

Western Sub Regional RTEP: AEP Supplemental Projects

August 18, 2023

Changes to the Existing Supplemental Projects

AEP S2781 Scope/Cost Update New Albany, Ohio

S2781: Need Number: AEP-2021-OH031, Posted to 2022 AEP local Plan

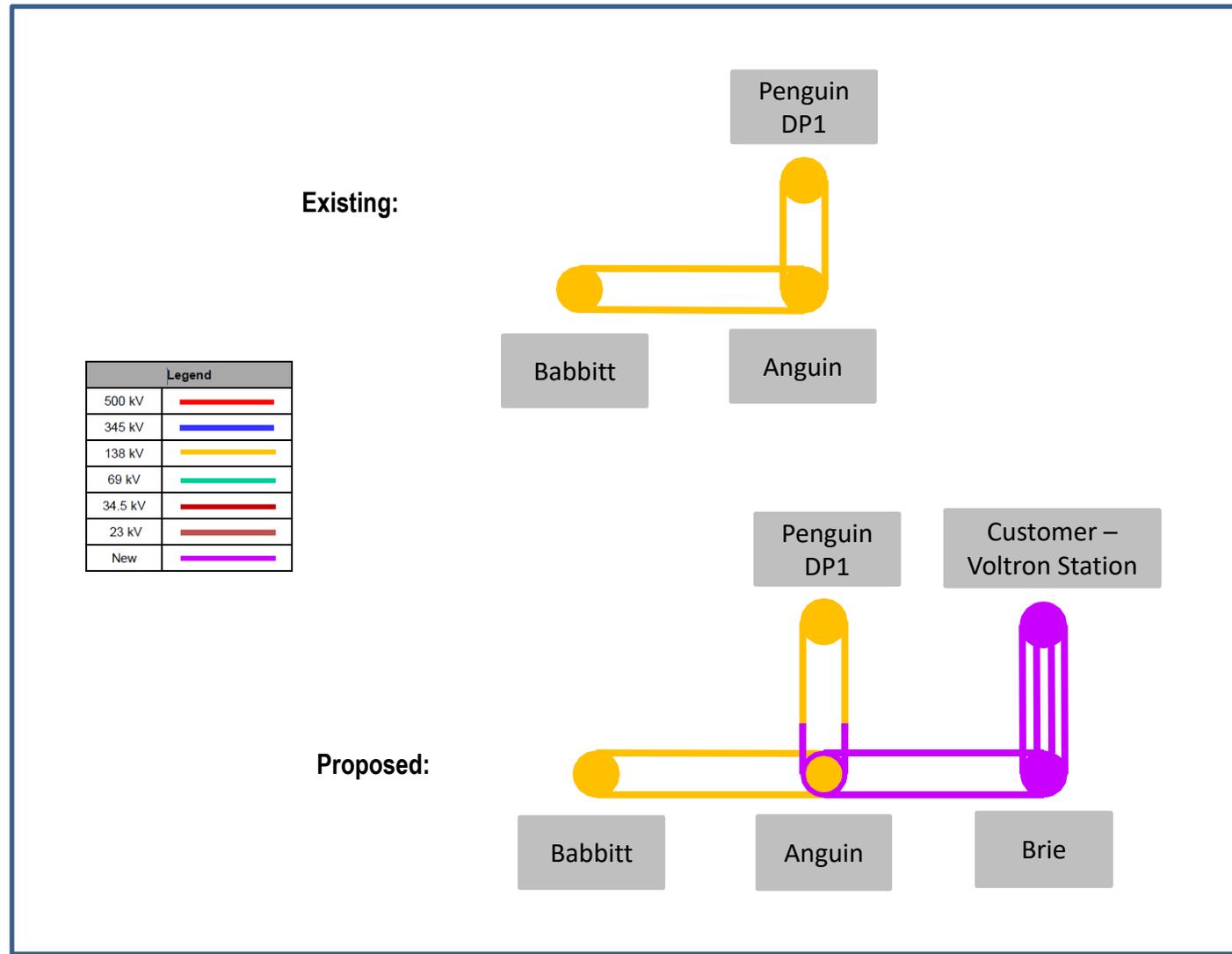
Project Description (Changes are marked in Red):

- **Anguin 138 kV Station:** Relocate the Anguin extension No. 4 into strings C & D at Anguin station installing two circuit breakers in each string to complete the strings. The new double circuit line to Brie station will be installed in strings A & B. Expand DICM to accommodate additional relays. **Estimated Cost: \$1.33M (s2781.1)**
- **Anguin – Penguin DP1 138kV:** Re-terminate the existing 138 kV Anguin Extension lines into strings C & D at Anguin Station. **Estimated Cost: \$0.78M (s2781.2)**
- **Brie 138kV Station:** Establish the greenfield 138kV Brie station. Two full breaker and a half strings and 2 partial strings will be initially installed; total of ten (10) 138 kV breakers. **Estimated Cost: \$11.04M (s2781.3)**
- **Anguin – Brie 138 kV:** Build ~1.5 miles of greenfield 138kV double circuit line between Anguin and Brie station with 2 Bundle ACSS 1033.5 Curlew. Extend the telecom fiber into Brie station for relaying/communication. Short span construction and larger than normal foundations are required in this area to maintain clearances and paths for future development from the customers in the area, leading to higher than normal costs for this line. **Estimated Cost: \$7.83M (s2781.4)**
- **Brie – Customer (Voltron)138kV:** **Construct approximately 2 miles of two double circuit 138 kV tie lines #1-4 to the customer’s facility. Estimated Cost: \$0.11M-\$4.11M (s2781.5)**

Total Estimated Transmission Cost: ~~\$21.08M~~ \$25.08M

Projected In-Service: ~~6/1/2023~~ 5/14/2024

Reason for the change: The specific location for the customer station was updated and is further from Brie station than originally thought.



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 East Liverpool, Ohio

Need Number: AEP-2021-OH047

Process Stage: Need Cancellation 08/18/2023

Previously Presented: 09/17/2021

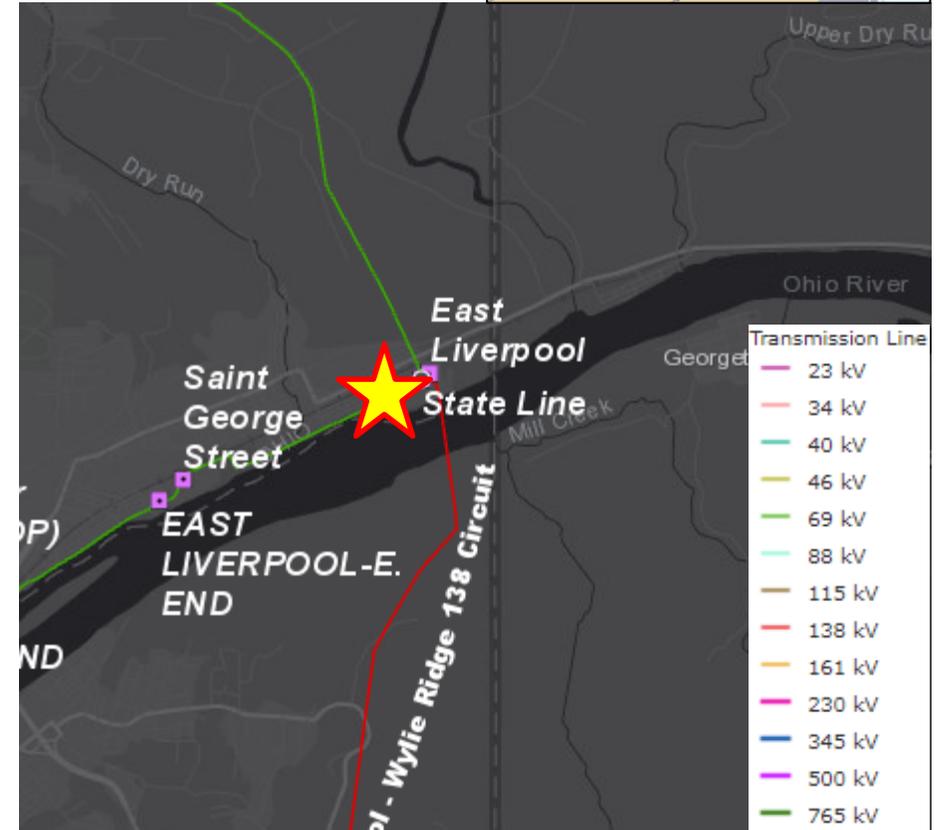
Project Driver: Customer Service

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

Problem Statement:

A new customer in East Liverpool, Ohio has requested new transmission service. The expected peak demand is 3 MW, with a forecasted in-service-date of December 2022.

Reason for Cancellation: The existing distribution customer has cancelled their expansion plans.



Need Number: AEP-2023-AP021

Process Stage: Needs Meeting 8/18/2023

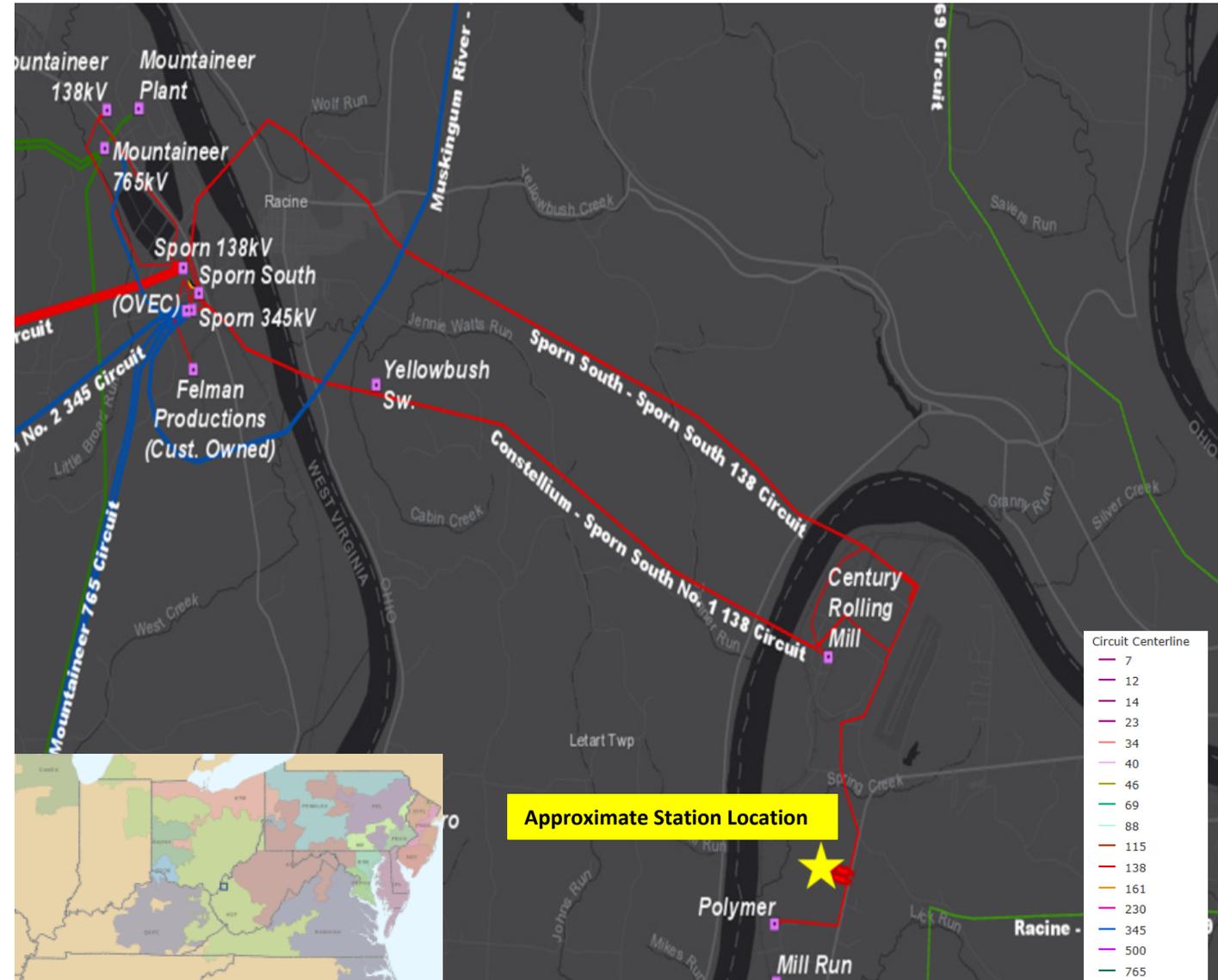
Supplemental Project Driver: Customer Service

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.

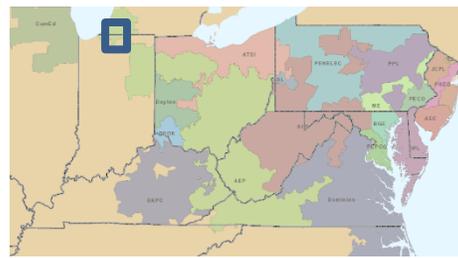
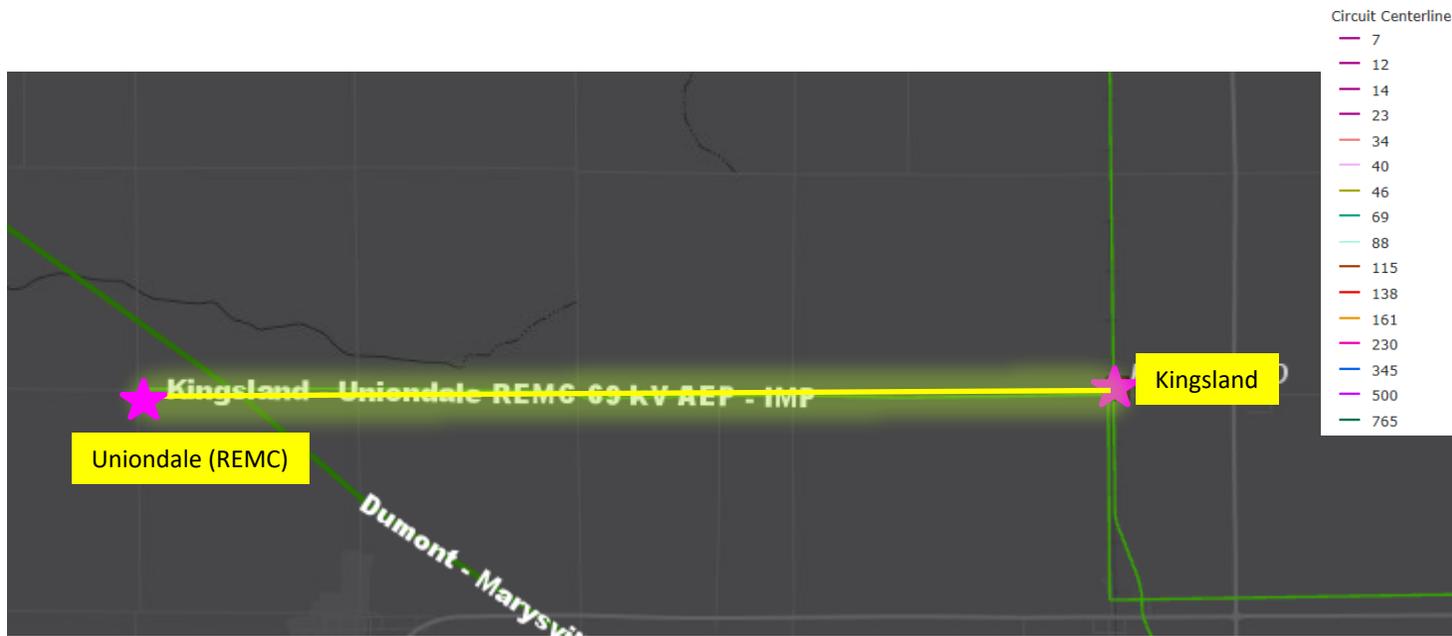
Projected load: 30 MVA initial load, upwards to a maximum of 80 MVA



Need Number: AEP-2023-IM017
Process Stage: Needs Meeting: 08/18/2023
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

Kingsland-Uniondale:

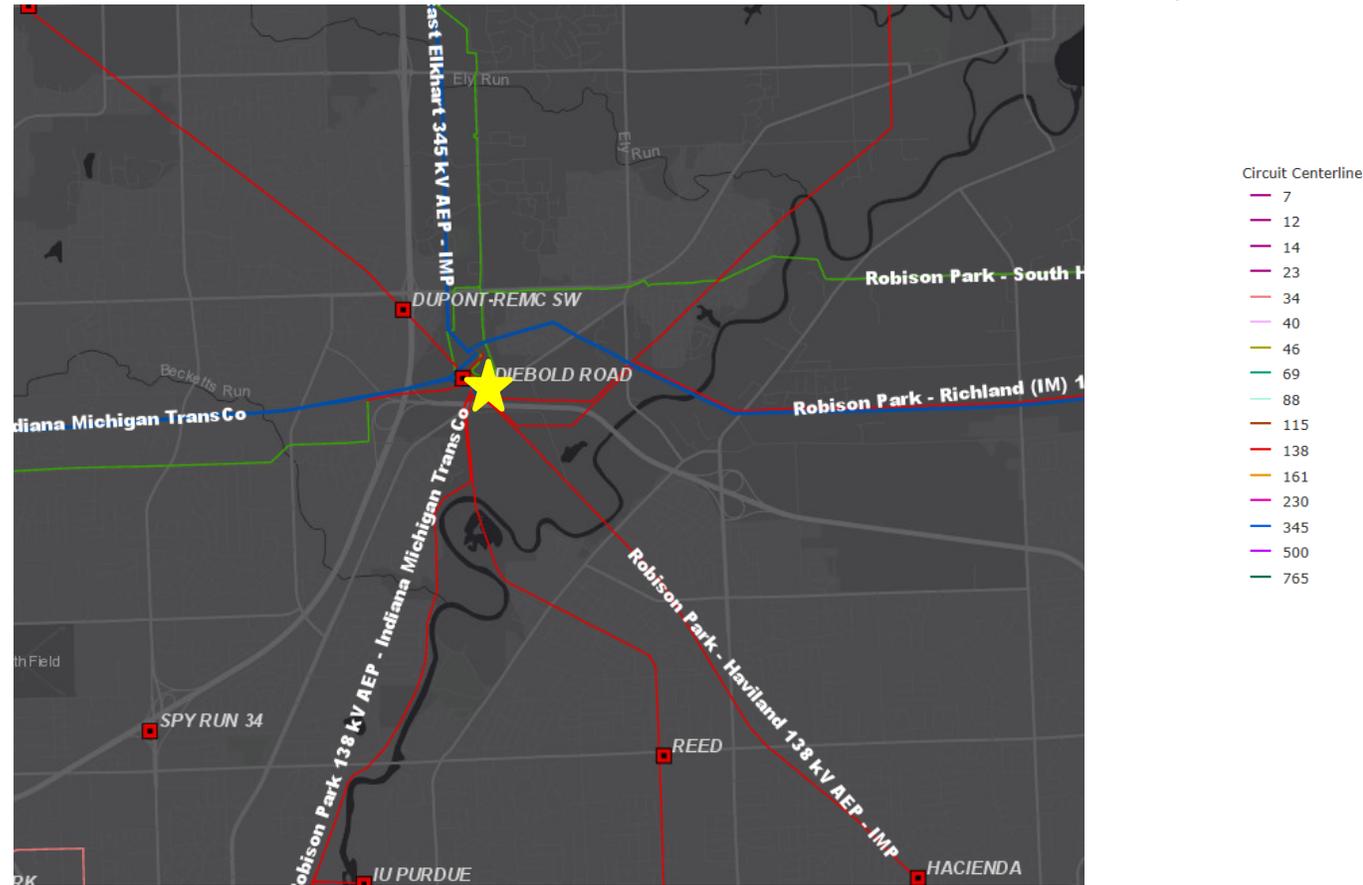
- The Kingsland-Uniondale is 4.43 mile long radial line originally installed in 1969 mostly consisting of wood poles that feeds Uniondale station.
- Structures fail to meet NESC Grade B and AEP structural strength requirements
- The insulators on the line do not meet current AEP standards
- The grounding method utilizes butt wraps on 1/3 of the structures which is inadequate for current AEP Standards.
- 38 structures were further assessed (24 by aerial drone and 14 by ground crew) 50% of the poles were found with deficiencies such as:
 - Decay beyond normal weather conditions
 - Many wood poles had moderate wood decay that includes shell decay, insect damage and woodpecker holes. Several poles have heavy checking and rotted pole tops
 - Brown porcelain horizontal post insulators with flashed insulators
 - Three structures have had steel enforcer systems added as temporary means to extend pole life until the structure can be replaced
 - Structure ground are installed on approximately 1/3rd of the line



Need Number: AEP-2023-IM019
Process Stage: Needs Meeting: 08/18/2023
Supplemental Project Driver: Customer Need
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Problem Statement:

Diebold 69/12kV Station:
 I&M Distribution has requested an expansion of Diebold Rd station.

Diebold Rd is a 69/12kV distribution station. Diebold Rd is the primary feed to the nearby cancer hospital and currently, the alternate feed is overloaded during summer peak. Diebold Rd station is currently non-recoverable for a transformer outage putting 4.4MVA and 1130 customer at risk that cannot be picked up without a mobile.

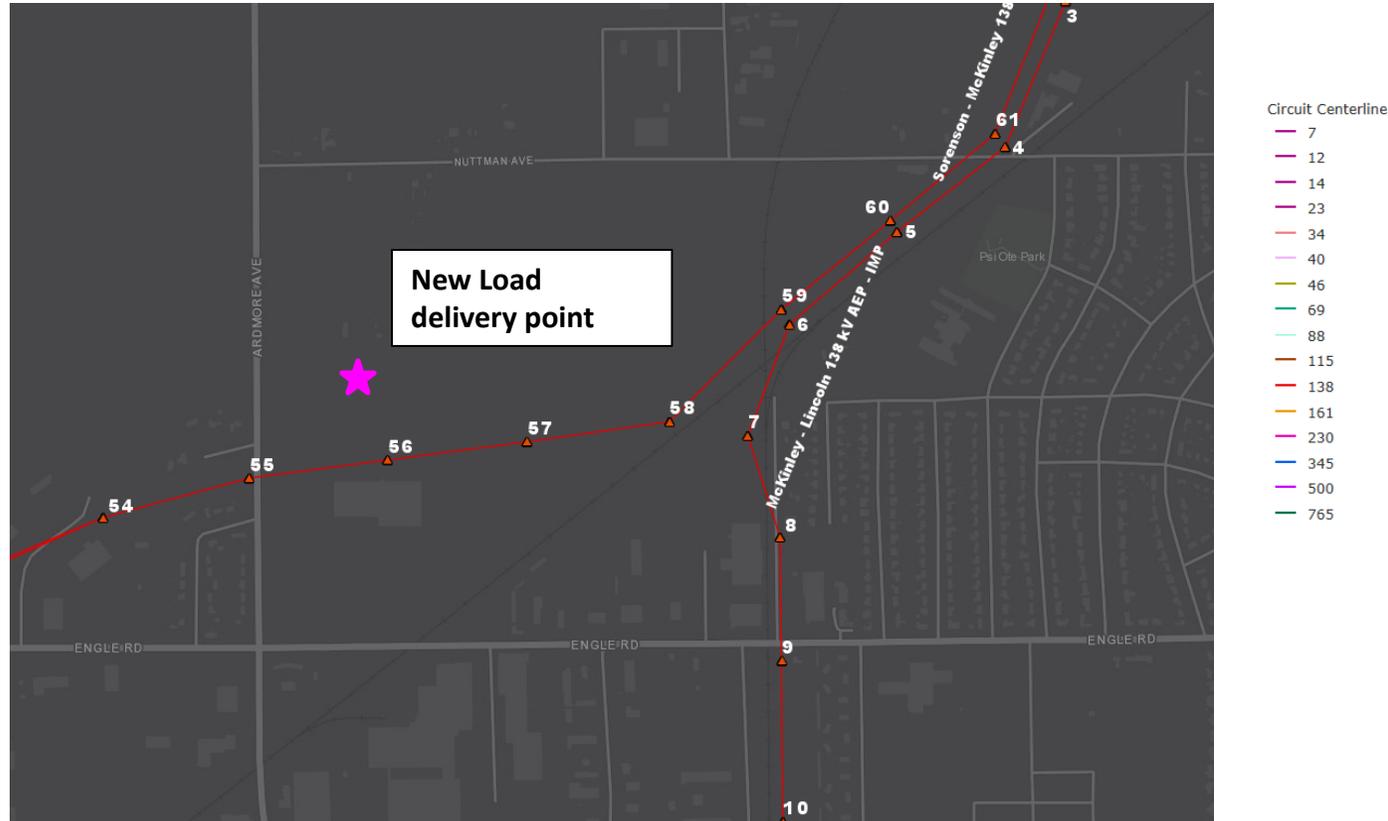


Solutions

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

Need Number: AEP-2022-IM012
Process Stage: Solutions Meeting 8/18/2023
Previously Presented: Needs Meeting: 6/15/2022
Supplemental Project Driver: Customer Need
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: N/A
Problem Statement:

AEP I&M distribution has requested a new delivery point on the southern side of Fort Wayne to serve 13MW of load, transferred from McKinley station. The requested in service date is 6/1/2025



Need Number: AEP-2022-IM012

Process Stage: Solution Meeting 08/18/2023

Proposed Solution:

Install a 138kV/12kV distribution station named Kekionga on the Mckinley-Ellison Road 138kV line. Install 138kV line extension from Mckinley-Ellison 138kV line with fiber (~0.15 miles from the 138kV line), install 138kV bus with 2-138kV switches and 138kV MOAB.

Total Estimated Transmission Cost: \$4.4 M

Alternative considered:

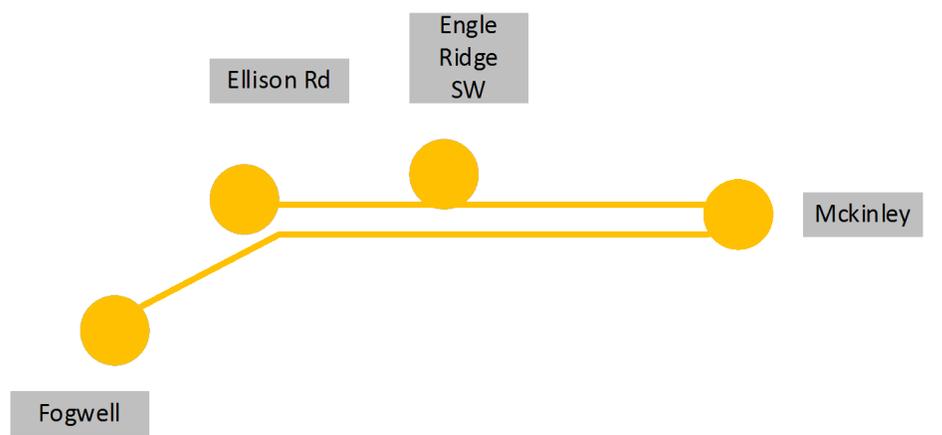
Install a 138kV/12kV distribution station on the Mckinley-Fogwell 138kV line. Install 138kV line extension from Mckinley-Fogwell 138kV line with fiber, install 138kV bus with 2X 138kV switch and 138kV MOAB. Since the location of the new station location is on the north side of the 138kV circuit, this alternate was not chosen.

Total Cost: \$4.4M

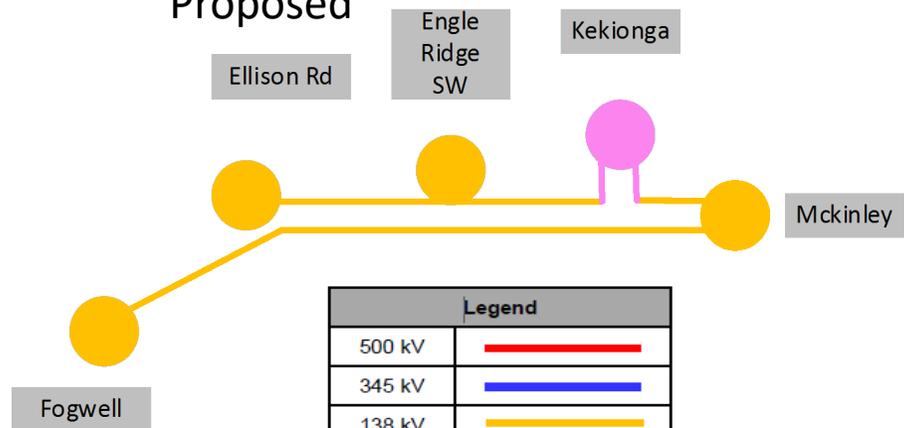
Projected In-Service: 11/12/2025

Project Status: Scoping

Existing



Proposed



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

AEP Transmission Zone M-3 Process East Liverpool, Ohio

Need Number: AEP-2022-OH041

Process Stage: Solution Meeting 08/18/2023

Previously Presented: Need Meeting 09/16/2022

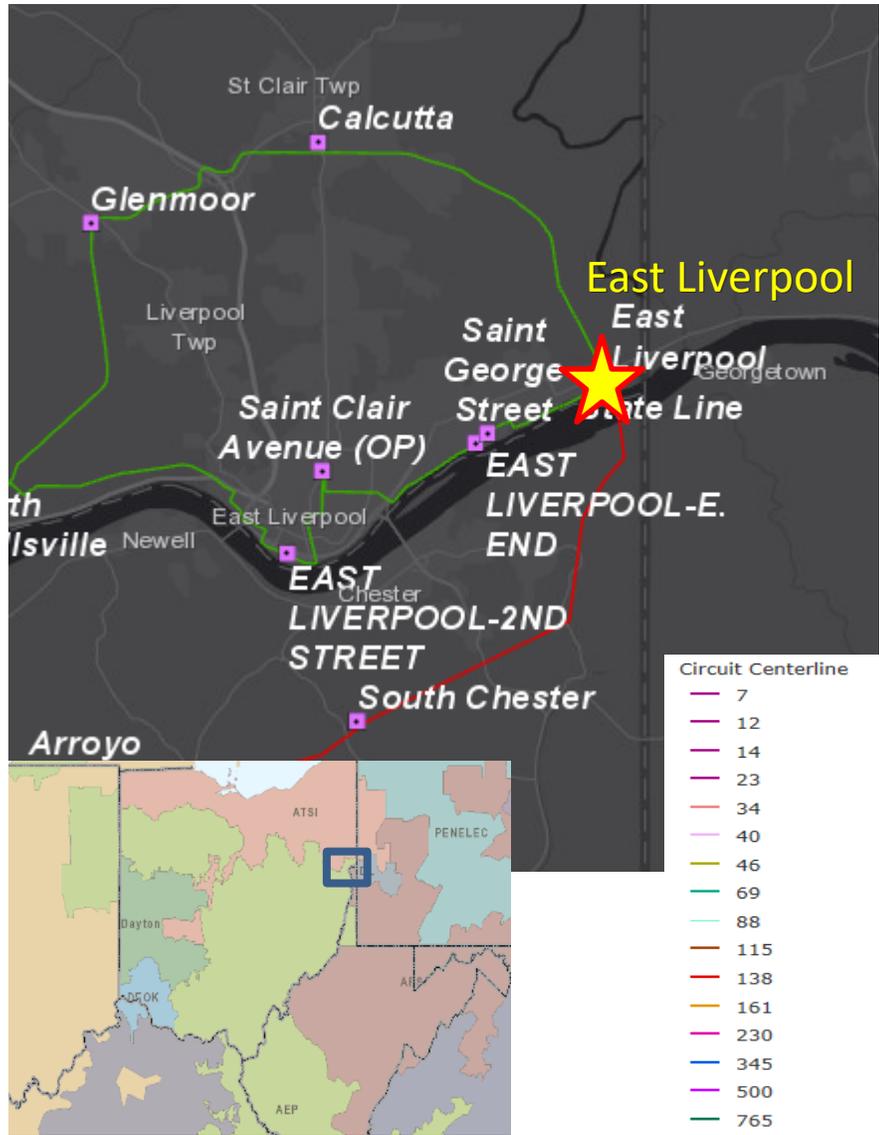
Project Driver:
Equipment Material/Condition/Performance/Risk; Operational Flexibility and Efficiency

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

Problem Statement:

Equipment Material/Condition/Performance/Risk:

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



AEP Transmission Zone M-3 Process East Liverpool, Ohio

Need Number: AEP-2022-OH041

Process Stage: Solution Meeting 08/18/2023

Previously Presented: Need Meeting 09/16/2022

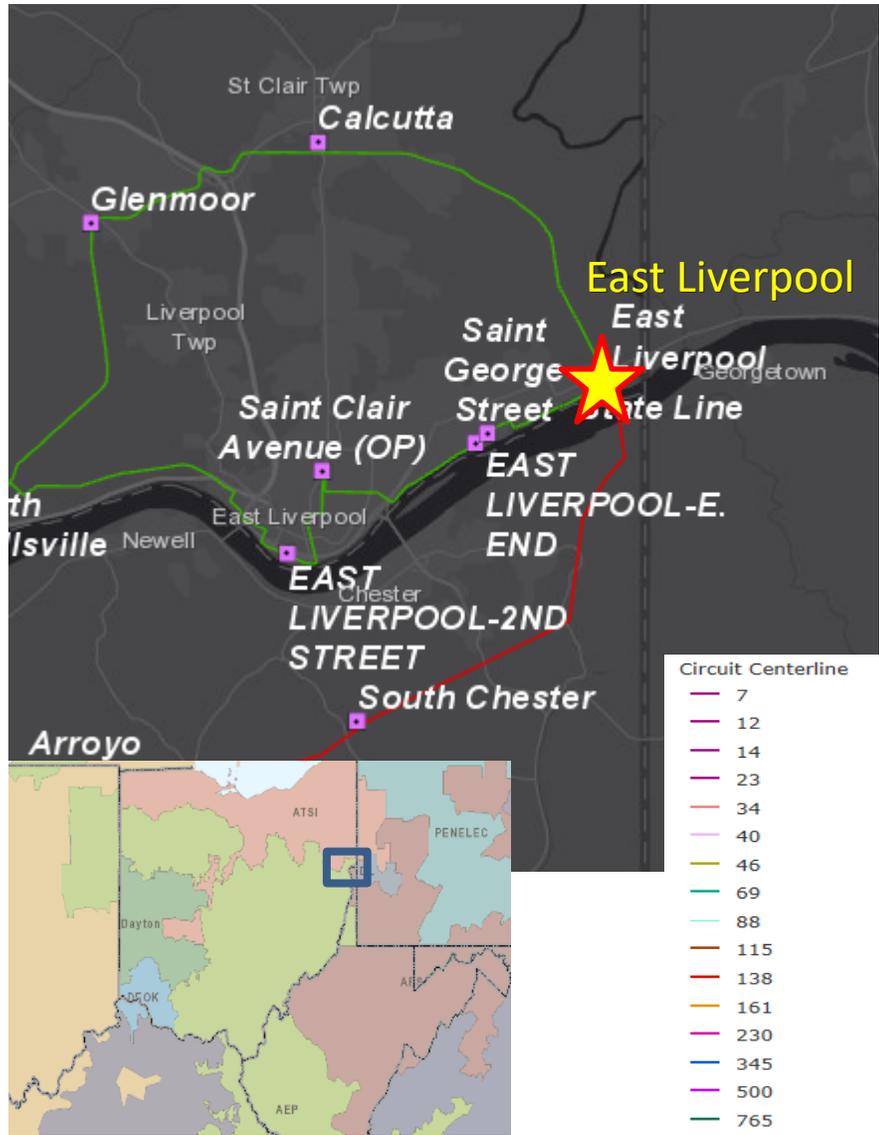
Project Driver:
Equipment Material/Condition/Performance/Risk; Operational Flexibility and Efficiency

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

Problem Statement:

Operational Flexibility and Efficiency:

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



AEP Transmission Zone M-3 Process East Liverpool Station Upgrade

Need Number: AEP-2022-OH041

Process Stage: Solution Meeting 08/18/2023

Proposed Solution:

- At East Liverpool station, replace the 138kV MOAB/ground switch system with a circuit breaker and new relays. Install a 69kV breaker on the low side of the 138-69kV transformer. Upgrade tie-line metering, relays, and expand SCADA functionality at the station. Replace the control house with a new prefabricated control building. \$3.0 Million
- At the 69kV remote end station of Second Street, replace the electromechanical relays and pilot wire communications with microprocessor-based relays, to coordinate with East Liverpool. Install new 69kV CCVT's. \$0.3 Million

Total Transmission Cost: \$3.3 Million

Alternatives Considered: Considering the availability of space and outages at the existing station, a greenfield option was not prudent.

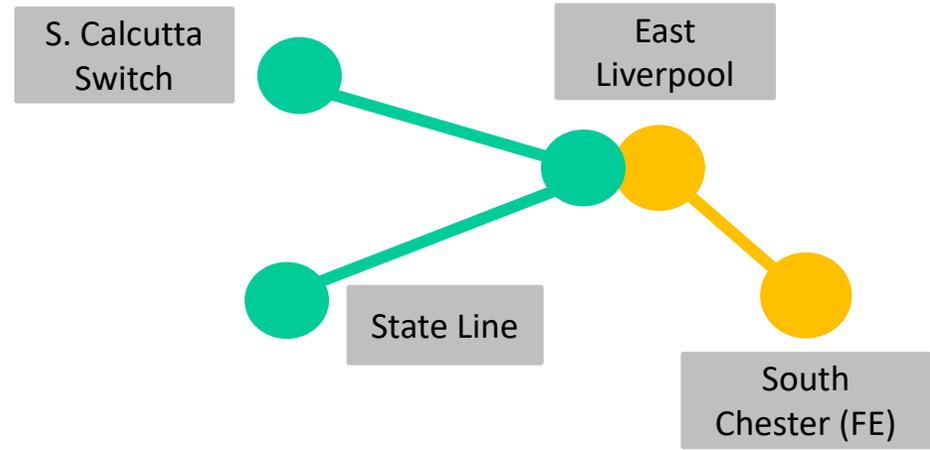
Projected In-Service: 5/1/2025

Project Status: Scoping

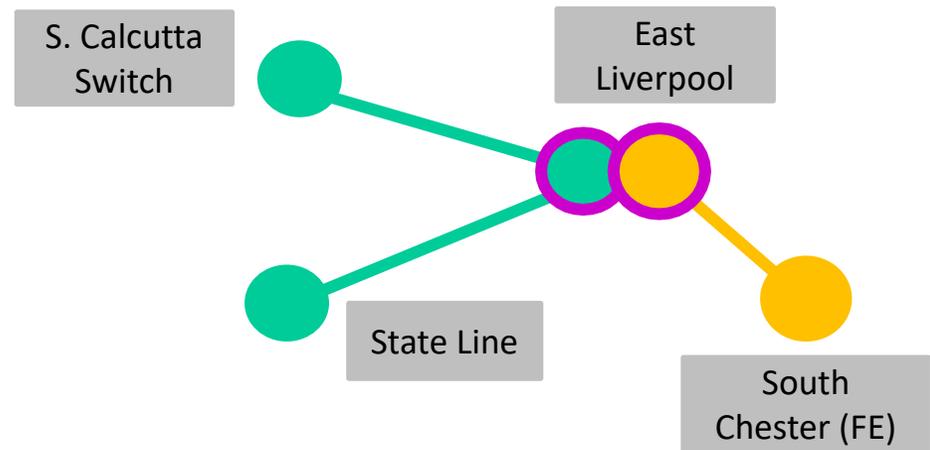
Model: 2027 PJM RTEP Models

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

Existing:



Proposed:



Need Number: AEP-2023-AP005

Process Stage: Solutions Meeting 8/18/2023

Previously Presented: Needs Meeting 2/17/2023

Supplemental Project Driver: Customer Service and Operational Flexibility

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

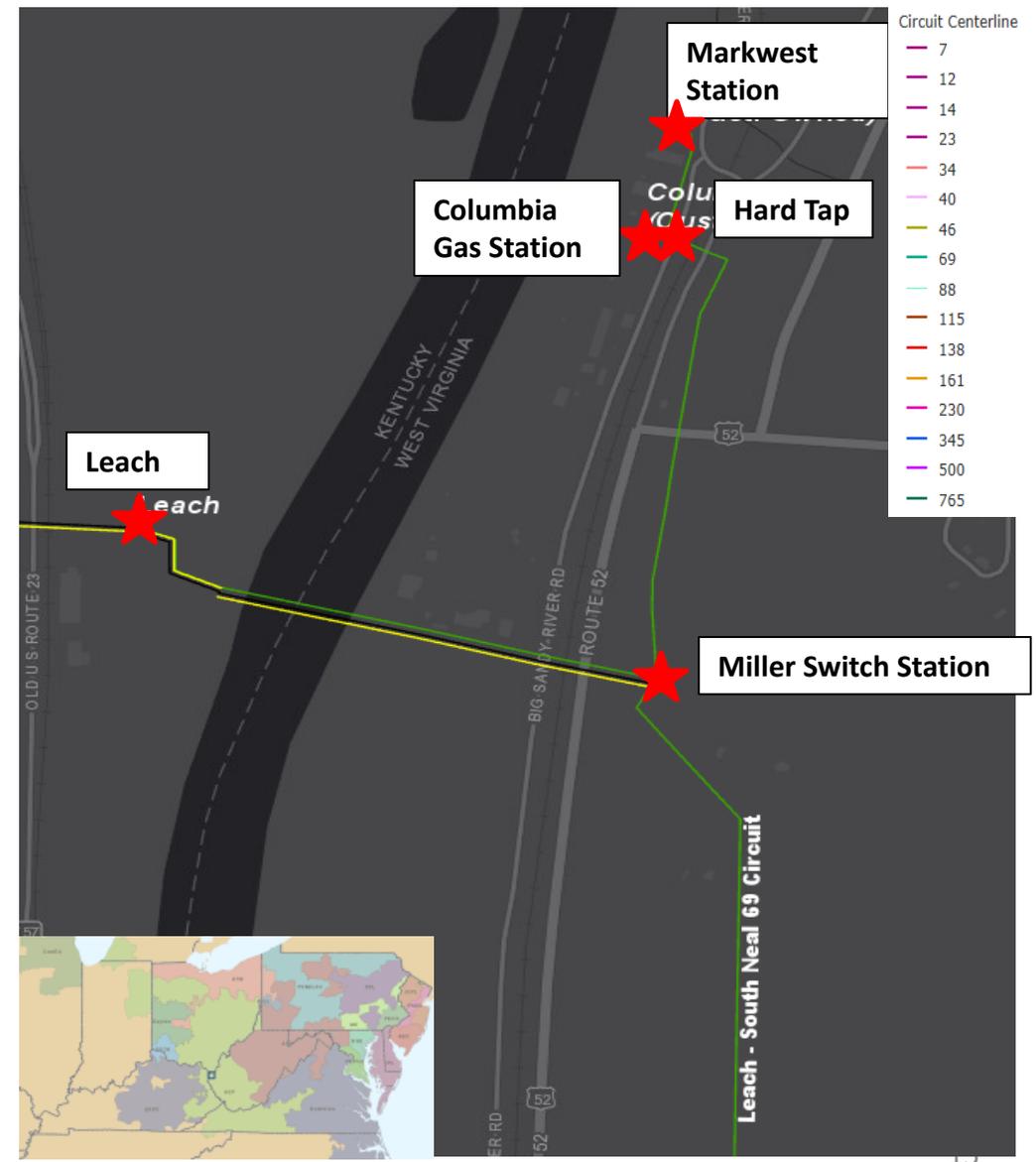
Problem Statement:

Miller Switch Station, on the existing Leach – South Neal 69 kV line currently serves two separate customers off of a 0.5 mile radial 69 kV line. Total existing load served off this line is approximately 8 MW. Radial lines complicate maintenance activities due to the customers needing to be taken out of service in order to perform any work on the line.

TC Energy – Kenova has requested a 12 MW load increase at their existing Columbia Gas Station delivery point served off the radial from Miller Switch. This load is currently served from a hard tap on the radial extension, which greatly complicates restoration activities and extend outages. This configuration also affects the customer served at the Markwest station as they are also fed from the radial line.

Summer projected load: 16 MVA

Winter projected load: 16 MVA.



Need Number: AEP-2023-AP005

Process Stage: Solutions Meeting 8/18/2023

Proposed Solution:

Cut in/out of the existing South Neal – Leach 69 kV line, install a new double circuit 69 kV 0.6 mile line which will replace the existing 69 kV radial tap line currently serving both Markwest and Columbia Gas. Build single circuit less than 0.1 mile back to Markwest from Sweet Run S.S. and to Columbia Gas from Pipeline S.S. Miller Switch Station will also be removed upon completion of the new line construction. Estimated Trans. Cost: \$5.6M

Replace existing hard tap serving Columbia gas with a new 3-way phase over phase switch. Estimated Trans. Cost: 1.1M

Install a new 3-way phase over phase switch on the new line outside of the existing Markwest delivery point. Estimated Trans. Cost: 1.1M

Total Estimated Transmission Cost: \$7.8M

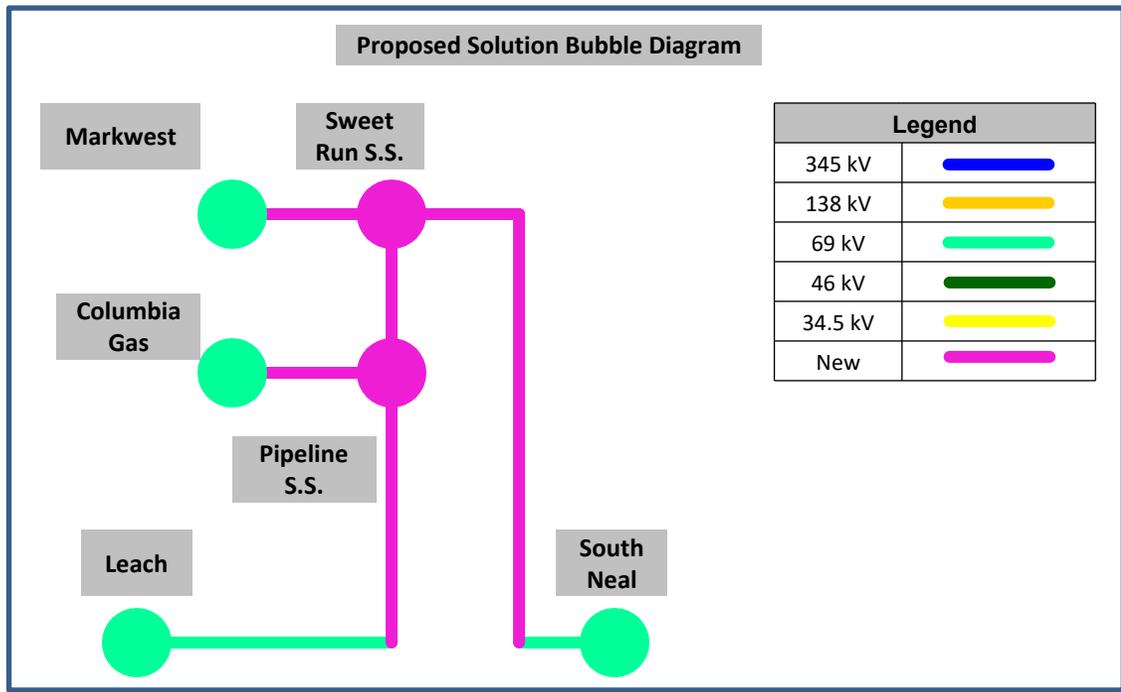
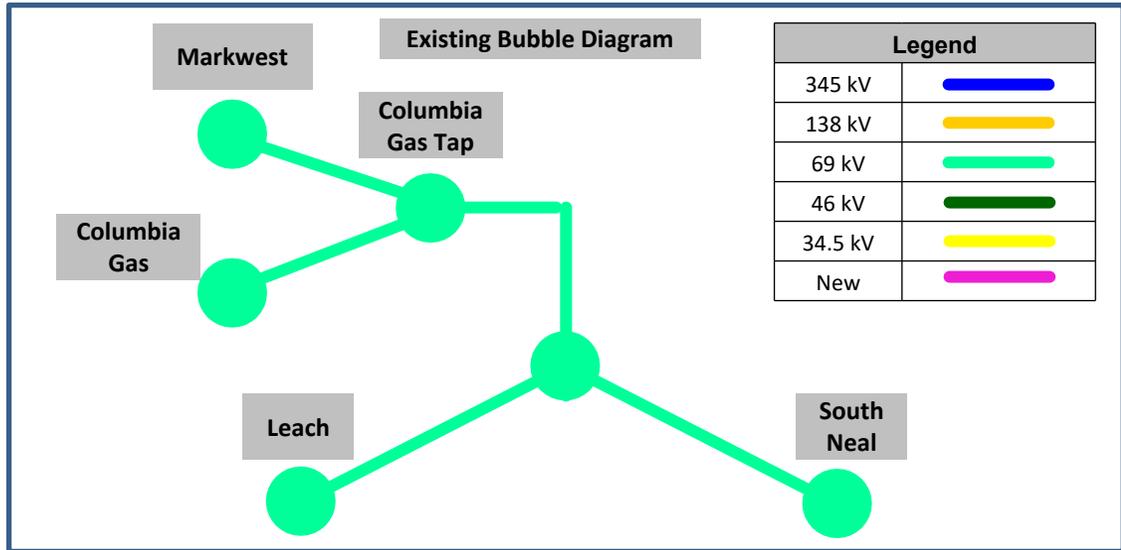
Alternate:

Replace existing hard tap with a new switch (Pipeline S.S.), install a new switch outside of Markwest (Sweet Run S.S.). Construct a new single circuit 69 kV line to Sweet Run S.S. in order to loop the existing single circuit radial 69 kV line. Remove existing Miller Switch. During the initial scoping for this project, it was determined that the existing line serving the customers cannot remain in its current location due to accessibility and terrain concerns. Therefore, the double circuit replacement option was chosen.

Projected In-Service: 6/1/2024

Project Status: Scoping

Model: 2028 RTEP



AEP Transmission Zone M-3 Process Pike County, Kentucky

Need Number: AEP-2022-AP007

Process Stage: Solutions Meeting 8/18/2023

Previously Presented: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

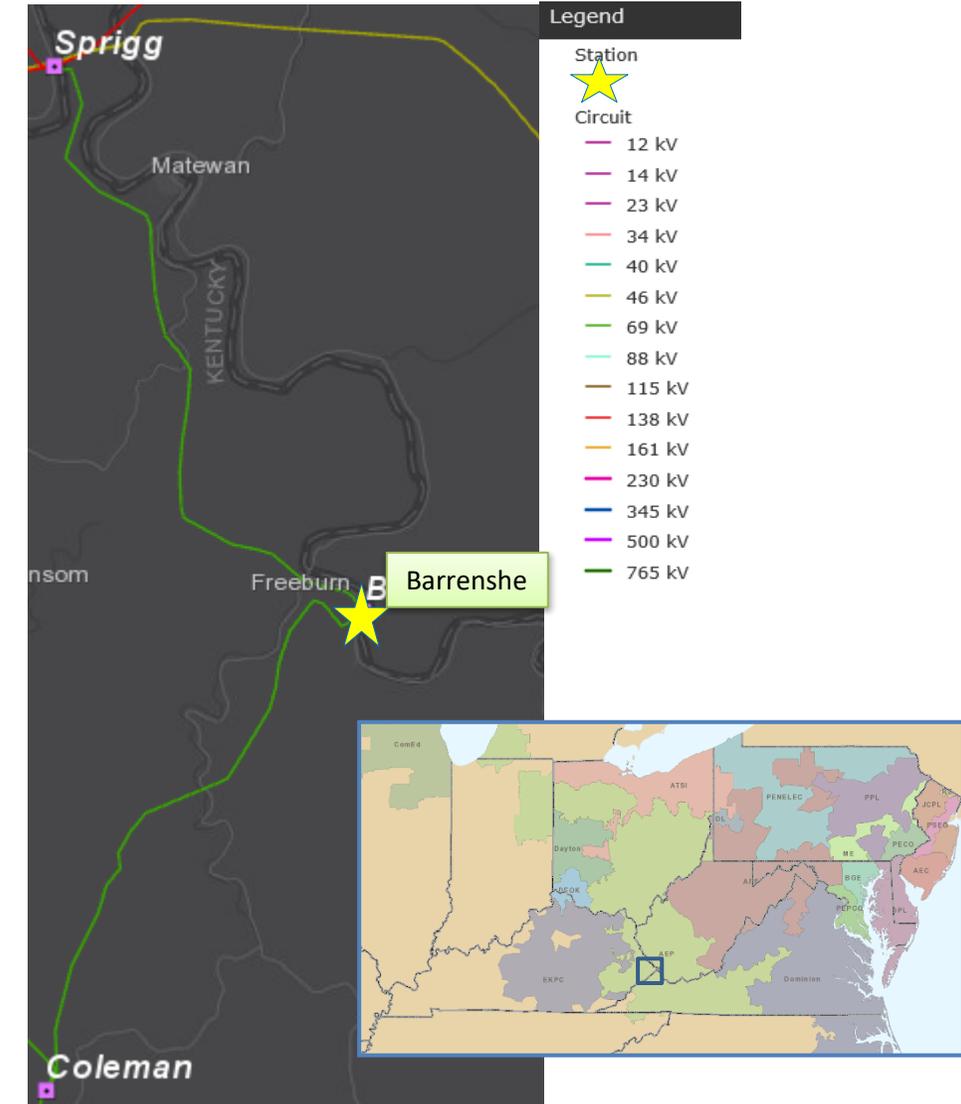
Specific Assumption Reference:

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: Solutions Meeting 8/18/2023

Previously Presented: 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

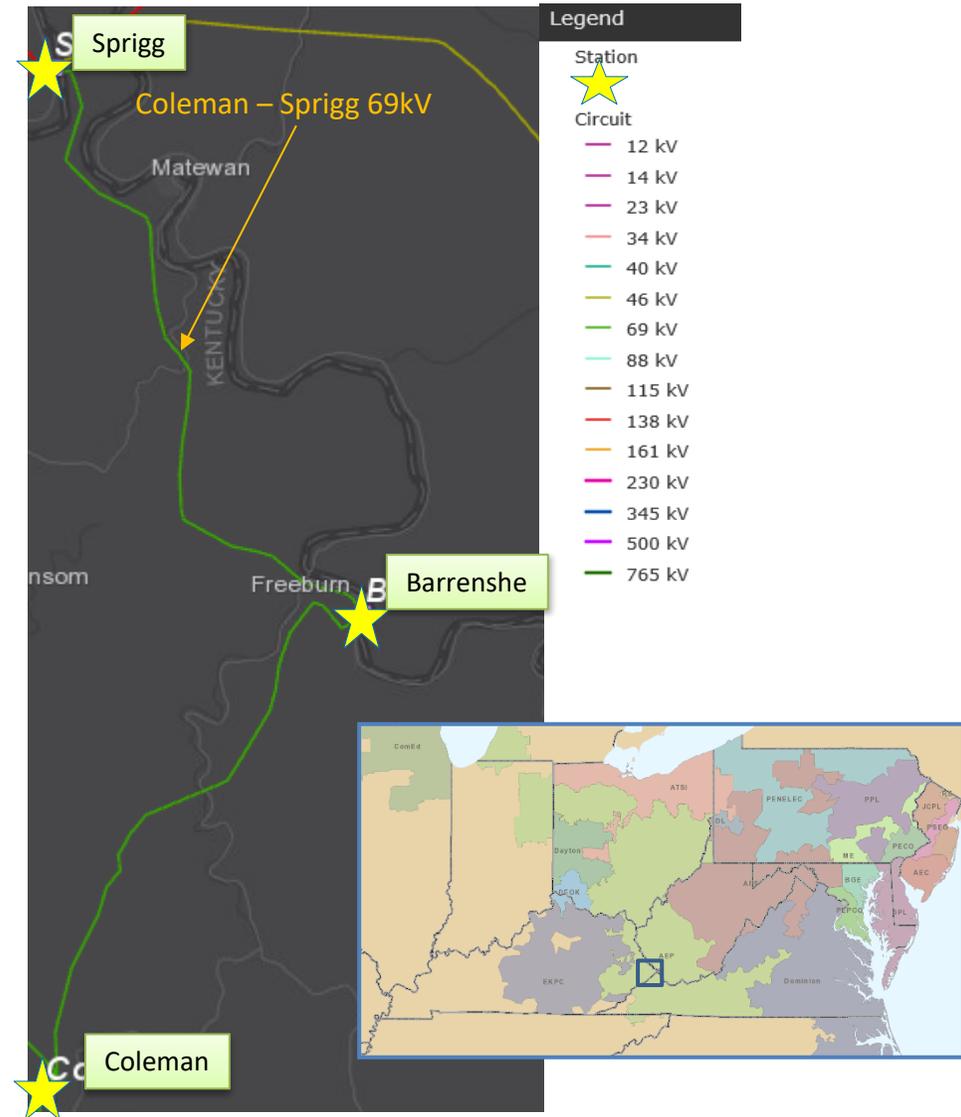
Original Line Construction Type: Wood

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: Solutions Meeting 8/18/2023

Previously Presented: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

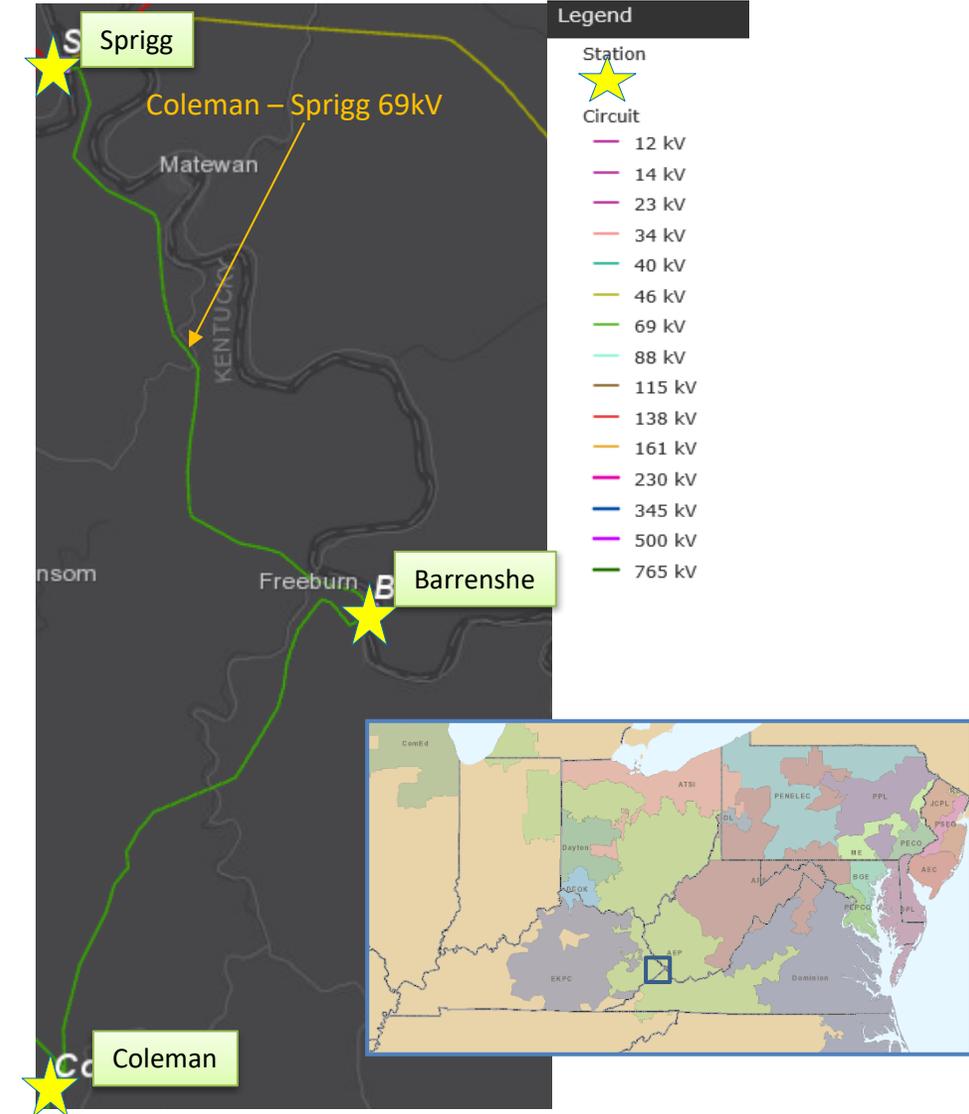
Specific Assumption Reference:

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 lightning 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: Solutions Meeting 8/18/2023

Previously Presented: 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

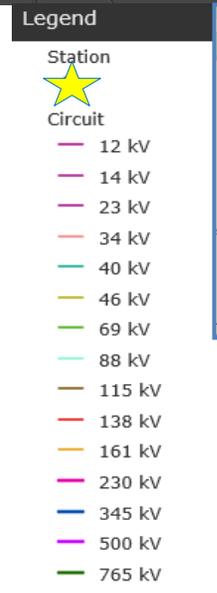
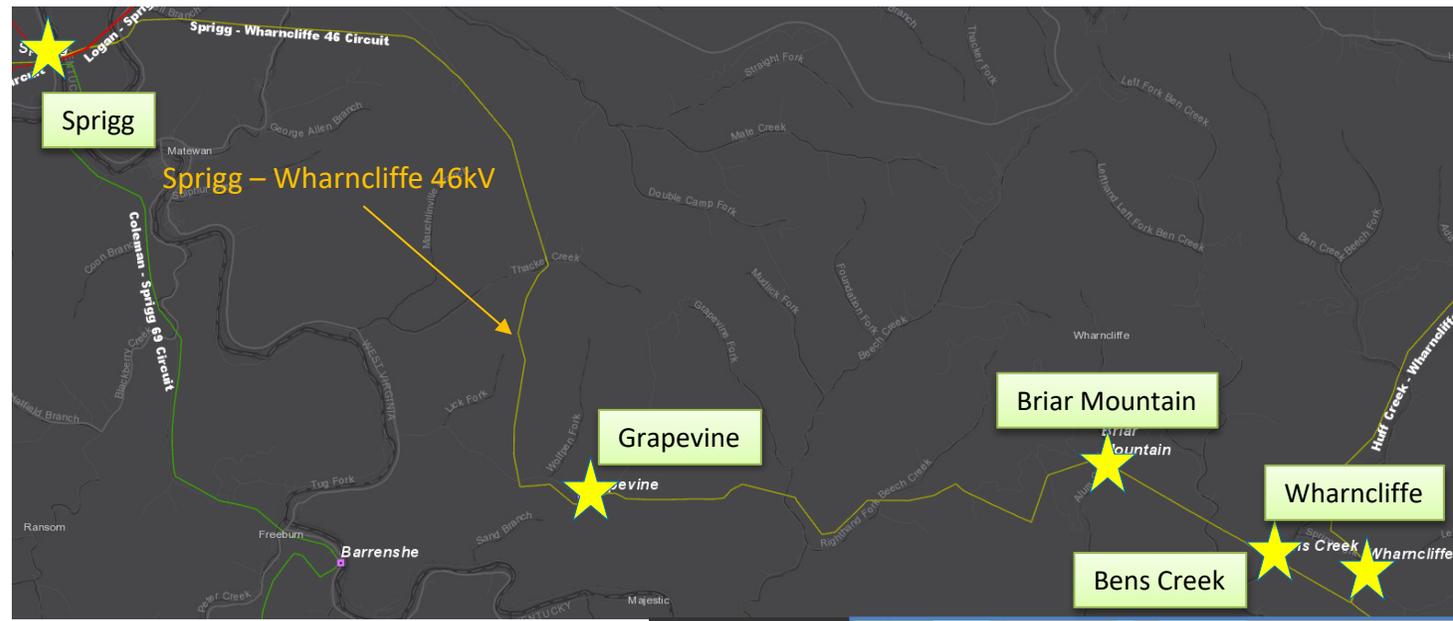
Original Line Construction Type: Wood

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.



Pike County, Kentucky and Mingo County, West Virginia

Need Number: AEP-2022-AP009

Process Stage: Solutions Meeting 8/18/2023

Previously Presented: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

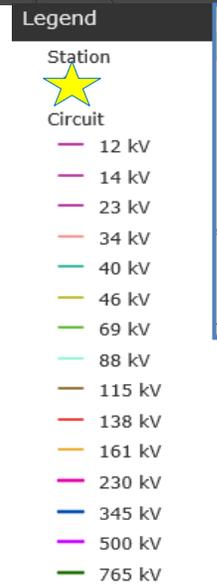
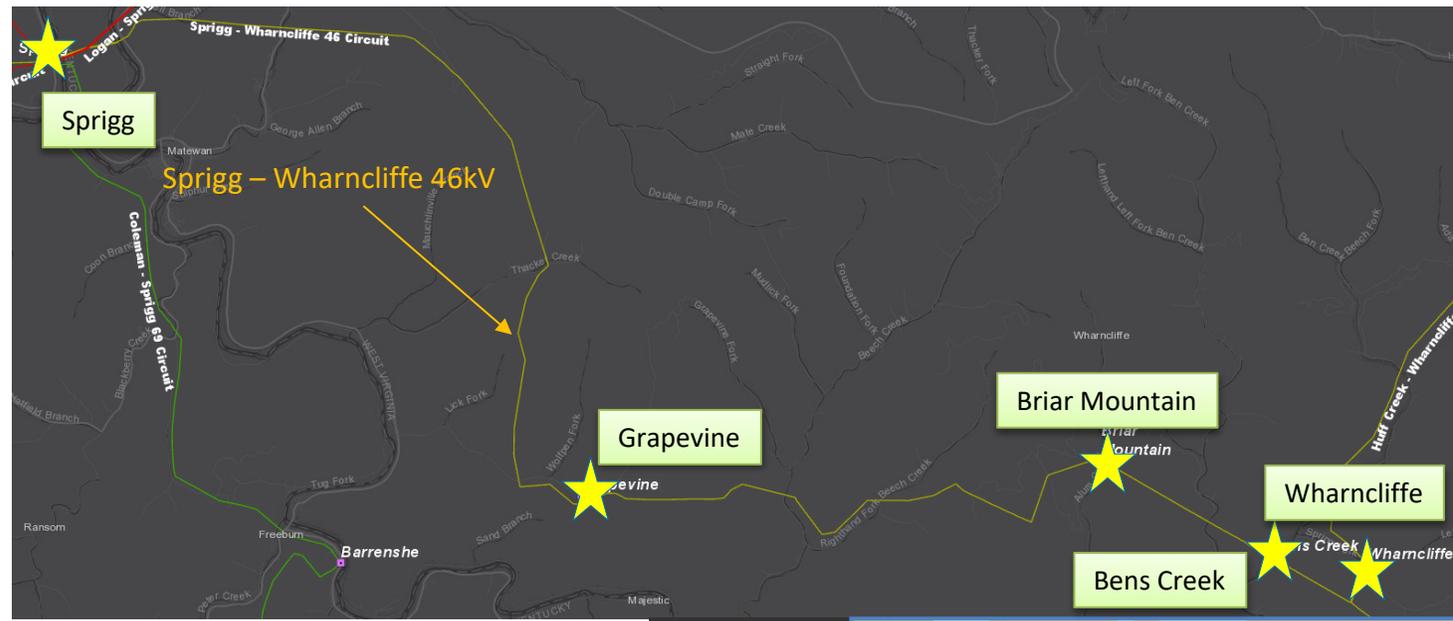
Specific Assumption Reference:

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 lightning 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: Solutions Meeting 8/18/2023

Previously Presented: 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 – Wharnccliffe 46 kV:

Original Install Date (Age): 1925 and 1930

Length of Line: ~25 mi

Total structure count: 162

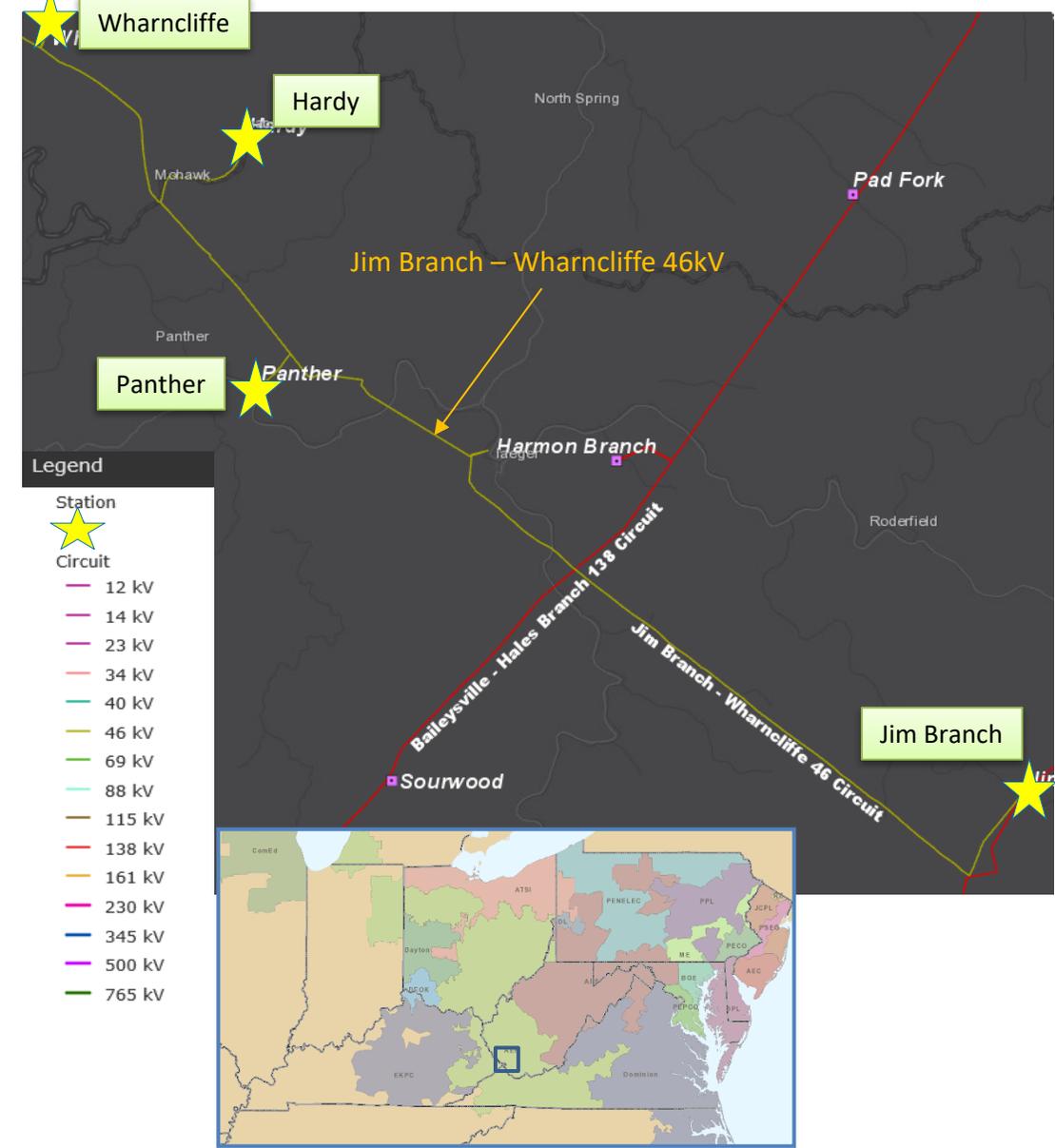
Original Line Construction Type: Wood

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: Solutions Meeting 8/18/2023

Previously Presented: Need Meeting 2/18/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

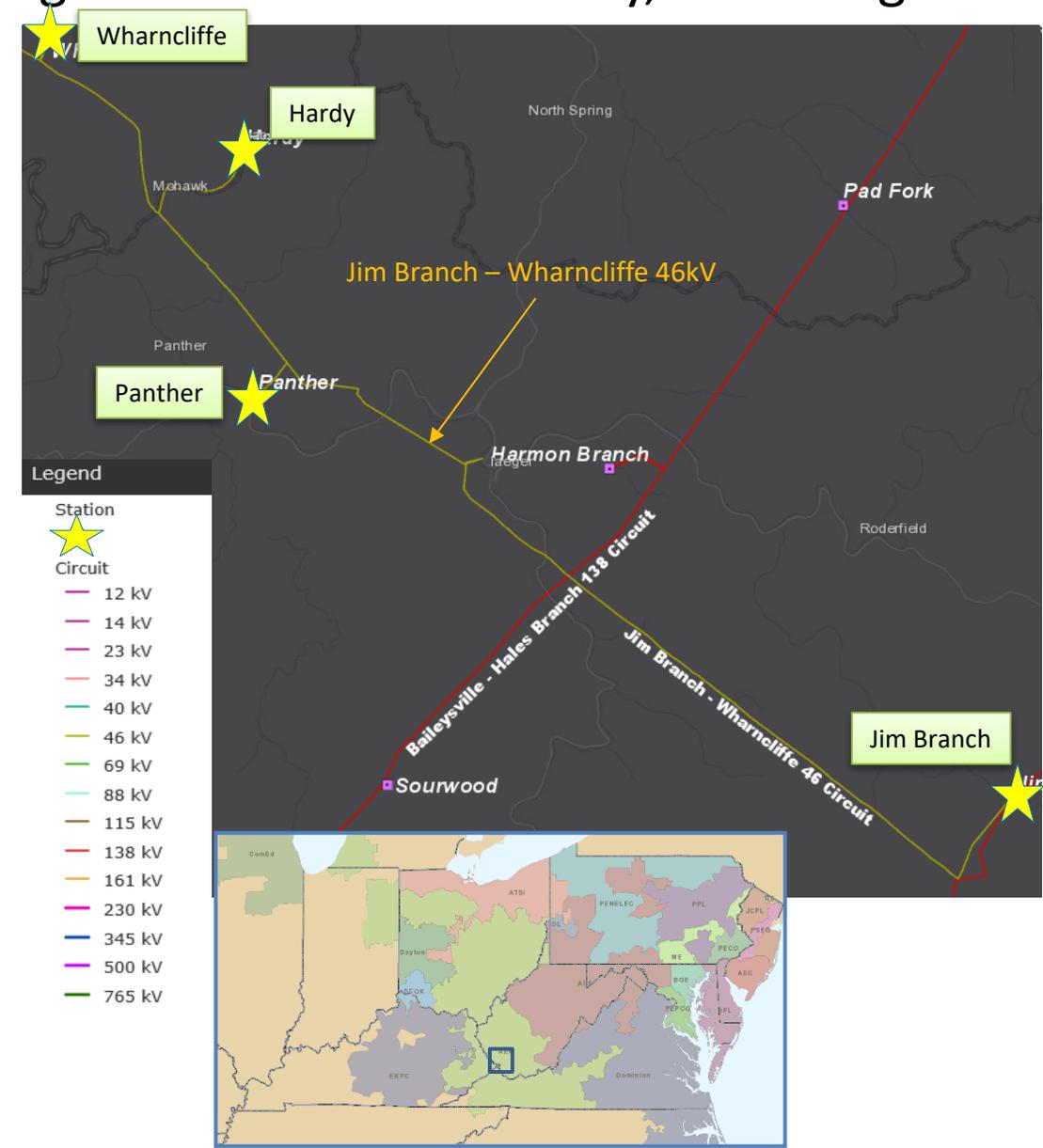
Specific Assumption Reference:

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: Solutions Meeting 8/18/2023

Previously Presented: 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

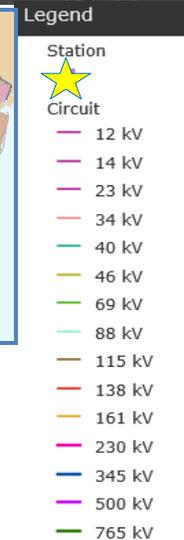
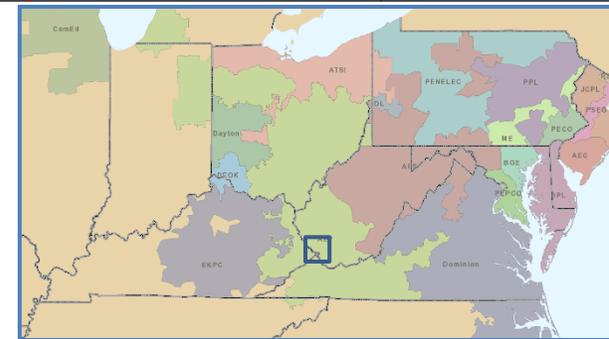
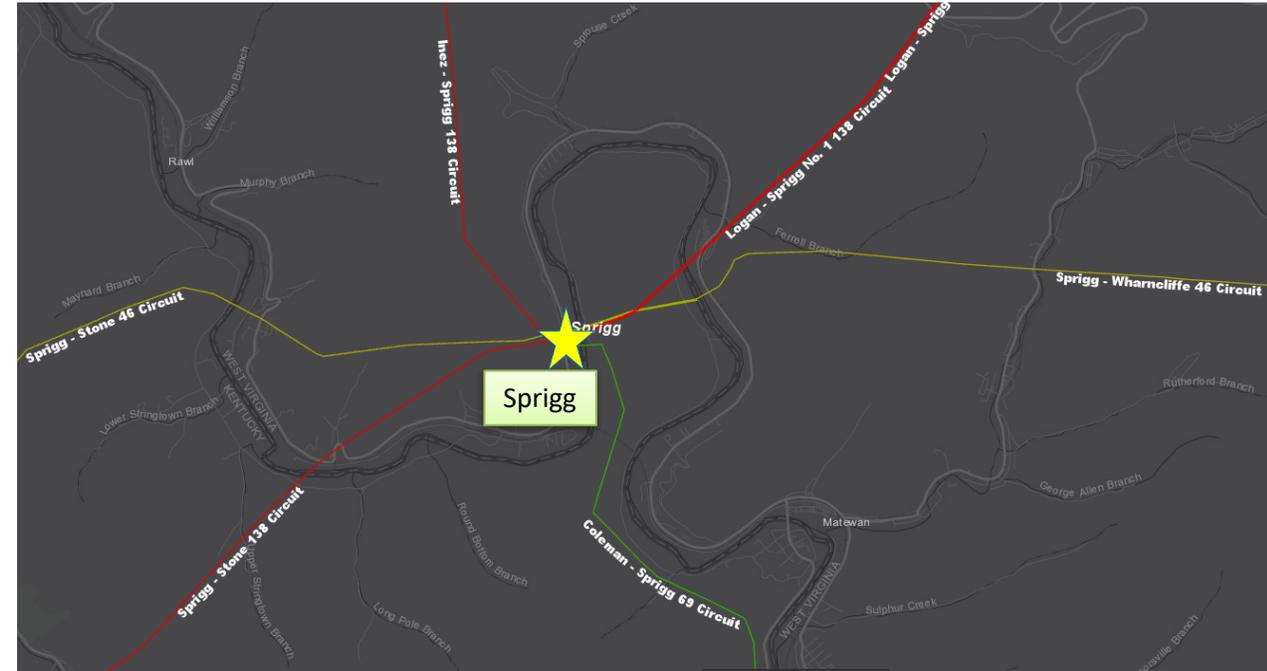
- 1971 Vintage Transformer
- The presence of Ethane, along with the indication of overheating faults, indicates decomposition of the paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
- The dielectric is driven by the upward trend in insulation 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: Solutions Meeting 8/18/2023

Previously Presented: 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

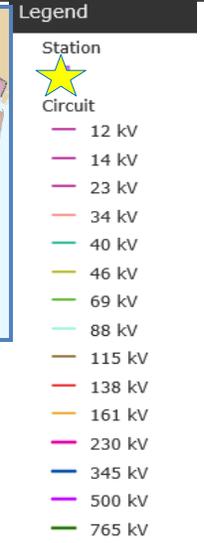
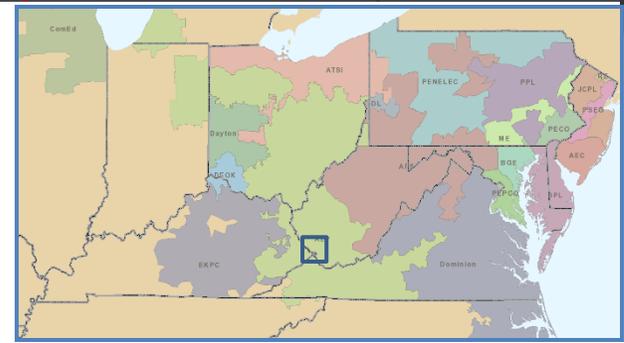
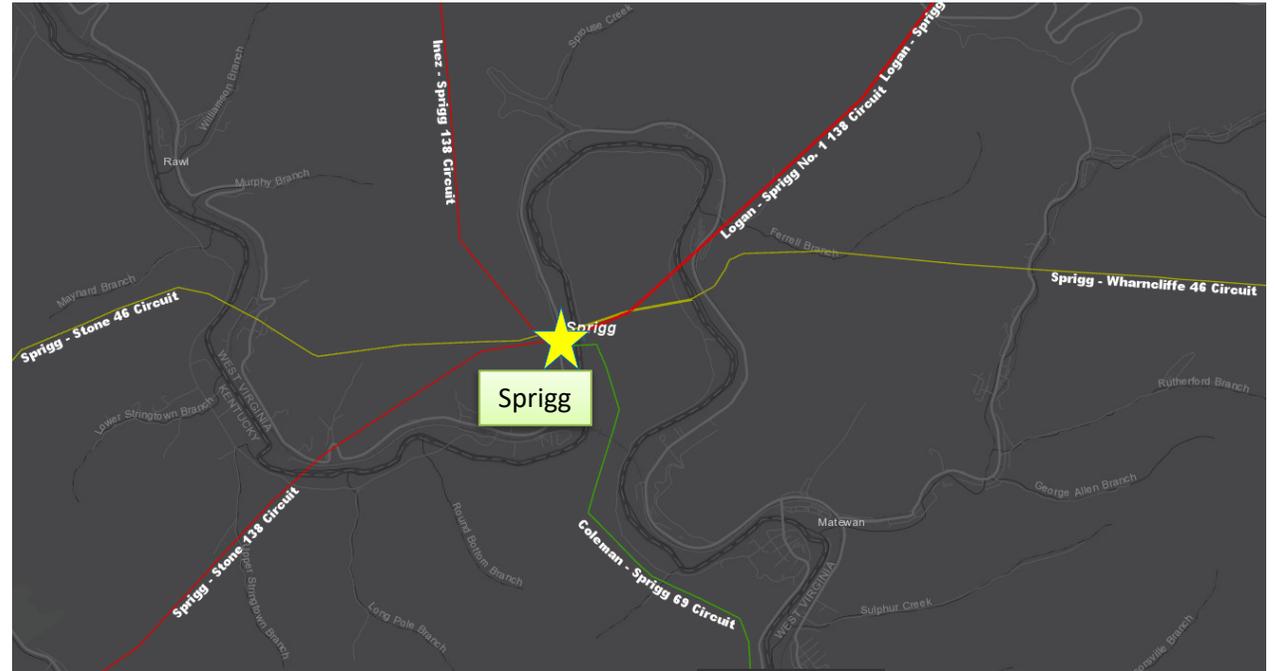
- A, B, C, and D are 1987 vintage and S is 1990 vintage SF6 filled circuit breakers.
- The manufacturer provides no support for these types of breakers and there are no spare parts available for these breakers.
- Circuit Breaker A, B, C, & D, have each exceeded the manufacturer’s recommended number of 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 McDowell County, West Virginia

Need Number: AEP-2022-AP028

Process Stage: Solutions Meeting 8/18/2023

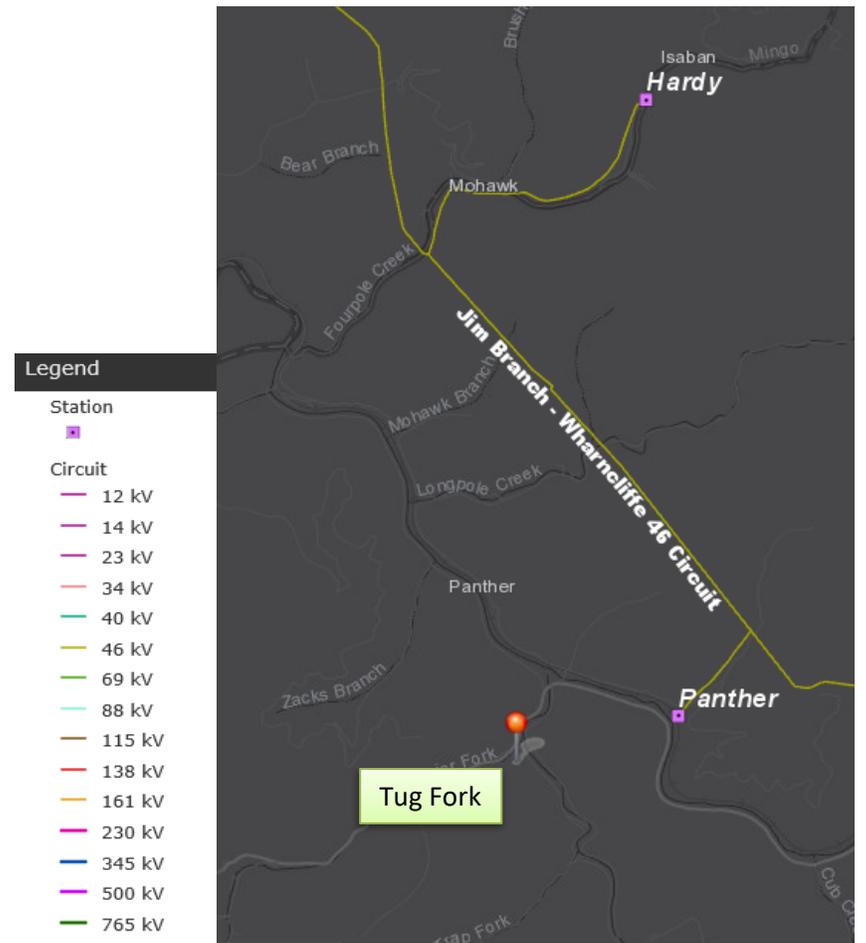
Previously Presented: Need Meeting 4/22/2022

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 (Tug Fork) to serve initially 5 MVA.
- Hardy station has no room for expansion. Hardy station is located directly in front of a church and the church parking making expansion difficult in any direction. Roads to the station are single lane making it challenging to bring large equipment to the station.
- The Distribution transformers at Hardy station are 1940s vintage and based on the age of the units' insulating materials, the paper insulation is becoming increasingly brittle. In addition, the units lack thermally upgraded paper insulation. PHs A and B have high levels of Ethylene which is indicative of high decomposition of the paper insulating materials and high temperature thermal faults. In addition, PH C has high levels of Carbon Dioxide and Ethane which is indicative of excessive decomposition of the paper insulating materials and overheating.
- Panther station is a compact station and is located between a main road and a hill side which doesn't allow for expansion. Wash out is a major concern with the station being built next to the hill side. Roads and bridges to the station are narrow making it difficult to bring large equipment to the station.
- The Distribution transformers at Panther station are 1940s vintage and based on the age of the units' insulating materials, the paper insulation is becoming increasingly brittle. In addition, the units lack thermally upgraded paper insulation. The units have poor dielectric strength, decreasing the ability of the oil to withstand fault events which can damage the paper insulation.
- Neither Hardy or Panther stations have mobile access to pick up the loads in case of any transformer failure or outage.



AEP Transmission Zone M-3 Process Buchanan County, Virginia

Need Number: AEP-2023-AP010

Process Stage: Solutions Meeting 8/18/2023

Previously Presented: Need Meeting 4/21/2023

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

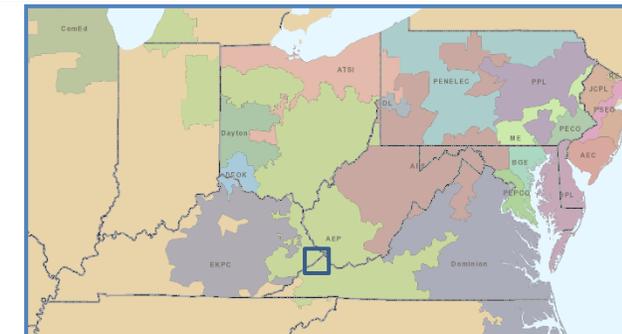
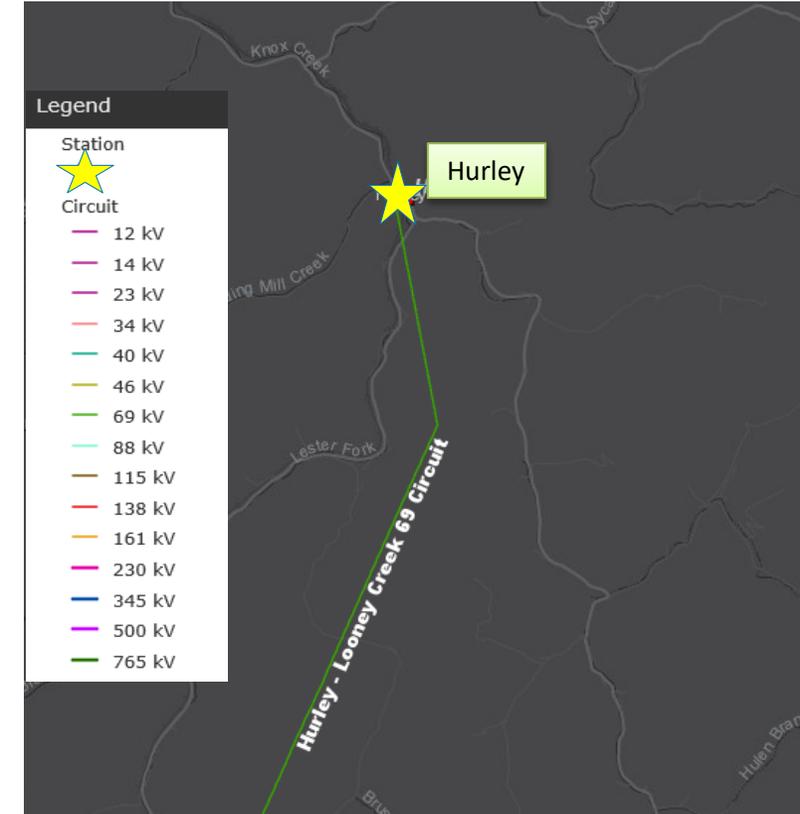
Problem Statement Hurley Station:

69/12kV TR-1

- 1977 Vintage Transformer
- The elevated and rising levels of acetylene indicate high decomposition of the paper insulating materials.
- The transformer has elevated moisture level which can be the result of gasket leaks or breakdown in the oil or paper/pressboard insulation. The decreasing and low level of dielectric strength, indicates an increase in particles within the oil, which in turn decreases the dielectric strength of the oil to withstand fault events. This can ultimately damage the paper insulation. The values of moisture and oil dielectric strength indicate the dielectric strength of the insulation system (oil and paper) is in poor condition.
- The condition of the transformer's wood tie foundation is unknown because it lies under the legacy asphalt oil containment.

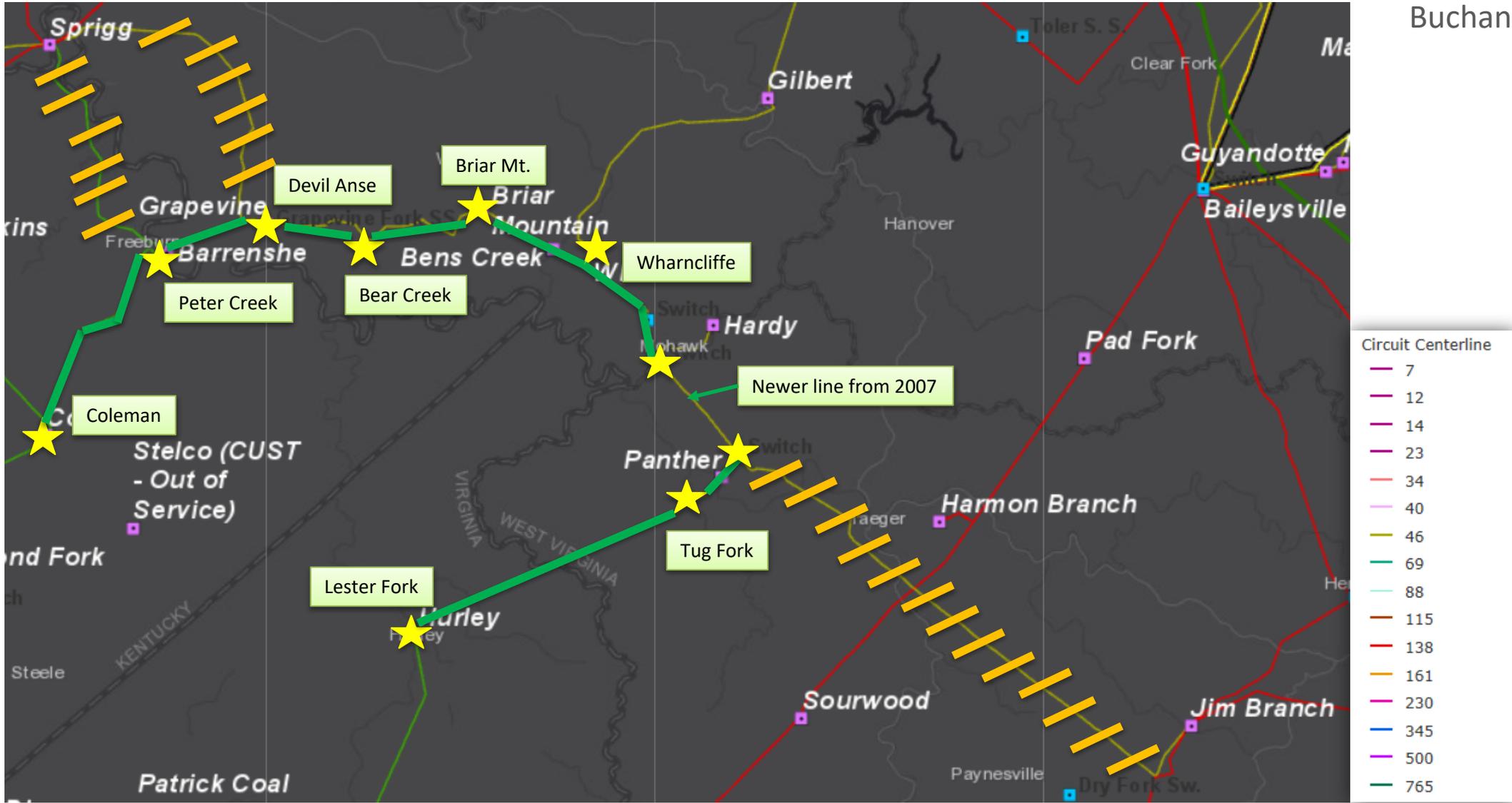
Relay

- There are currently 7 electromechanical type relays which have significant limitations with regard to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. 9 of the 11 relays (82% of all station relays) are in need of replacement.
- Station exists within the 100-year floodplain. This site has flooded multiple times, most recently in 2021.
- Low side expansion is not feasible due to proximity of the station to the road and high side expansion would be difficult without major earthwork due to the station being against a hillside.
- One 69kV line outage on the Hurley – Looney Creek 69kV circuit from 2017 to 2022 caused 863,000 CMI for distribution customers at Hurley due to being on a radial 69kV service and Distribution not having any transferable capability. The radial 69kV line is 10.1 miles long and the Distribution load is 12.5 MVA.
- Limited access off the road for station ingress/egress.



Overview Map

AEP Transmission Zone M-3 Process
 Pike County, KY and Mingo & McDowell Counties, WV
 Buchanan County, VA



AEP Transmission Zone M-3 Process Pike County, KY Mingo & McDowell Counties, WV Buchanan County, VA

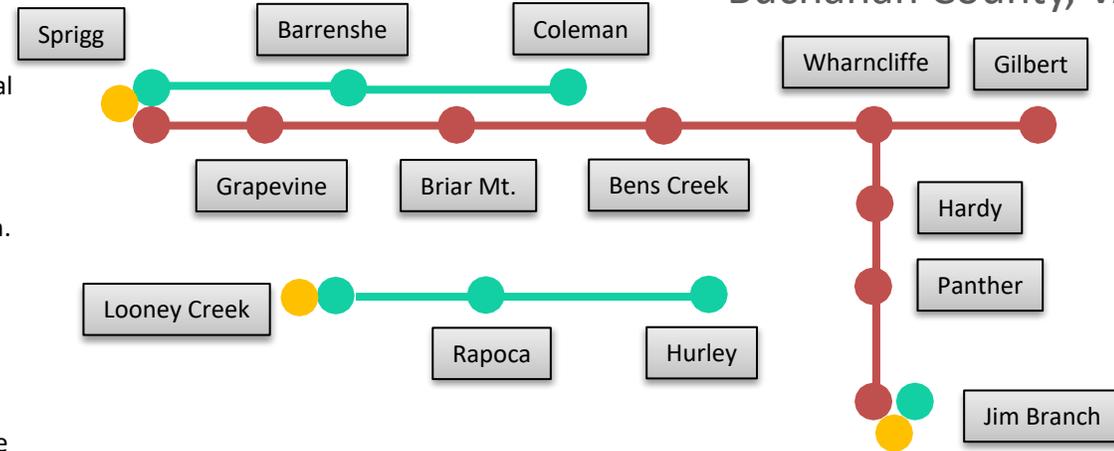
Need Number(s): AEP-2022-AP007, AEP-2022-AP008, AEP-2022-AP009, AEP-2022-AP010, AEP-2022-AP011, AEP-2022-AP028, AEP-2023-AP010

Process Stage: Solutions Meeting 08/18/2023

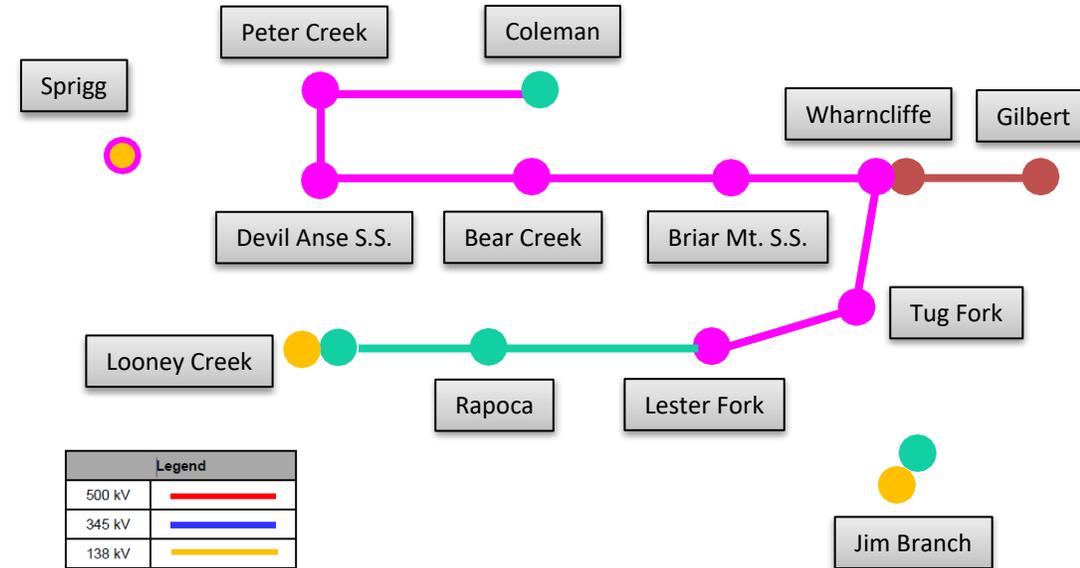
Proposed Solution:

- Coleman - Peter Creek 69kV line - Install new 69kV line with OPGW from Coleman station to Peter Creek Station. Total line length 5.8 miles. Rebuilding within the existing ROW, but some new ROW will be required to get from Coleman station to Peter Creek station. **Estimated Cost: \$19.2 M**
- Peter Creek - Wharnccliffe 69kV line - Install new 69kV line with OPGW from the KY/WV State Line to Peter Creek Station. Total line length 0.1 miles. New ROW will be required to get from the WV/KY state line to Peter Creek station. **Estimated Cost: \$0.3 M**
- Peter Creek - Wharnccliffe 69kV line - Install new 69kV line with OPGW from the KY/WV State Line to Wharnccliffe Station. Intermediate station includes Bear Creek. Includes switching structures Devil Anse and Briar Mt. for Transmission customers and their delineation poles. Total line length 12.7 miles. Rebuilding within the existing ROW, but some new ROW will be required to get from the WV/KY state line to Devil Anse S.S. **Estimated Cost: \$44.7 M**
- Devi Anse S.S. Metering - One 69kV meter for the Transmission customer and one 69kV meter facing the WV/KY state line. **Estimated Cost: \$0.5 M**
- Briar Mt. S.S. Metering - One 69kV metering structure for the Transmission customer. **Estimated Cost: \$0.9 M**
- Huff Creek - Wharnccliffe 46kV line - The remove the span into the takeoff and the first structure 556-109 then re-terminate the line into the new station takeoff structure on the Huff Creek – Wharnccliffe 46kV line. **Estimated Cost: \$0.25 M**
- Tug Fork - Wharnccliffe 69kV line - Install a new single circuit 69kV with OPGW line from existing Wharnccliffe station to Tug Fork station totaling 5.9 miles long. Also reusing 2.3 miles of the Jim Branch – Wharnccliffe line asset at 69kV that was rebuilt in 2007. Create 2.2 miles of greenfield ROW and reuse 3.7 miles of existing ROW from Tug Fork to Wharnccliffe stations. **Estimated Cost: \$24.3 M**
- Lester Fork - Tug Fork 69kV line - Install a new single circuit 69kV with OPGW line from Lester Fork to Tug Fork stations crossing the VA/WV state border totaling 8.0 miles long. Create greenfield ROW from Lester Fork to Tug Fork stations crossing the VA/WV state border. **Estimated Cost: \$33.9 M**
- Looney Creek - Lester Fork 69kV line - Install new 69kV line with OPGW from structure 343-1A to the new Lester Fork Station at 0.25 miles. Remove structure 343-1 and the span into the Hurley Station at 0.1 miles. Create greenfield ROW from structure 343-1A to Lester Fork station at 0.25 miles. **Estimated Cost: \$2.51 M**
- Rapoca 69kV Customer - Replace the Rapoca Station hard tap from the Hurley - Looney Creek 69kV circuit with a Phase over Phase switch. **Estimated Cost: \$0.7 M**
- Bear Creek Station - Two 69kV MOABs that are automatic, and SCADA controlled for the Bear Creek 69kV work. **Estimated Cost: \$0.9 M**

Existing



Proposed



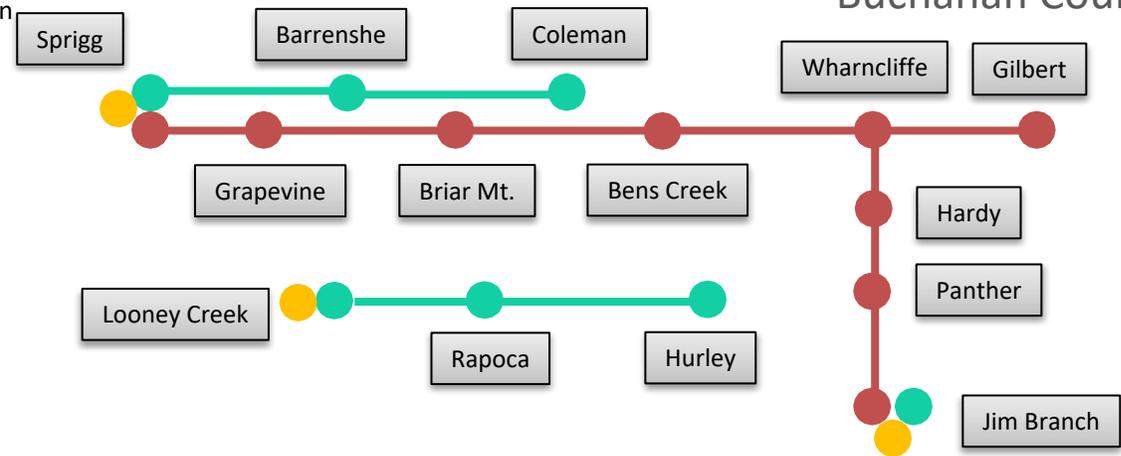
Legend	
500 kV	—
345 kV	—
138 kV	—
69 kV	—
46 kV	—
23 kV	—
New	—

AEP Transmission Zone M-3 Process
 Pike County, KY
 Mingo & McDowell Counties, WV
 Buchanan County, VA

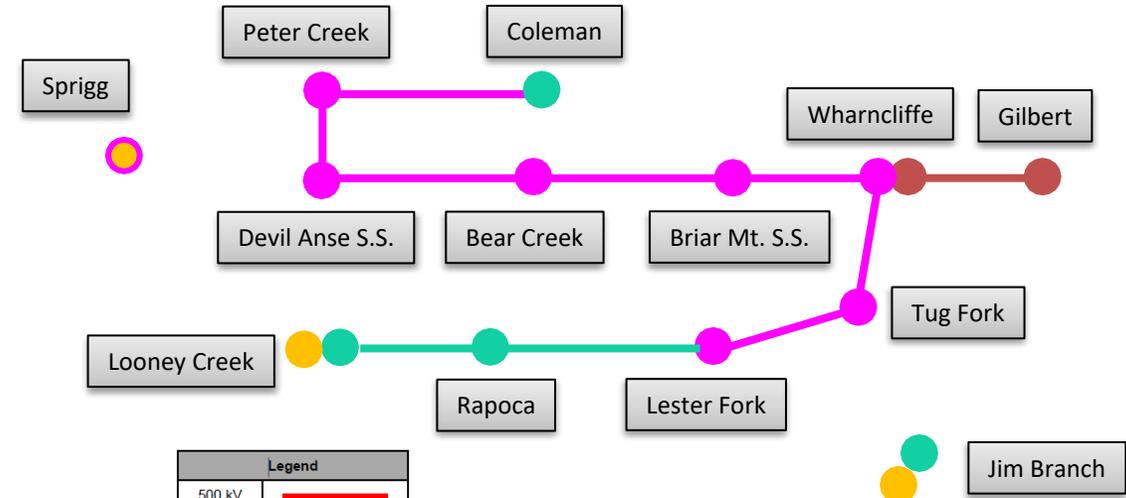
Proposed solution Continued:

- Wharnccliffe Station - Upgrade the existing Wharnccliffe station to 69kV. One 69kV Capacitor bank that is 11.5 MVAR and circuit switcher. One 69/46kV 50 MVA transformer and one 46kV circuit breaker facing Gilbert on the low side of the transformer. Reusing the existing three Transmission circuit breaker for the high side of the transformer and lines facing Tug Fork and Briar Mt. S.S. **Estimated Cost: \$5.9 M**
- Tug Fork Station - Two 69kV circuit breakers with one facing Wharnccliffe and the other facing Lester Fork stations. Includes 69kV bus work. **Estimated Cost: \$2.1 M**
- Lester Creek Station - One 69kV meter facing Tug Fork for the state line crossing. **Estimated Cost: \$0.3 M**
- Looney Creek Station - Replace the existing 69kV MOAB facing Lester Fork with a 69kV circuit breaker. **Estimated Cost: \$1.2 M**
- Sprigg - Barrenshe 69kV line - Remove approximately 6.9 miles of Sprigg - Barrenshe 69kV line. **Estimated Cost: \$0.024 M**
- Barrenshe – Coleman 69kV line - Remove approximately 6.2 miles of Barrenshe - Coleman 69kV line. **Estimated Cost: \$0.024 M**
- Sprigg - Wharnccliffe 46kV line - Remove approximately 1.29 miles of Sprigg - Wharnccliffe 46kV line in KY. **Estimated Cost: \$1.1 M**
- Sprigg - Wharnccliffe 46kV line - Remove approximately 18.3 miles of Sprigg - Wharnccliffe 46kV line in WV and remove the Grapevine Switching Structure. **Estimated Cost: \$14.2 M**
- Jim Branch - Wharnccliffe 46kV line - Remove approximately 19.7 miles of Jim Branch - Wharnccliffe 46kV line. **Estimated Cost: \$15.3 M**
- Hardy Tap 46kV line - Remove approximately 2.0 miles of the Hardy Tap 46kV line and remove the Hardy Switching Structure. **Estimated Cost: \$1.9 M**
- Panther Tap 46kV line - Remove approximately 0.7 miles of the Panther Tap 46kV line. **Estimated Cost: \$0.69 M**
- Briar Mt. Tap 46kV line - Remove approximately 0.1 miles of the Briar Mt. Tap 46kV line. **Estimated Cost: \$0.12 M**
- Grapevine Tap 46kV line - Remove approximately 0.1 miles of the Grapevine Tap 46kV line. **Estimated Cost: \$0.45 M**
- Jim Branch station Removal - Remove the 46kV Circuit Breaker P facing Panther and the Grounding Bank. **Estimated Cost: \$0.087 M**
- Sprigg Station ~~Removal~~ - Remove all the 46kV bus and attached equipment. Remove the 138/69 – 46kV transformer and the 46/7.2KV GND Bank. Remove the 69kV bus and attached equipment. **Remove the 138kV equipment. Rebuild the station as a four 138kV circuit breaker ring bus station. Estimated Cost: \$1.1M-\$5M**

Existing



Proposed



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

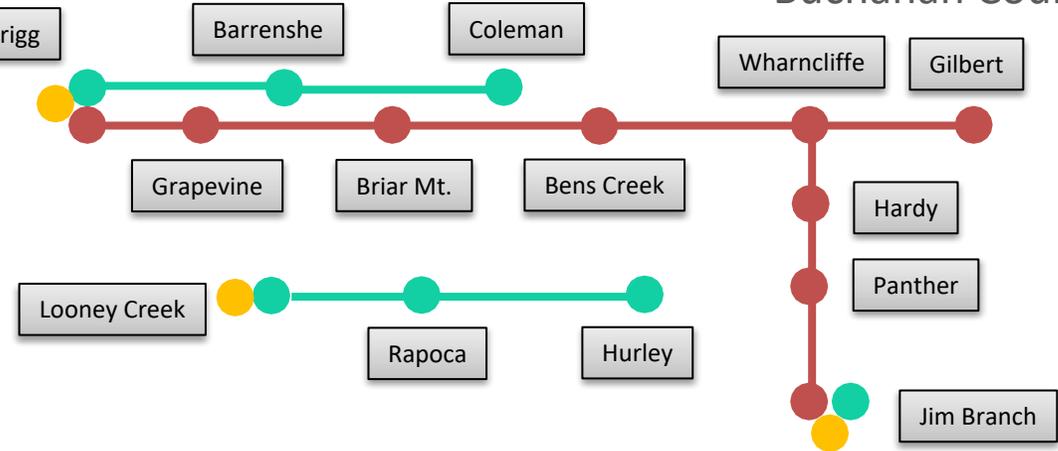
AEP Transmission Zone M-3 Process
 Pike County, KY
 Mingo & McDowell Counties, WV
 Buchanan County, VA

Proposed solution Continued:

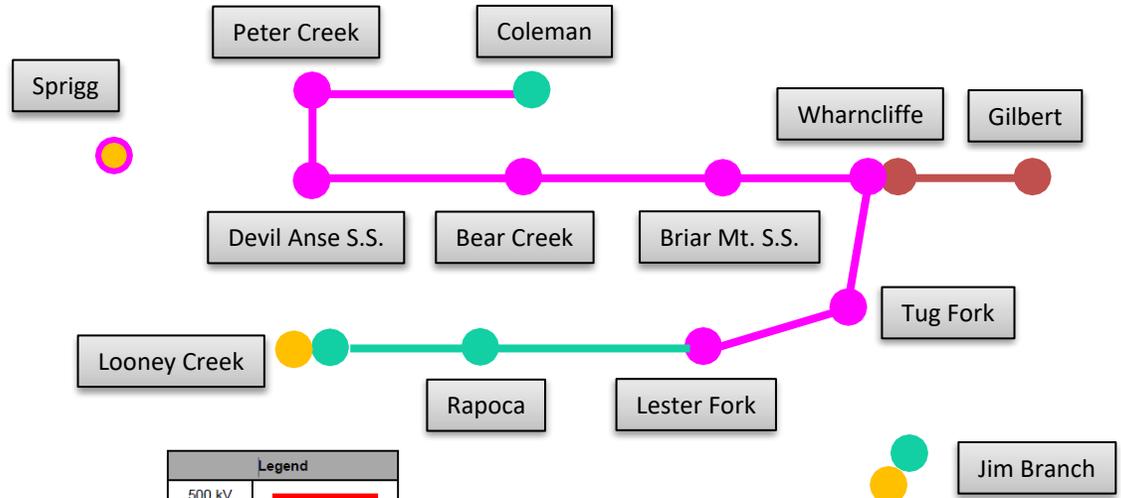
- Coleman Station - Replace 69kV circuit breaker H towards Peter Creek and risers. **Estimated Cost: \$0 (Distribution Cost)**
- Barrenshe Station - Removal of the Distribution station and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Peter Creek Station - A new Distribution station that is replacing Barrenshe station that has a MOAB that is Scada controlled facing Coleman and a 69kV circuit breaker facing Devil Anse S.S. One 69kV circuit switcher and a 20 MVA 69/12kV Transformer and 4 Distribution feeders. **Estimated Cost: \$0 (Distribution Cost)**
- Grapevine Station - Removal of the Distribution station and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Bear Creek Station - A new Distribution station that is replacing Grapevine station that has one 69kV circuit switcher and a 20 MVA 69/34kV Transformer and two Distribution feeder. Also helping to break up a large Distribution circuit out of Pigeon Creek station. **Estimated Cost: \$0 (Distribution Cost)**
- Briar Mt. Station - Removal of the Distribution station and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Bens Creek Station - Removal of the Distribution station and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Wharncliffe Station - Add one 69kV circuit switcher and a 20 MVA 69/12kV transformer and one Distribution feeder to pick up the load from the retired Bens Creek and Briar Mt. stations. **Estimated Cost: \$0 (Distribution Cost)**
- Tug Fork Station - A new Distribution station that is replacing Hardy and Panther stations that has one 69kV circuit switcher and a 20 MVA 69/12kV Transformer and three Distribution feeder. **Estimated Cost: \$0 (Distribution Cost)**
- Hardy and Panther Stations - Removal of the Distribution stations and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Lester Fork Station - A new Distribution station that is replacing Hurley station that has two MOABs that are Scada controlled, one 69kV circuit switcher and a 20 MVA 69/12kV Transformer and three Distribution feeder. **Estimated Cost: \$0 (Distribution Cost)**
- Hurley Station - Removal of the Distribution station and equipment. **Estimated Cost: \$0 (Distribution Cost)**
- Build 2 fiber station transitions using OPGW at Coleman and Peter Creek stations. **Estimated Cost: \$0.2 M**
- Build 4 fiber station transitions using OPGW at Devil Anse S.S. Bear Creek, Briar Mt. S.S. and Wharncliffe. **Estimated Cost: \$0.7 M**
- Lester Fork – Wharncliffe Fiber - Build 3 fiber station transitions using OPGW at Tug Fork, Wharncliffe and Lester Fork. Remove one of the existing shield wires and replace it with an OPGW at 2.3 miles on the Jim Branch – Wharncliffe line asset that is being reused from 2007. **Estimated Cost: \$5.1 M**

Total Estimated Transmission Cost: ~~\$178.66 M~~-\$182.56 M

Existing



Proposed



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

AEP Transmission Zone M-3 Process Pike County, KY Mingo & McDowell Counties, WV Buchanan County, VA

Proposed solution Continued:

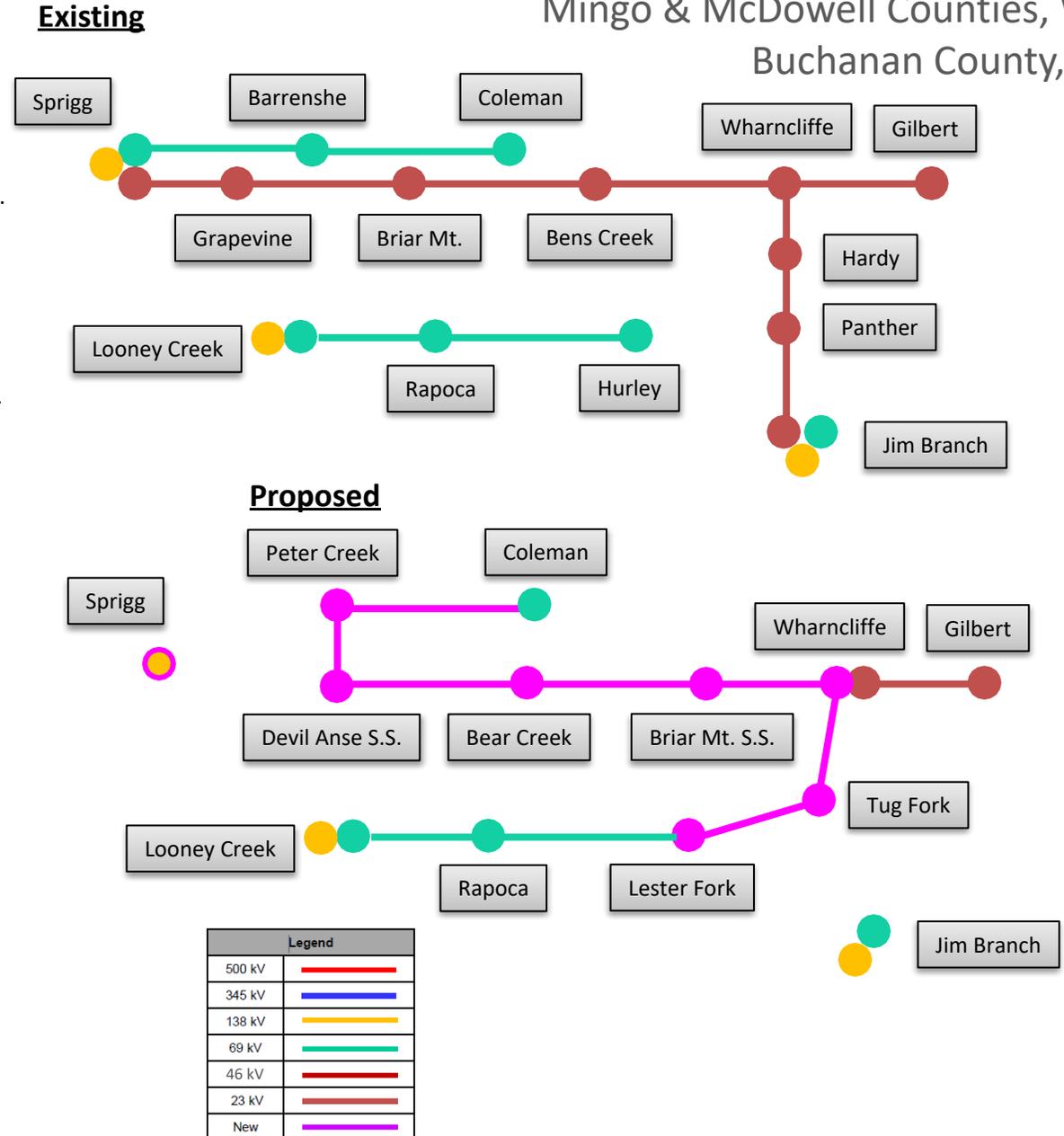
Ancillary Benefits: The greenfield stations and new 69kV line addresses asset concerns on stations and lines that were in the flood plain, had aging equipment, tight clearances, and little to no room for vehicle pull off. The project will provide better sectionalizing to Distribution and Transmission customers. The project will retire roughly 40 miles of legacy 46kV lines and replace with less overall line mileage (31 miles). The project will bring looped Transmission service to the Distribution customer served from the old Hurley station. Hurley station exceeds the 75 MVA * mile guideline.

Alternatives Considered:

An Alternative that was examined was a straight rebuild of the existing assets but operated at 69kV. Hardy and Panther would still be replaced with the new Tug Fork station. Wharncliffe station would still require a 69/46 transformer and two new circuit breakers. This option was not selected due to the longer line mileage of the straight rebuild at 57 miles vs the proposed solution of ~31 miles. This option also did not bring looped Transmission service to Hurley station. This option would have continued to use the existing stations that have space constraints making circuit breaker sectionalizing difficult to add. This option has a conceptual estimate of \$248 Million.

Projected In-Service: 6/1/2030

Project Status: Scoping



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

8/8/2023 – V1 – Original version posted to pjm.com

8/17/2023 – V2 – Corrections were made to the solution for the following need numbers, and corrections are redlined on slides 30-31: AEP-2022-AP007, AEP-2022-AP008, AEP-2022-AP009, AEP-2022-AP010, AEP-2022-AP011, AEP-2022-AP028, AEP-2023-AP010