Western Sub Regional RTEP:
AEP Supplemental Projects

October 20, 2023

Changes to the Existing Projects

AEPTransmission Zone: Supplemental S1598 Scope change

S1598: Originally presented in 3/27/2018 and 4/17/2018 W-SRRTEP

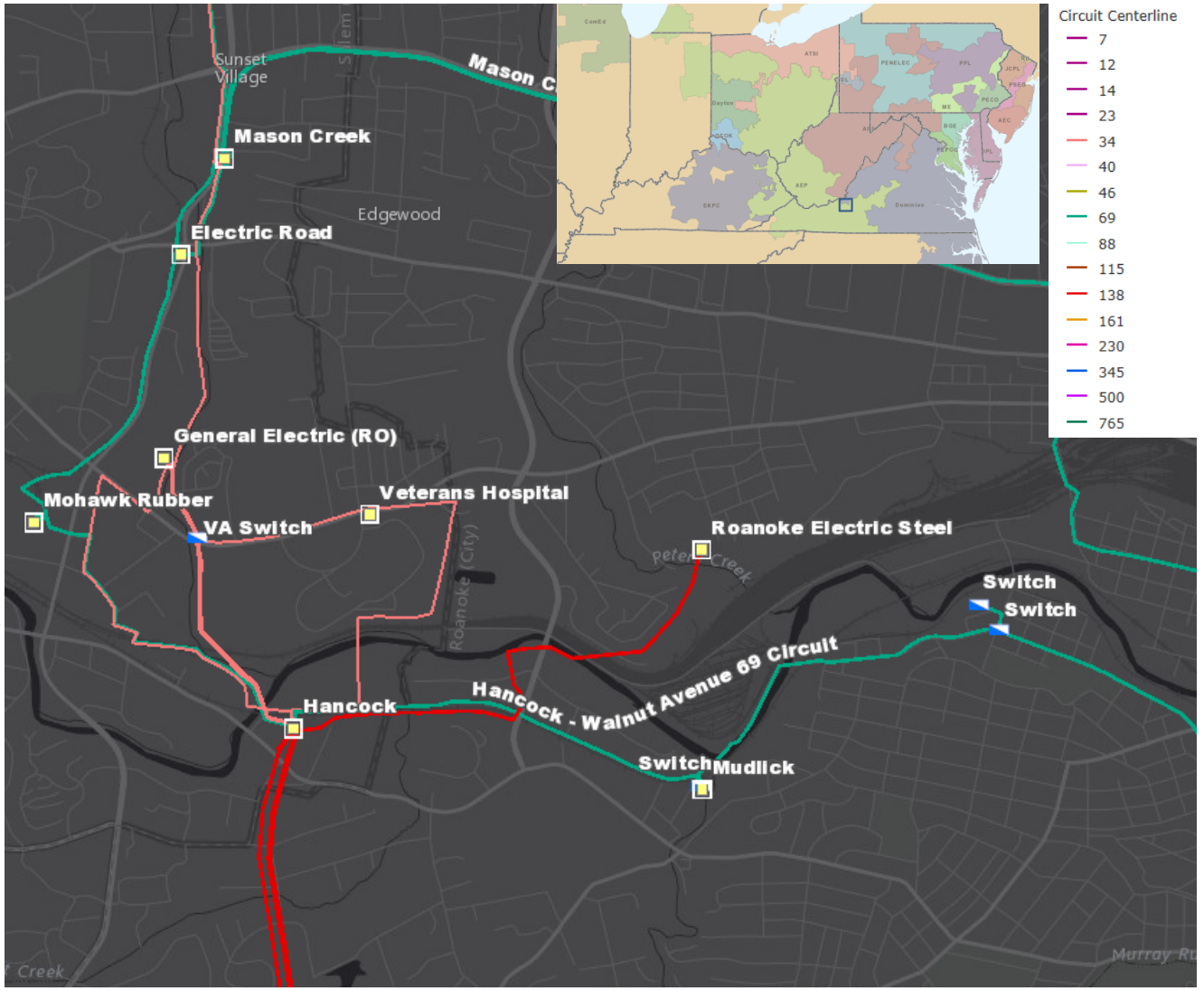
Changes are marked in red

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Hancock station 138 kV circuit breakers 'A', 'B' & 'C', ~~69 kV circuit breakers 'CA', 'M' and 'N',~~ 34 kV circuit breakers 'J', ~~'I',~~ 'P', ~~'R' & 'S'~~ are oil type breakers without oil containment. In general, oil breakers have become increasingly difficult to maintain due to the oil handling requirements. Oil spills are frequent with failures and routine maintenance which is also an environmental hazard. Other drivers include damage to bushings. CBs 'A', 'B', 'C', ~~'CA', 'N',~~ 'J', ~~'I'~~ & 'P' are also legacy oil-filled FK type breakers which have little to no replacement parts. ~~69KV circuit breaker 'Q' is a EPB Gas Circuit Breaker with gas leaks, bushing failures and CT gasket problems.~~

Following a Station Engineering evaluation and site visit, it was determined the 34.5 kV bus work needed to be replaced due to its age, condition and safety concerns around potential error traps to try and replace in place. The 34.5 kV bays are 51 years old and the bus conductor is copper. An existing 69 kV circuit passes through the 34.5 kV bay adding to the existing safety and switching concerns.



AEPTransmission Zone: Supplemental S1598 Scope change

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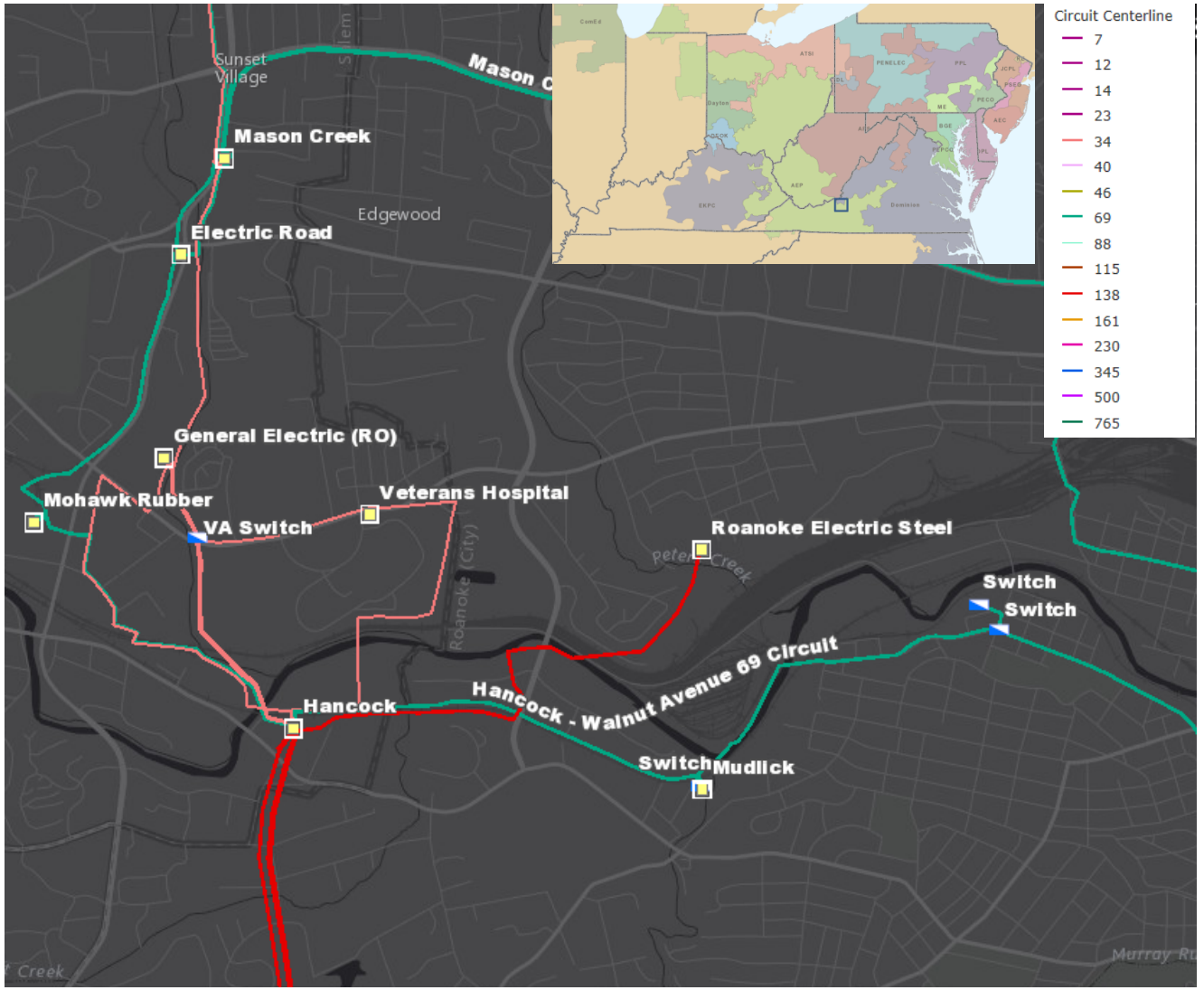
Hancock 138/69/34.5 kV Transformer #2, 1951 vintage, is currently in a poor physical and operational condition. All three single phase transformers are showing short circuit strength breakdown caused through fault events, gassing of the unit, and a significant number of overheating events. There is an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress through aged gaskets, tank or pump leaks, or a breakdown of paper insulation of the transformer windings. In the Phase 1 tank, the most current reading for ethylene is at IEEE Condition 3 and has been steadily rising over the bank's lifetime. In the Phase 2 and 3 tanks, the most current reading for carbon dioxide is at IEEE Condition 3 and 2, respectively, and has recently been on the rise.

The Hancock 138/69-34.5 kV Transformer #1 was manufactured in 1969 and has elevated trends in insulation power factor, which indicates an increase in particles in the oil. Also, elevated moisture levels were observed in relation to the dielectric health of the unit in addition to increased levels of CO2.



AEPTransmission Zone: Supplemental S1598 Scope change

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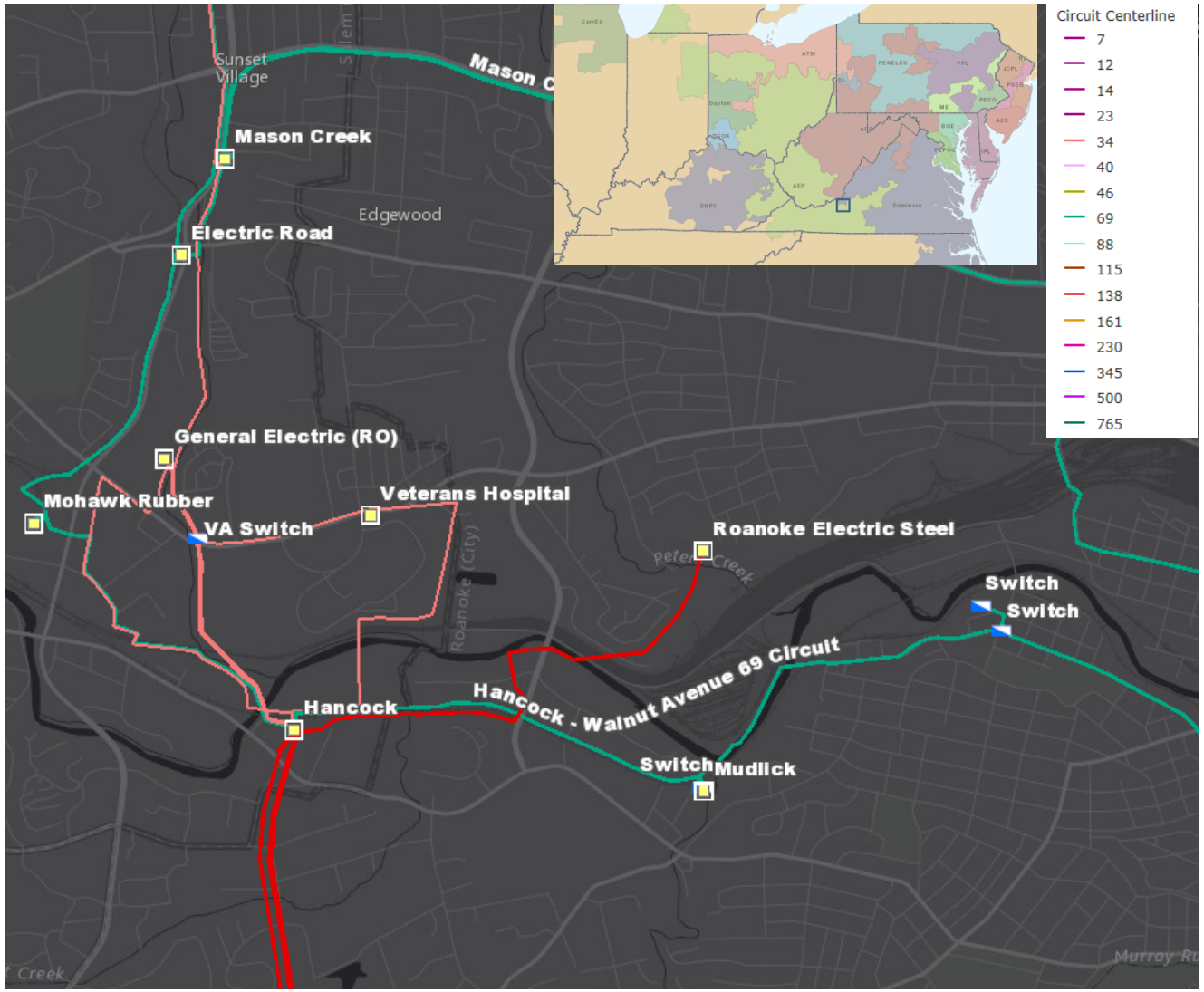
Circuit Switcher BB is a Mark V which is no longer supported by the manufacturer and parts are not available. We have to scavenge for parts during maintenance. These are older designed circuit switchers with old controls that no longer coordinate well with modern relaying. The associated 138 kV, 50.4 MVAr capacitor bank "BB" has approximately half of the capacitor cans have failed.

The 34.5 kV transmission owned circuit switcher AA is a VBM-34 type switcher. This switcher is of 1990's vintage. This model family has experienced malfunctions including failing to trip due to pole malfunction, worn out stops on the control yoke or solenoid nylon pin binding not allowing it to trip due to corrosion, loose bolts, or broken poles. Older VBM types have been very problematic over the years especially on higher voltages where there are two vacuum interrupters in series per phase. In addition, these breakers performed poorly in cold weather, leading to more malfunctions.

The 69 kV Mason Creek and Walnut Ave. lines have pilot wire line relaying. Copper pilot wire is a relatively obsolete technology, and since the telephone companies almost never use it anymore, it is increasingly difficult to find suitable pilot wire cable and hardware. Consequently, we are avoiding like-kind replacement of pilot wire because the technology will be increasingly difficult to maintain. Hancock Substation currently deploys 156 relays, implemented to ensure the adequate protection and operation of the substation. Currently, 132 of the 156 relays (85% of all station relays) are in need of replacement. All 116 of the electromechanical type and 7 static type have significant limitations with regards to spare part availability and fault data collection and retention and are in need of replacement. In addition, these relays lack of vendor support. Currently, 9 of the 33 microprocessor relays are past their average life expectancy and have outdated firmware.



AEPTransmission Zone: Supplemental S1598 Scope change

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Operational Flexibility and Efficiency

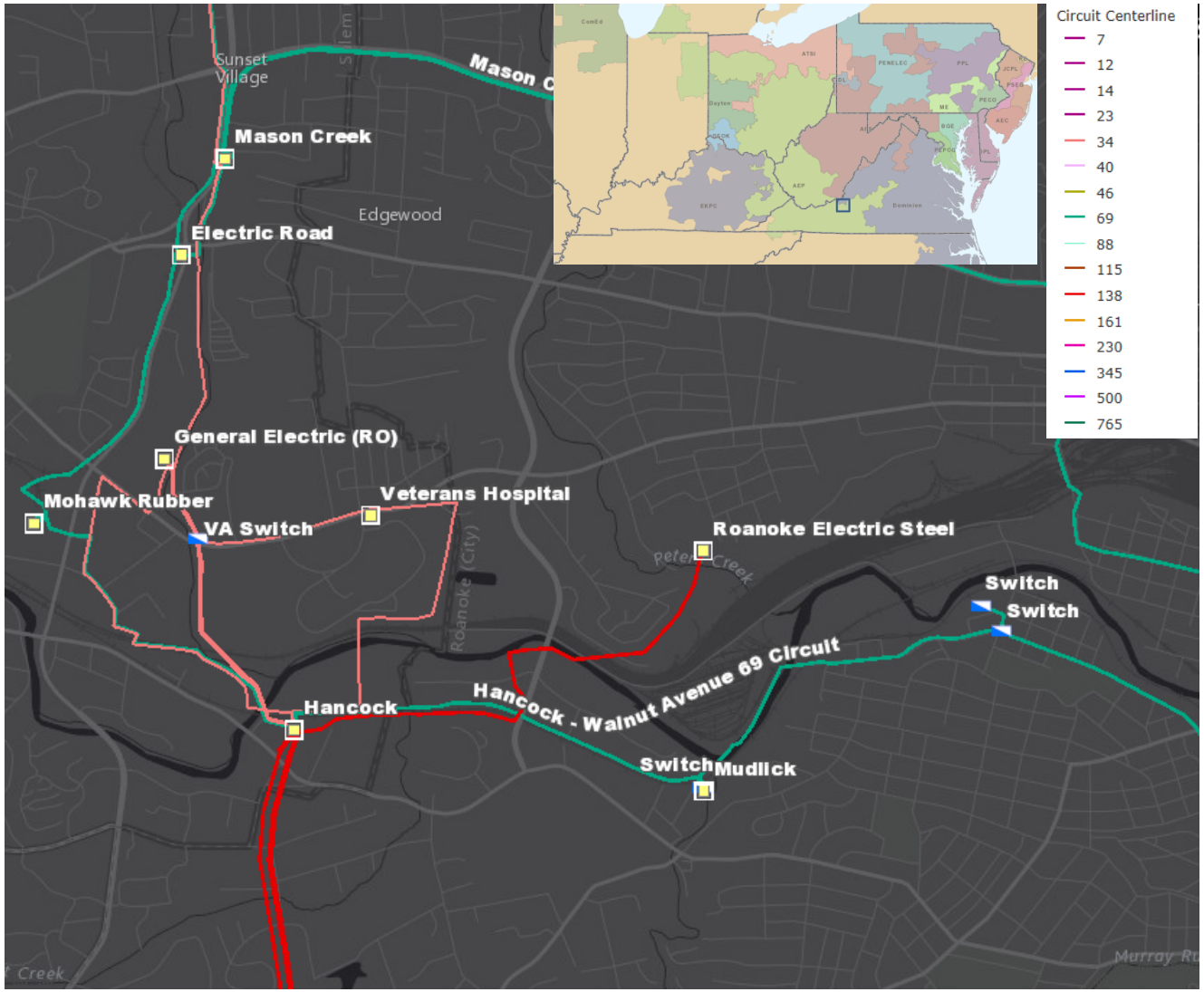
~~The breaker and half configuration will break the three dissimilar zones of protection (138 kV bus #2, transformer #1 and transformer #2), increase reliability, and allow for shorter maintenance outages. With the current configuration we are susceptible to a station outage with a breaker failure of 138 kV bus tie breaker "F".~~

The existing 138 kV high-side MOAB transformer protection for 138/69-34.5 kV T1 and 138/34.5 kV T2 and the MOAB located on the radial feed to Roanoke Electric Steel, are susceptible to momentary outages in addition to their associated 138 kV high-side 138 kV buses. Also, three overlapping zones of protection exist between the 138/69-34.5 kV T1, 138/34.5 kV T2 and 138 kV Bus 2.

The Hancock Distribution 34.5/34.5 kV #3 transformer is 2016 vintage, presents operational and safety concerns due to its non-standard configuration. The bypass switches utilized create the potential for poor grounding conditions, creating an unsafe switching hazard even when the equipment is properly operated. This is 34.5/34.5 kV non-standard configuration has no spare units of its kind on the AEP System.

Customer Service:

Hancock is a critical station for customers in the area. It feeds Roanoke Electric Steel (RES), VA Hospital, General Electric and City of Salem. Roanoke Electric Steel (RES) is large industrial customer (~65 MVA) served from a 1.75 mile radial 138 kV line out of Hancock Station. The radial line to RES is connected directly to the Hancock 138 kV bus #1 via a 138 kV MOAB switch.



AEP Transmission Zone: Supplemental S1598 Scope change

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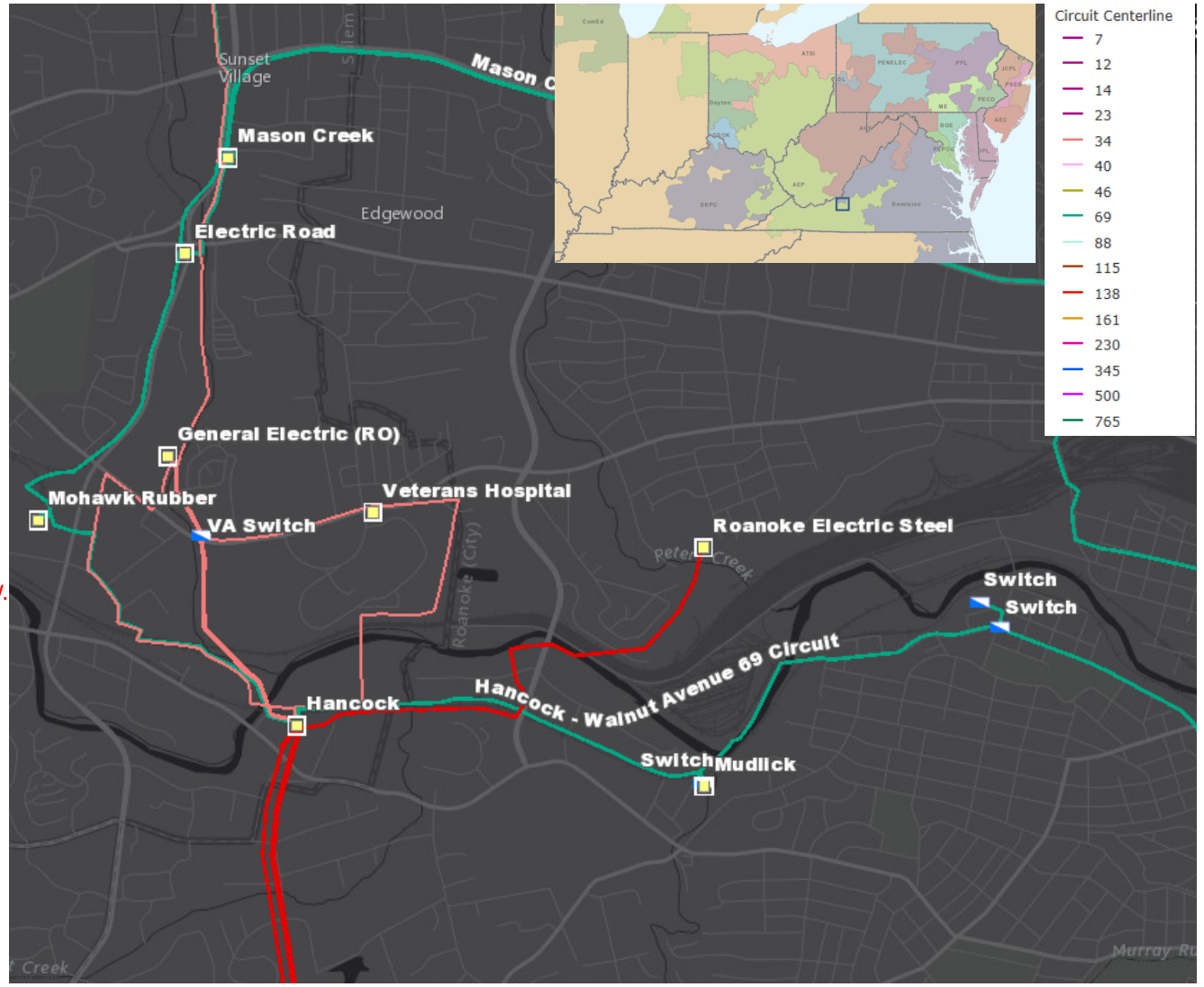
Potential Solution

~~At Hancock station, build a new 138 kV breaker and half configuration with 3 strings. Install 9 new 3000 A/40 kA circuit breakers. Replace the existing 69 kV/27 kA/1800 A CB "N" and "CA", 1200 A/21 kA CB "M" and 2000 A/31.5 kA CB "Q" with 3000 A/40 kA circuit breakers. Replace the existing 34.5 kV/560 A/12 kA CB "R" and "S", 1200 A/16.8 kA CB "I" with 1200 A/25 kA circuit breakers. Install new DICM. Replace 138/34.45 MVA Transformer #2 with new 138/69/34.5kV 130MVA. Add new 138/34.5 kV 30 MVA Transformer #3 with high side Circuit Switcher (3000 A, 40 kA). Replace the existing 138 kV 1200 A/61 kA Circuit Switcher "BB" with new 650A, 31.5 kA CS. Replace 138kV Bus #1, 34.5kV Bus #1 and 34.5kVBus #2 CCVT's. Replace 34.5 kV Circuit Breakers "P" and "J" with new 34.5 kV, 3000 A, 40 kA CB's. Replace 34.5 kV Capacitor Bank Circuit Switcher "AA" with new 40 kA CS. Install Bus Regulators on 34.5kV Bus #3. Replace remote end line relaying.~~ **~~Estimated Cost: $30.0M~~**

Reason for Revision:

The initially proposed breaker and a half configuration was determined not to be feasible physically. Also, after additional engineering investigation, the 138 kV bus work was in relatively good condition and the 34.5 kV equipment was in need of repair. Several of the 69 kV and 34.5 kV circuit breakers had already been replaced.



AEP Transmission Zone: Supplemental S1598 Scope change

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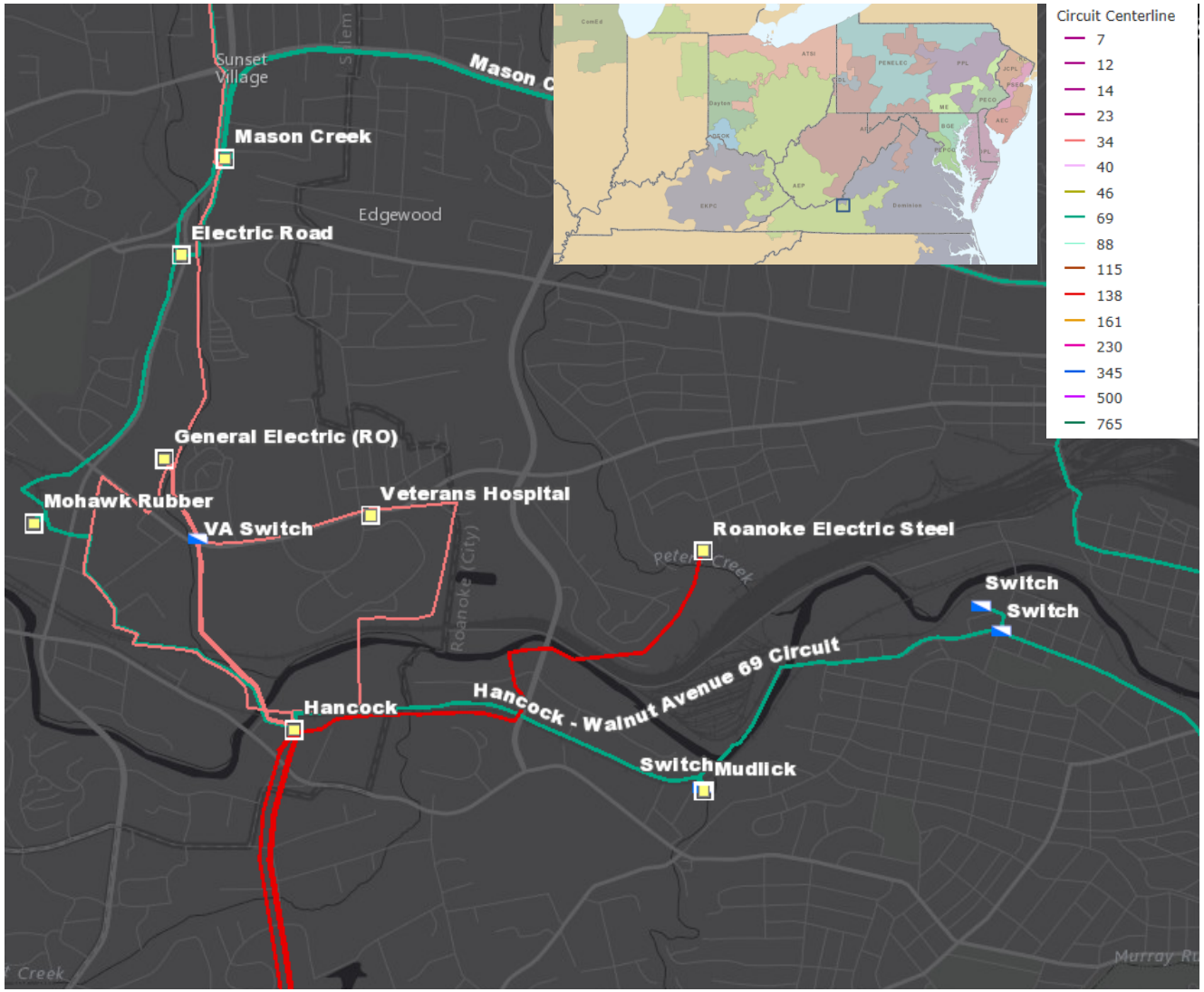
Potential Solution

At Hancock Station:

- Replace 138 kV CBs A, B, C and associated disconnect switches, foundations, and CCVTs
- Install 2 additional 138 kV bus tie breakers and utilize the position between the breakers to feed Roanoke Electric Steel
- Replace 138/69/34.5 kV T1, install a high-side circuit switcher and change connection to bus #1, Install ground bank on 69 kV side
- Replace 138/34 kV T2, install a high-side circuit switcher, new foundations, add oil containment, Install ground bank on 69 kV side
- Replace 138 kV, 50.4 MVAr Capacitor Bank and Circuit Switcher BB, associated switches and foundation
- Replace all Transmission 34.5 kV bus work, circuit breakers, associated disconnect switches and foundations. Replacement 34.5 kV breakers will be 3000 A, 40 kA. Replace 34.5 kV capacitor bank AA with 9.6 MVAr bank, associated circuit switcher and foundation.
- Expand control house and replace all electromechanical relays (116), 7 static relays and 9 microprocessor relays
- Install 138/34.5 kV 30 MVA non-LTC Transformer with high side circuit switcher replacing the non-standard 34.5/34.5 kV configuration and removing the N.O. by-pass around 34.5 kV CB K

Estimated Cost: $30.5 M



AEP Transmission Zone: Supplemental S1598 Scope change

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Alternatives:

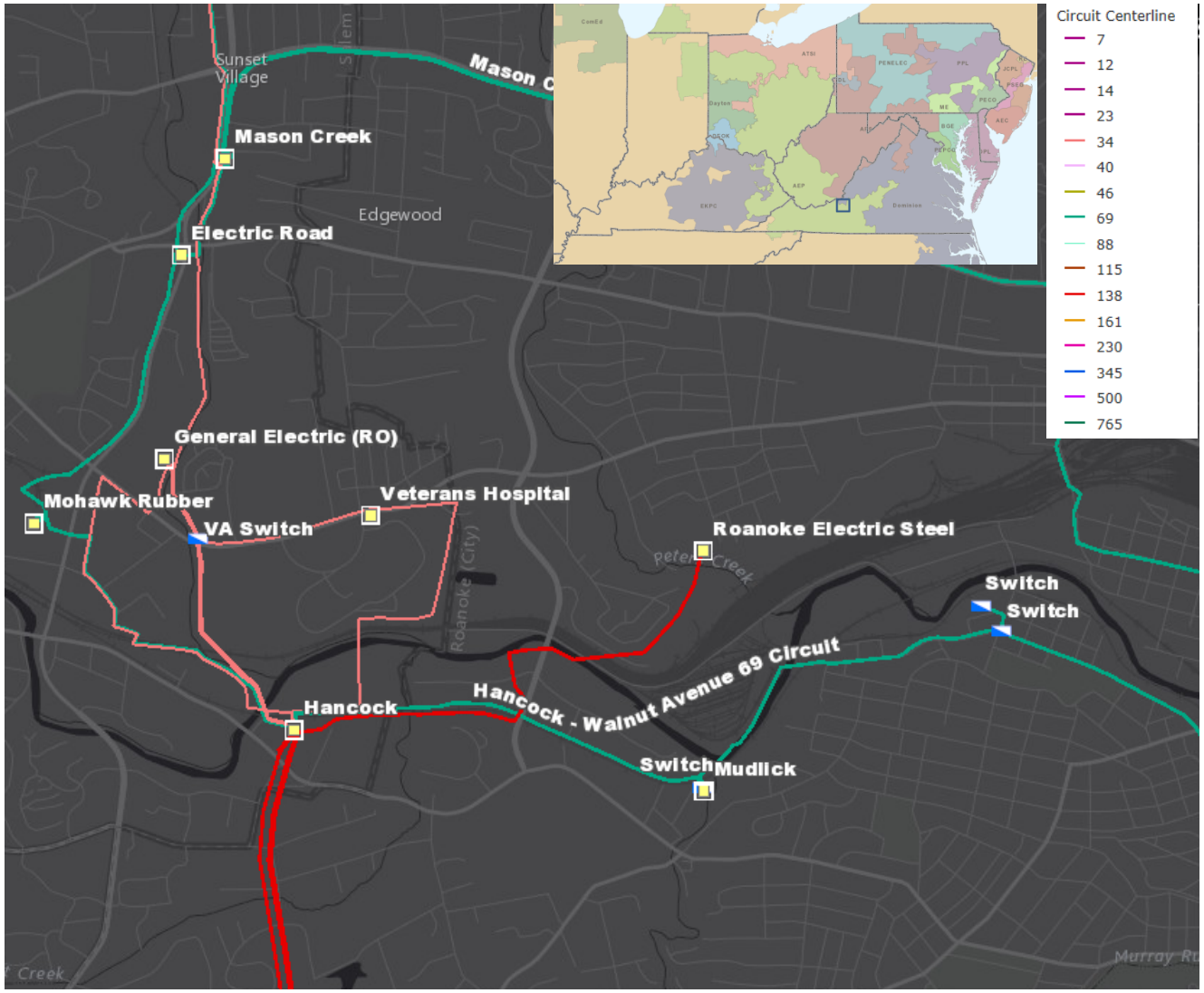
~~Use existing 138 kV structures, replace 138 kV circuit breakers in place, add 138 kV breaker on Roanoke Electric Steel line, add a 138 kV bus tie breaker between 138/69/34 transformer #1 and 138/34 kV transformer #2. Replace 138/34 kV transformer #2 with new 138/69/34 kV 130 MVA transformer and install high side circuit switcher. Install 138 kV circuit switcher on 138/69/34 transformer #1. Install a new 138/34 kV 30 MVA transformer and move 34.5 kV distribution load here. Adding the second bus tie breaker was going to require to reinforce the existing 138 kV structures. Long outages on the 138 kV would have necessary to accomplish this. Due to the customers in the area it was going to be difficult to coordinate and get approval for an outage of this magnitude. With the second 138 kV bus tie breaker Hancock Station would have had three 138 kV buses and still open to a loss of all transformers with a breaker failure scenario. The 138 kV breaker and half scheme has proven to be the most reliable configuration and gives flexibility for performing maintenance without affecting customers.~~ ~~**Estimated Cost: $18M**~~

Construct a new breaker and a half 138 kV greenfield station in the clear, keeping it adjacent to the existing Hancock station site, however, no site nearby was feasible due to the proximity of buildings, roads and Roanoke River to the existing station site. The greenfield station would include all the 138 kV associated equipment with the intent to leave the 69 kV and 34.5 kV equipment in the existing station. Nine (9) 138 kV circuit breakers would be required to establish the breaker and a half arrangement. Significant line re-termination work would be required to accommodate the relocation of the station site. In addition, the 34.5 kV work would still be necessary. The project team also evaluated providing a looped feed to the large industrial customer, RES, but it was not physical feasible due to the urban location

Estimated Cost: $43 M – *for comparison purposes only, does not account for associated T-line relocation costs, since a feasible site was not found.*

Projected In-service: ~~12/18/2021~~ 10/14/2024

Project Status: Engineering



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
Buchanan County, VA

Need Number: AEP-2023-AP023

Process Stage: Need Meeting 10/20/2023

Project Driver:

Customer Service

Specific Assumption Reference:

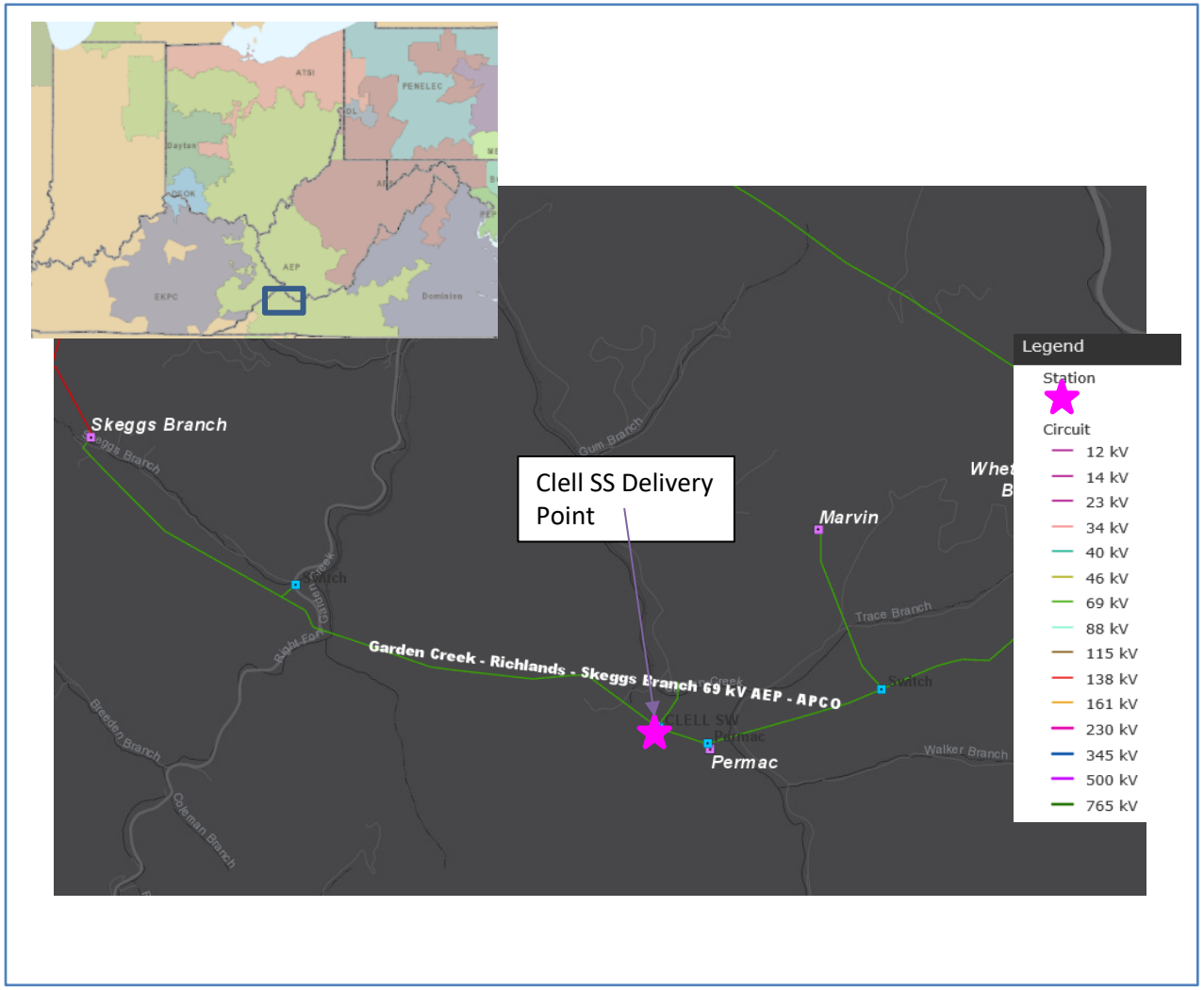
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- Coronado Global Resources, Inc has requested load increase for their facility served out of Clell SS in Buchanan County, VA.
- Coronado has also requested relocation of the 69kV Tap to allow for construction of their new facilities.
- The customer has indicated that their ultimate peak demand will be 17 MW at the site.
- The customer has requested an ISD of 12/01/2023

Model: 2028 RTEP



AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP024

Process Stage: Need Meeting 10/20/2023

Project Driver:

Customer Service

Specific Assumption Reference:

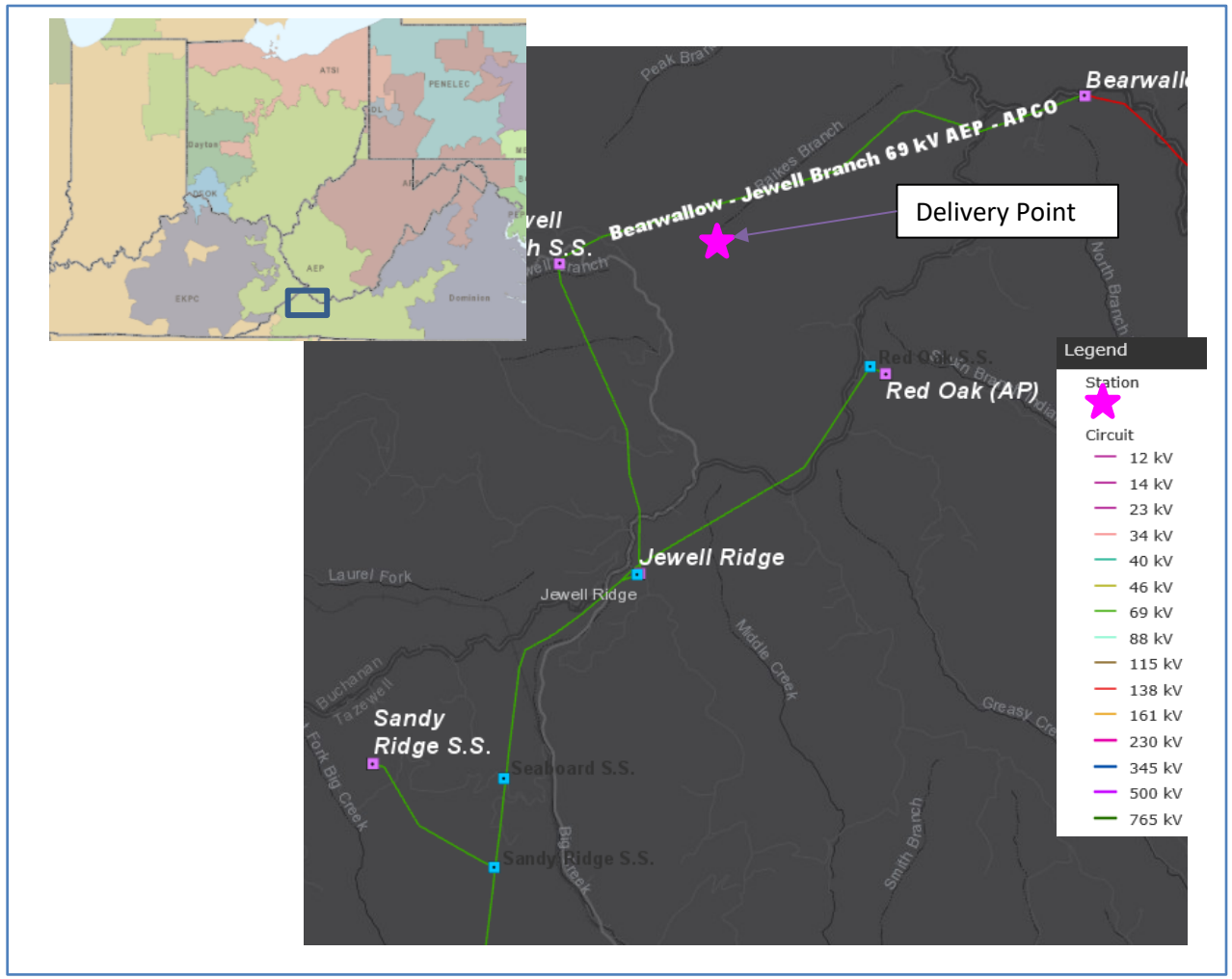
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- Coronado Global Resources Inc. has requested new delivery point for their facility at Jones Fork Rd, Buchanan County, VA.
- The anticipated Peak load for this facility is 2 MW (future possible load ramp of up to 5MW).
- The customer has requested an ISD of 06/01/2024

Model: 2028 RTEP



AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP025

Process Stage: Need Meeting 10/20/2023

Project Driver:

Customer Service

Specific Assumption Reference:

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

Problem Statement:

Dismal River Substation:

A flooding event heavily damaged and failed Dismal River substation in July 2022.

APCo Distribution has requested a new station to replace Dismal River substation

AEP Transmission Zone M-3 Process
Sullivan County, TN

Need Number: AEP-2023-AP026

Process Stage: Need Meeting 10/20/2023

Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Problem Statement:

Fort Robinson – West Kingsport 34kV line:

Original Install Date (Age): 1956

Length of Line: 6.7 mi

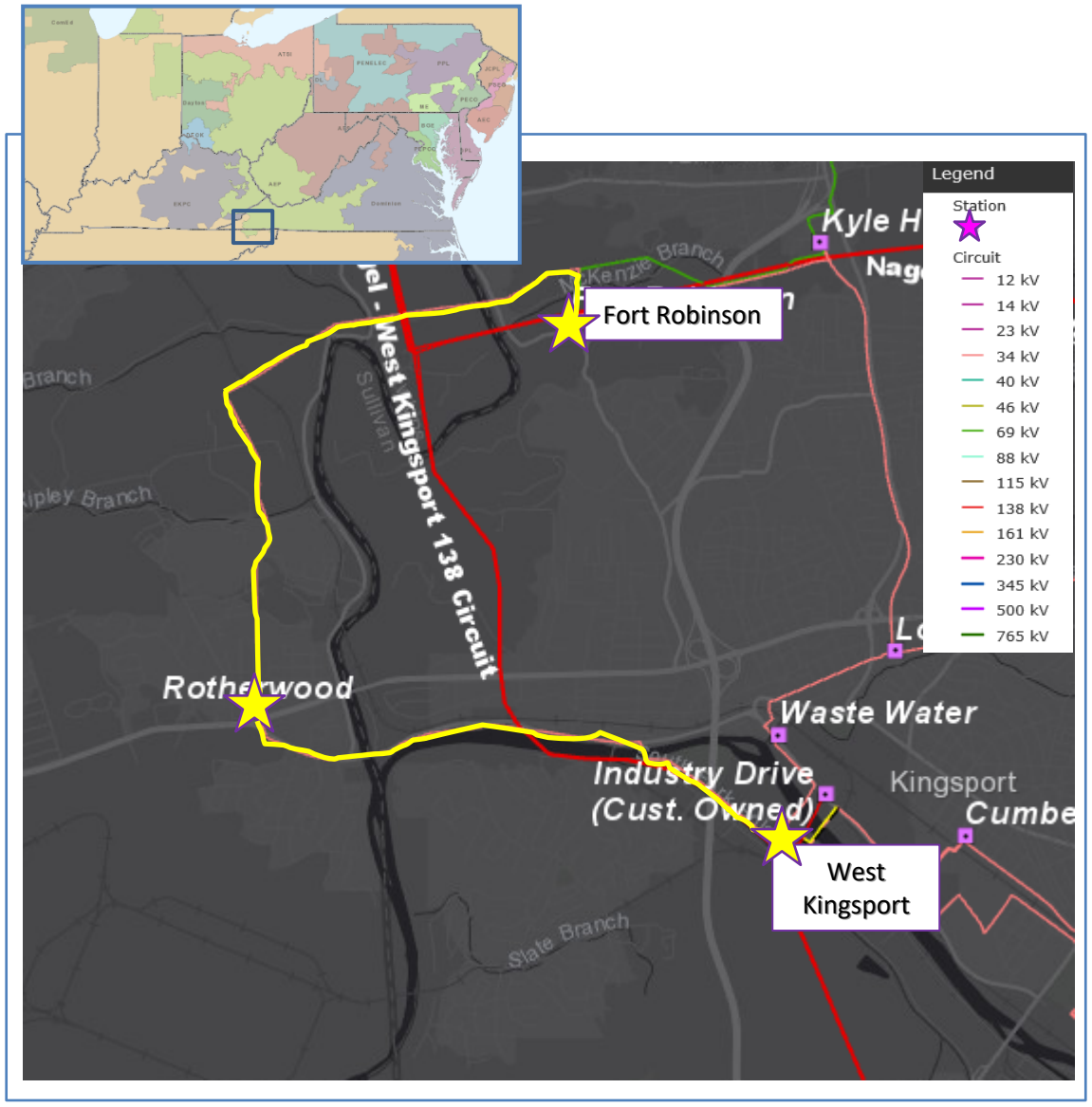
Total Structure Count: 129

Original Line Construction Type: Wood, Steel

Conductor Type: 556,500 CM ACSR 26/7 (Dove)

Momentary/Permanent Outages: 2 Permanent

- The line consists mainly of original 1956 vintage wood structures including original 115 wood pole structures which is 89% of the line.
- From January 1, 2018, to January 19, 2023, there have been 2 permanent outages on the Fort Robinson – West Kingsport 34.5kV Circuit that directly impacted customers. These permanent outages were both due to vegetation fall-ins from outside of the AEP ROW. This outage caused 796k minutes of interruption for customers at Rotherwood substation.
- The representative structure meet current AEP structural strength requirements and fails to meet the current ASCE structural strength requirements. The line is grounded with butt wraps which does not meet current AEP standards
- There are 21 structures (16%) with at least one open condition.
- There are currently 27 open structural conditions including 13 for poles with woodpecker damage, 3 for poles with rot top, 2 for poles with insect damage, 2 for broken poles, 1 for crossarms with rot top, 1 for poles with rot heart, 1 for crossarms with rot heart, 1 for delaminated crossarms, 1 for a bowed pole, 1 for a burnt pole, and 1 for a damaged pole. There is currently one open conductor condition for a burnt conductor. There are currently 5 open grounding conditions including 4 for broken ground lead wires and 1 for stolen ground lead wires. There are currently 2 open hardware conditions for a broken insulator and a buried guy.



AEP Transmission Zone M-3 Process
Sullivan County, TN

Need Number: AEP-2023-AP026

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

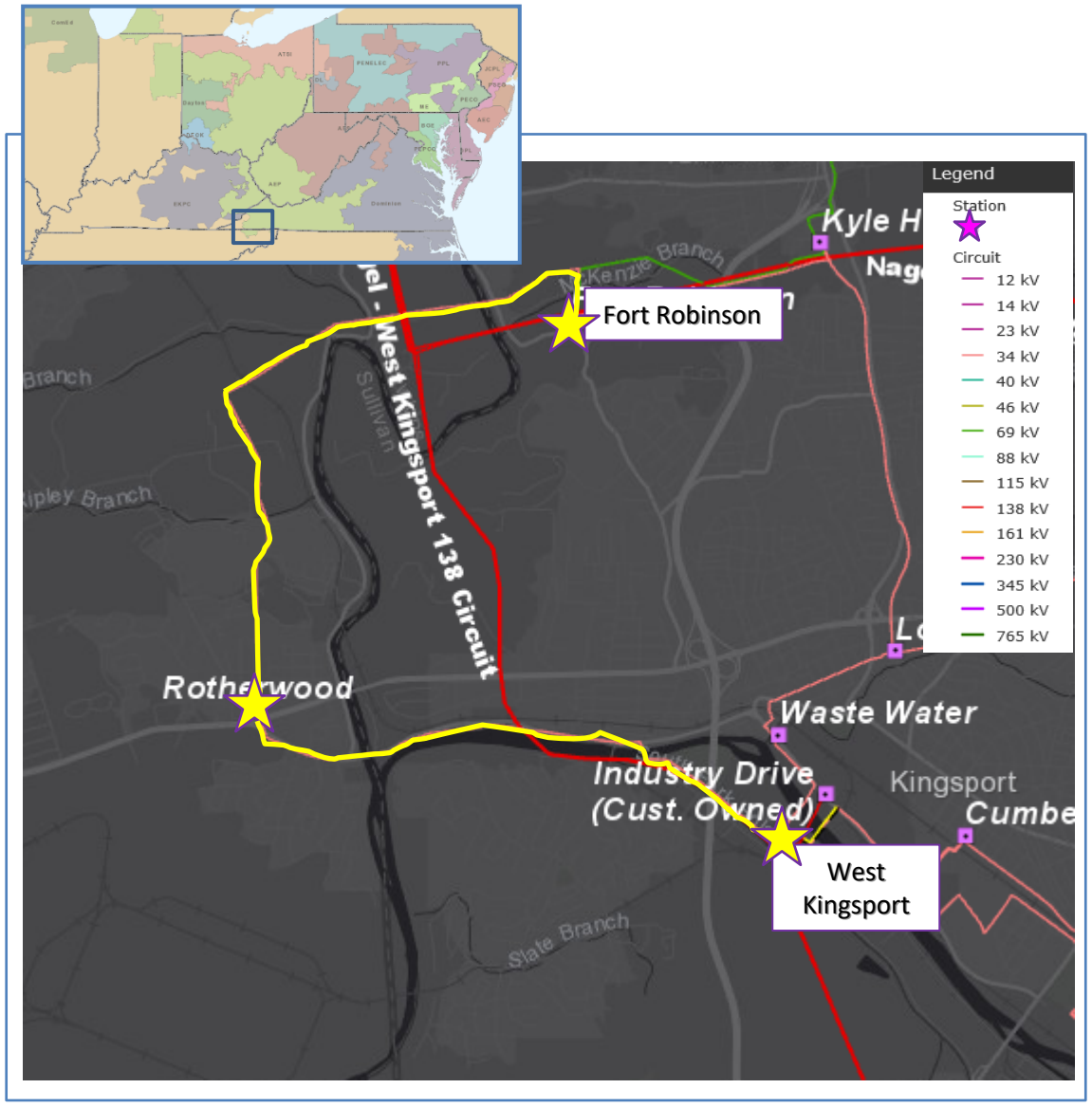
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Fort Robinson – West Kingsport 34kV line:

Cont.

Other:

- There is a Normally Open switch at Rotherwood substation towards West Kingsport substation. The 34kV source for Rotherwood substation at Fort Robinson is fed from the 34kV subtransmission bus which also has 34kV distribution feeders on it requiring maintenance of grounding banks at Fort Robinson. This 34kV sources is served via tertiary winding of the Fort Robinson Transformer. The 34kV source for Rotherwood substation at Fort Robinson is fed from the 34kV subtransmission bus which also has 34kV distribution feeders on it requiring maintenance of grounding Banks at West Kingsport.
- The Fort Robinson – West Kingsport 34kV Circuit serves a peak load of 26 MW at Rotherwood substation.



AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP027

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Problem Statement:

Hales Branch Substation:

Hales Branch 138/69-12kV 75 MVA XFR #1

- 1966 Vintage Transformer
- Increase in particles within the oil, indicating that the overall dielectric strength of the insulation system (oil and paper) is in poor condition, which impairs the unit's ability to withstand electrical faults.
- Elevated levels of carbon dioxide and carbon monoxide indicating high decomposition of the paper insulating materials.
- The changes in bushing dielectric data indicate capacitive layer deterioration.
- The presence of ethane and carbon dioxide, along with the indication of overheating faults, indicates decomposition of the increasingly brittle and non-thermally upgraded paper insulation that impairs the unit's ability to withstand future short circuit or through fault events.
- The transformer 1 slab foundation is in poor condition and in need of replacement.

12/34.5kV Grounding Transformer

- 1956 Vintage transformer
- Indication of elevated levels of carbon dioxide and carbon monoxide indicating high decomposition of the paper insulating materials.
- Elevated levels of acetylene indicating increased decomposition of paper insulating materials.

AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP027

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Hales Branch Substation:

69kV Breakers A and B:

- A and B are 1960 Vintage CF-48 type Oil Filled Circuit Breakers. Circuit Breaker A has experienced 12 faults against recommended faults operations of 10. No support from manufacturers is available for this family of circuit breakers so spare parts are not available. This model family has experienced major malfunctions associated with their hydraulic mechanism, which includes low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off.

138kV Circuit Switcher BB:

- The Circuit Switcher BB is 1998 Vintage MARK V type SF6 filled Circuit Switcher. The Mark V family of circuit switchers have no gas monitor and currently in-service units on the AEP system have experienced 110 malfunctions.

69kV Circuit Switcher AA:

- The Circuit Switcher AA is of 1990 vintage 2030-69 type SF6 Filled Switcher. This family of circuit switchers have no gas monitor and currently in-service units on the AEP System have experienced 80 malfunctions. The major malfunction events, which account for 80% of recorded malfunctions, include gas loss, interrupter failures, operating mechanism failures, and trip or reclose failures.

AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP027

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Hales Branch Substation:

Relaying:

- 74 of the 81 relays (91% of all station relays) are in need of replacement.
- There are 60 electromechanical type and 8 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 6 legacy microprocessor relays in need of replacement due to obsolescence.

Other:

- There are Hook Stick switches within the substation. The station was originally installed in 1955 with some station steel dating back to original installation.
- 138kV MOABs 'U' and 'W' have obsolete motor mechanism and are in need replacement.
- (4) 138 kV transmission lines connect to (2) 138 kV buses in a single breaker/bus configuration with a bus-tie breaker between the buses, (2) 69 kV transmission lines, in a single breaker/bus configuration with a bus-tie switch between the lines outside the station. 3-138kV lines do not have a circuit breaker for protection, resulting in overlapping zones of protection at the station. Baileysville and Looney Creek form a three-terminal line with Hales Branch.

AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP028

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

Problem Statement:

Garden Creek – Clinch River 139kV line:

Original Install Date (Age): 1963

Length of Line: 23.75 mi

Total Structure Count: 121

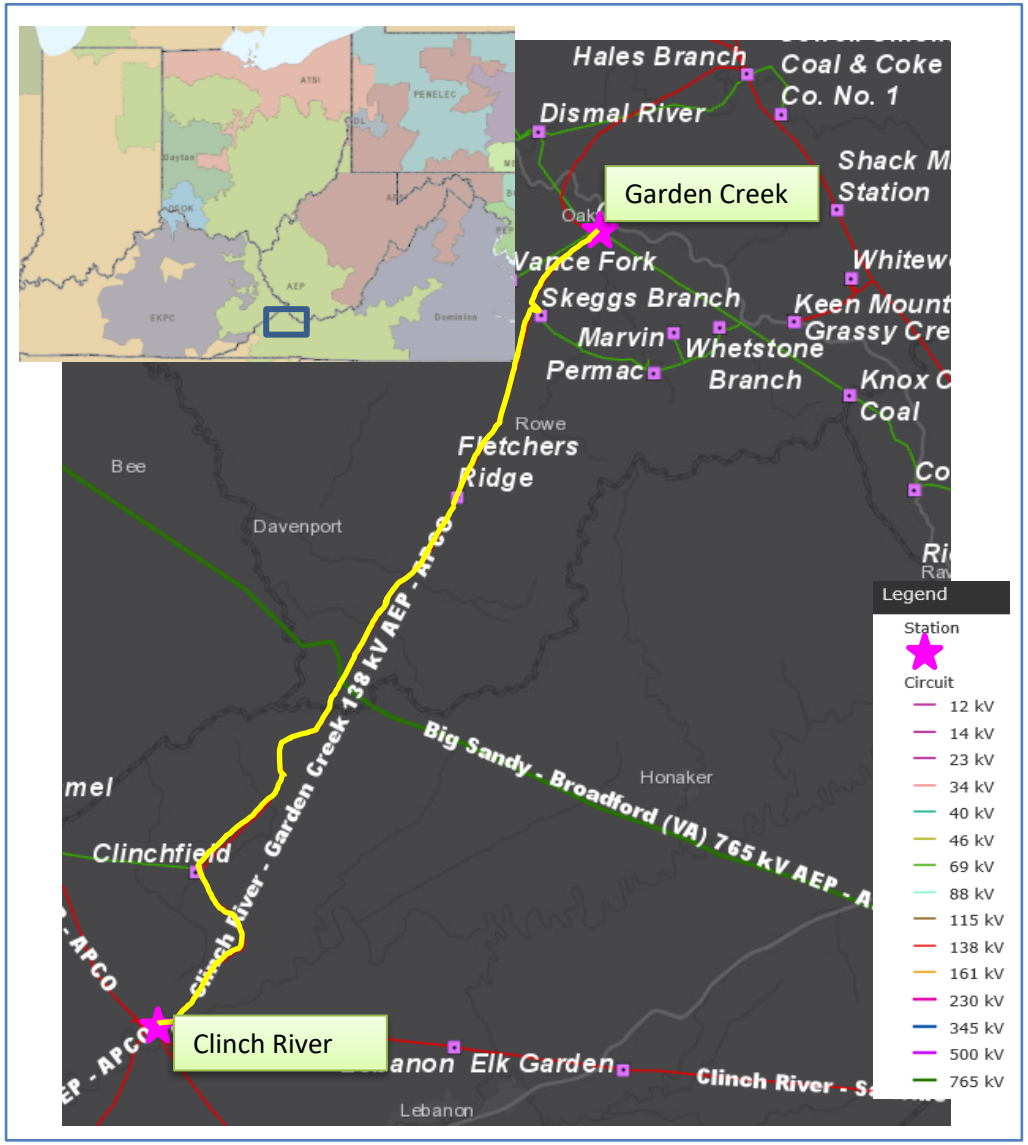
Original Line Construction Type: Wood, Steel, Lattice Steel

Conductor Type: 636,000 CM ACSR 26/7 (Grosbeak), 954,000 CM ACSR 54/7 (Cardinal)

Momentary/Permanent Outages: 3 Momentary, 3 Permanent

Line Conditions:

- The line consists mainly of original 1963 vintage structures (93%) including 108 wood pole structures and 4 vintage steel lattice towers.
- There have been 3 momentary and 3 permanent outages on the Clinch River – Garden Creek 138kV Circuit. The momentary outages were all due to lightning. The permanent outages were due to vegetation fall-in from outside the AEP ROW (2) and wind (1) causes, resulting in 203k minutes of customer interruption for those served at Fletcher's Ridge, Permac, and V.P. No. 6 Substations.
- There are 45 structures of 121 (37%) with at least one open condition. There are currently 144 open structural conditions related to rot top poles, crossarms, and filler blocks (97), woodpecker damaged poles (14), insect damaged crossarms, a pole, and a knee/vee brace (6), rot heart poles (6), bowed crossarms and a knee/vee brace (5), damaged poles (4), split poles and a crossarm (4), leaning in-line poles (3), cracked poles (2), a broken knee/vee brace (1), corroded crossarm (1), and a loose knee/vee brace (1).



AEP Transmission Zone M-3 Process
Buchanan County, VA

Need Number: AEP-2023-AP028

Process Stage: Need Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13,14,15)

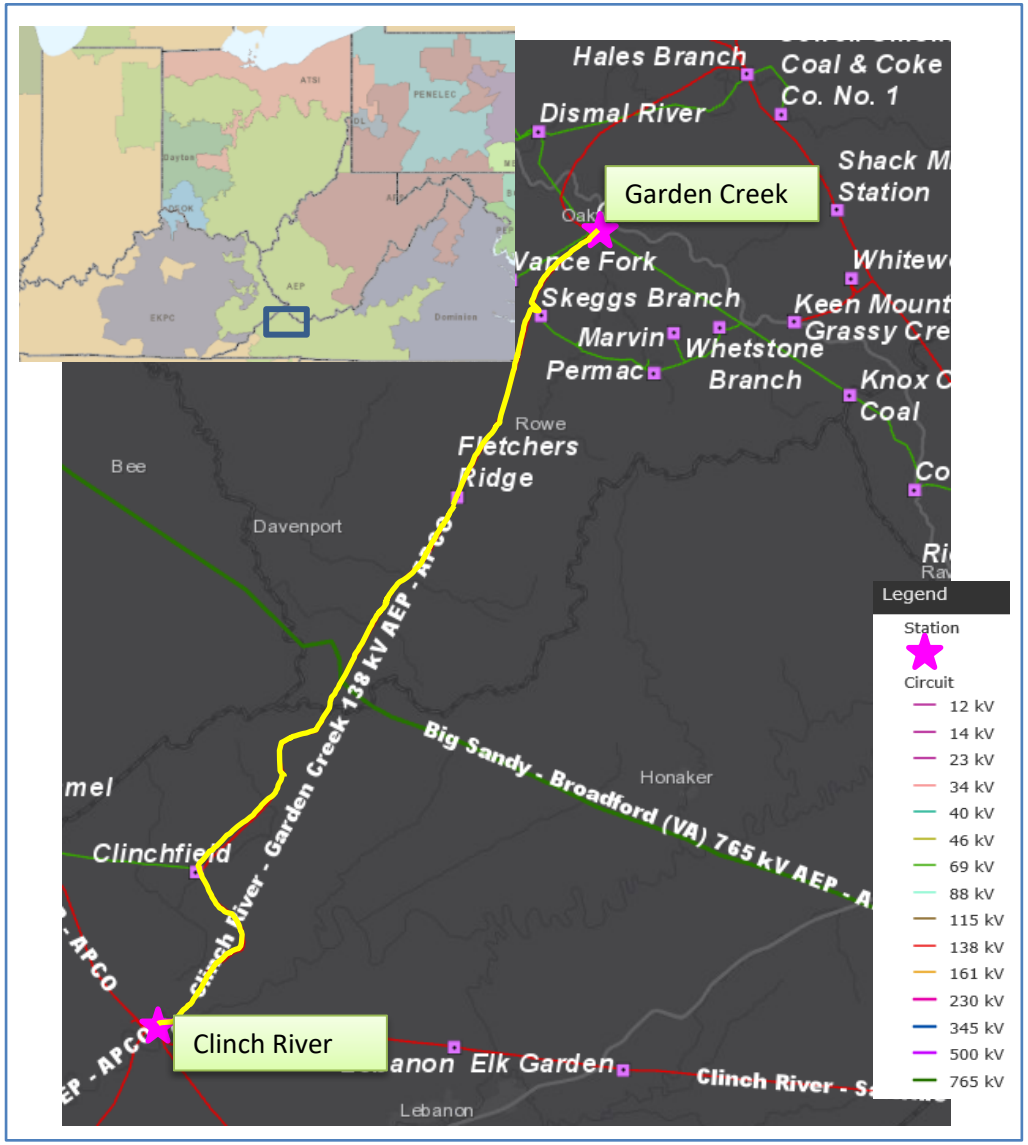
Garden Creek – Clinch River 139kV line:

Line Conditions:

- There are 13 open grounding conditions related to broken (10) and missing (2) ground wire leads. These grounding conditions can contribute to the poor lighting performance that the associated circuit has experienced. There is currently 1 open conductor condition related to damaged conductor.
- The Clinch River – Garden Creek 138kV Circuit serves a peak load of 22 MW at Fletcher's Ridge Substation and well as the 69kV V.P. No. 6 and Permac Substations. The 69kV served customers at Permac and V.P. No. 6 are impacted by outages on this 138kV circuit because of lack of sectionalizing and poor performance of this line. The 69 kV line is operated normally open towards Whetstone Branch.
- This line and its structures are difficult to access due to the difficulty of the terrain, limited access roads, gas well and gas lines, and active surface mining sites. Several grounding leads have been stolen over the years.

Operational needs:

- The Clinch River – Clinchfield 138kV Line Segment can overload in real time under summer peak conditions if there is a south to north transfer bias for the double contingency loss of Clinch River – Saltville #1 and Clinch River – Fremont 138kV Circuits. Other real time N-1-1 contingencies can overload this line too. The Clinchfield – Fletchers Ridge 138kV Line Segment can overload under summer peak conditions if there is a south to north transfer bias for the double contingent loss of Clinch River – Saltville #1 and Broadford 765/138 TR1.
- Skeggs Branch substation is served via a Hard tap on the Clinch River – Garden Creek line



AEP Transmission Zone M-3 Process
Wyoming/Raleigh County, WV

Need Number: AEP-2023-AP029

Process Stage: Need Meeting 10/20/2023

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Poplar Gap – Slab Fork 46 kV Line Segment (Bolt – Tams Mountain 46 kV Circuit)

Momentary/Permanent Outages: 24 Momentary, 12 Permanent

Circuit Performance:

- Since 2016, there have been 24 momentary and 12 permanent outages on the Bolt - Tams Mountain 46kV Circuit (8.9 of the 13.1 circuit miles consists of the of the Poplar Gap – Slab Fork Line). The momentary outages were due to lightning, vegetation fall-in from outside AEP ROW, ice/snow, and other weather causes. The permanent outages were due to vegetation fall-in from outside AEP ROW and lightning causes, resulting in a total of 2,485 hours of circuit outage time. These outages caused 43k minutes of customer interruption at Slab Fork Substation.

Original Install Date (Age): 1940

Length of Line: 8.9

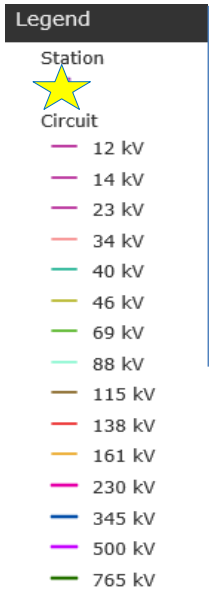
Total Structure Count: 53 (62% of the line is 1940s wood)

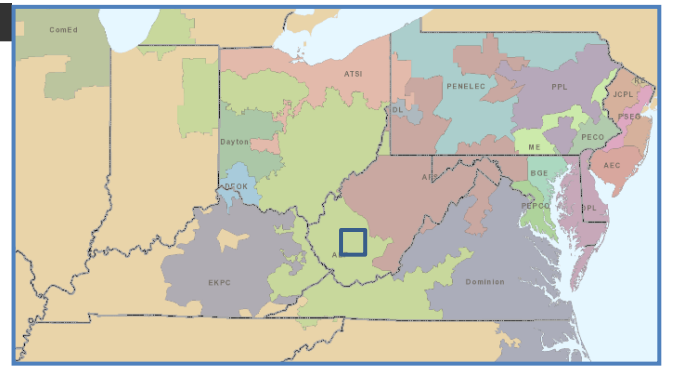
Original Line Construction Type: Wood

Conductor Type: 3/0 ACSR 6/1 (Pigeon), 1,033,500 CM ACSR 54/7 (Curlew)

Line Conditions:

- Currently, there are 16 structures with at least one open structural condition, which relates to 30% of the structures on the line segment. There are currently 29 open structural conditions related to rot top crossarms and poles, broken knee / vee braces, rot heart poles, insect damaged pole and knee / vee brace, a rot heart crossarm, a broken crossarm, and a woodpecker damaged pole. There are 13 open forestry conditions related to brush clearances, vines, and a hazard tree. There is 1 open conductor condition related to broken conductor strands. There is 1 open hardware condition related to broken guys.





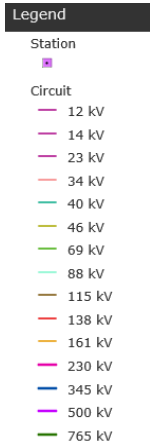
AEP Transmission Zone M-3 Process
New Carlisle Customer Needs

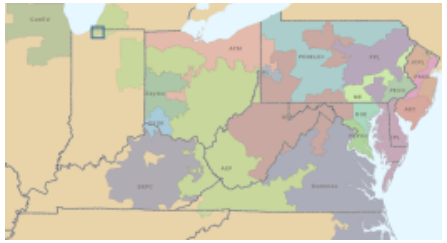
Need Number: AEP-2023-IM020
Process Stage: Needs Meeting 10/20/2023
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Interconnection Guidelines (AEP Assumptions Slide 7)

Problem Statement:

- A customer has requested new service for a 120MW manufacturing facility in New Carlisle, IN area.

Requested In Service Date: 12/1/2025



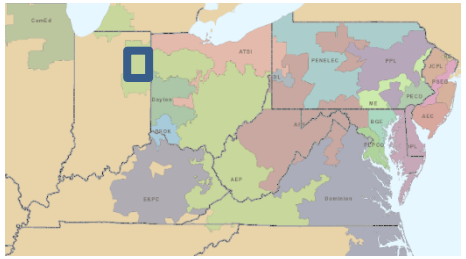


AEP Transmission Zone M-3 Process
Markle, Indiana

Need Number: AEP-2023-IM021
Process Stage: Needs Meeting: 10/20/2023
Supplemental Project Driver: Customer Need
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)
Model: 2027 RTEP

Problem Statement:
WVPA has requested a new delivery point for a peak load of 12MW in Markle, Indiana.

Requested ISD: 06/01/2025



AEP Transmission Zone M-3 Process
Louisville, OH

Need Number: AEP-2023-OH003

Process Stage: Need Meeting 10/20/2023

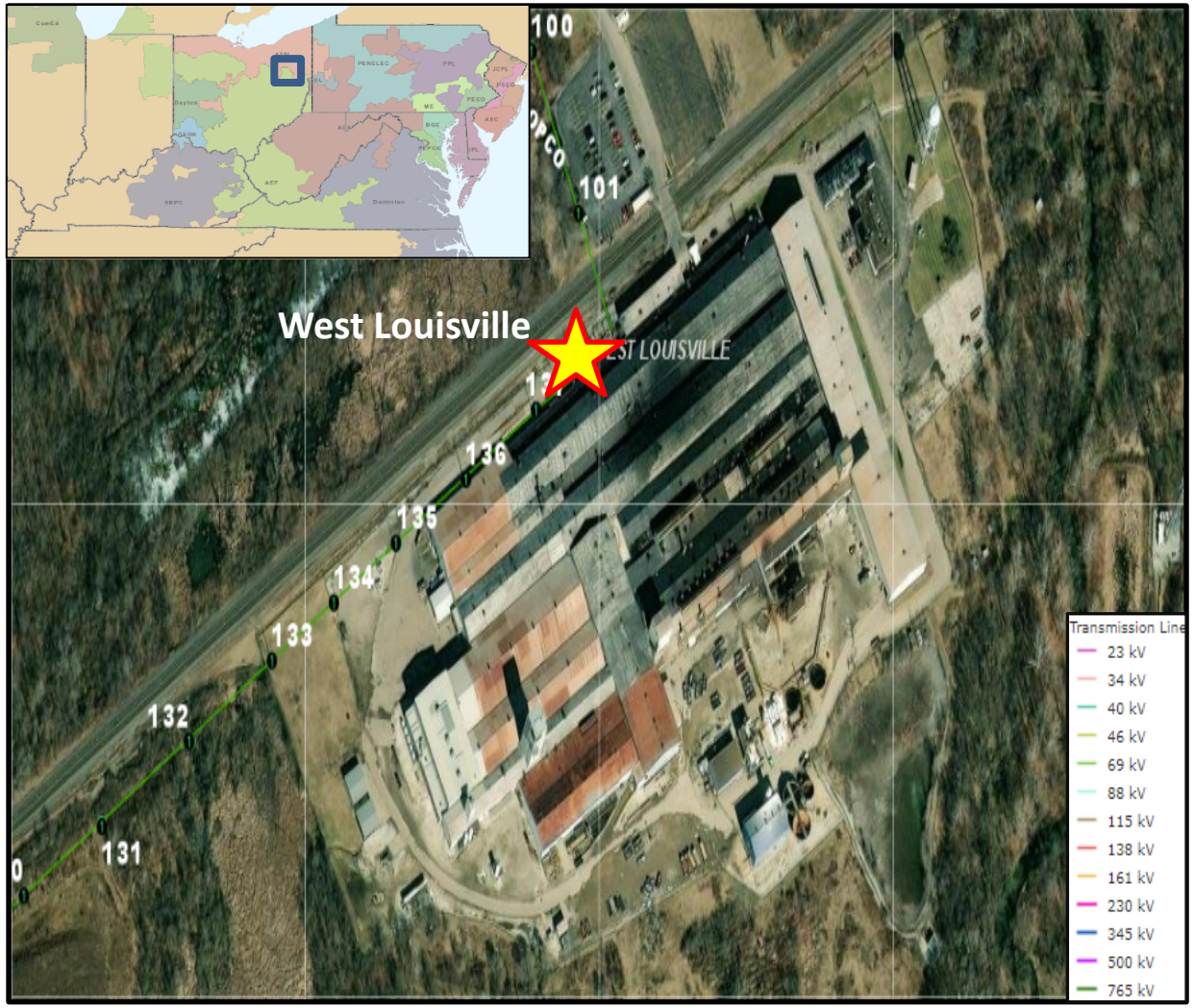
Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

<u>69 kV Circuit Breakers A, B & C:</u>

- Breaker age: A & B = 1962, C = 1967
- Interrupting Medium: (Oil)
- Additional Information:
    - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. The manufacturer provides no support for 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 vacuum oil and oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.



AEP Transmission Zone M-3 Process
Louisville, OH

Need Number: AEP-2023-OH003

Process Stage: Need Meeting 10/20/2023

Problem Statement, continued:

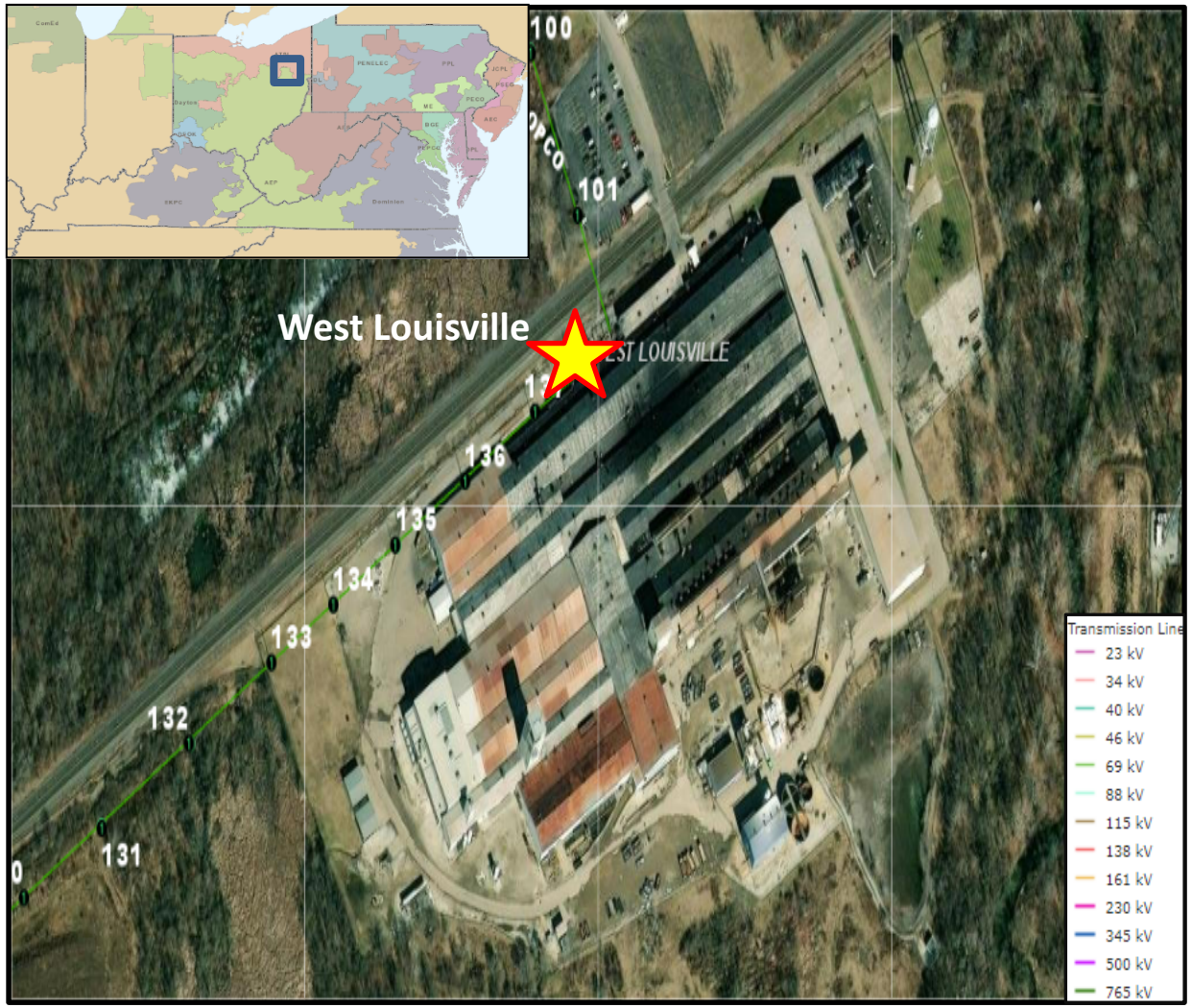
<u>69 kV Circuit Breakers Cap Switcher D:</u>

- Breaker age: 2003
- Interrupting Medium: SF6
    - The 69kV transmission owned circuit switcher CS-D is a SF6 filled switcher. It's 2000s vintage switcher kind and this type across the AEP system have had numerous malfunctions across the AEP fleet. Failed operational components including high contact resistance, gas loss, and interrupter failure represent half of these malfunctions. Two malfunctions of note were catastrophic equipment failures involving failures to trip. The first was an explosive failure of an interrupter of the capacitor switcher and the second was catastrophic failure of the capacitor bank caused by a failure of the switcher to operate. in addition, this caused significant oil loss and a grass fire. Parts are expensive, especially because interrupters can only be replaced, not repaired, as they are hermetically sealed.

Facilities/Yard: The control house is in poor condition and has peeling lead paint and asbestos. The station steel is heavily rusted and corroded due to the neighboring industrial customer. There are numerous cap-and-pin insulators, along with minimal bus clearances throughout the station. The control cables are all direct-buried (not housed in conduit/trenching).

<u>Relays & Protection Concerns:</u>

- Currently, 40 of the 41 relays (98% of all station relays) are in need of replacement. 37 of these are of the electromechanical type and 1 is of the static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support. There are 2 microprocessor relays that were commissioned in 2003 that may have firmware that is unsupported. These 2 microprocessor relays are within scope for SEL upgrades due to age.
- The two 69-7kV distribution transformers lack a high-side interrupting device and require tripping one of the 69kV transmission buses to clear faults (station is a split bus design).



AEP Transmission Zone M-3 Process
Lima, Ohio

Need Number: AEP-2023-OH039

Process Stage: Need Meeting 10/20/2023

Supplemental Project Driver:

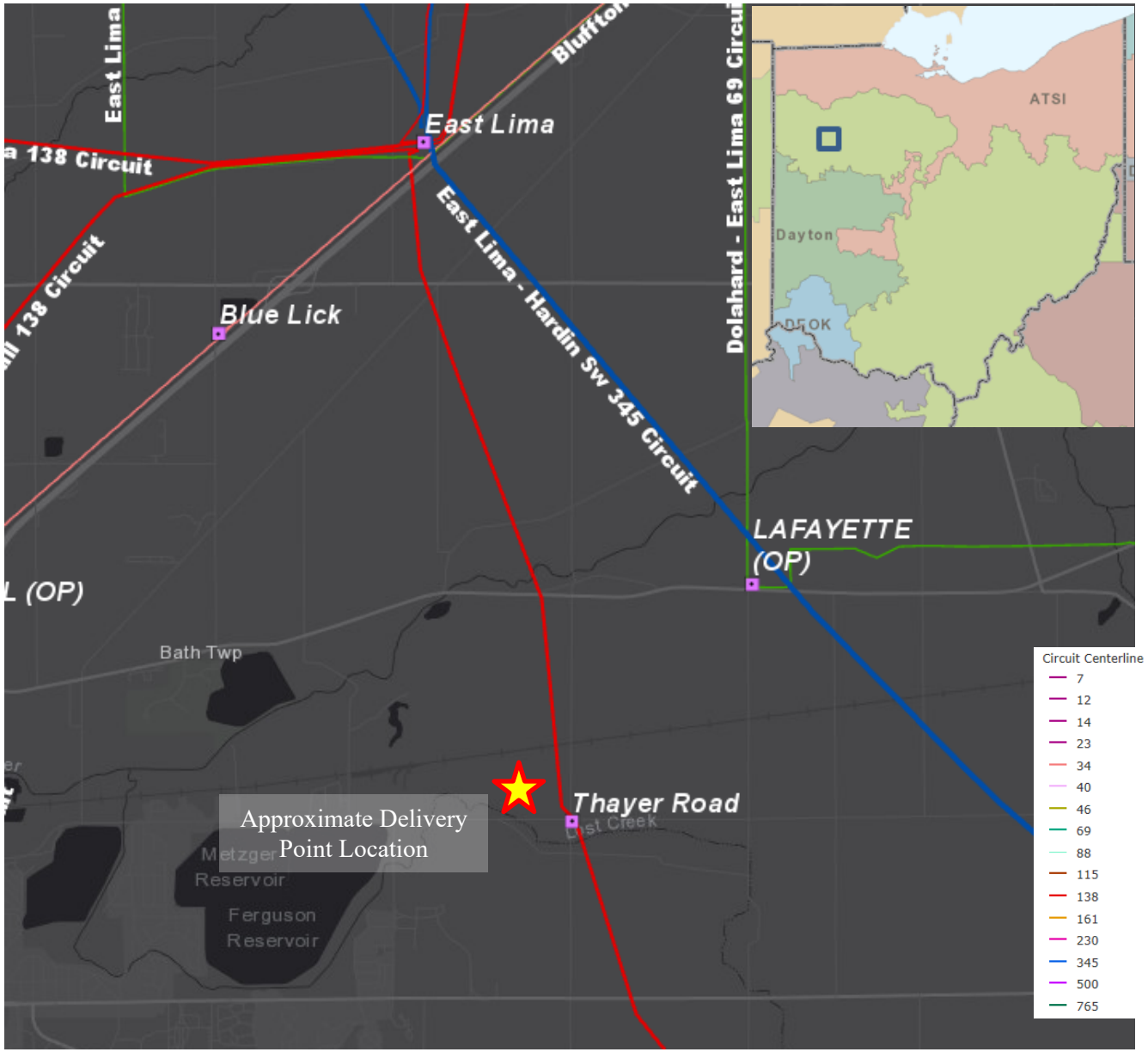
Customer Service

Specific Assumption Reference:

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

Problem Statement:

- Buckeye Power is requesting on behalf of Midwest Electric Co-op a new 138kV delivery point tapped off of the East Lima - Sterling Circuit by January 2025. Anticipated load is about 7.5 MVA.



AEP Transmission Zone M-3 Process
Franklin, OH

Need Number: AEP-2023-OH055

Process Stage: Need Meeting 10/20/2023

Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

<u>138 kV Circuit Breaker CB - 101:</u>

- Breaker age: 1974
- Interrupting Medium: (Oil)
- Additional Information:
    - This breaker is oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. The manufacturing company does not provide any support for these circuit breakers and spare parts are increasingly more difficult and expensive to obtain. Within the AEP system, these kind of breakers are known to have several types of malfunctions; 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.
- Relays:
    - Currently, 12 of the 29 relays (41% of all station relays) are in need of replacement. 1 of these is of the static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack any vendor support. There are also 11 microprocessor based relays commissioned between 2002 – 2011 that may have firmware that's unsupported

AEP Ohio has indicated additional needs on 138/12kV distribution equipment at OSU station

AEP Transmission Zone M-3 Process
Franklin, OH

Need Number: AEP-2023-OH056

Process Stage: Need Meeting 10/20/2023

Project Driver: Equipment Material/Condition/Performance/Risk

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

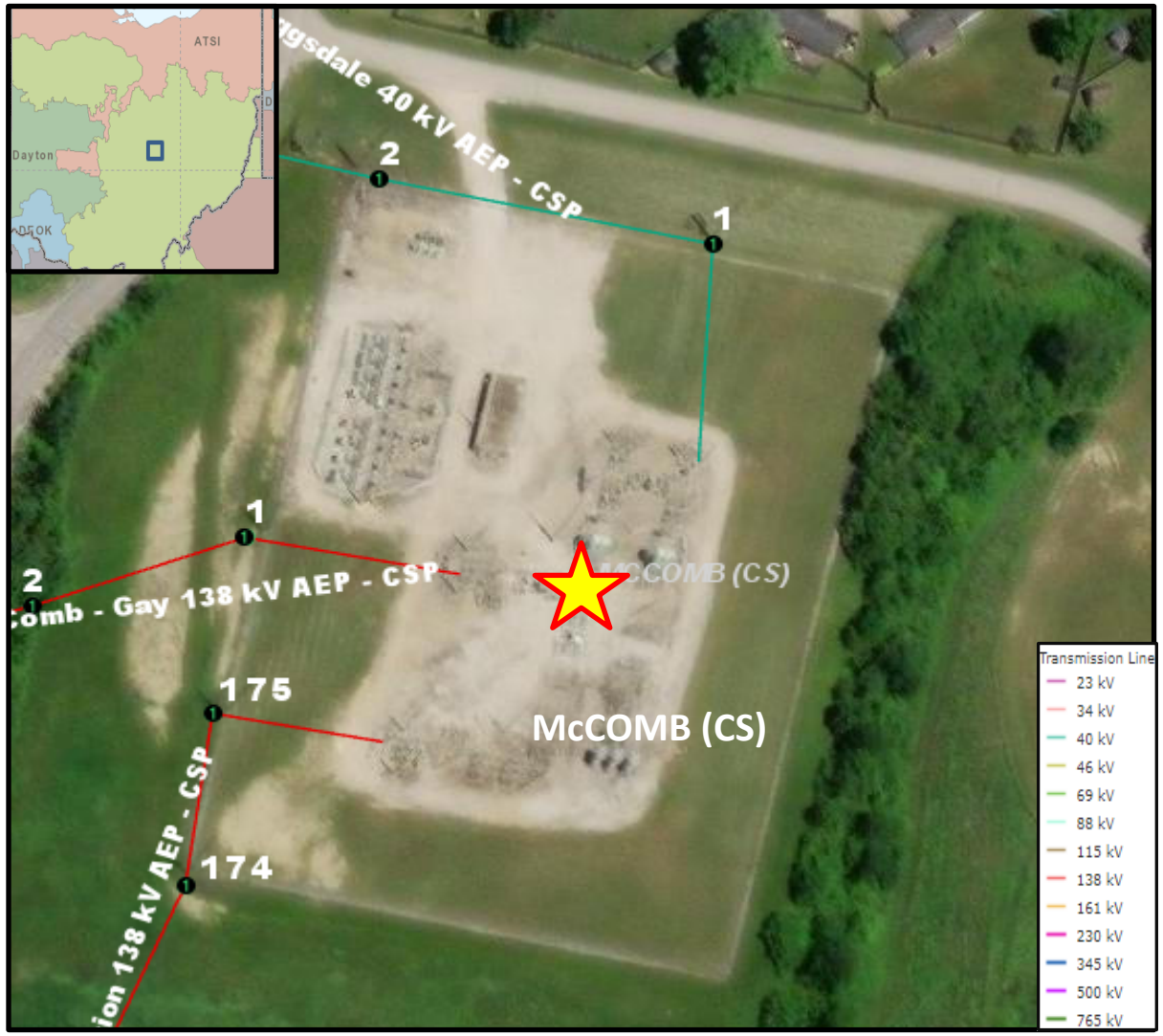
Problem Statement:

<u>138 kV Circuit Breaker CS - CC:</u>

- Breaker age: 1998
- Interrupting Medium: SF6
- Number of Fault Operations: 1
    - The 138kV transmission owned circuit switcher, CS-CC, is a MARK V-138 type, SF6 filled 1998 vintage switcher. This family of circuit switchers have no gas monitor and currently in-service units on the AEP system have experienced numerous malfunctions in the past. Failed operational components including high contact resistance, gas loss, and interrupter failure represent half of these malfunctions. Two malfunctions of note were catastrophic equipment failures involving failures to trip. The first was an explosive failure of an interrupter of the capacitor switcher. The second was a catastrophic failure of the capacitor bank caused by a failure of the in-service MARK V to operate; in addition, this caused significant oil loss and a grass fire. Parts are expensive, especially because interrupters can only be replaced, not repaired, as they are hermetically sealed.

<u>Relays:</u>

- Currently, 101 of the 123 relays (82% of all station relays) are in need of replacement. Of these, 98 are of the electromechanical and static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support.



AEP Transmission Zone M-3 Process
Franklin, OH

Need Number: AEP-2023-OH056

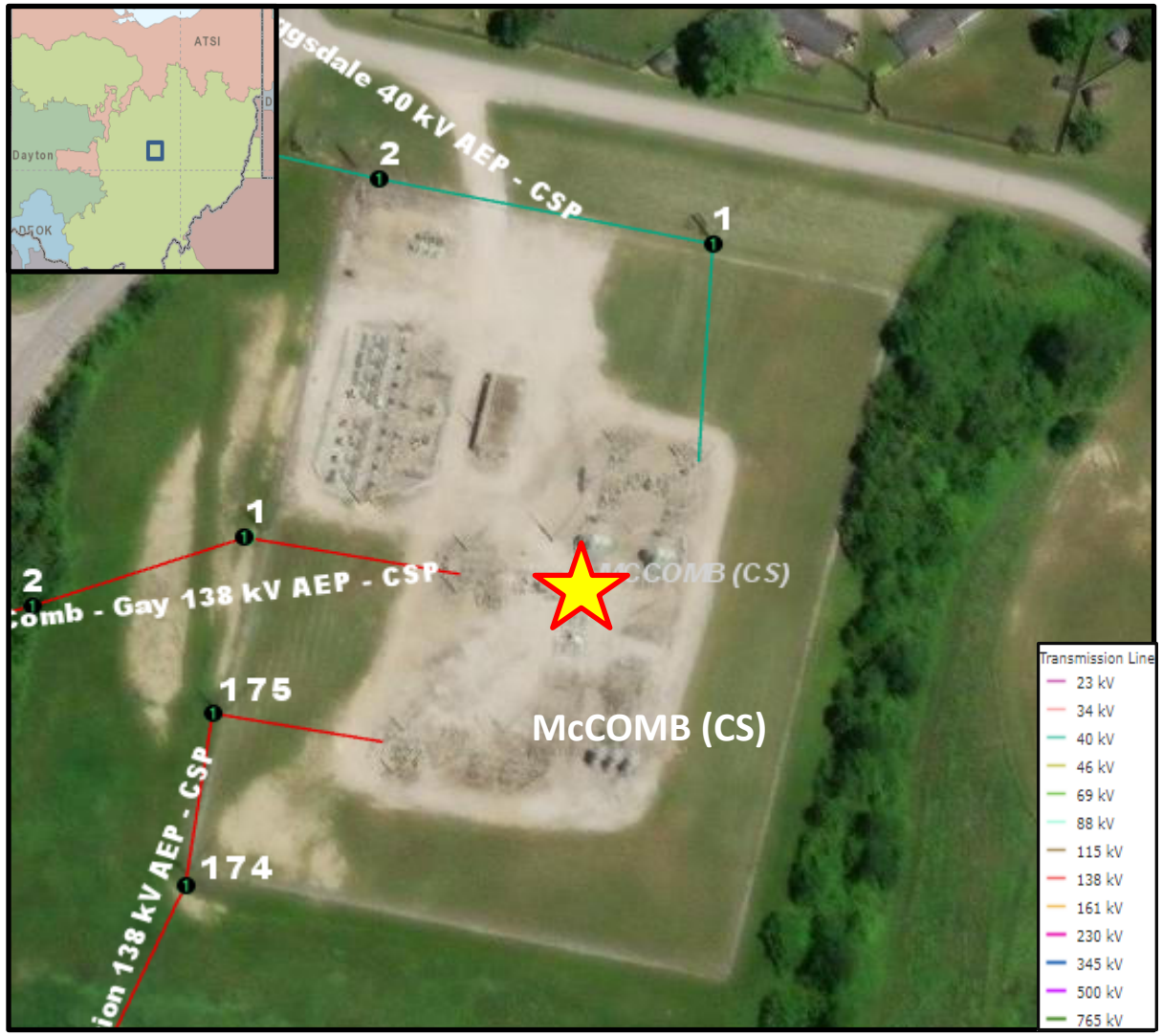
Process Stage: Need Meeting 10/20/2023

Problem Statement, continued:

<u>138kV Station Configuration</u>

In its current configuration, McComb presents complications from a protection and control perspective. The 138kV layout has multiple overlapping protection zones which include the Beatty- McComb 138kV line, transformer #1 and the 138kV cap bank. Overlapping protection zones create challenges when attempting to clear a fault and can lend more equipment to be out of service than necessary when a fault occurs.

AEP Ohio has indicated additional needs on the 138/12kV McComb distribution station



AEP Transmission Zone M-3 Process
Marshall Co WV

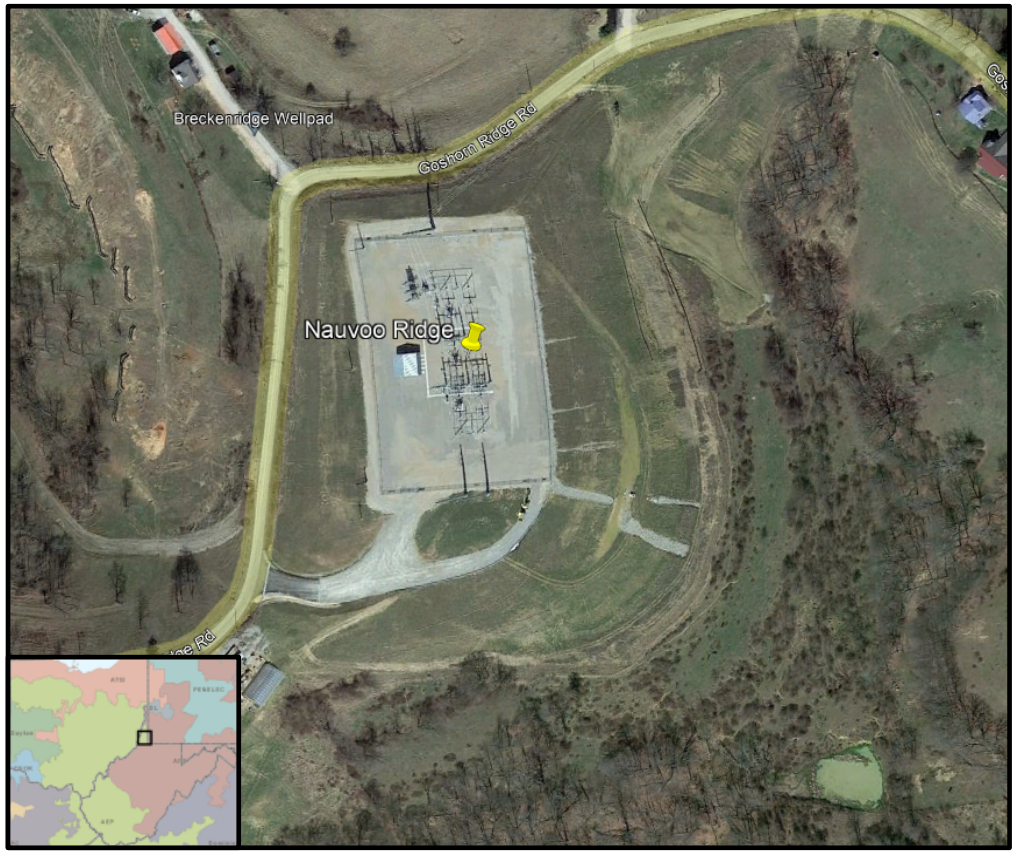
Need Number: AEP-2023-OH075

Process Stage: Need Meeting 10/20/2023

Project Driver: Customer Service

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

Problem Statement: AEP Ohio has requested to add capacity at Nauvoo Ridge station, to meet growing load and bolster the area's existing distribution circuits. The anticipated peak load is approximately 6.7 MVA. The requested in-service date is November 2025.



Need Number: AEP-2023-OH078

Process Stage: Need 10/20/2023

Project Driver:

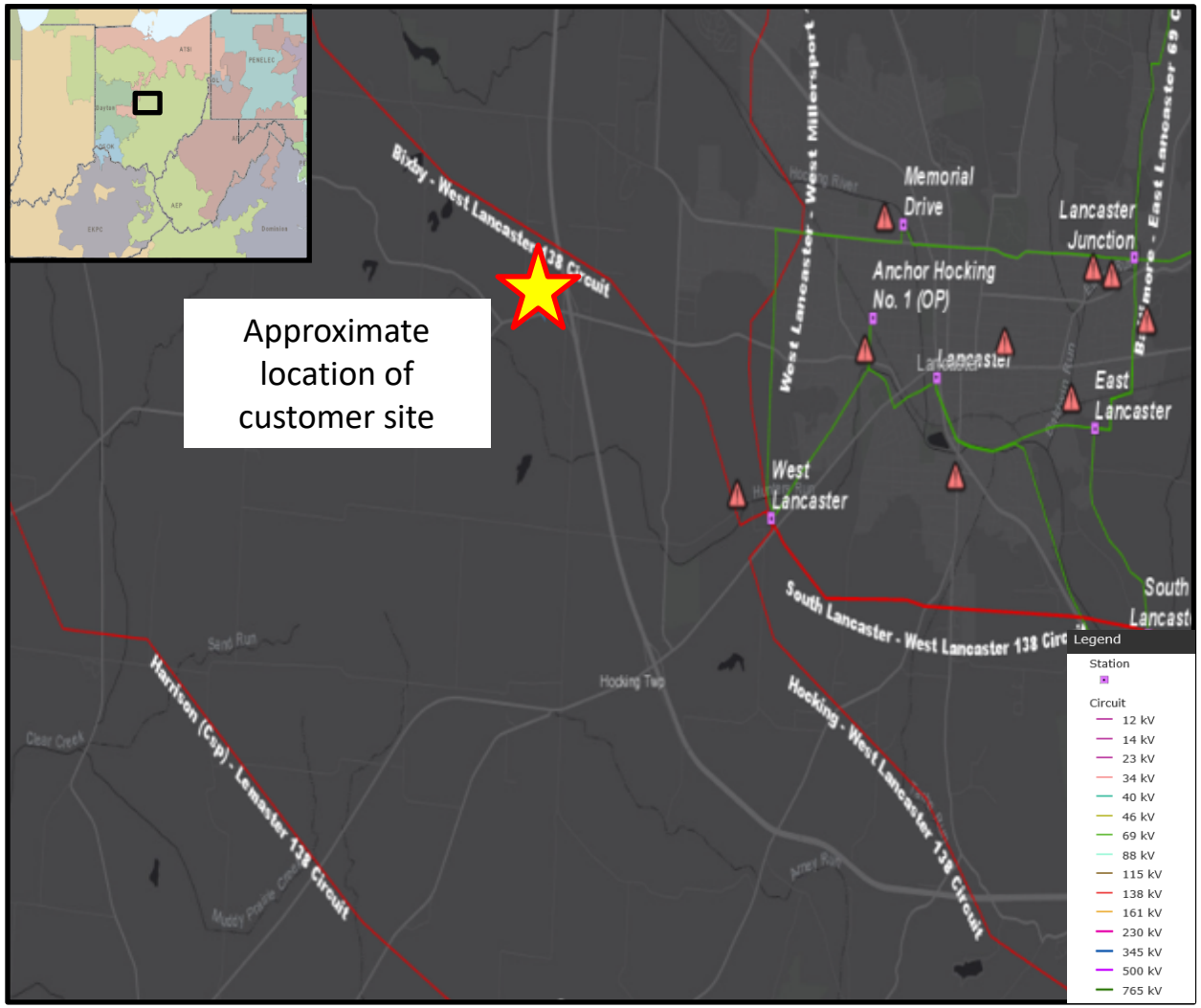
Customer Service

Specific Assumption Reference:

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

Problem Statement:

- A customer has requested additional transmission service in Lancaster Ohio, near Sifford station.
- The incremental projected demand for the site is 96 MW, bringing the total load for the customer's site to 196 MW.
- Customer requested in-service date of 09/30/2024.



AEP Transmission Zone M-3 Process
Licking County, Ohio

Need Number: AEP-2023-OH081

Process Stage: Need Meeting 10/20/2023

Supplemental Project Driver:

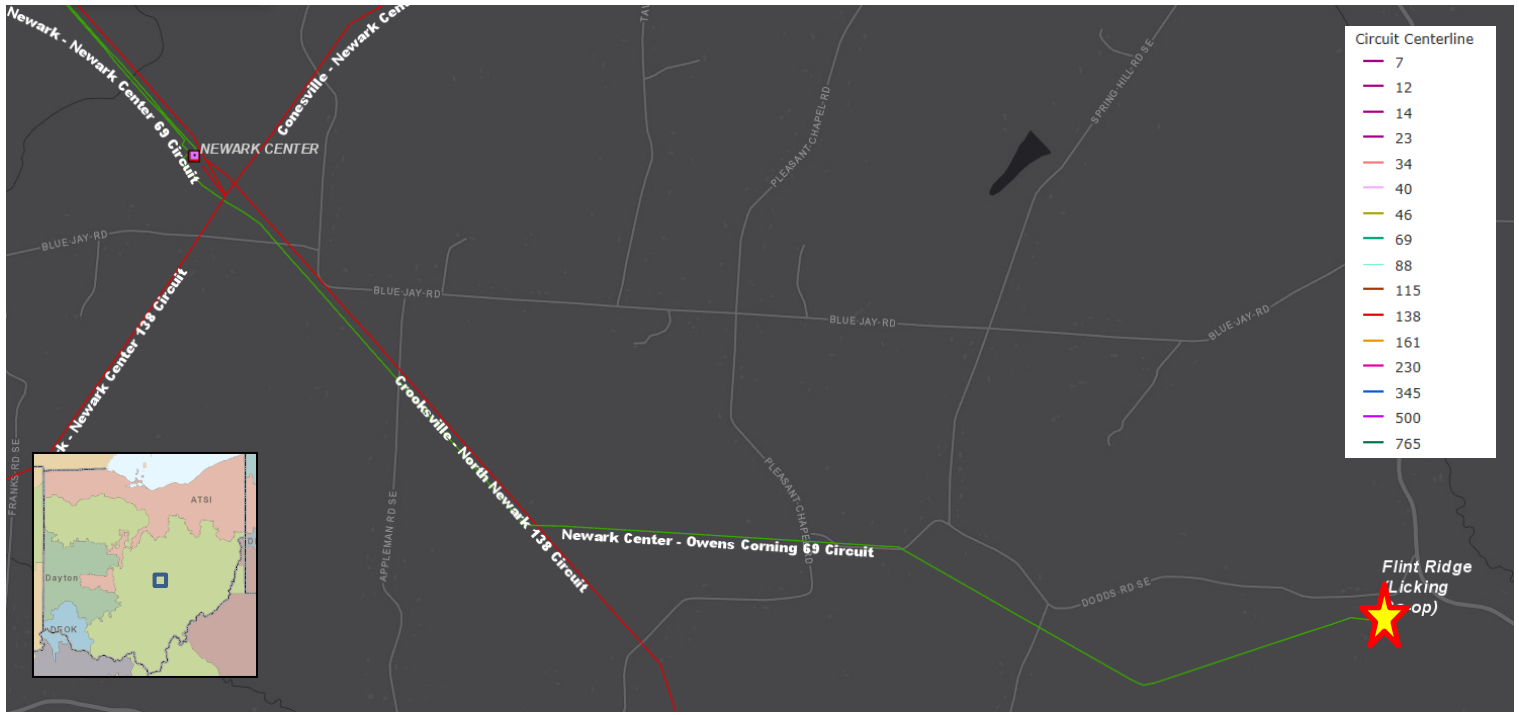
Customer Service and Operational Flexibility

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (slide 12 & 14)

Problem Statement:

- Licking Rural Electrification Co-op's Flint Ridge delivery point is served via a hard tap from the Newark Center - Owens Corning 69kV circuit, with no line sectionalizing switches present. The hard tap limits operational capabilities for this circuit. LRE loses service to Flint Ridge for any fault on the western portion of the circuit, and AEP Ohio loses service to Owens Corning for faults on the radial to Flint Ridge.
- Load is approximately 6.256 MW
- CMI: There were 6 permanent outages in the last 5 years totaling 8,219,652 customer minutes of interruption for 1,997 customers.



Solutions

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

AEP Transmission Zone M-3 Process
Coshocton, Holmes, & Wayne Counties, Ohio

Need Number: AEP-2021-OH025

Process Stage: Solution Meeting 10/20/2023

Previously Presented: Need Meeting 5/21/2021

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

South Coshocton – Wooster 138 kV Transmission Line: is 39.7 miles long and consists of mostly wooden H-frame structures with vertical insulators, originally installed in 1957 with 477,000 CM ACSR 26/7 (Hawk) conductor. The line asset comprises 22.8 miles of the Ohio Central-West Millersburg circuit, 15.2 miles of the West Millersburg-Wooster circuit (entirety), and 1.7 miles of the Ohio Central-South Coshocton circuit.

Total Structure Count: 214

Outage History:

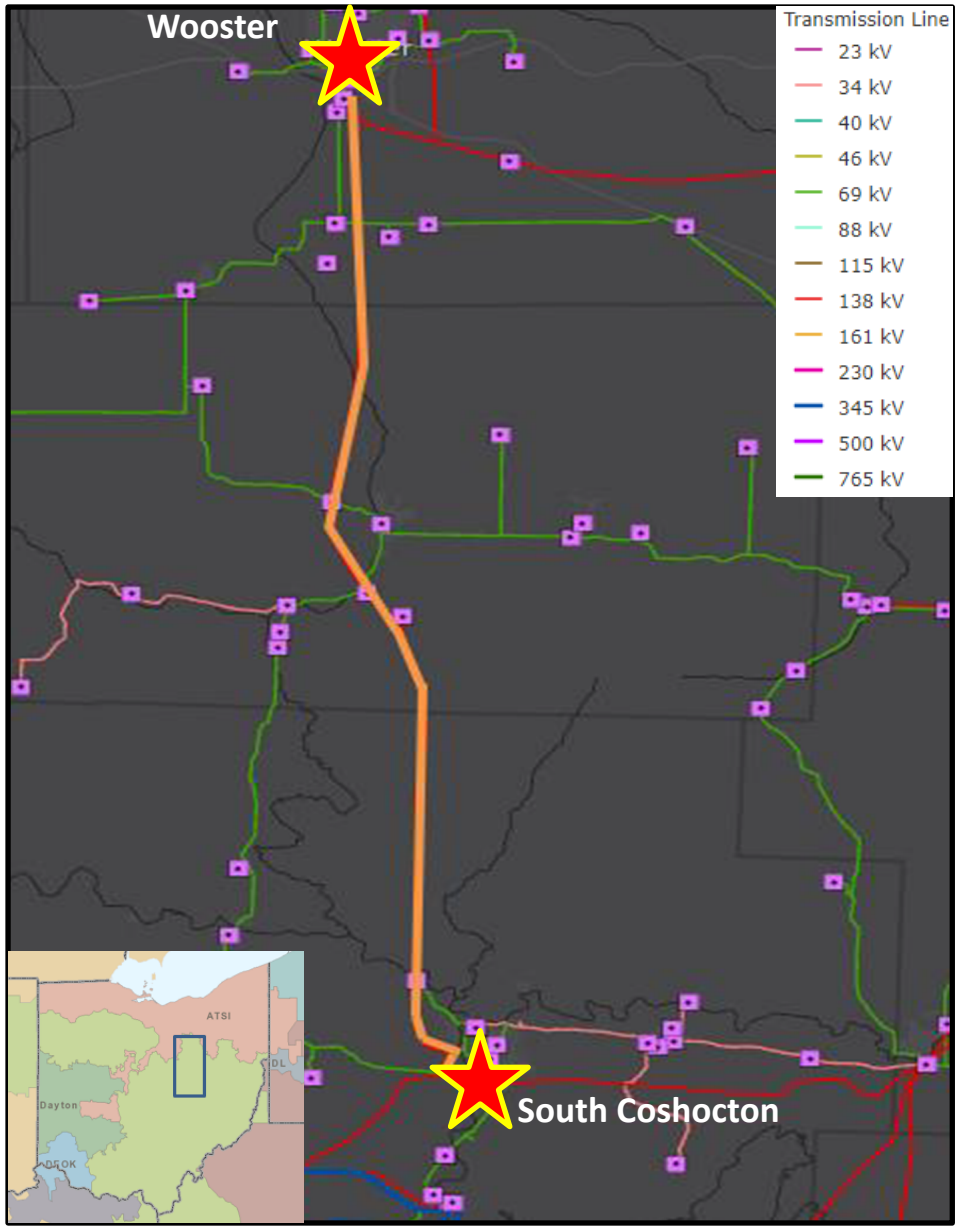
- Momentary (10) & Permanent Outages (7)
- CMI: 545,905 (Past Five Years)

Open Conditions:

- 54 structures with at least one open condition, which equates to 25.4% of the structures on this line.
- 40 structure-based open conditions consisting of broken structures, insect damage, rot heart, rot top, woodpecker holes, rot pocket, split poles and rot top on filler blocks.
- 1 conductor-based open condition consisting of a damaged conductor.
- 4 grounding-based open conditions consisting of broken ground lead wires and broken structure grounds.
- 9 hardware-based open conditions consisting of broken/burnt insulators.
- Structure Age: 79% 1950's, 4% 1960's, 1% 1970's, 16% 1980's, 1% 1990's, 4% 2000's

Operational Concerns:

- The 138kV pathway provides a 138kV source for 4- sub-transmission source stations (South Coshocton, West Coshocton, West Millersburg, and Wooster).
- The 138kV pathway serves customers at two Holmes-Wayne Co-op stations and two AEP Ohio distribution stations.
- The 138kV pathway has experienced real-time PCLLRW overload alerts during heavy west-to-east and south-to-north system transfer periods.



AEP Transmission Zone M-3 Process
South Coshocton – Wooster Rebuild

Need Number: AEP-2021-OH025

Process Stage: Solution Meeting 10/20/2023

Proposed Solution:

Wooster – South Coshocton: The 37.7-mile line will be rebuilt using 795 ACSR DRAKE to alleviate identified asset renewal conditions. This includes the 15.2-mile West Millersburg – Wooster 138kV circuit as well a portion of the 30.9-mile single circuit Ohio Central – West Millersburg 138kV circuit up to structure 13 outside Ohio Central station. **Estimated Cost $96.5M**

Perform remote end work at Wooster **Estimated Cost $0.501M**

Perform remote end work at West Millersburg **Estimated Cost $0.503M**

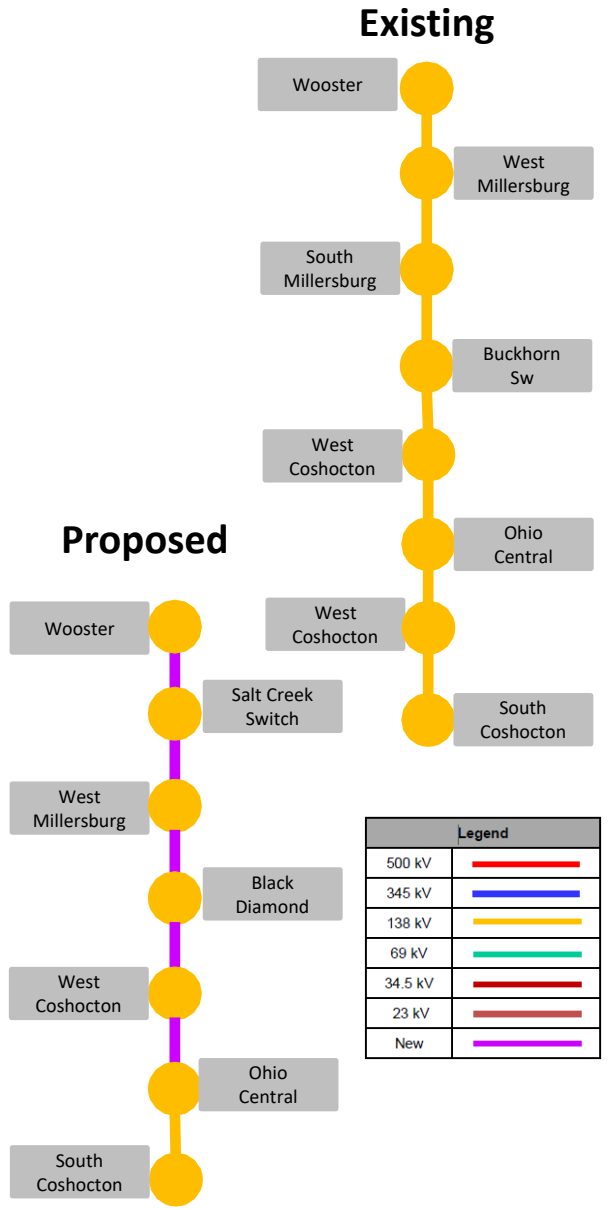
Total Estimated Transmission Cost: $97.54M

Alternatives Considered:

- Rebuild South Coshocton – Wooster in the clear acquiring new ROW. Due to portions of the line not in need of rebuild and other projects affecting the topology in the area, this option was not selected. Estimated cost: $127.6M

Projected In-Service: 10/31/2026

Project Status: Scoping



AEP Transmission Zone M-3 Process
Paulding & Van Wert Co., OH

Need Number: AEP-2022-OH043

Previously Presented: Need Meeting 07/22/2022

Process Stage: Solution Meeting 10/20/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

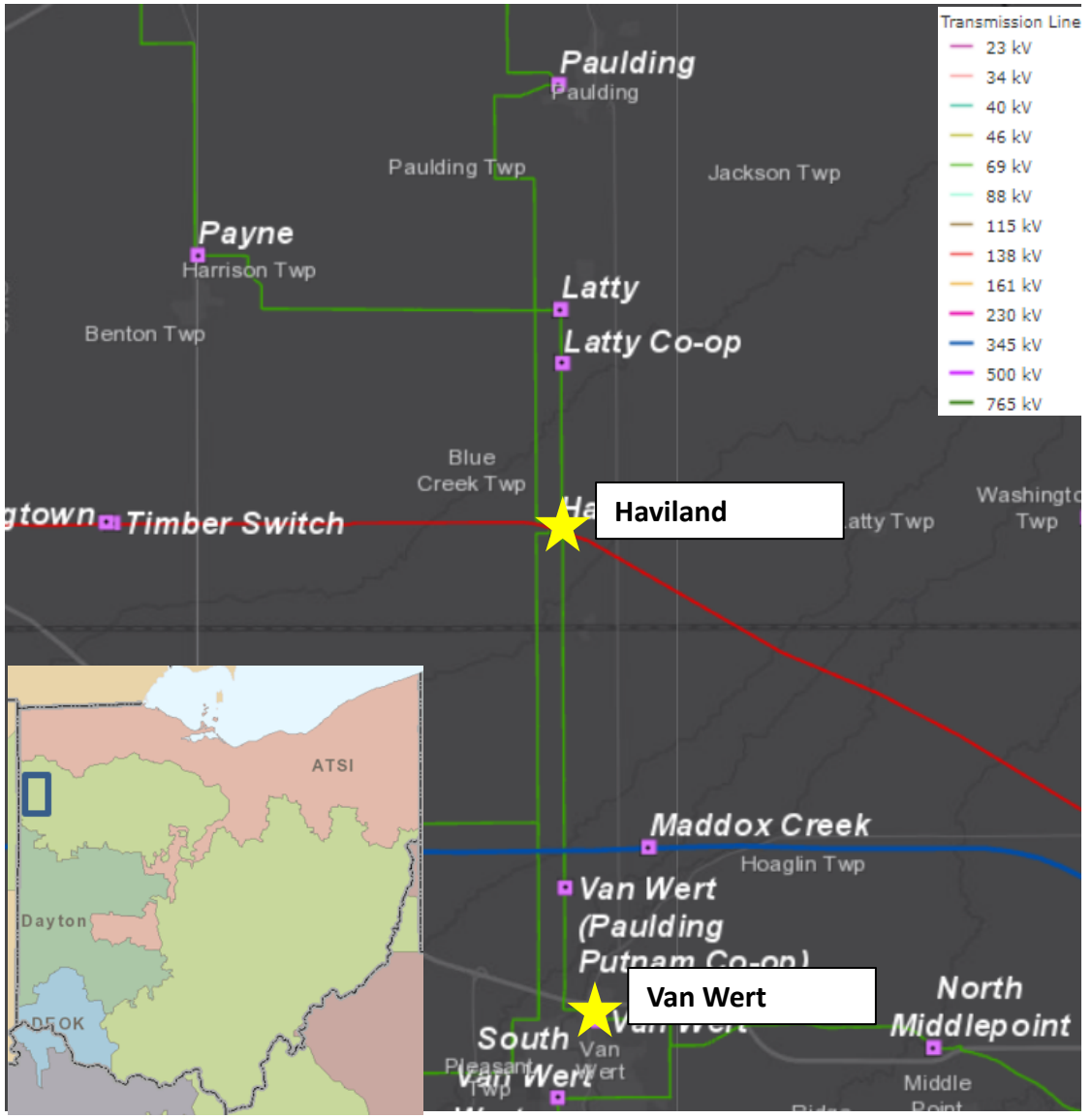
Specific Assumption Reference:

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

Problem Statement:

Van Wert - Haviland 69kV Line(1926) :

- Length of Line: 10.06 Miles
- Total Structure Count: 249
    - Wooden, Steel Monopole Structures
    - Vertical post insulators
- Conductor Types: 556.5 ACSR 18/1 (Osprey), 4/0 COOPER, 556.5 ALUMINUM 19 (Dahlia),795 ACSR 26/7 (Drake)
- Outage History: 1 Momentary and 2 Permanent outages – average duration of 38.72 hours, 66.6K CMI between 2015 and 2020
- Open Conditions: 19, including splice/dead end conductor issues, damaged/missing ground lead wires, broken shield wire, disconnected grounding mat and chipped insulators
- The Van Wert - Haviland line fails to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements. The line is insulated with vertical post insulators that do not meet current AEP standards for CIFO and minimum leakage distance requirements.



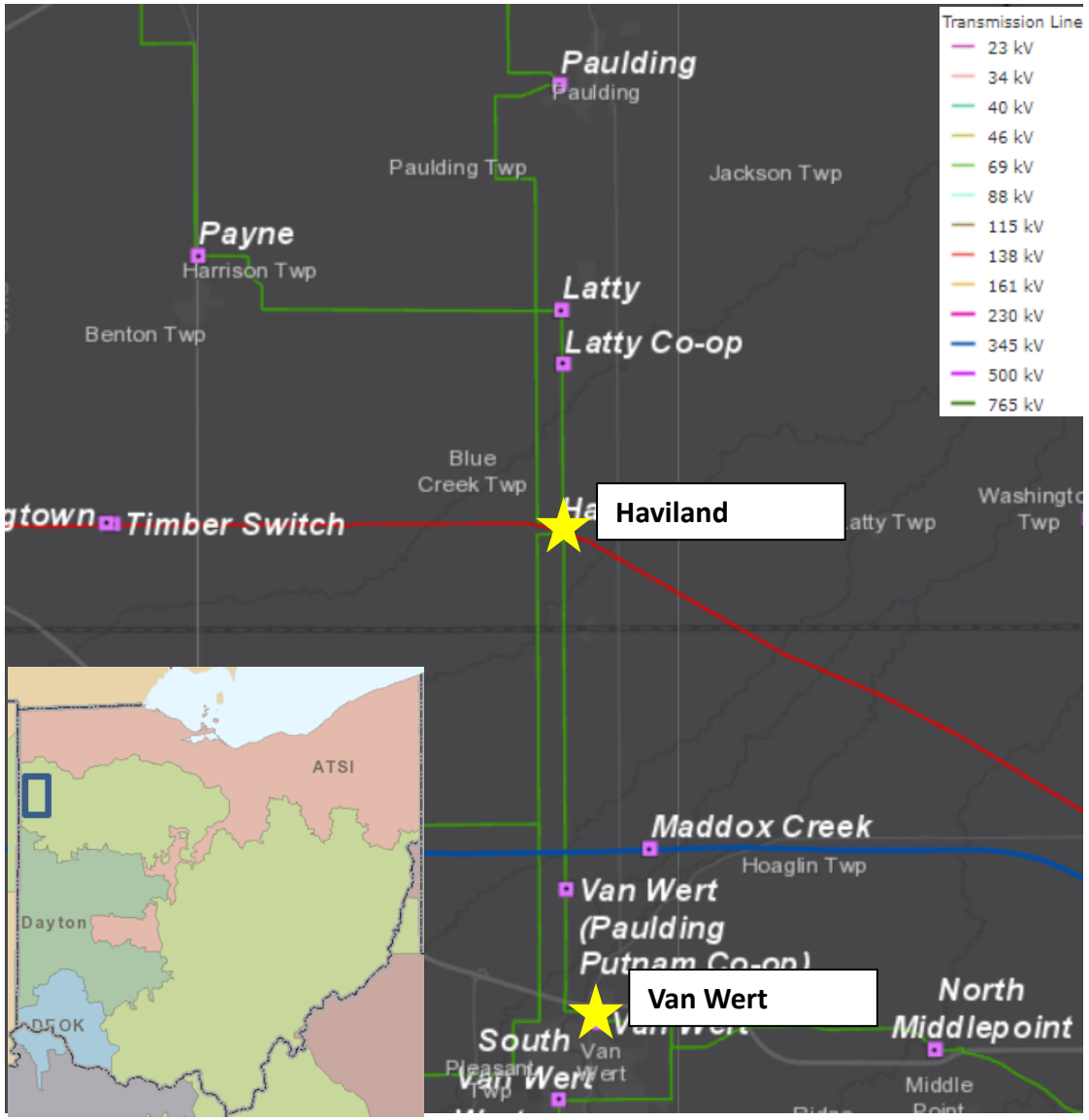
AEP Transmission Zone M-3 Process
Paulding & Van Wert Co., OH

Problem Statement continued:

- 15 structures were further assessed by a ground crew. 73% of those structures had reported conditions, which included the following: one structure had PLP deadends in the shield wire, one structure had pole top decay and a twisted crossarm, one structure had pole top decay, a PLP splice in the shield wire, brown porcelain tie-top post insulators with aluminum bases (failure risk) and an insulator with broken skirts, one structure had insect damage to a crossarm, a twisted crossarm, spliced conductors, a PLP splice in the shield wire and a 2-pole brace structure with a bent anchor, one structure had a compression splice in the shield wire, one structure had a stolen "S" downlead, one structure had brown porcelain tie-top insulators (failure risk), one structure had crossarm splitting and rotting, one structure had un-guyed distribution primary lateral that is deflecting the pole, one structure had a distribution secondary that is deflecting the pole and one structure had a PLP splice in the shield wire.

Additional Information:

During the 2012 Derecho and 2017 straight-line wind storms Van Wert- Haviland experienced multiple cascading pole failure events. These failed structures were replaced with steel monopole type structures. There are 55 newer steel structures, representing 22% of the structures on the line.



AEP Transmission Zone M-3 Process
Van Wert Co., OH

Need Number: AEP-2023-OH065

Previously Presented: Need Meeting 04/21/2023

Process Stage: Solution Meeting 10/20/2023

Project Driver: Customer Service

Specific Assumption Reference:

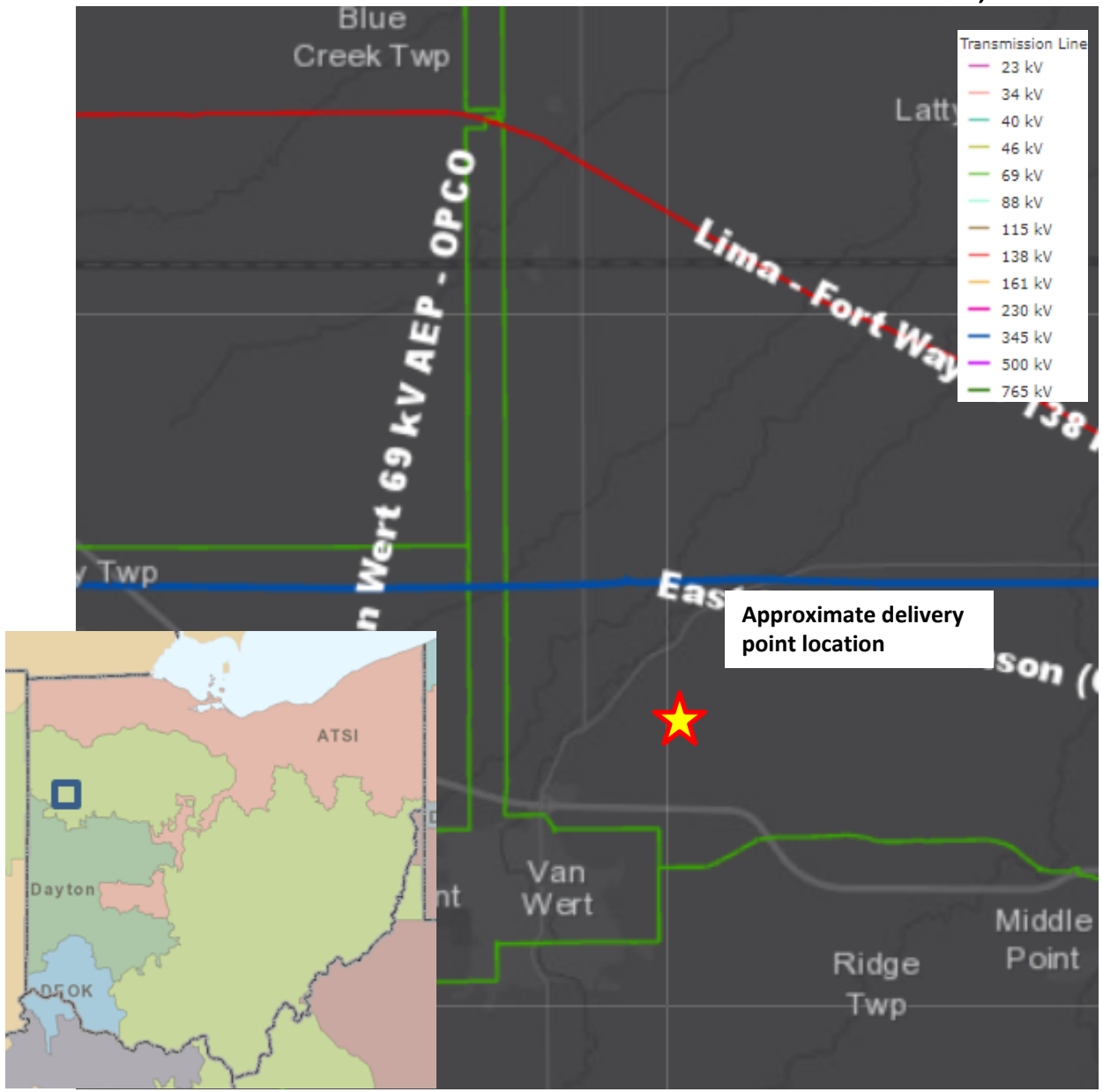
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

Problem Statement:

Van Wert Mega Site:

The Van Wert Mega industrial site is located north of Van Wert in Van Wert County Ohio. The site is approximately one mile east of AEP's Van Wert - Haviland 69kV circuit. The site has been heavily targeted by regional and state economic development efforts and will continue to be. The site is highlighted by JobsOhio and its partner Regional Growth Partnership as its top available property for EV manufacturing. From January 2022 to March 2023 AEP Economic Development has had 32 requests for electric service plans at the site. The prospective customer's electric demand ranged from 5MW to 760MW. Around the industrial site, significant investment has been performed to prepare the site for manufacturing industry development, including installation of a rail spur.

Many of these prospective customers cannot be connected to the existing Van Wert area 69kV network without significant upgrades.



AEP Transmission Zone M-3 Process
Haviland-Van Wert Rebuild

Need Number: AEP-2022-OH043, AEP-2023-OH065

Process Stage: Solution Meeting 10/20/2023

Proposed Solution:

Haviland - Van Wert: Rebuild the line to double circuit 138kV design using 1033 Curlew ACSR conductor. The line will be six wired and operated at 69kV. The rebuild will include a 2.6-mile greenfield section to route the line near several new industrial sites. The overall line length will be 10.8 miles. Newer installed poles will be re-used elsewhere. **Estimated Cost $27.8M**

Modify the b3359 scope from single circuit 69kV construction to double circuit 1033 Curlew at 138kV design **Estimated Cost $2.89M**

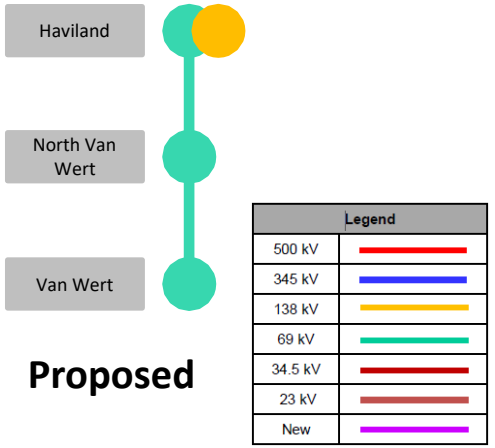
Perform remote end work at Haviland **Estimated Cost $1.03M**

Perform remote end work at Van Wert **Estimated Cost $0.635M**

Upgrade telecom equipment at South Van Wert, Logtown, Maddox Creek, Timber Switch and North Delphos stations **Estimated Cost $0.194M**

Total Estimated Transmission Cost: $32.57M

Existing



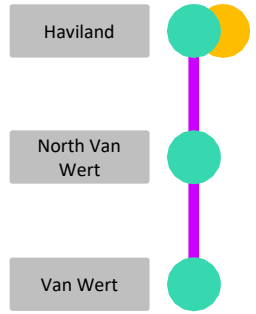
Proposed

Ancillary benefits:

- Upgrading the maximum possible line voltage with double circuit construction allows flexibility for future Van Wert area projects. The proposed solution can be used as part of the service plan for loads at the Van Wert Mega site with less greenfield construction. The Van Wert area does not currently have facilities greater than 69kV. This 138kV double circuit design allows AEP to use the exiting ROW to establish a new 138kV path to the load site. In the future, the circuits could be split and operated independently to support planning needs, load growth or operational concerns while maintaining the 69 kV network.

Alternatives Considered:

- Rebuild Haviland - Van Wert using single circuit 69kV design construction. This option was not selected due to the lack of ancillary benefits and future flexibility to serve load. Estimated cost: $23M
- Rebuild the line and re-utilize the newer failure replaced poles. This would require single pole dead ends before and after the continuous segments of new poles.
  Estimated Initial cost: $32.17M
  Additional cost needed to convert to 138kV in the future: 5.78M



Model: PJM 2027 RTEP

Projected In-Service: 1/1/2026

Project Status: Scoping

AEP Transmission Zone M-3 Process
Pulaski County, Virginia

Need Number: AEP-2023-AP011

Process Stage: Solution Meeting 10/20/2023

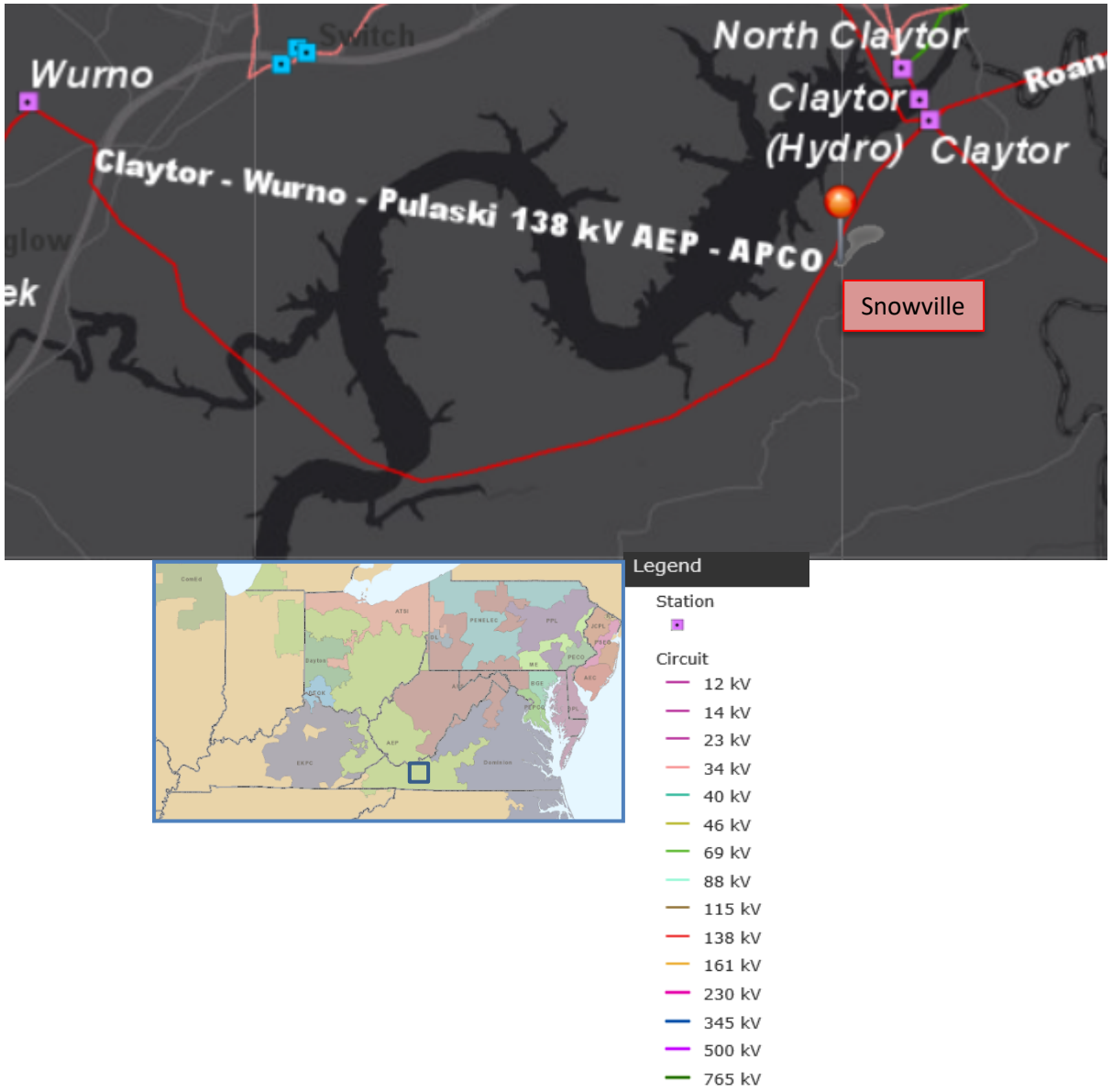
Previously Presented: Need Meeting 4/21/2023

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 (Snowville).
- The Distribution customers south of Claytor Lake are fed by one 34.5kV distribution circuit out of Wurno station and the circuit has one lake crossing. This circuit is currently 187-line miles long and has no other 34.5kV distribution circuit ties. Over the past five years, there were 223 distribution outages resulting in 5.9 million CMI.
- The greenfield Snowville station will pick up 6.5 MVA from Wurno station.



AEP Transmission Zone M-3 Process
Pulaski County, Virginia

Need Number(s): AEP-2023-AP011

Process Stage: Solutions Meeting 10/20/2023

Proposed Solution:

Snowville Station

- The greenfield station will contain a 138/34.5 kV 30 MVA transformer with high side circuit switcher. There will be two 34.5 kV feeders from the station. The 138 kV side will be a straight bus with two 138 kV MOABs. **Estimated Cost: $0 (Distribution cost)**

Snowville 138kV Line Extension

- The line extension will tap the Claytor – Wurno - Pulaski 138kV line and bring the line in and out of the greenfield Snowville station by building 0.1 miles of greenfield double circuit 138kV line. **Estimated Cost: $1.48M**

Snowville Fiber Line Extension

- Build 2.0 miles of 144 ADSS Telecom underbuilt cable to connect Snowville station to Claytor station. **Estimated Cost: $0.5M**

Estimated Total Transmission Cost: $1.98 M

Ancillary Benefits: Distribution customers are currently served from Wurno station on the other side of the lake, causing a lot of outages due to one lake crossing. Snowville station will reduce outages for Distribution customers due to having a reliable source on their side of the lake.

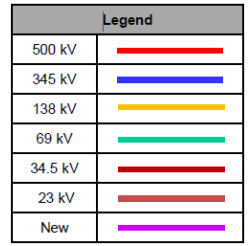
Alternatives Considered: Considering the location of the request and the proximity to the existing 138 kV line, no other transmission solutions were considered to provide additional reliability to the distribution network.

Projected In-Service: 10/31/2025

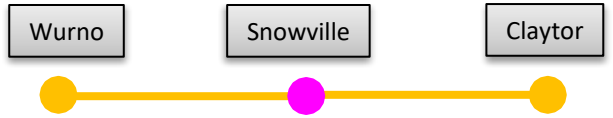
Project Status: Scoping

Model: 2028 RTEP

Existing



Proposed



Appendix

High Level M-3 Meeting Schedule

Assumptions

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

Needs

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

Solutions

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

Submission of Supplemental Projects & Local Plan

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

Revision History

10/6/2022– V1 – Original version posted to pjm.com