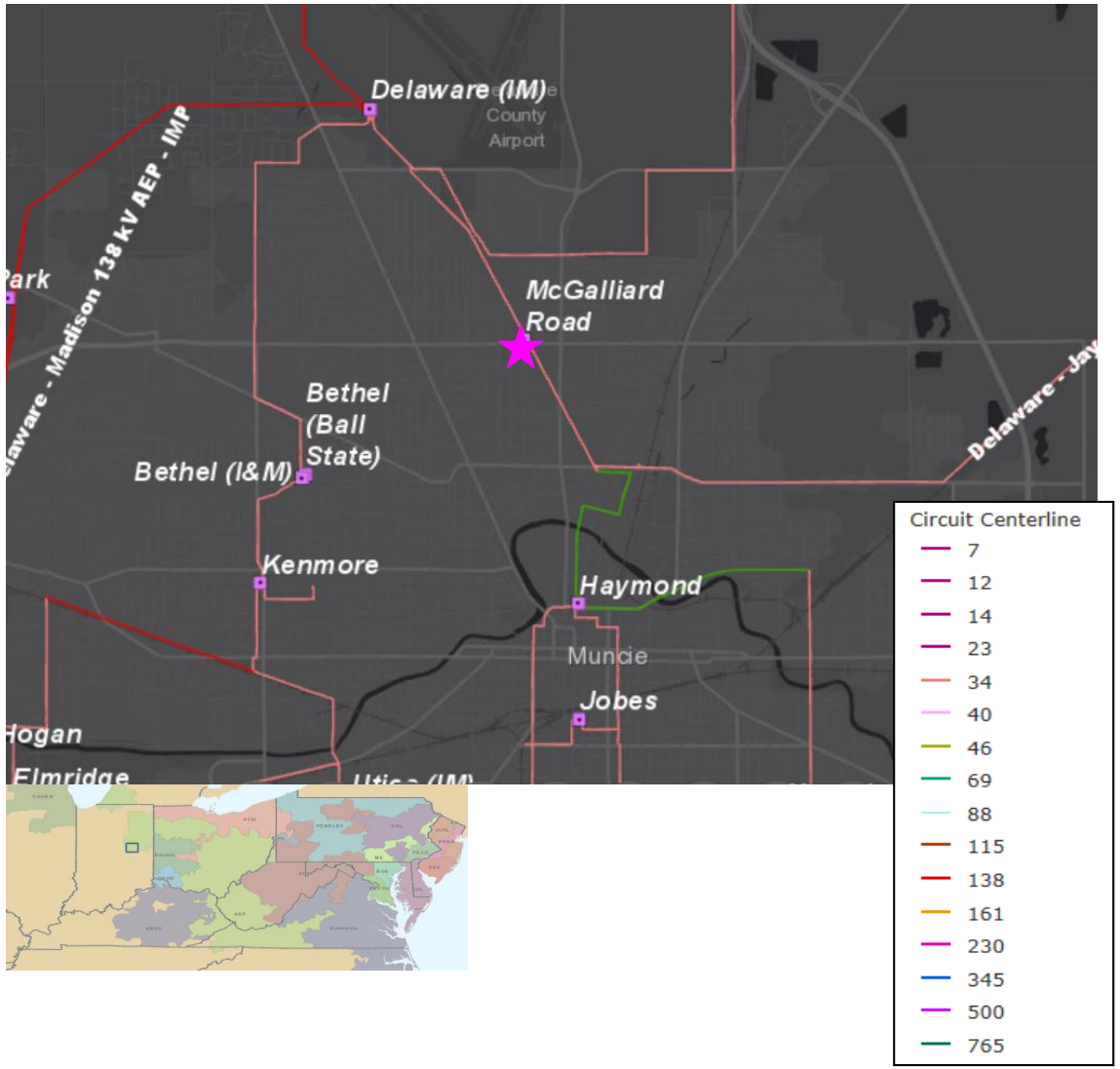
Project Driver: Equipment Material Condition, Performance and Risk

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

Problem Statement:

McGalliard Road 34.5 kV:

- The McGalliard Road 34.5 kV Moab switches "A" and "B" have Delta Star SF22 mechanisms that are no longer supported by the manufacturer
- Both switches are over 70 years old
- The 34.5 kV Moab "A" is a center break switch that is in a deteriorated condition and is no longer supported by the manufacturer
- The 34.5 kV Moab "B" is a vertical break switch that does not fully open and is in a deteriorated condition
- The structure foundations are in deteriorating condition
- Need on the switches was identified with Distribution concerns around 12kV equipment at the station



AEP Transmission Zone M-3 Process
Berne, IN

Need Number: AEP-2022-IM008

Process Stage: Need Meeting 2/18/2022

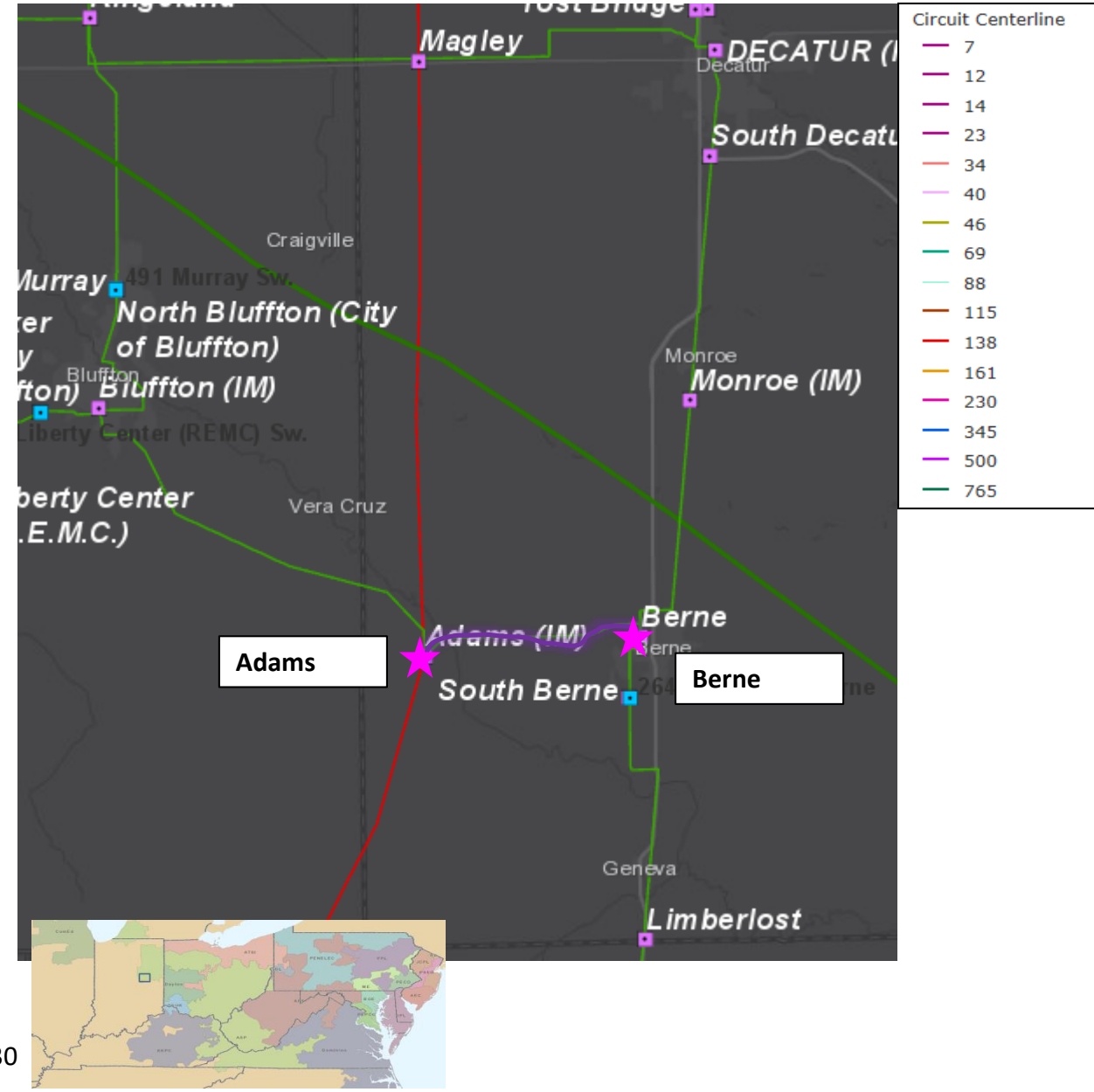
Project Driver: Equipment Material Condition, Performance and Risk

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

Problem Statement:

Adams – Berne 69 kV (Vintage 1956)

- Length of Line: 4.90 miles
- Total structure count: 46 with 45 dating back to original installation.
- Line Construction Type:
  - Wood H-frames, guyed 3-pole wood structures, single wood poles
  - Legacy brown porcelain horizontal line post insulators which are prone to base or cap separation failures.
- Conductor Type:
  - 556,500 CM ALUM/1350 19 Dahlia
- Condition Summary
  - Momentary outages: 2
  - Number of open conditions: 17 structure open conditions with 6 structure related open conditions.
    - Open conditions include X-brace, knee brace, pole insect damage, broken poles, pole rot conditions and missing ground lead wire.
  - Ground crew and aerial drone assessment also identified:
    - Insect damage found at braces and arms.
    - Ground line heart and or shell rot found at 50% of the structures assessed by the crew. Cross arms are splitting or have decay pockets at 12% of the H-frame structures.
    - Broken ground down leads at 40% of the structures
    - Damaged horizontal posts due to flash-over
    - Moderate to advanced wood decay from insect and bird damage
  - The grounding method utilizes butt wraps on every other structure, providing reduced lightning protection for the line.



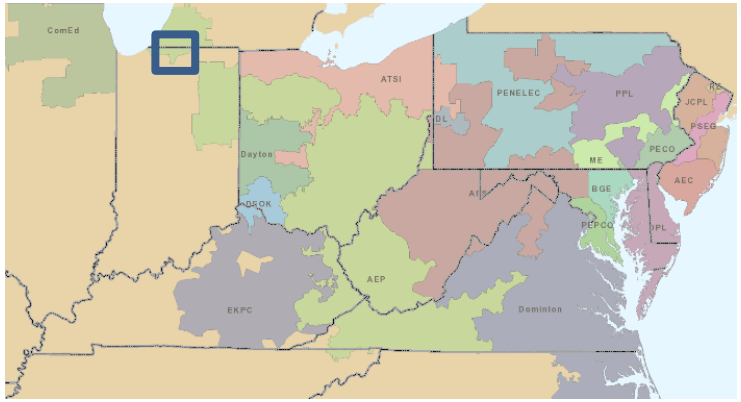
AEP Transmission Zone: Supplemental
St. Joseph County, IN

Need Number: AEP-2022-IM009
Process Stage: Needs Meeting 2/18/2022
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Edison 138kV

- Circuit breakers A, B, and C are 1988 138kV 145-PA type breakers.
  - As of May 11, 2020, there have been 437 recorded malfunctions of this 145-PA model family on the AEP System. The most common issues are related to loss of SF6 gas and mis-operations. The expected life of the bushing gaskets and door inspection port seals is 25 years; these units have reached this age. Seals that are no longer adequate cause SF6 leaks to become more frequent. SF6 leaks impact the environment. The manufacturer provides no support for this family of circuit breakers and spare parts are not available.
  - Circuit breaker C has experienced 12 fault operations, which is over the manufacturer's recommendation of 10



AEP Transmission Zone M-3 Process
Steubenville, Ohio

Need Number: AEP-2022-OH025

Process Stage: Need Meeting 02/18/2022

Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Fort Steuben Station

Circuit Breakers: A, B, C, D, & I (69 kV)

- Breaker Ages: (1975 A, B, C, D, & I)
- Fault Operations: B 13, C 71 (recommended manufacturers limit: 10)
- These breakers are oil filled FK-type 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 this fleet of circuit breakers and spare parts are not available.

Relaying: 45 of the 45 relays (100% of all station relays) 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 are no longer supported by the vendor.

RTU: The existing RTU installed at Fort Steuben substation is a legacy RTU unit which is no longer supported by the vendor and has no spare part availability. It only has basic station alarm capabilities.

The 69kV bus #1 and #2 protection is a legacy scheme with no backup protection in place. The station has very little SCADA functionality, limiting real-time awareness of the station conditions.

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: Supplemental North Bluffton 69kV Load Addition

Need Number: AEP-2021-IM013
Process Stage: Solutions Meeting 2/18/2022
Previously Presented: Needs Meeting 03/19/2021

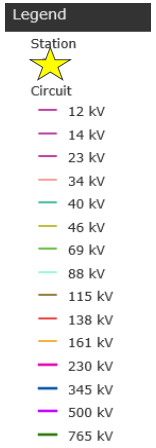
Supplemental Project Driver: Customer Request
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

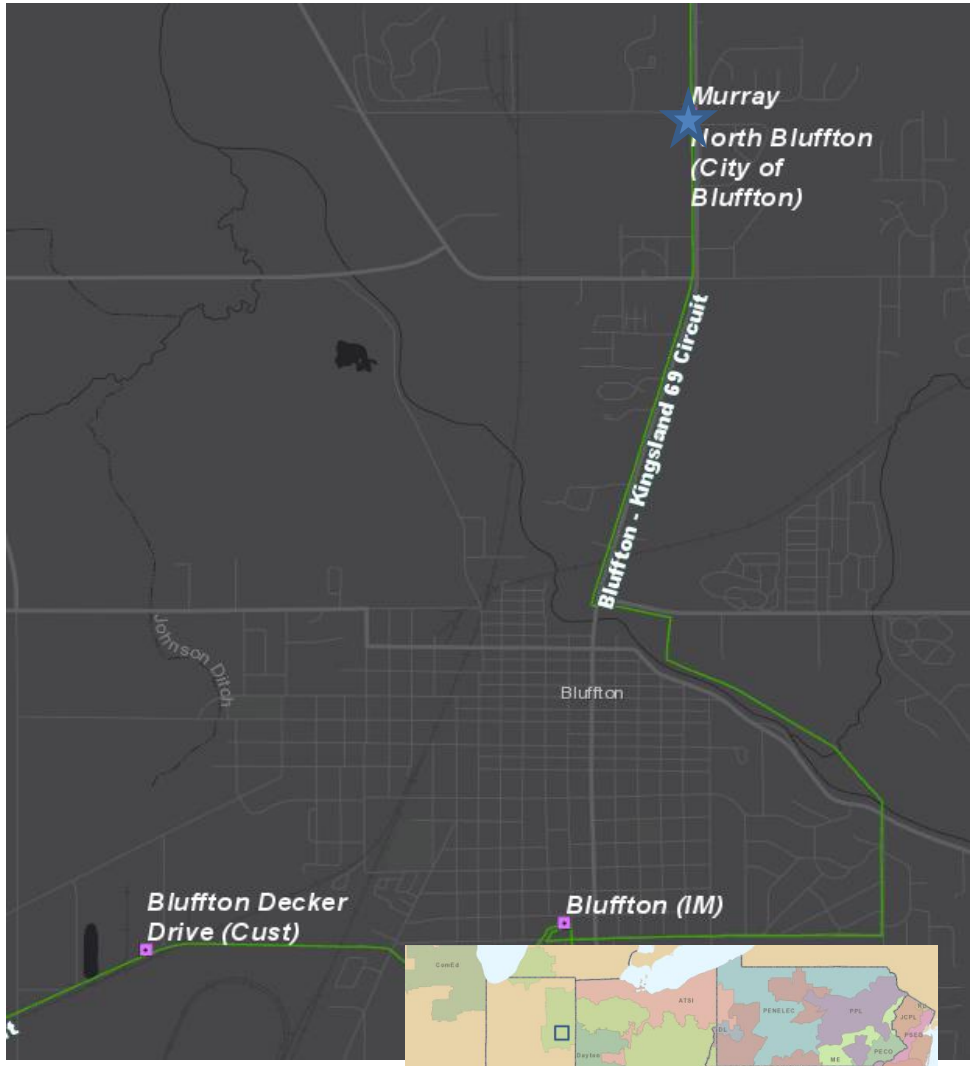
Problem Statement:

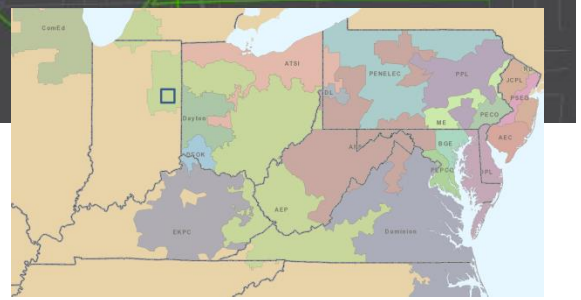
North Bluffton 69kV

- City of Bluffton has requested an expansion to their delivery point to serve a new 5MW load increase by November 1, 2021

Model: 2025 RTEP







AEP Transmission Zone: Supplemental
•North Bluffton 69kV Load Addition

Need Number: AEP-2021-IM013

Process Stage: Solution Meeting 2/18/2022

Proposed Solution:

North Bluffton 69kV Switch:
Install a new Switchpole to feed the new North Bluffton 69kV XFR.
Estimated Cost: $0.3M

Kingsland – Bluffton 69kV:
Cut the new pole at North Bluffton into the 69kV line.
Estimated Cost: $0.3M

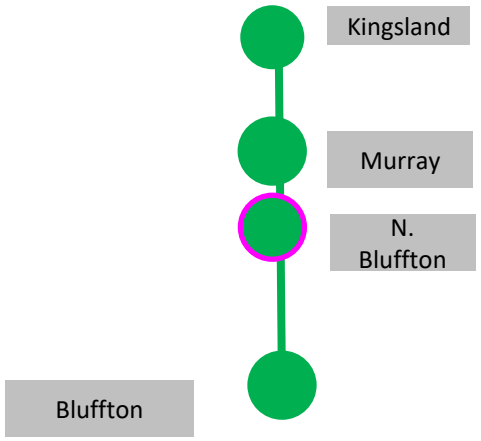
Total Estimated Cost: $ 0.6 Million

Alternatives:

Rebuild North Bluffton and Murray as a ring station to feed all three load points. This was not chosen due to added cost and required time to serve not meeting the customers timeline. In addition, the MPOI/FOI of this line did not necessitate the addition of a MOAB or a breaker.
Estimated Cost: $6M

Projected In-Service: 02/21/2022

Project Status: Scoping



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

AEP Transmission Zone M-3 Process
Babbitt 138 kV

Need Number: AEP-2021-OH058

Process Stage: Solutions Meeting 2/18/2022

Previously Presented: Need Meeting 11/19/2021

Project Driver:

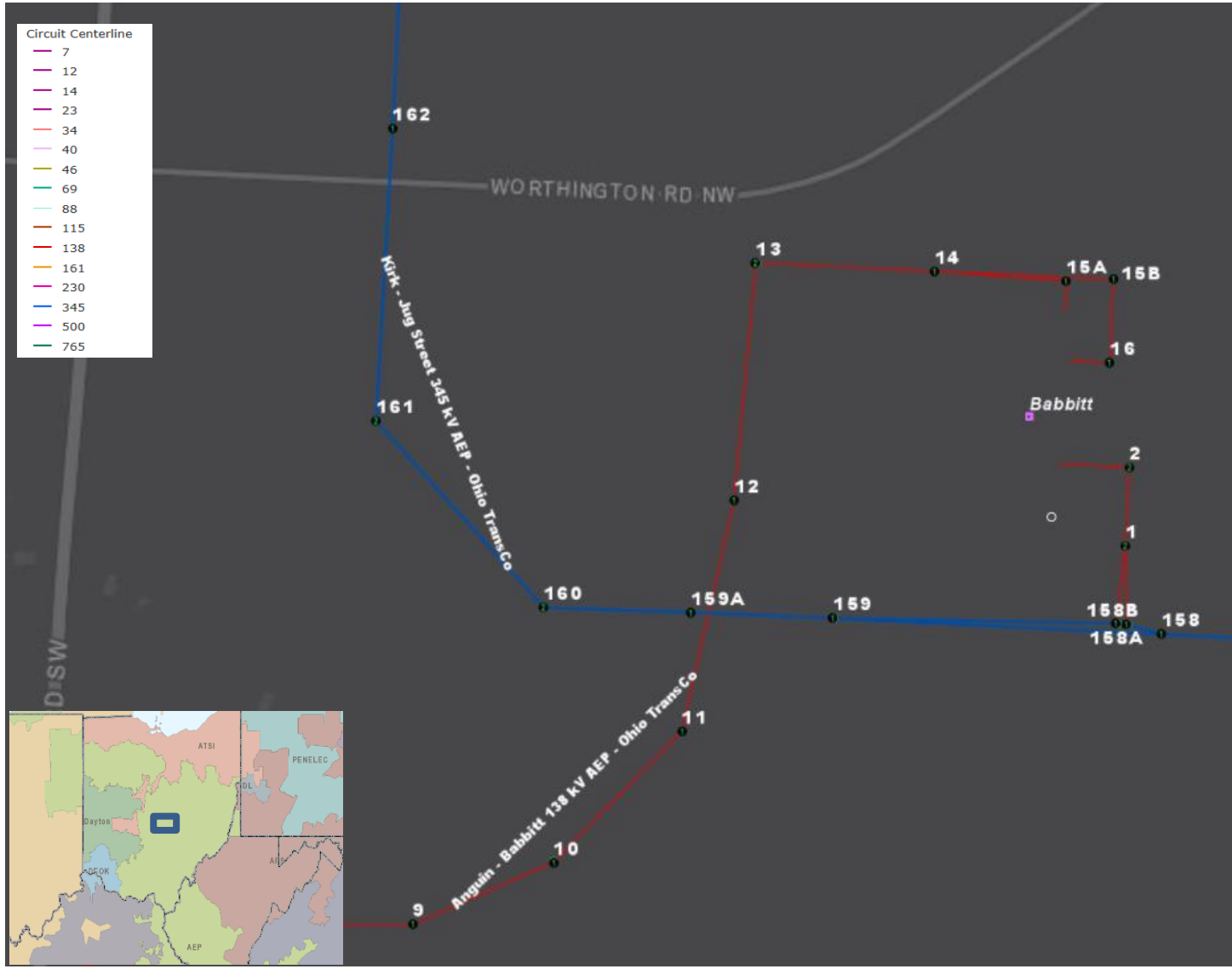
Customer Service

Specific Assumption Reference:

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

Problem Statement:

- AEP Ohio has requested a permanent capacity arrangement at Babbitt Station to replace the temporary skid station installed that is currently feeding long term load.
- **Model:** 2025 RTEP



Need Number: AEP-2021-OH058

Process Stage: Solutions Meeting 2/18/2022

Proposed Solution:

- **Babbitt 138 kV station:** Install (1) 138 kV 4000 A 63 kA circuit breaker & breaker control relays to accommodate the installation of a new 138/34.5 kV distribution bank at the station. **Estimated Cost: $0.7M** (Cost does not include the distribution scope of work to install the new permanent transformer)

Total Estimated Transmission Cost: $0.7M

Alternatives Considered:

Considering the location of the load and availability of space at Babbitt station, no other alternative was considered.

Projected In-Service: 9/01/2023

Project Status: Scoping

Model: 2025 RTEP

Need Number: AEP-2021-AP030

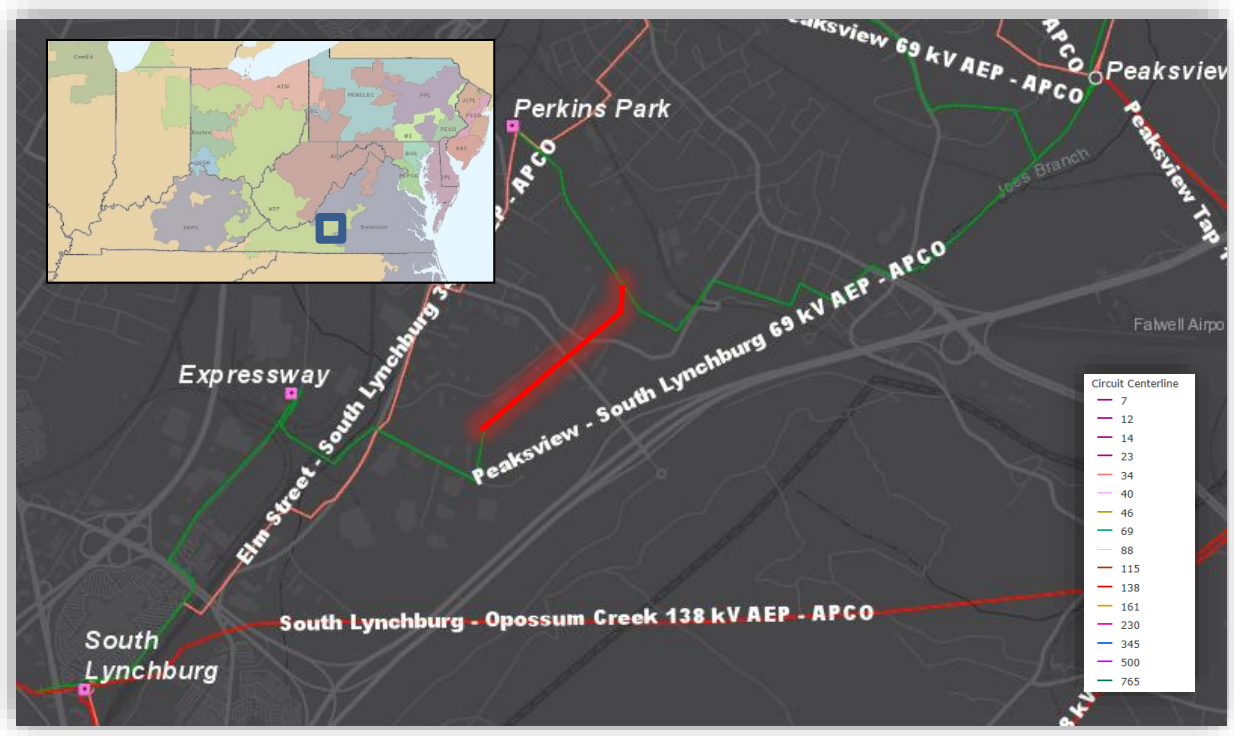
Process Stage: Solutions Meeting 02/18/2022
Previous Presented: Needs Meeting 09/17/2021
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

- **Peaksview-South Lynchburg 69 kV Line Asset**
  - 0.63 miles of 4/0 COPPER 7 conductor is 1938 vintage
  - Structures 443-43 to 443-49 are all wood poles
    - Structure 48 is 2004 vintage
    - 1 of the 3 poles of Structure 443-49 is 2001 Vintage
  - 2 Open Structural Conditions on this section (woodpecker damage and corroded cross-arms)

- **Performance**
  - 4 Permanent Outages for 37.5 Total Hours
    - 180,000 Customer Minutes of Interruption (CMI)
  - 16 Momentary Outages - Lightning (7), Distribution (3), Unknown (2), Station Insulator (1), Other Station Equipment (1), Animal (1) & Other (1)
  - Operational studies identified thermal overloads of this line section during upcoming scheduled construction outages in the area. Addressing the 4/0 COPPER section will allow for upcoming outages to continue without risk to load served in the area.



Need Number(s): AEP-2021-AP030

Process Stage: Solutions Meeting 02/18/2022

Proposed Solution:

Expressway-Perkins Park 69 kV

- Rebuild ~0.63 miles of 4/0 copper between Expressway and Perkins Park Tap 69 kV (Str.443-43 to Str. 443-49) **($1.71 M)**

Ancillary Benefits:

Per Energy Delivery Operations, during the beginning of the scheduled fall of 2023 outage when both the Boonsboro – Reusens 138 kV and Graves Mill – Reusens 138 kV lines are out related to PJM supplemental project s2192, the Expressway – Perkins Park 69 kV line section can overload as high as 143% for the loss of the Opossum Creek – South Lynchburg 138 kV circuit. Upgrading the 4/0 Cu overhead conductor will provide additional operational flexibility in order to sustain upcoming scheduled outages.

Alternatives Considered:

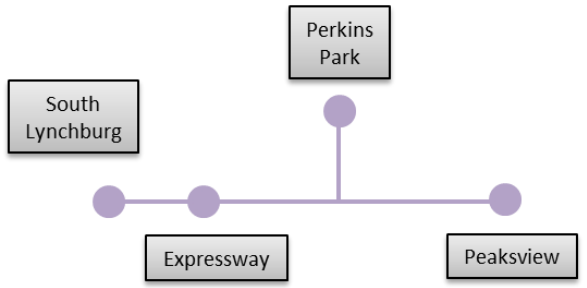
No viable cost effective solution was identified.

Estimated Cost: $1.71 M

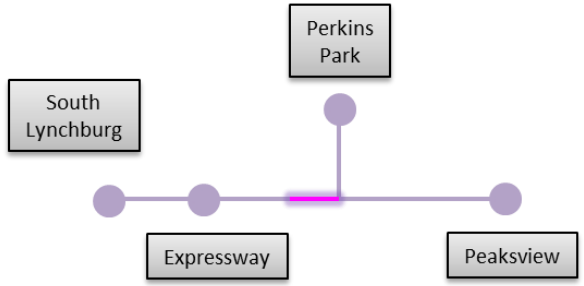
Projected In-Service: 10/31/2022

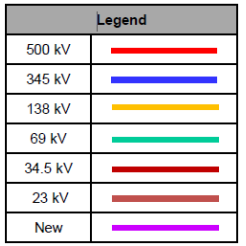
Project Status: Scoping

Existing



Proposed





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

Need Number: AEP-2020-AP043

Process Stage: Solutions Meeting 2/18/2022

Previously Presented: Need Meeting 11/20/2020

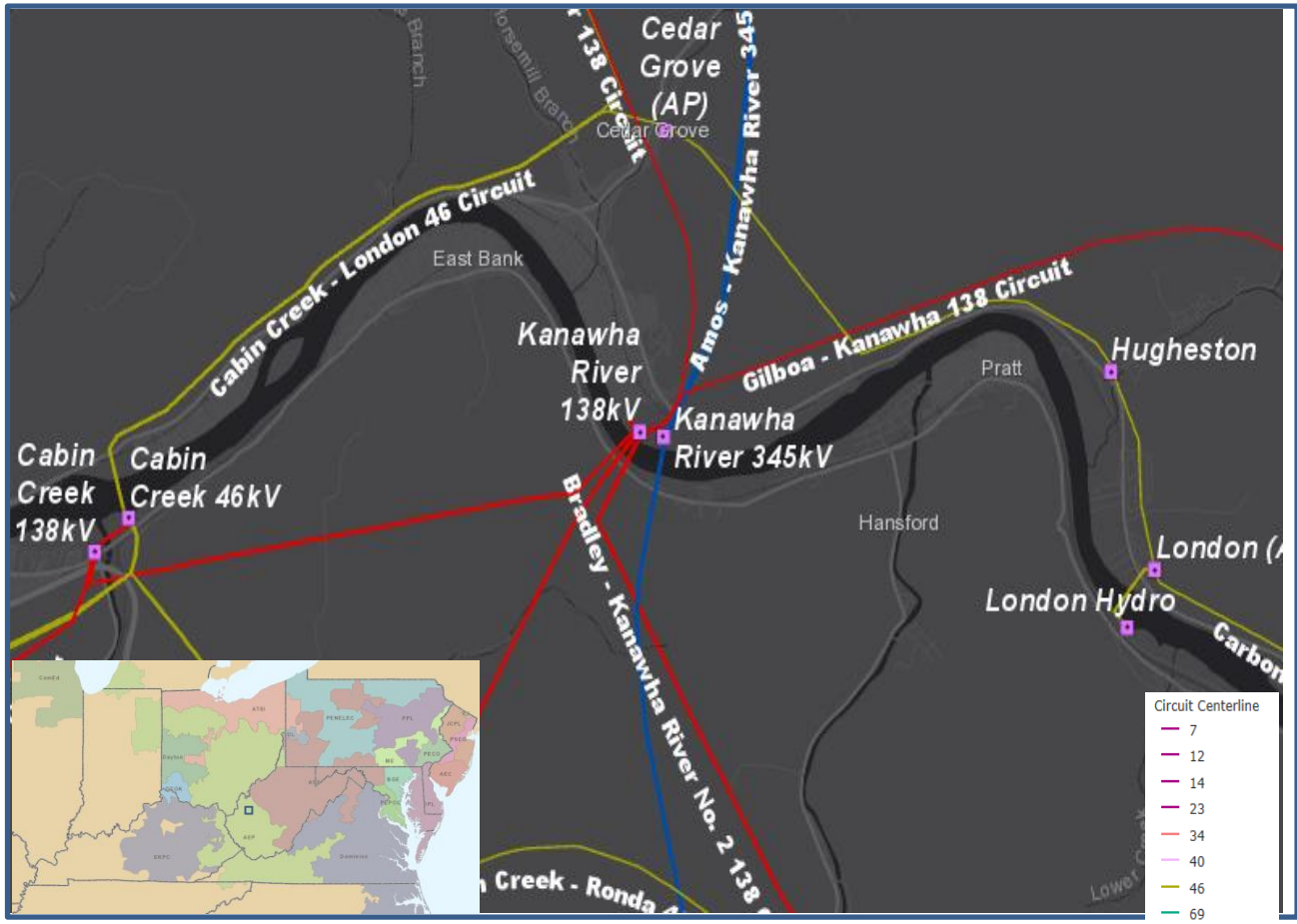
Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Cabin Creek – London 46 kV (8.35 miles)

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



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

Need Number: AEP-2020-AP045

Process Stage: Solutions Meeting 2/18/2022

Previously Presented: Need Meeting 11/20/2020

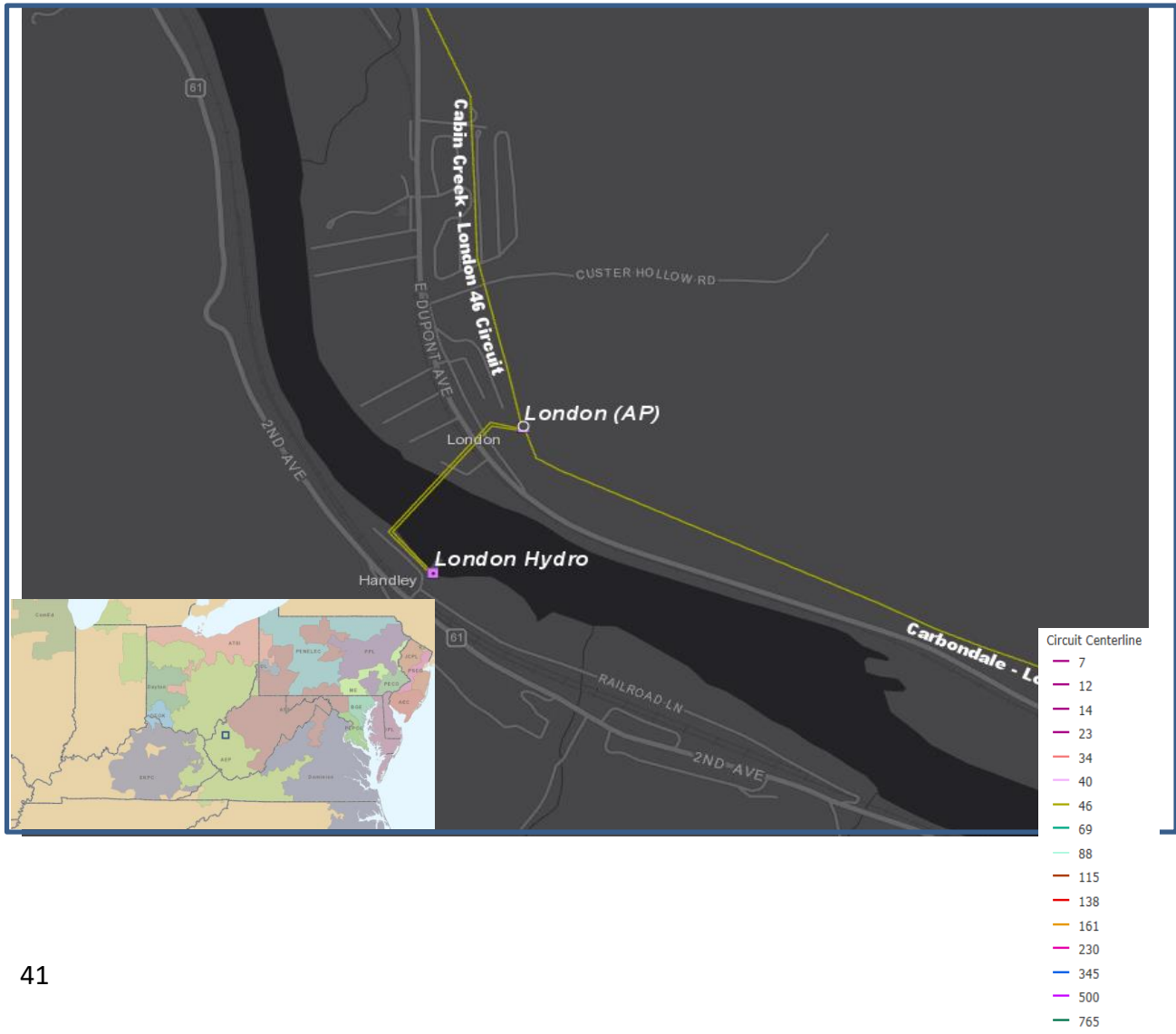
Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

London Station

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



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

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

Process Stage: Solutions Meeting 2/18/2022

Proposed Solution:

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

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

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

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

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

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

Total Estimated Transmission Cost: $37.2M

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

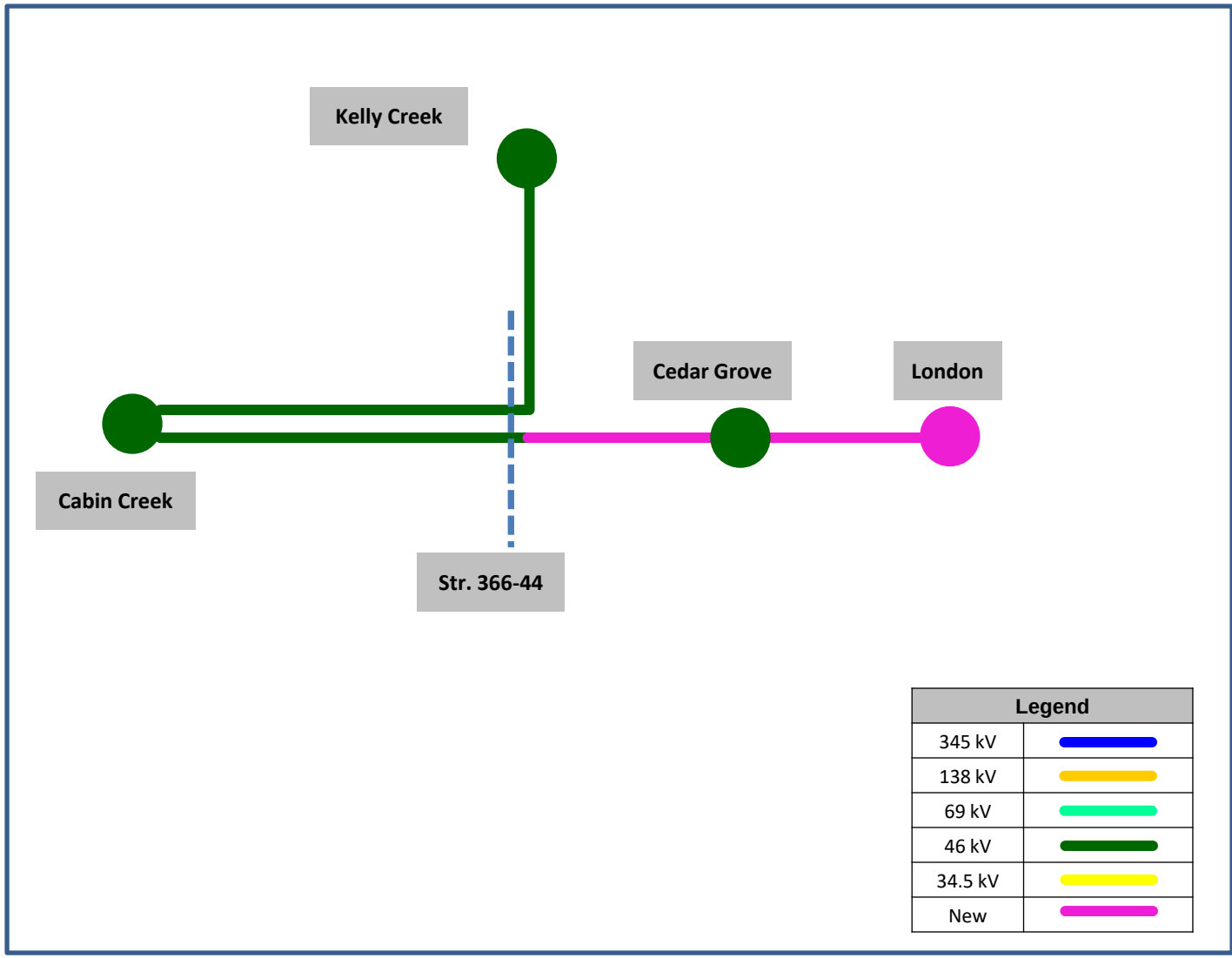
Alternatives Considered:

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

Projected In-Service: 5/1/2025

Project Status: Scoping

Model: 2025 RTEP



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

2/8/2022 – V1 – Original version posted to pjm.com