

Sub Regional RTEP Committee: Western AEP Supplemental Projects

May 21, 2021

Changes to Existing Supplemental Projects

Supplemental Project: S1851 (Need AEP-2018-AP001, posted to 2019 AEP local plan)

Original Scope: Construct a new 69 kV line (approximately 15 miles) from Jubal Early Station to Independence Station. Install a 69 kV circuit breaker at Jubal Early Station and two 69 kV circuit breakers at Independence Station

Original Estimated Transmission cost: \$32.5M

Original Projected IS Date: 6/1/2022

New Scope:

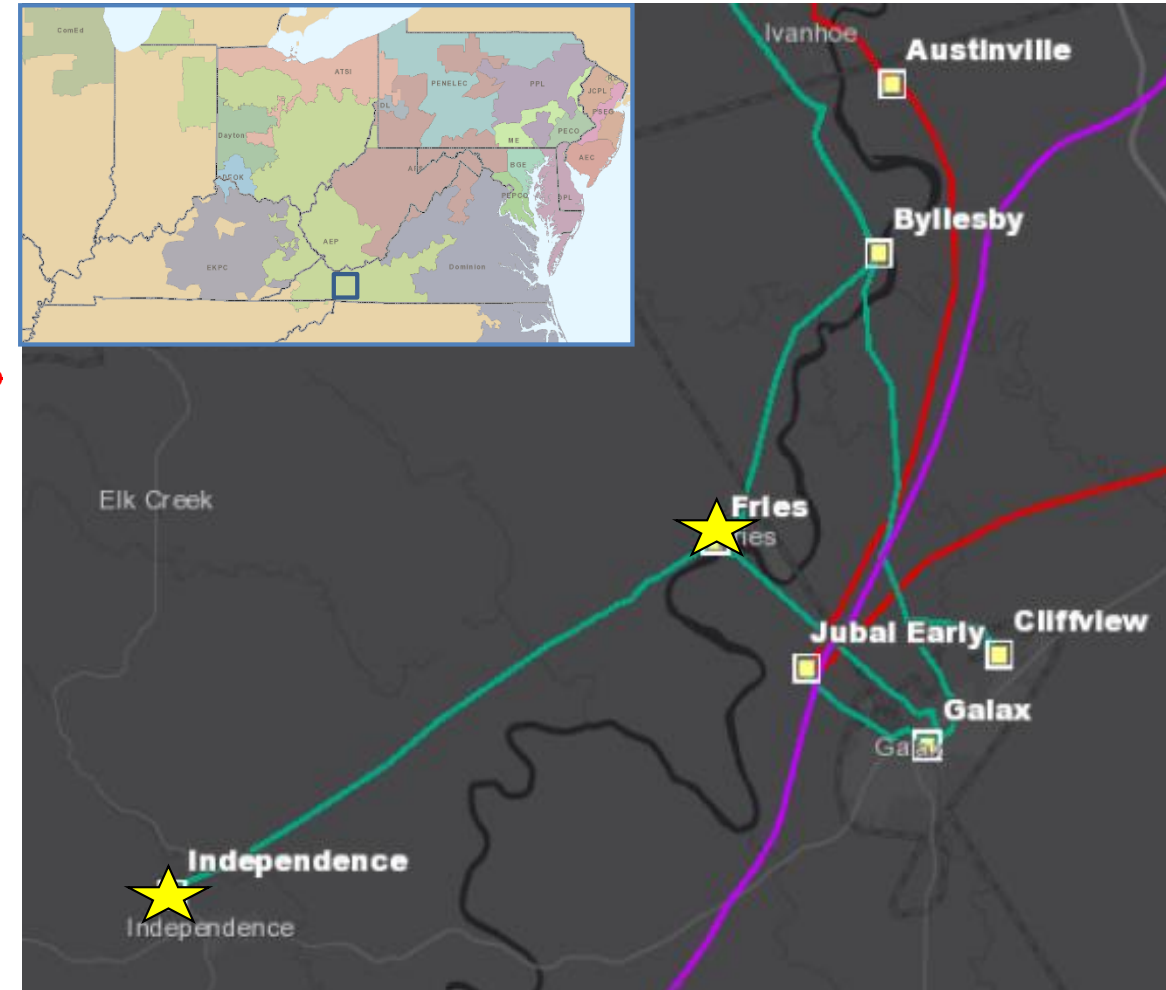
- Construct a new 69 kV line (approximately 14.25 miles) from Jubal Early Station to ~~Independence Point Lookout Station~~. Install a 69 kV circuit breaker at Jubal Early Station ~~and two 69 kV circuit breakers at Independence Station~~. The increased cost for the greenfield line is driven by an increase of rock and erosion control required for construction as well as access road along the new line route that was better defined as the scope was developed further.

Estimated Transmission Cost: ~~\$32.5M~~ \$42.7M (S1851)

- Relocate Independence Station to a new property and rebuilt as Point Lookout Station. Point Lookout Station will consist of a 69 kV bus, a 11.5 MVAR cap bank, two 69 kV circuit breakers. The station will also include a 69/34.5 kV 30 MVA transformer with two 34.5 kV distribution circuit breakers and a 69/12 kV 20 MVA transformer with one 12 kV distribution circuit breaker. The new cap bank at Point Lookout Station is replacing the existing cap bank at Fries Station due to the space limitations at Fries Station associated with remote end work. The cap bank at Fries Station can not be retired due to a voltage violation scenario and the new cap bank will maintain the voltages above our criteria thresholds. **Estimated Transmission Cost: \$0 (station is considered Distribution) (S1851.1)**

New Projected IS Date: 6/1/2024

Reasons for the scope change: Due to the space restrictions at Independence Station, the station will be relocated to a new property.



Supplemental Project: s1996 (Need AEP-2018-AP005, posted to 2019 local plan)

Original Scope:

Replace the existing Clendenin Station with the new Jarrett Station, approximately 0.2 miles away from Clendenin Station, located outside of the flood plain. Install a new 138/46 kV 90 MVA XFR, with a high side circuit switcher. Install two 138 kV 40 kA CBs and three 46 kV 40 kA CBs. Install a 9.6 MVAR capacitor bank. Re-route the existing 138 kV and 46 kV transmission lines into the new station.

Original Estimated Transmission Cost: \$21.3M

Original Projected IS Date: 8/26/2021

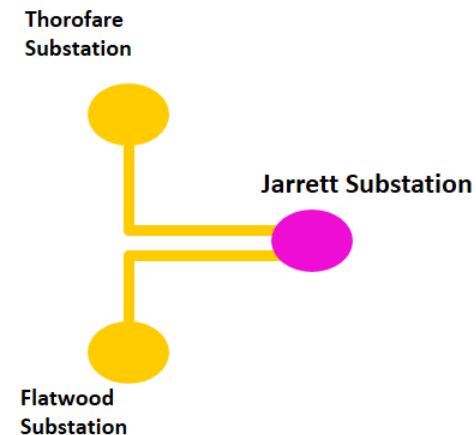
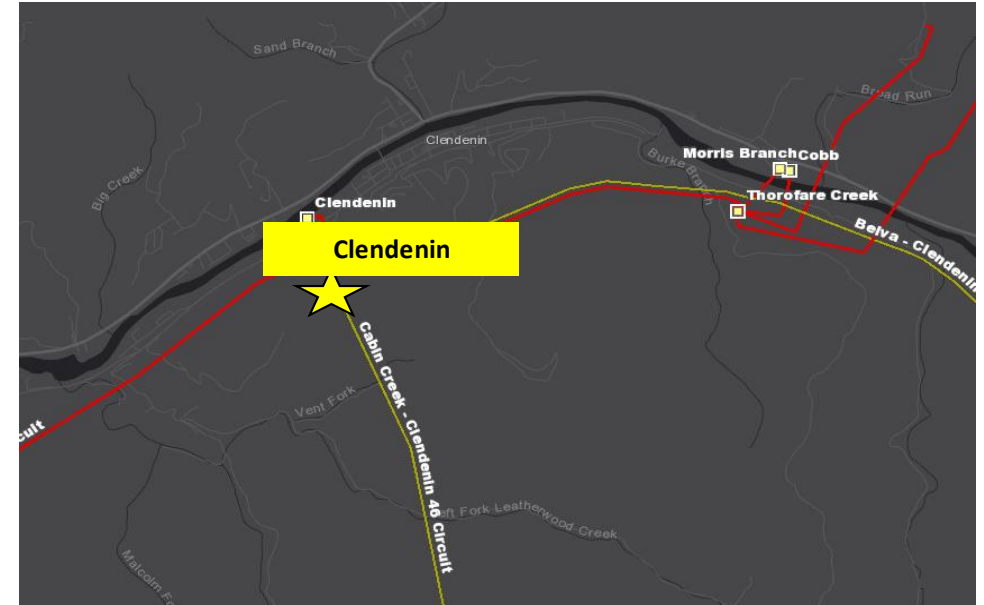
New Scope:

Replace the existing Clendenin Station with the new Jarrett Station, approximately ~~0.2~~ **0.1** miles away from Clendenin Station, located outside of the flood plain. Install a new 138/46 kV 90 MVA XFR, with a high side circuit switcher. Install two 138 kV 40 kA CBs and three 46 kV 40 kA CBs. Install a ~~9.6~~ **34.6** MVAR capacitor bank. Re-route the existing 138 kV and 46 kV transmission lines into the new station.

New Estimated Transmission Cost: ~~\$21.3M~~ \$21.2M (Note: cost does not include Distribution scope of work to install a new 138/34.5 kV 30 MVA transformer).

New Projected IS Date: 3/15/2023

Reason for Revision: Prior to the 2020 RTEP window, preliminary analysis identified radial 715 criteria voltage violations on the following 138 kV buses: Jarrett (.83pu), Morris Branch (.83pu), Cobb (.83pu), Broad Run (.83pu), Thorofare S.S. (.83pu), and Ambler Ridge (.83pu) for the loss of Jarrett – Coco 138 kV (AEP_P1-2_#11225) and Ambler Ridge – Linden Road 138 kV (AEP_P1-2_#9102), which requires a larger cap bank to be installed. These are not considered baseline because the configuration change associated with the supplemental rebuild caused the violations; therefore, the cap bank size increase is supplemental.



Legend	
345 kV	
138 kV	
69 kV	
46 kV	
New	

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

Need Number: AEP-2021-AP019

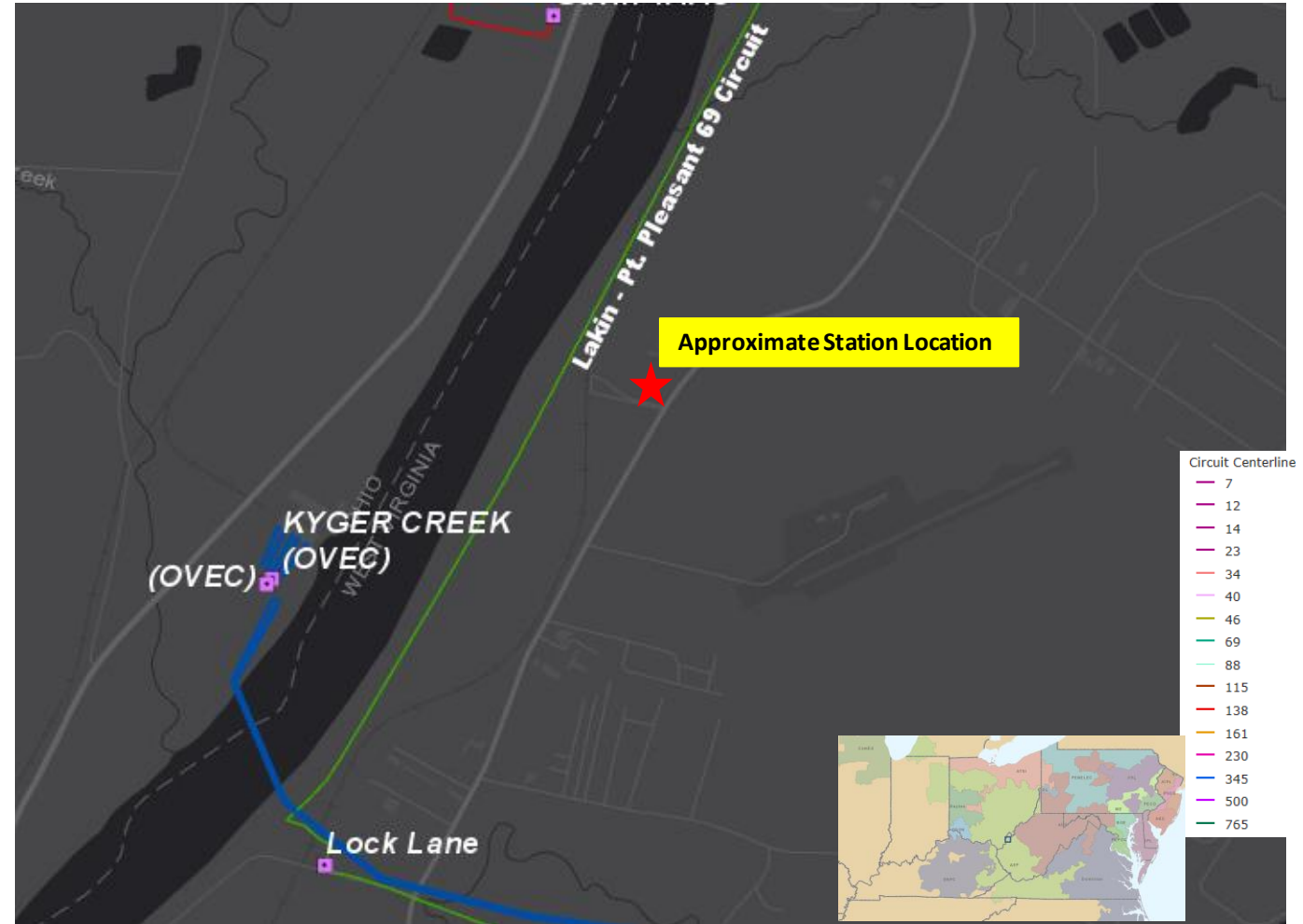
Process Stage: Needs Meeting 5/21/2021

Supplemental Project Driver: Customer Service

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

Problem Statement:

APCO Distribution has requested a new distribution station supporting West Virginia Business Ready Sites Program (House Bill 144) located in Raleigh County, West Virginia.



AEP Transmission Zone: Supplemental Grayson County, VA

Need Number: AEP-2021-AP020

Process Stage: Needs Meeting 05/21/2021

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

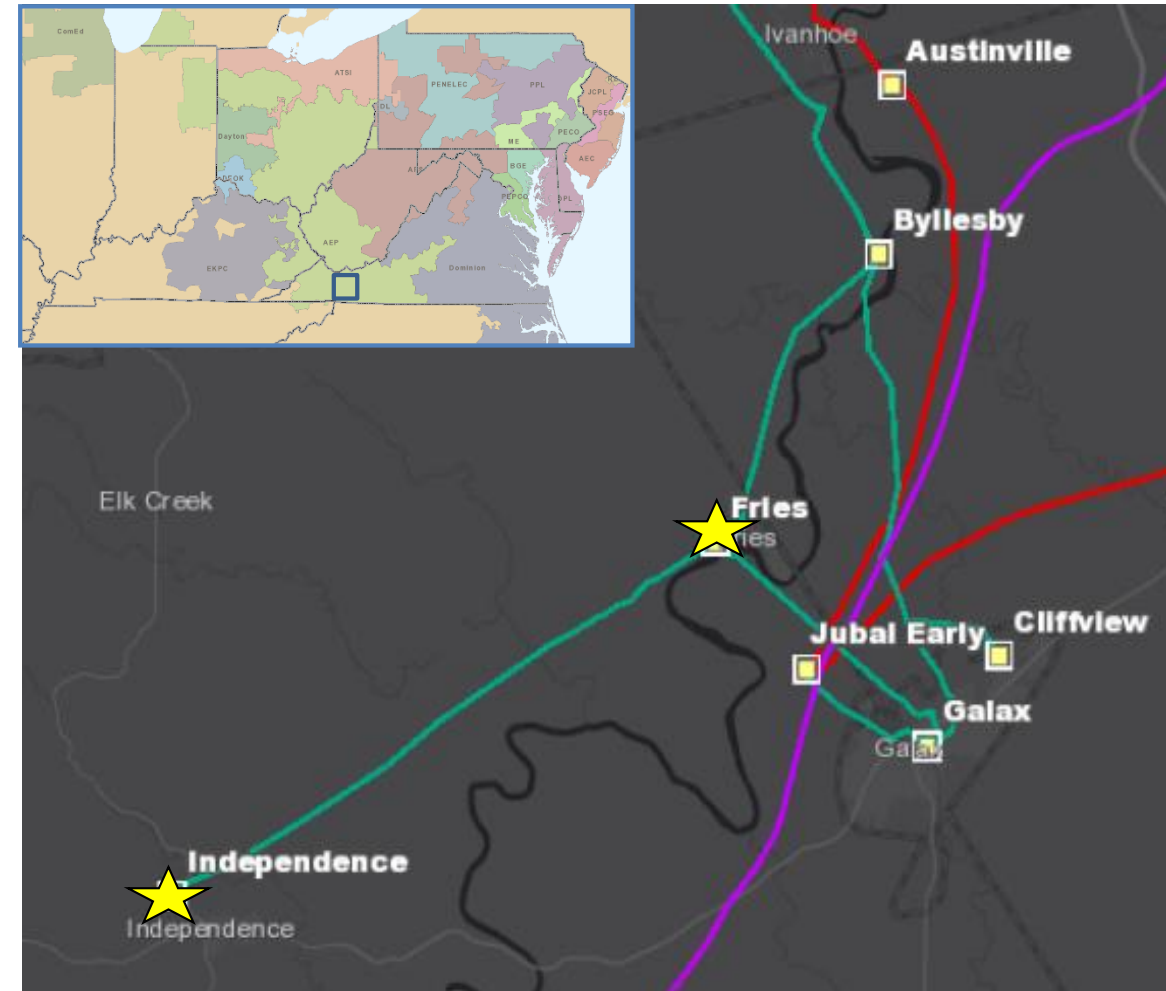
Problem Statement:

The Fries – Independence 69 kV line has 35 open conditions associated with the structures that make up 41% of the line. Conditions include woodpecker damage and rot top. Majority of the circuit utilizes 1950s wood structures.

Since 2013, there has been 5 momentary and 6 permanent outages on the Fries - Independence 69kV Circuit. The 5 momentary outages were due to lightning (3), ice/snow (1), and wind (1) causes. The 6 permanent outages were due to wind (2), lightning (1), vegetation fall-in from outside AEP ROW (2), and relay (1) causes.

The structures on the Fries – Independence 69kV Circuit fail to meet 2017 NESC Grade B loading criteria, fail to meet current AEP structural strength requirements, and fail to meet the current ASCE structural strength requirements. The line is grounded using the butt wrap method which does not meet current AEP standards. The line shielding angle on the typical tangent structure is measured at 33°, which is inadequate for current AEP shielding angle requirements.

S1851 was updated to present a scope change at Independence station due to space constraints and a cost update. The remaining need on the condition of the existing line is presented here.



Need Number: AEP-2021-IM007

Process Stage: Needs Meeting 5/21/2021

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

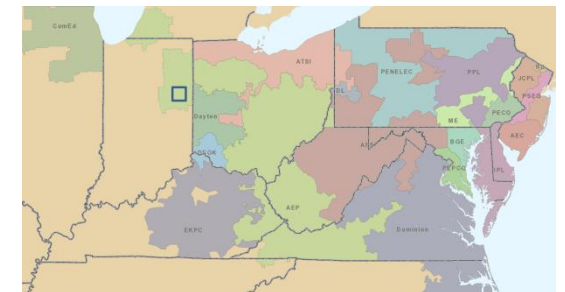
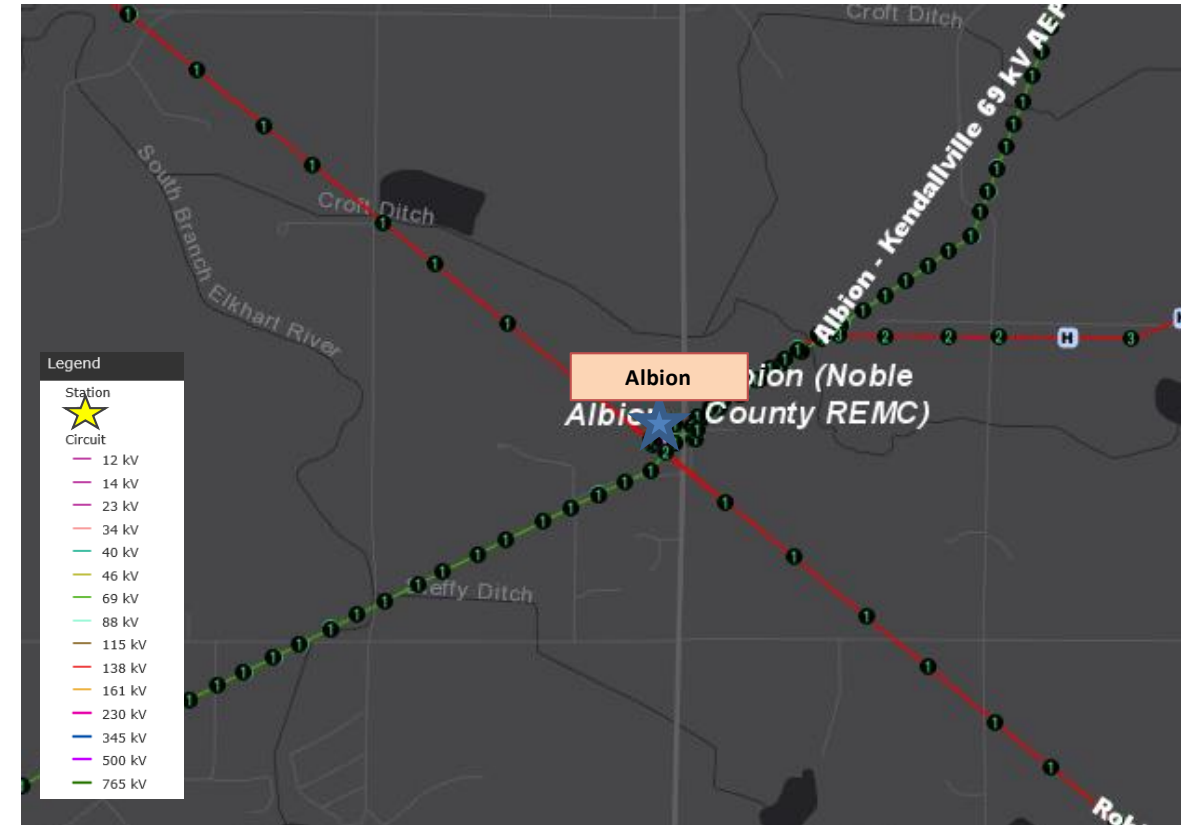
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Albion 138/69kV

- Circuit Breaker “F” is a 1994 138kV 145-PA type Breaker.
 - The 145-PA Type Breakers are experiencing marked increases in malfunctions. There have been 437 recorded malfunctions on 132 total units of this model type on the AEP System. The most common issues are related to loss of SF6 gas and mis-operations. The expected life of the bushing gaskets and door inspection port seals is 25 years. Seals that are no longer adequate can cause SF6 leaks to become more frequent. Low SF6 pressure in the breaker reduces the ability of the breaker to correctly interrupt a fault. Additionally, low pressure alarms and SF6 leaks lead to increased maintenance costs. The manufacturer provides no support or parts for this model of circuit breakers. Finally, SF6 leaks impact the environment.
 - This breaker has experienced 17 faults, over the manufacturer recommended 10.
- Cap Switcher “BB” is a 1980’s vintage 138kV Mark V Cap Switcher.
 - Due to numerous malfunctions, cost of repair and lack of monitoring, AEP is replacing these units where viable.

Model: N/A



Need Number: AEP-2021-IM016

Process Stage: Needs Meeting 5/21/2021

Supplemental Project Driver: Equipment Condition/Performance/Risk

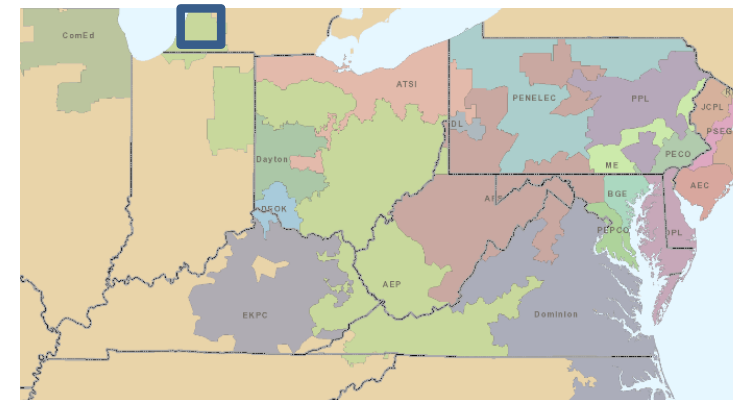
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Model: N/A

Problem Statement:

New Buffalo – Bridgman 69kV line:

- 22.1 miles of mostly 1964-68 wood pole
- Conductor is 336.4 ACSR and 4/0 ACSR
- Since 2015 there have been 4 momentary and 6 permanent outages on the Three Oaks – Bridgman circuit.
- Since 2015 there have been 8 momentary and 2 permanent outages on the Three Oaks – Bosserman circuit.
- 4,488,189 CMI from 2015-2020 on the Bosserman – Three Oaks circuit
- Structures fail NESC Grade B, and AEP Strength requirements with portions failing ASCE structural strength standards
- 23 of 53 structures assessed had wood decay such as rot, heavy checking or woodpecker damage.
- All inspected poles show moderate to heavy shell decay



AEP Transmission Zone M-3 Process Vicksburg , MI

Need Number: AEP-2021-IM023

Process Stage: Needs Meeting 5/21/2021

Supplemental Project Driver: Equipment Condition/Performance/Risk

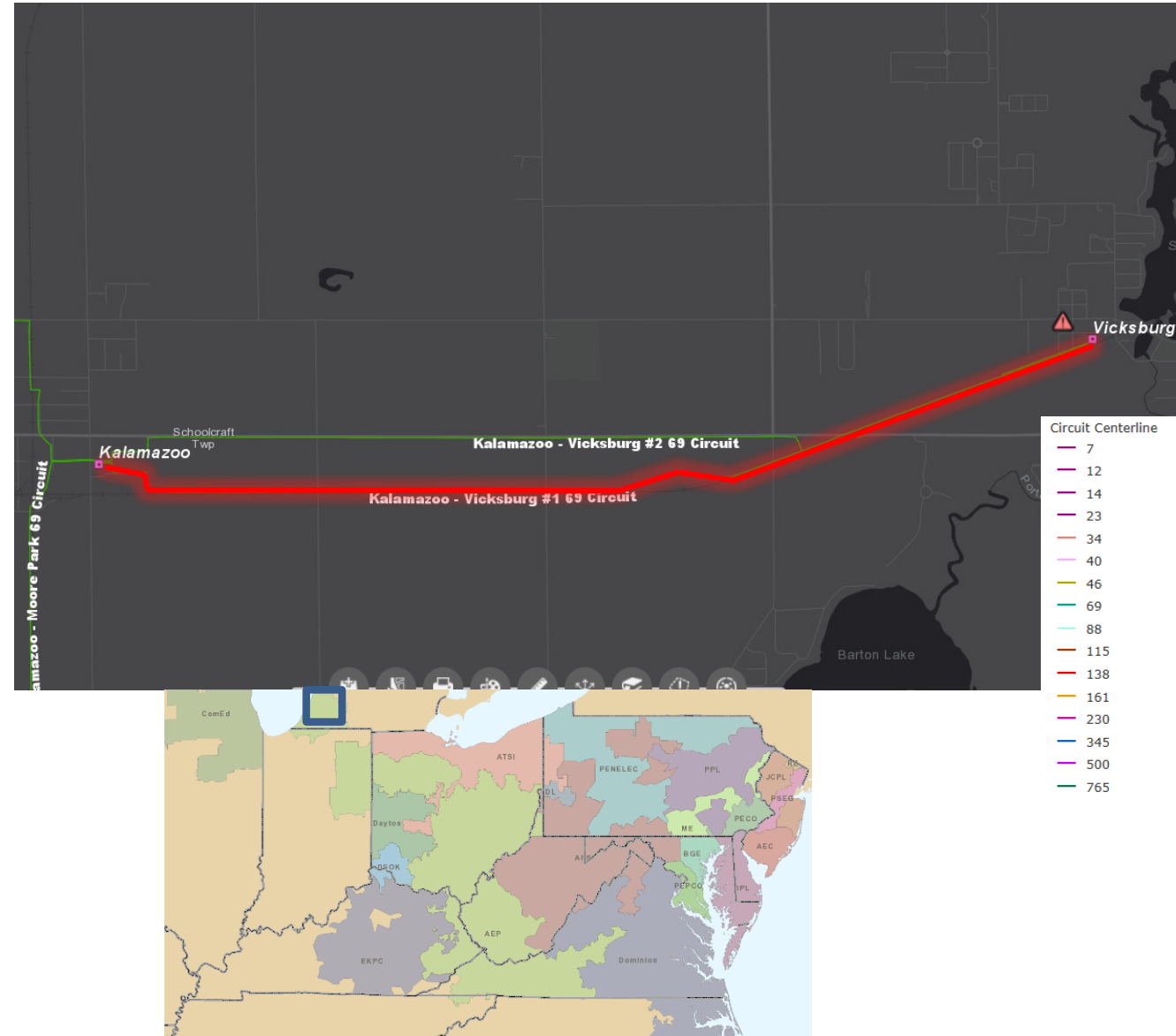
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Model: N/A

Problem Statement:

Kalamazoo - Vicksburg 69kV line:

- 4.72 miles of mostly 1972 wood pole
- Conductor is 3/0 ACSR
- Since 2015 there have been 7 momentary and 1 permanent outages
- Structures fail NESC Grade B, AEP Strength requirements and ASCE structural strength standards
- There are 26 structures with open conditions (41% of line). 17 of these are structure related including pole rot, split and woodpecker damage



AEP Transmission Zone: Supplemental Fort Wayne, IN

Need Number: AEP-2021-IM024

Process Stage: Needs Meeting 05/21/2021

Supplemental Project Driver: Customer Request

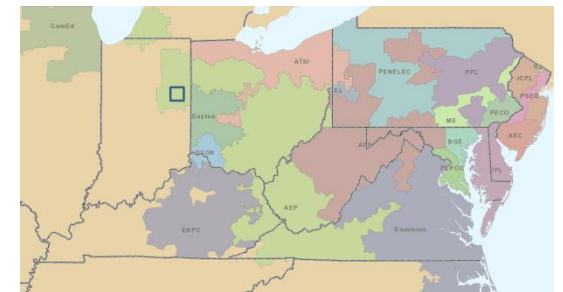
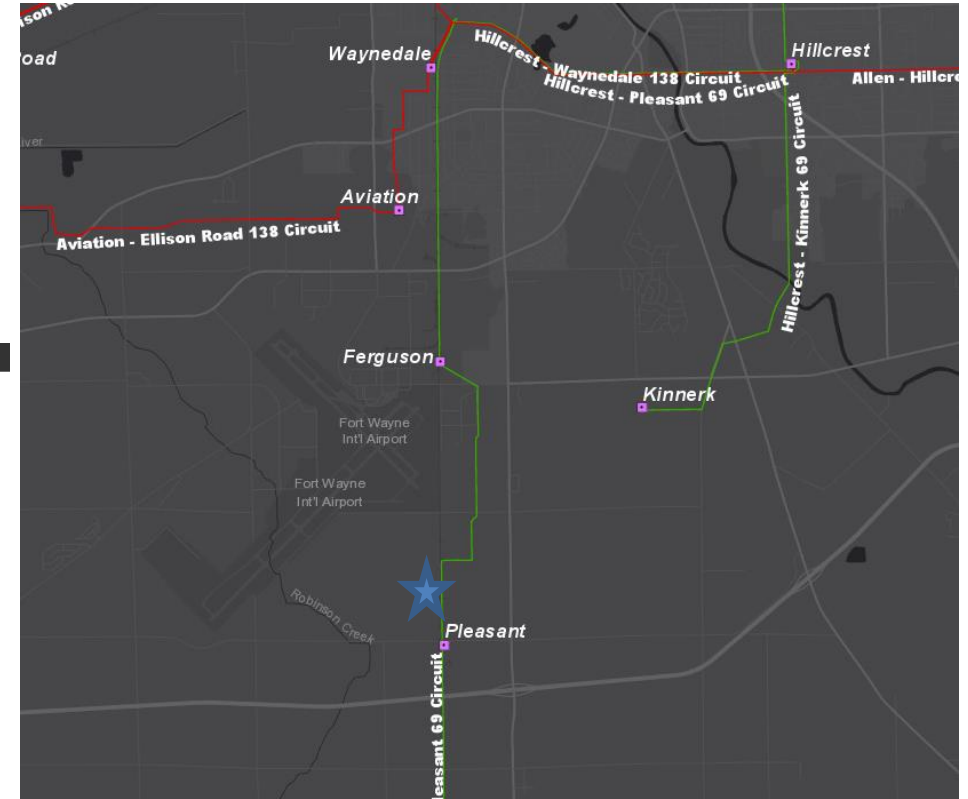
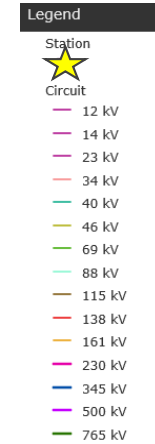
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

Problem Statement:

New 69kV Delivery

- Wabash Valley Power Authority has requested a new delivery point to help serve their growing load in the southern Fort Wayne, IN area. The station will feed 4MW initially and is expected to grow to 5MW by 2025.

Model: 2025 RTEP



Need Number: AEP-2021-OH016

Process Stage: Need Meeting 05/21/2021

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Transmission Circuit Breakers (69 kV): C, E, & L

Distribution Circuit Breaker (12kV): P

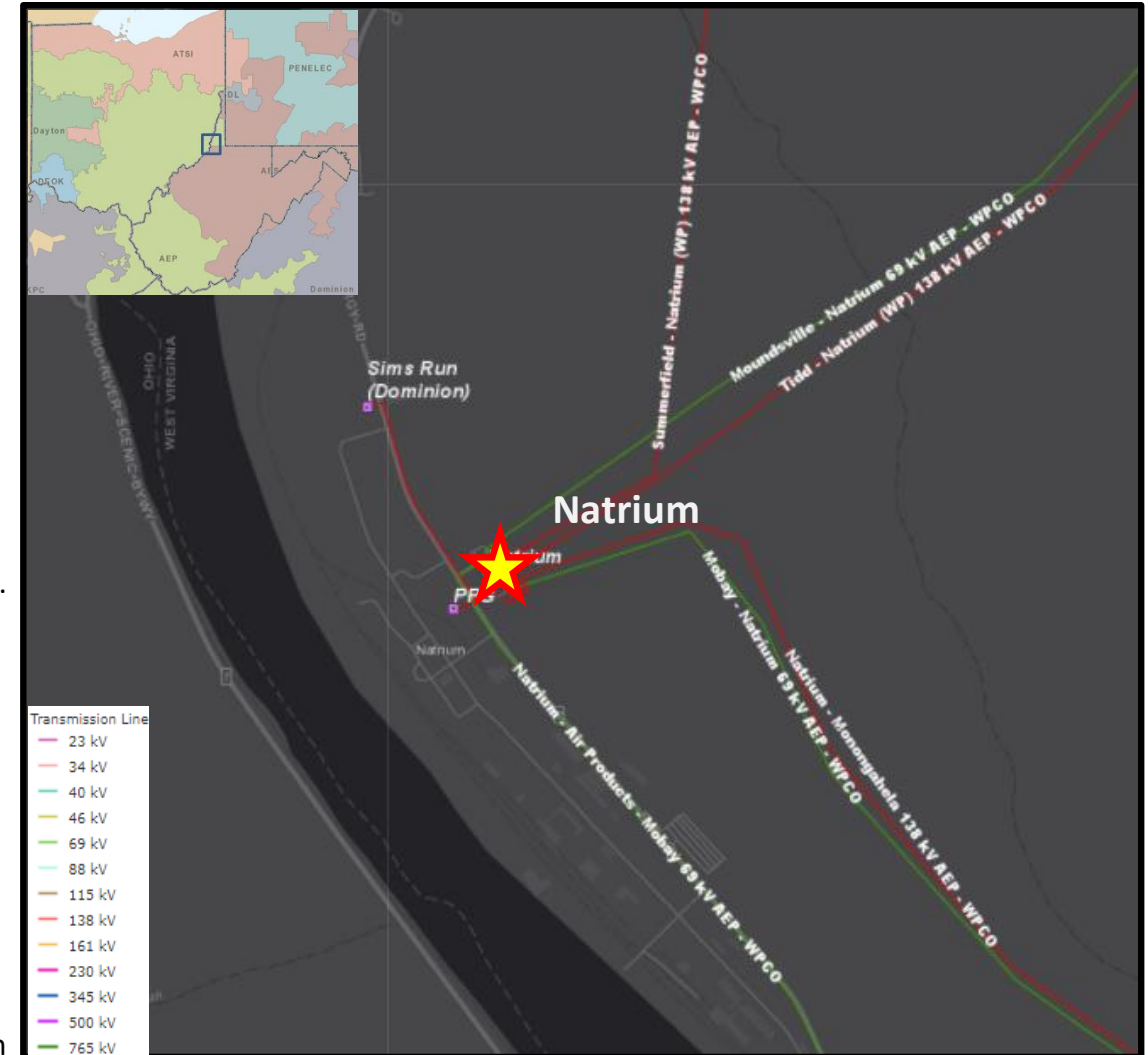
- Breaker Age:
 - 1960'-70's vintage
 - Interrupting Medium: (Oil)
- Fault Operations:
 - Number of Fault Operations: C: 2, E: 28, L: 8, P: 67
- These breakers are oil filled without oil containment; oil filled breakers have much more maintenance requirements due to oil handling that their modern, SF6 counterparts do not require.
- The 69kV breakers have experienced belt, pump, and motor failures in recent years.

Relaying:

- Currently, 102 of the 134 relays (76% of all station relays) are in need of replacement. All 102 of these are of the electromechanical and static type which have significant limitations with regards to spare part availability, fault data collection, and SCADA functionality. In addition, these relays lack of vendor support.
- Both 138kV bus 1 & 2, and 69kV bus 1A & 1B contain electromechanical bus protection relays without redundancy

RTU:

- The existing RTU installed at Natrium Substation are a legacy GE D200MEII/Ethernet unit and a Cooper SMP 16/CP Unit. The GE D200MEII/Ethernet unit is now beyond its warranty period, with limited to no spare parts availability and no vendor support



Need Number: AEP-2021-OH016

Process Stage: Need Meeting 05/21/2021

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Yard & Facilities:

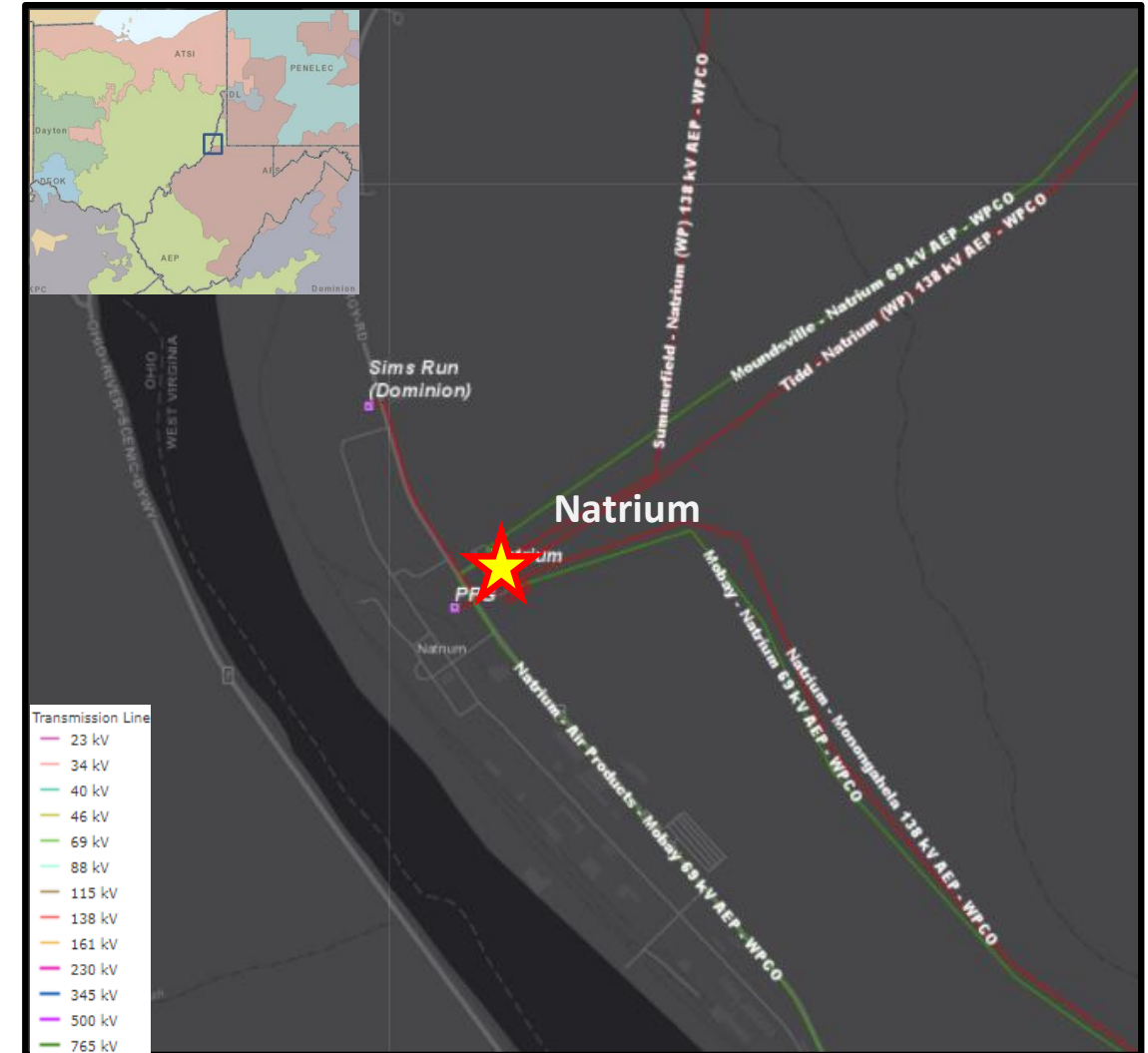
- The station contains two control houses. The older building (1947 vintage) has various issues: leaking roof, asbestos, access issues, broken HVAC, and completely full cable trenches.
- The station service for the 69kV & 12kV yard is from a corner-ground source, which is a safety concern.
- Yard cabinets and PT stands are heavily-rusted (adjacent to two chemical and industrial plants, leading to above-average contamination)

Electrical:

- 138kV bus 1 and 2, along with 69kV bus 1A & 1B are made with copper conductors of questionable structural integrity.
- Bus PT's have various oil leaks
- The 69kV station area is made of steel lattice that is heavily-rusted

Operational Concerns:

- Transformer #1 has no high-side fault-interrupting device, and instead requires clearing the entire 138kV bus 1 (4- breakers). Transformer #2 has the same issue, but has a future Baseline project to address.
- The single 138kV cap bank (29 MVAR) is undersized, due to the several large industrial customers served nearby. AEP Transmission Operations has requested an increase in MVAR size, or an additional cap bank, to better control real-time low voltages.



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

Need Number: AEP-2021-OH025

Process Stage: Need Meeting 05/21/2021

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

South Coshocton – Wooster 138 kV Transmission Line: 39.7 miles long, consisting 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:

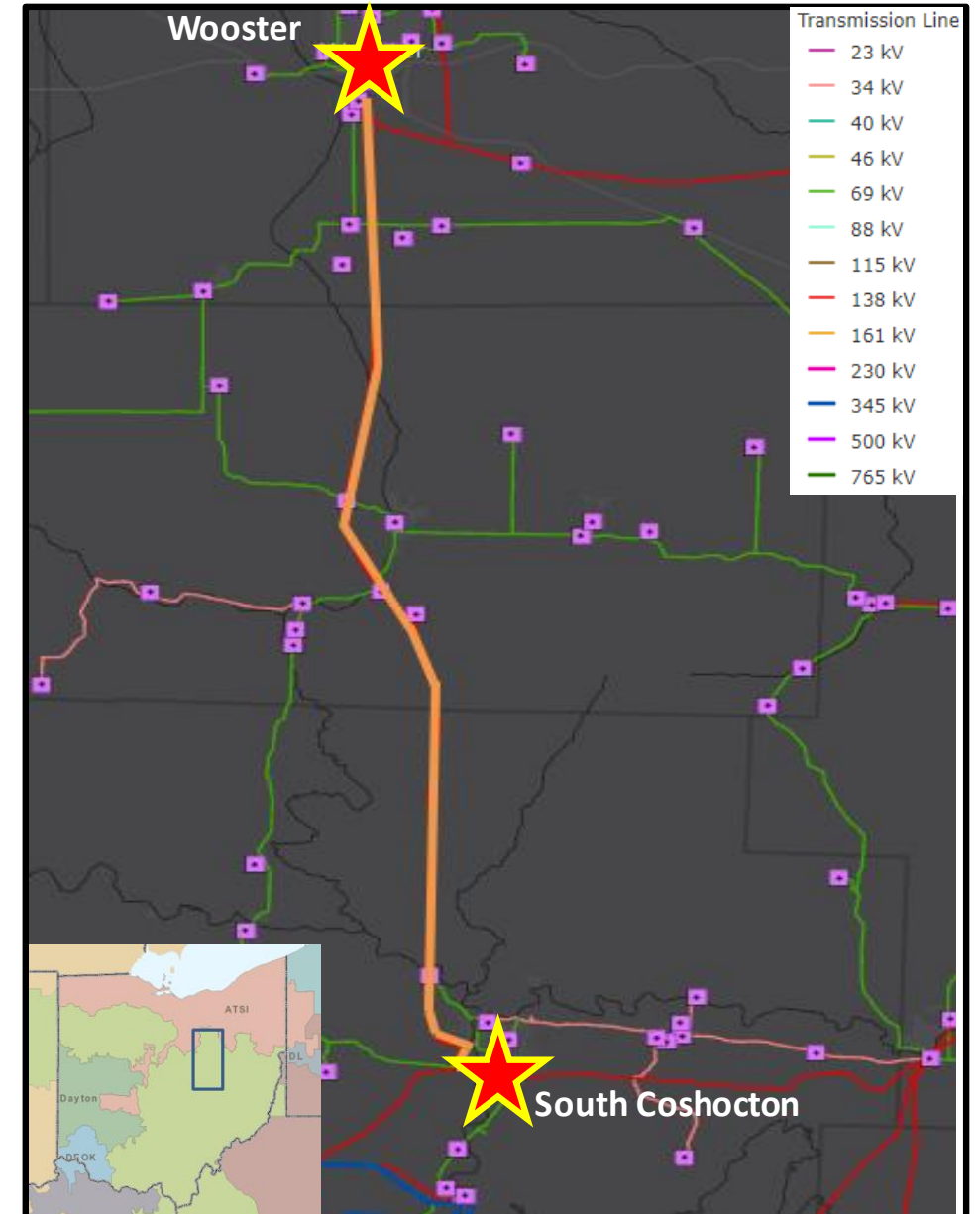
- Momentary (10) & Permanent Outages (7)
- CMI: 545,905 (Past Five Years)

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:

- This 138kV line provides a 138kV source for 4- sub-transmission source stations (South Coshocton, West Coshocton, West Millersburg, and Wooster).
- This 138 kV line serves two Holmes-Wayne Co-op stations and two AEP Ohio distribution stations.
- This 138kV line 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 Lancaster Ohio

Need Number: AEP-2021-OH026

Process Stage: Need Meeting 05/21/2021

Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

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

- Age: 1955
- Length of Line Section: ~0.02 Miles
- Structure Count: 2
 - Structure Type: Wood
- Conductor Type: 556,500 CM ACSR 18/1 (Osprey)
- Outage History: 12 Momentary and 4 Permanent outages with a total CMI of 3,113,139.
- This is currently a three terminal line, which can cause miss-operations and over-tripping of the line.

Section of the South Lancaster – East Lancaster 69kV Line, Single Circuit (East Lancaster – Str 310):

- Age: 1965
- Length of Line Section: ~0.01 Miles
- Structure Count: 1
 - Structure Type: Wood
- Conductor Type: 556,500 CM ACSR 18/1 (Osprey)
- Outage History: 8 Momentary and 2 Permanent outages
- This is currently a three terminal line, which can cause miss-operations and over-tripping of the line.

Clouse–West Lancaster 138kV, Double Circuit:

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



Need Number: AEP-2021-OH027

Process Stage: Need Meeting 05/21/2021

Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

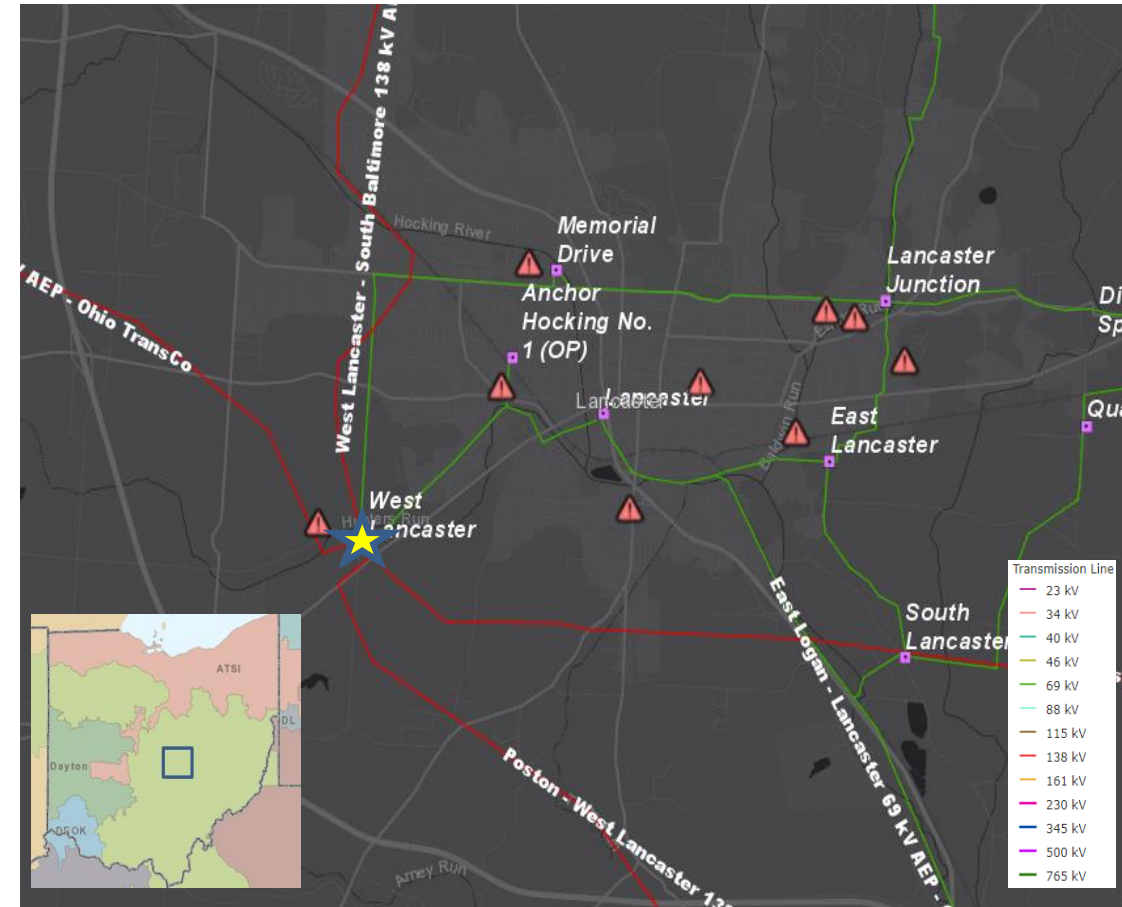
West Lancaster Station

Circuit Breakers: D & E (138 kV)

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

Circuit Breakers: C & J (69 kV)

- Breaker Age: 1966: C & 1963: J
- Interrupting Medium: (Oil)
- Fault Ops: C: 87 & J: 5 (Manufactured recommended number of fault ops is 10)
- Additional Info: . These breakers are McGraw-Edison CF/CG/CGH/CH family of oil filled breakers without oil containment; Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. This model family has experienced major malfunctions associated with their OA-3 hydraulic mechanism, which includes low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off. These mechanism malfunctions have led to several failures to close and other types of mis-operations across the AEP fleet.



Problem Statement Continued:

West Lancaster - continued

Circuit Switcher: BB (69 kV)

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

138/69kV Transformer 2 (60 MVA)

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

Relaying:

Currently, 40 of the 74 relays (54% of all station relays) are in need of replacement. There are 38 of the electromechanical type and 2 of the static type which have significant limitations with regards to fault data collection and retention. These relays lack vendor support and have little to no access to spare parts.

Control House:

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



Need Number: AEP-2021-OH028

Process Stage: Need Meeting 05/21/2021

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

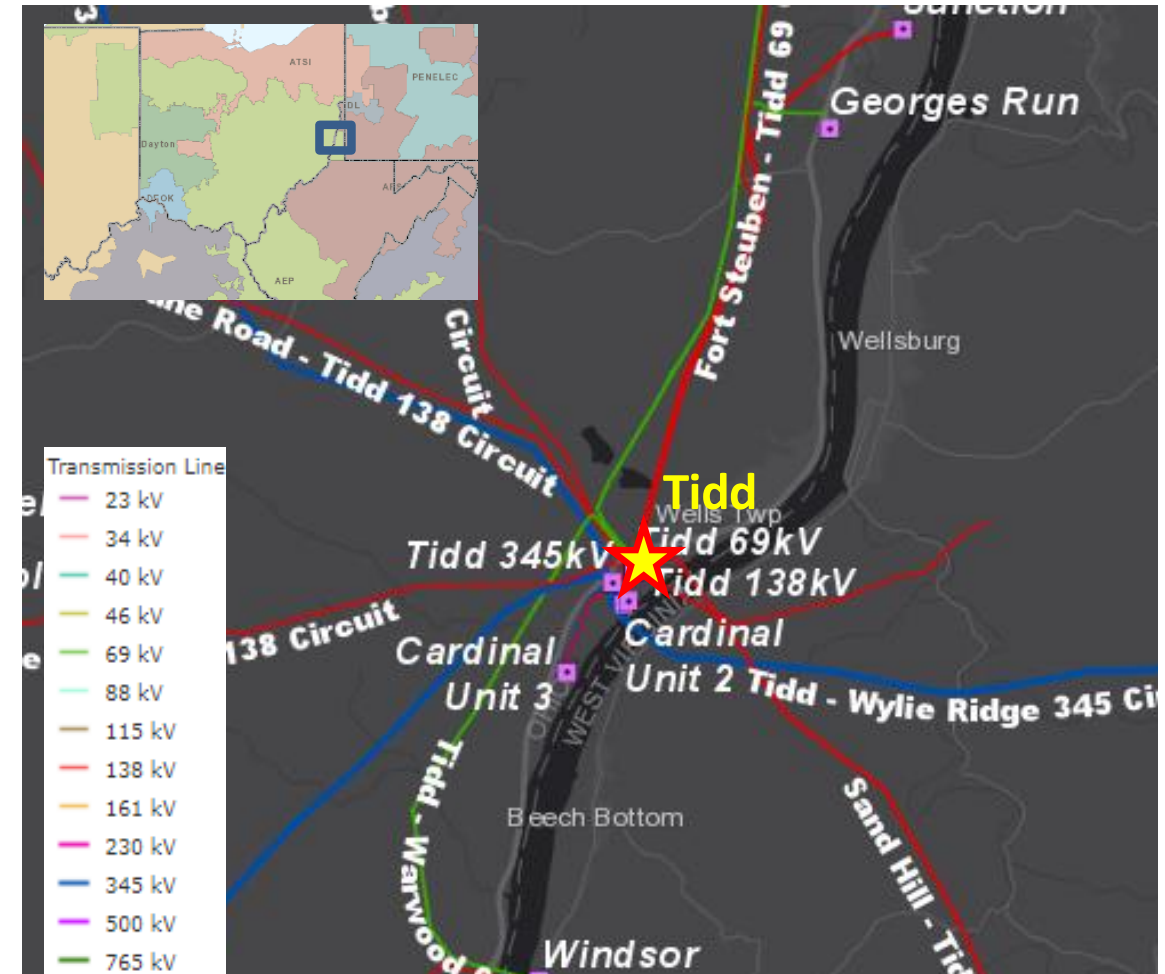
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Transmission Circuit Breaker Concerns (69 kV): AN

Tidd 69kV circuit breaker 'AN' failed in April 2021. Failure documented by very high sulfur dioxide (SO₂) readings in the SF6 gas, due to past fault activity. The SO₂ can cause internal corrosion, leading to mechanical and operational defects.

- Breaker Age: 1997 (installed in 1998)
- Interrupting Capability: 31.5 kA
- Ampacity Rating: 2000 A
- Interrupting Medium: SF6 Gas
- Number of Fault Operations: 38



Need Number: AEP-2021-OH030

Process Stage: Need Meeting 05/21/2021

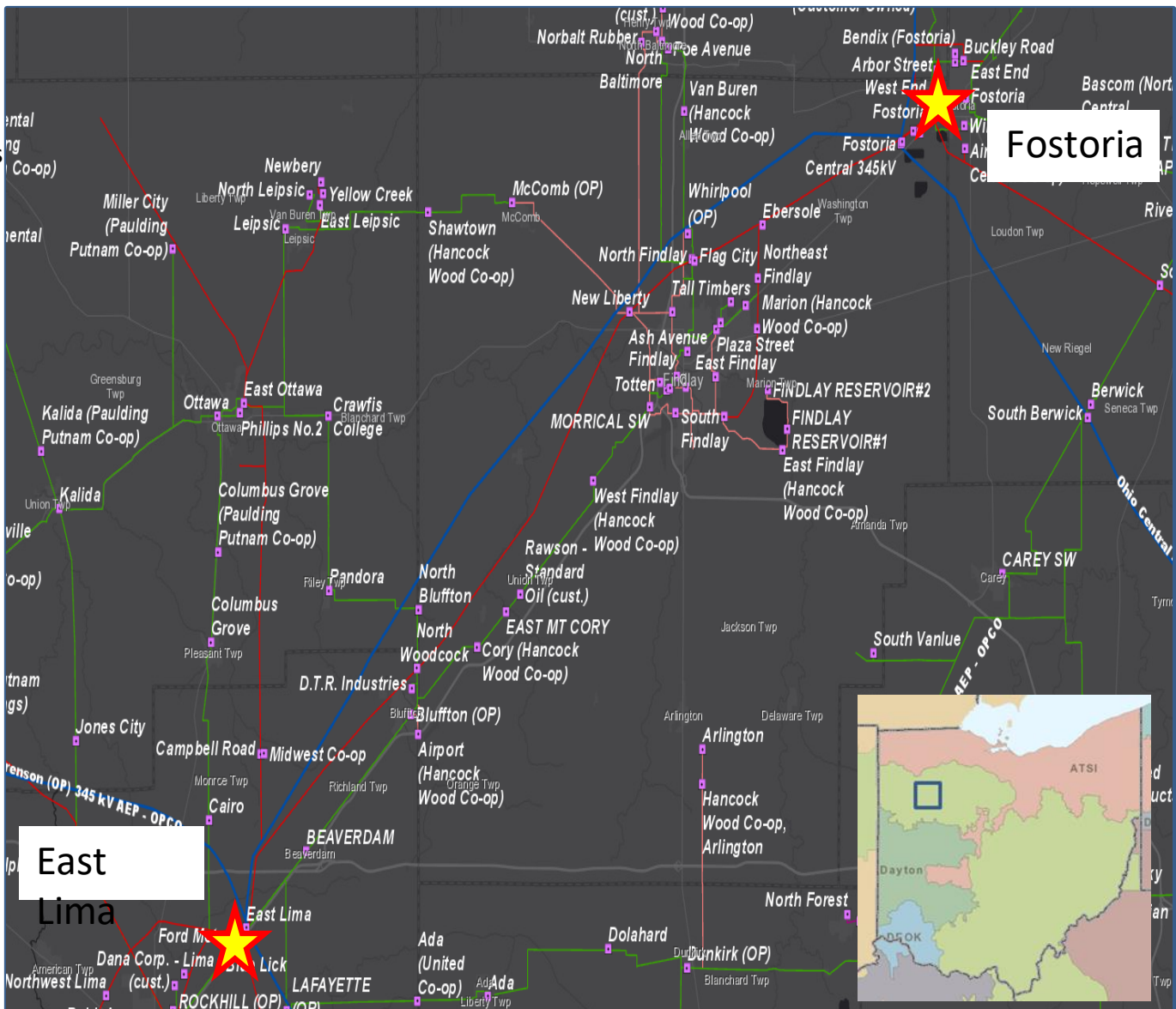
Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Fostoria – East Lima 138kV

- **Original Construction Date:** 1924
- **Length:** 41.26 miles
- **Total structure count:** 205
- **Original Line Construction Type:** Double circuit steel lattice towers with vertical insulators
- **Conductor Types:** 397,500 CM ACSR 30/7 (Lark) & 336,400 CM ACSR 30/7 (Oriole)
- **Outage History:** Since 2015, there have been 2 permanent outages and 6 momentary outages. The Ebersole – New Liberty Circuit has accounted for 19,640 customer minutes of interruption for 326 distribution customers at the Flag City Substation.
- **Condition Summary:** Currently, there are 44 structures with at least one open condition, which relates to 22% of the structures on this line.

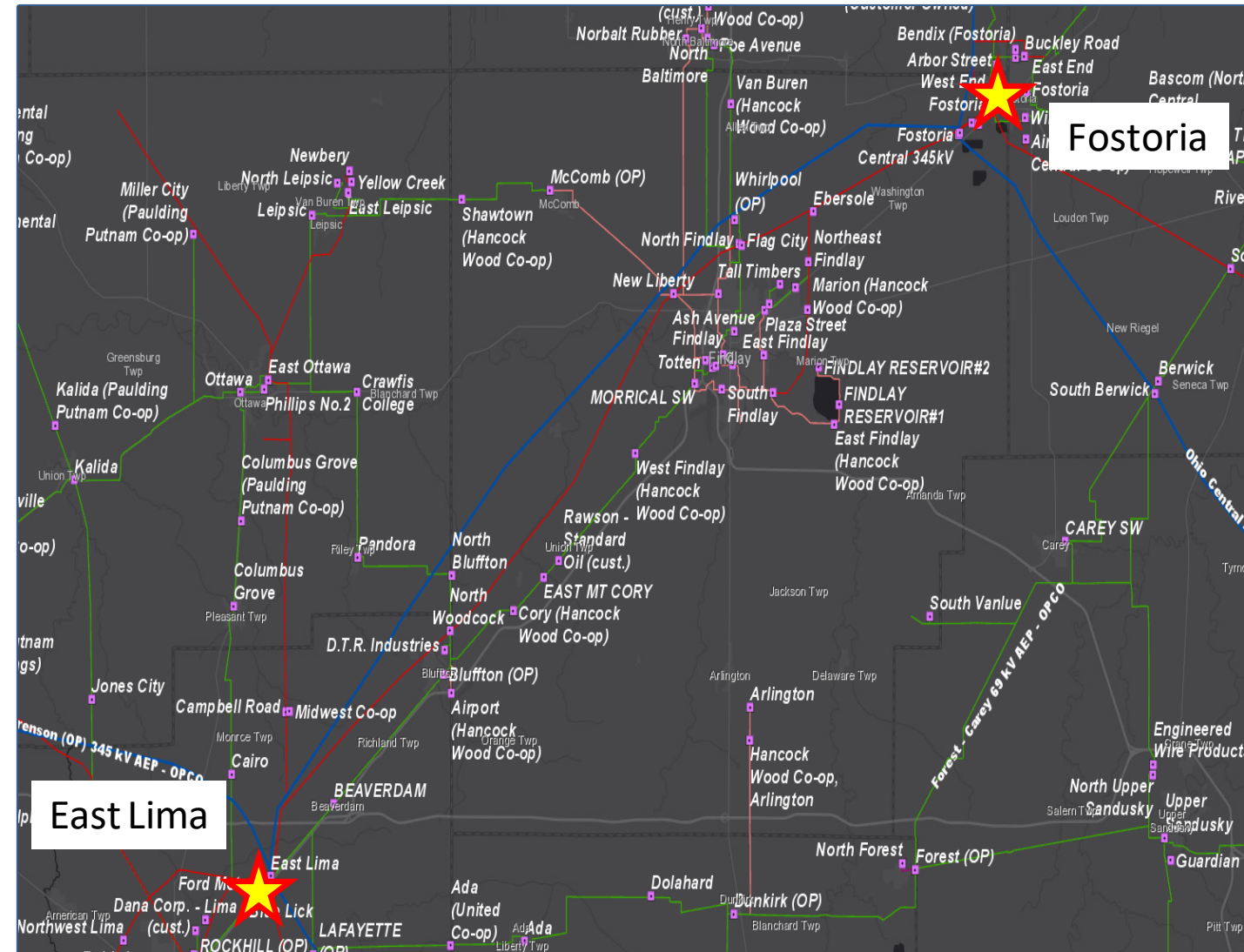


Problem Statement (contd.):

Additional Information: Multiple issues are starting to emerge on this line indicating accelerated deterioration phase of its life. Structures inspected either aerially or by ground crews showed heavy visible corrosion on conductors and shield wire, surface rust on towers, insulator end fittings and dampers.

Additional Info on Insulator & Hardware Corrosion:

- Section on Loss: The connecting elements including the tower attachment hole and the insulator hook have experienced serious cross-section loss due to corrosion and wear. This loss of metal cross-section significantly reduces the capacity of the connection
 - Corrosion: The insulator caps and connecting hardware have experienced heavy to complete loss of galvanizing. When the protective galvanized coating is gone or significantly compromised, the bare steel corrodes at an accelerated rate
 - Tower members with corrosion and damage. Lattice tower structures have little structural redundancy. A failure of one member of the structure will impact the integrity of the structure and may cause the entire tower to collapse.
- **Customer Impact:** This double-circuit line provides significant support to the Findlay area 34.5 kV and 69 kV systems via transformers at North Woodcock, New Liberty, North Findlay, and Ebersole and Flag City. Simultaneous outages at both ends of the double-circuit line would likely lead to a major area-wide outage.
 - **Risk:** Significant deterioration results in loss of strength and performance posing a significant risk of failure under conditions the assets should be able to withstand.
 - May cause frequent and extended outages
 - May create significant economic losses
 - May endanger public safety



AEP Transmission Zone M-3 Process New Albany, OH

Need Number: AEP-2021-OH031

Process Stage: Needs Meeting 5/21/2021

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

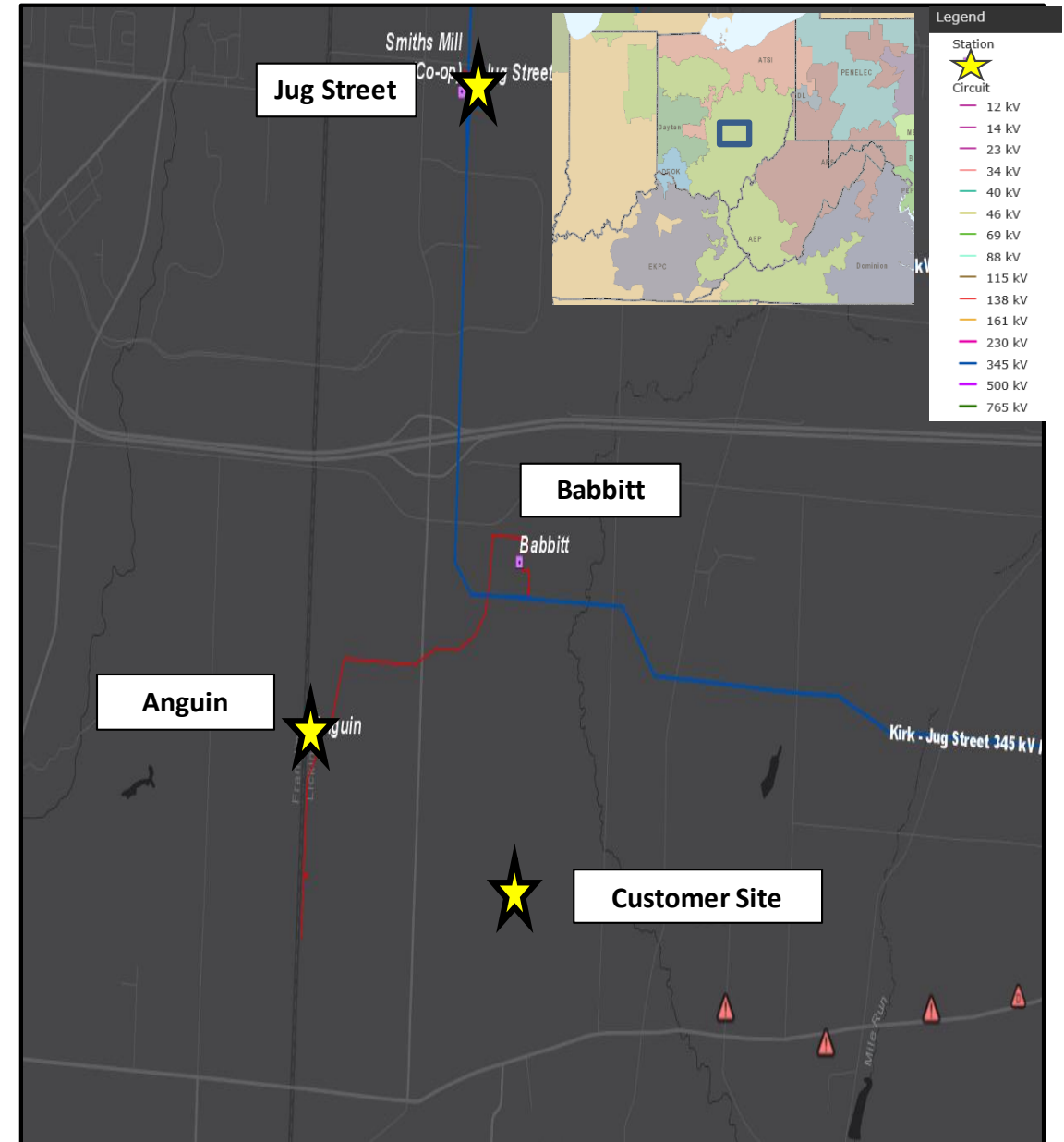
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- A customer has requested transmission service at a site in New Albany, OH.
- The customer has indicated an initial peak demand of 84 MVA with an ultimate capacity of up to 240 MVA at the site.

Model: 2026 RTEP



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 Lakin – Point Pleasant 69 kV Rebuild

Need Number: AEP-2020-AP017

Process Stage: Solutions Meeting 5/21/2021

Previously Presented: Needs Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

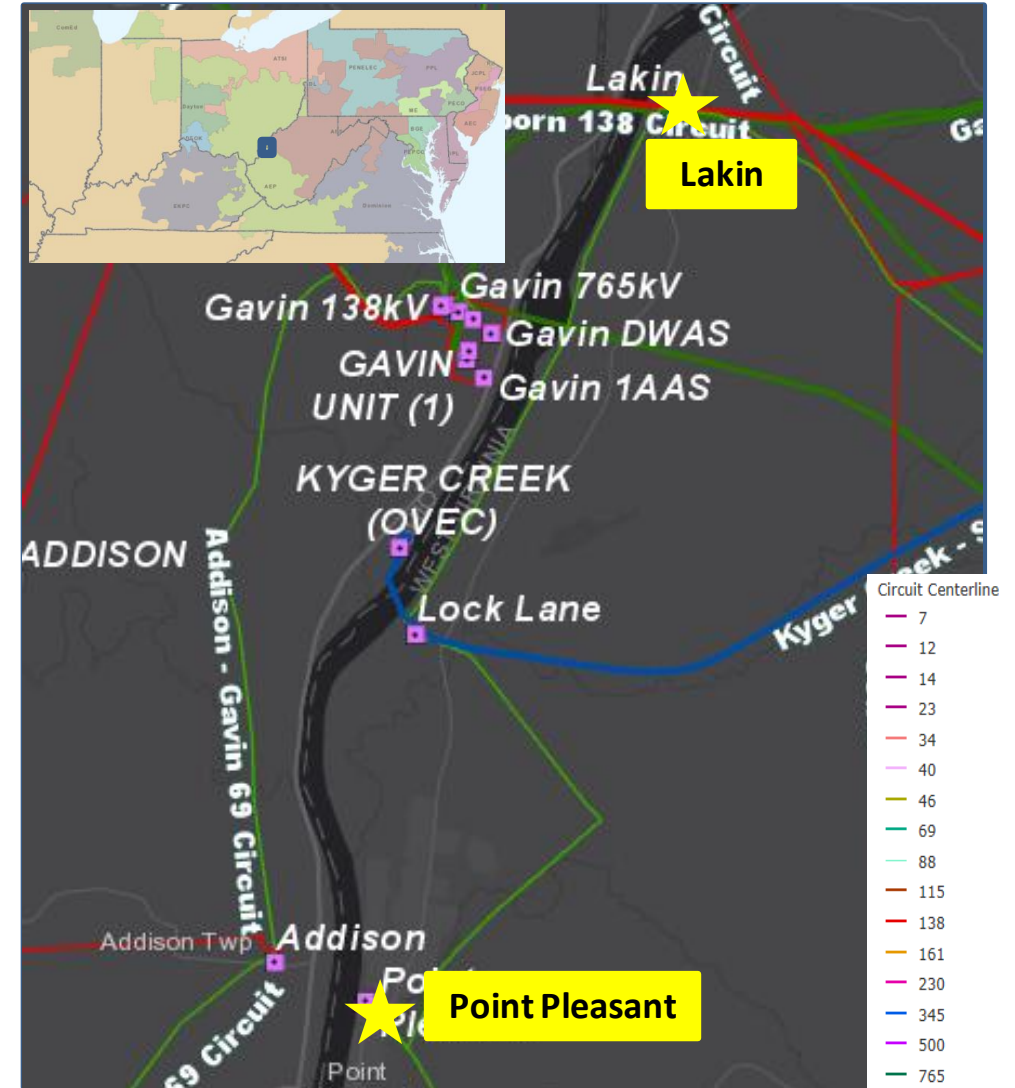
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Lakin – Point Pleasant 69 kV (11 miles)

- The line entirely consists of 1960s wood pole structures with 4-bell porcelain insulators
 - Line was originally installed in 1966, with a combination of 556 ACSR and 3/0 ACSR conductor
 - Structures on the line failed to meet 2017 NESC Grade B loading criteria, failed to meet current AEP structural strength requirements, and failed to meet current ASCE structural strength requirements
 - The insulators do not meet current AEP standards for CIFO and minimum leakage distance requirements.
 - There are currently 95 structures (86% of the line) with at least one open condition
 - A total of 222 open conditions on the line, related to damaged/worn shield wires, rotted crossarms and poles, woodpecker damage, broken or missing ground wire leads, broken or loose guys.
- Since 2014 there have been 17 momentary and 7 permanent outages on the circuit
- CMI: 3.1M

Model: N/A



AEP Transmission Zone M-3 Process Mason County, WV

Need Number: AEP-2020-AP019

Process Stage: Solutions Meeting 5/21/2021

Previously Presented: Needs Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

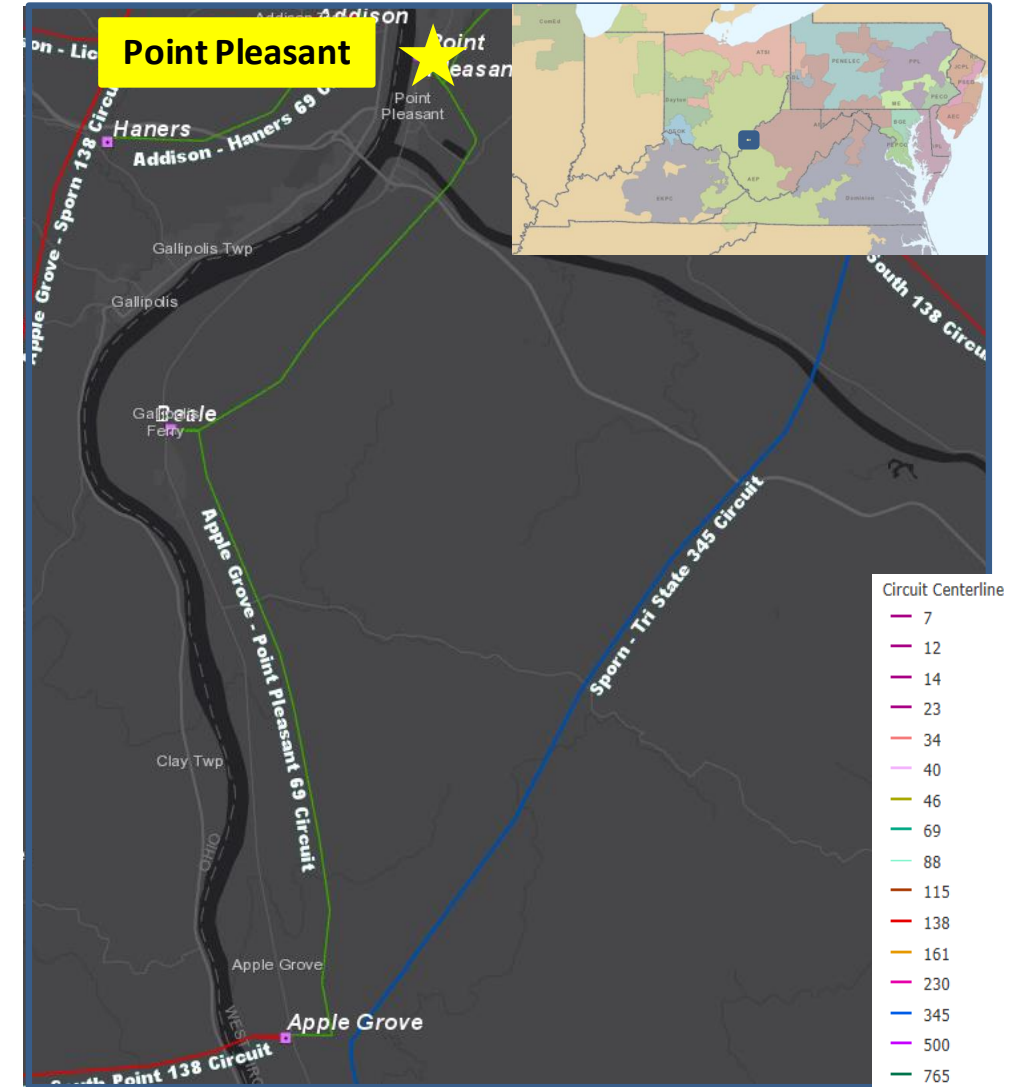
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Point Pleasant Station

- 69 kV circuit breakers G and H are an CF type oil filled breaker, without oil containment.
 - 1968 vintage
 - Oil filled breakers need more maintenance due to the oil handling required
 - The manufacturer does not provide support for this type of breaker and spare parts not available.
 - Oil spills can result in significant mitigation costs.
- 69 kV circuit switcher AA is a 2030-69 type SF6 switcher.
 - 1991 vintage
 - S&C 2030 circuit switcher has no gas monitor and sister units have experienced numerous malfunctions
- 39 out of the 40 relays (98% of all station relays) are in need of replacement
 - 34 relays are electromechanical type and 5 static type which have significant limitations with regards to fault data collection and retention.

Model: N/A



AEP Transmission Zone M-3 Process Lakin – Point Pleasant 69 kV Rebuild

Need Number: AEP-2020-AP017, AEP-2020-AP019

Process Stage: Solutions Meeting 5/21/2021

Proposed Solution:

Rebuild the existing 5.36 mile Lakin – Lock Lane 69 kV line. **Estimated Trans. Cost: \$11.9M**

Point Pleasant Station: replace existing 69 kV circuit breakers G and H with two new 69 kV 3000 A 40 kA circuit breakers. Replace existing cap switcher AA with a new 69 kV cap switcher. **Estimated Trans Cost: \$2.1M**

Total Estimated Trans Cost: \$14.0M

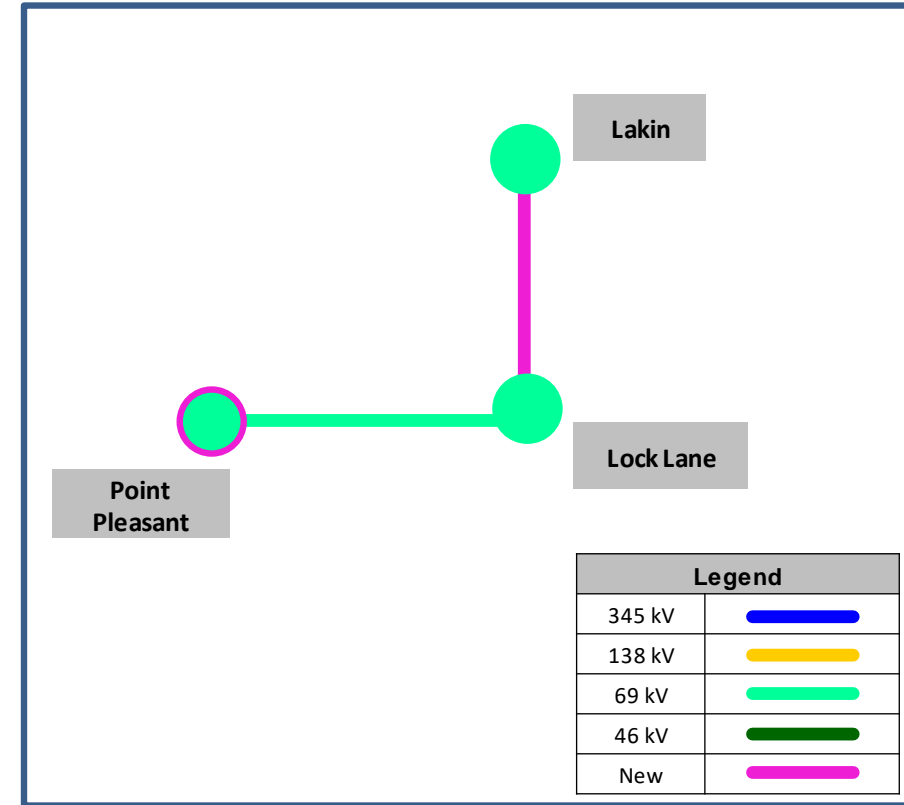
Ancillary Benefits: Project will be coordinated with PJM Baseline project B3284 that addresses 5.44 miles of 69 kV line from Lock Lane – Point Pleasant.

Alternatives Considered: Considering the location of customers served and new service requests to be served from the line and the previously approved baseline rebuild scope, no additional alternatives were identified.

Projected In-Service: 10/31/2025

Project Status: Scoping

Model: 2025 RTEP



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Need Number: AEP-2020-OH028

Process Stage: Solutions Meeting 05/21/2021

Previously Presented: Need Meeting 7/17/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

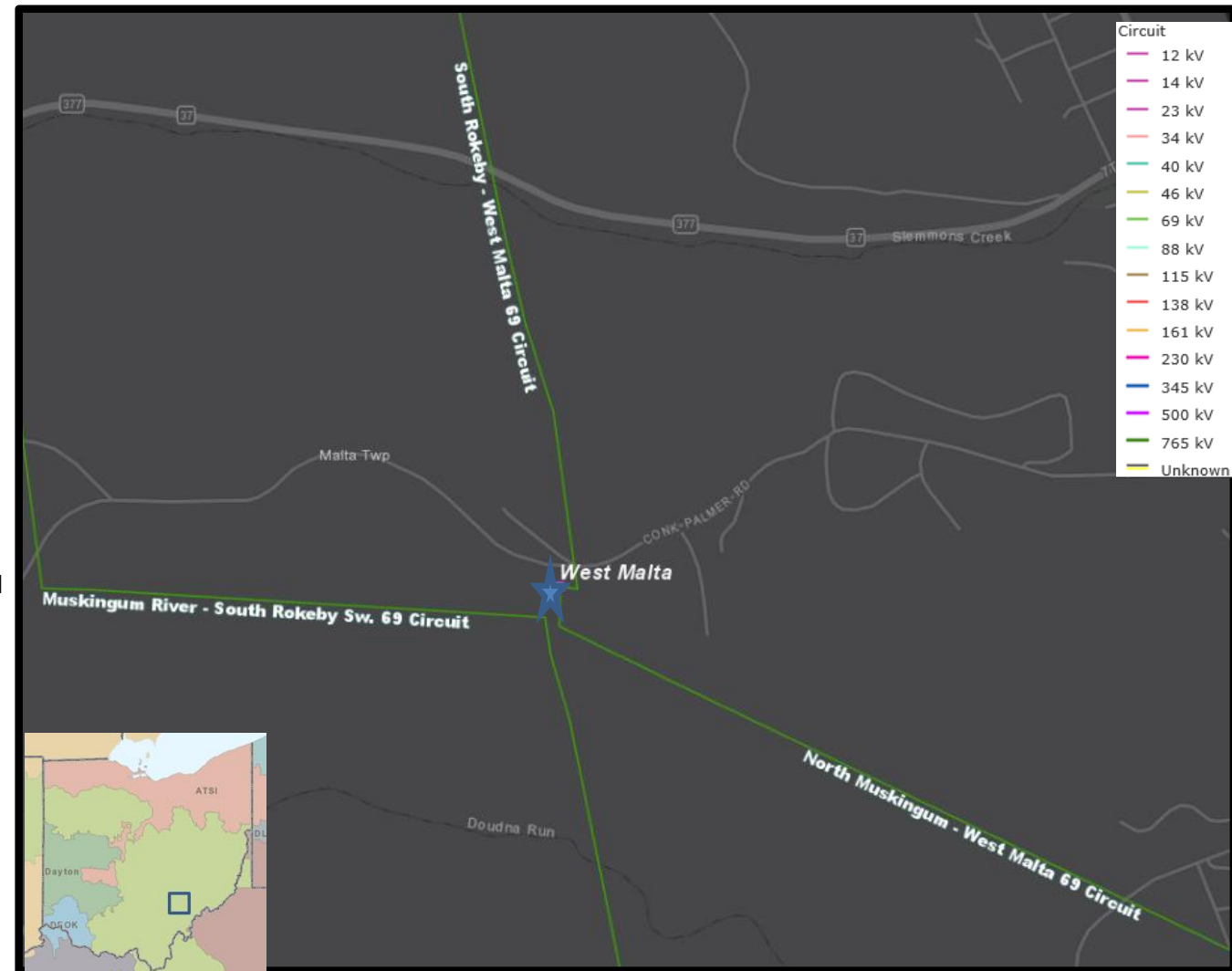
West Malta 69kV

Circuit Breaker "A" 1965

- Interrupting Medium: Oil
- Additional Information:
 - Interrupting Capability: 21 kA
 - Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. Spare parts for these units are not available due to their obsolescence.

Additional Information:

- MOAB X has a retrofitted motor mechanism installed that prohibits the switch from opening correctly.
- Overlapping zone of protection exist at the station between a 69 kV line, the bus, and the 69/12 kV transformer which can result in relay coordination issues.
- 23 of the 25 relays at the station are of the electromechanical type and 2 of the static type all of which have significant limitations with regards to fault data collection and retention. In addition, these no longer have vendor support and spare parts are unavailable.



AEP Transmission Zone M-3 Process West Malta Station Upgrades

Need Number: AEP-2020-OH028

Process Stage: Solutions Meeting 05/21/2021

Proposed Solution:

- West Malta: Replace circuit breaker “A” with a 69kV 3000A 40kA circuit breaker. Replace MOAB “X” with a 69kV SCADA controlled switch. Remove Capacitor bank “AA” and the circuit switcher. Estimated Cost: \$1.87M (Note: Distribution scope of work to replace 69/12 kV bank is not included in this cost.)
- South Rokeby: Remote end upgrades to coordinate with new relaying at West Malta will require a transclosure at South Rokeby and an upgrade to the existing station service. Estimated Cost: \$0.69M

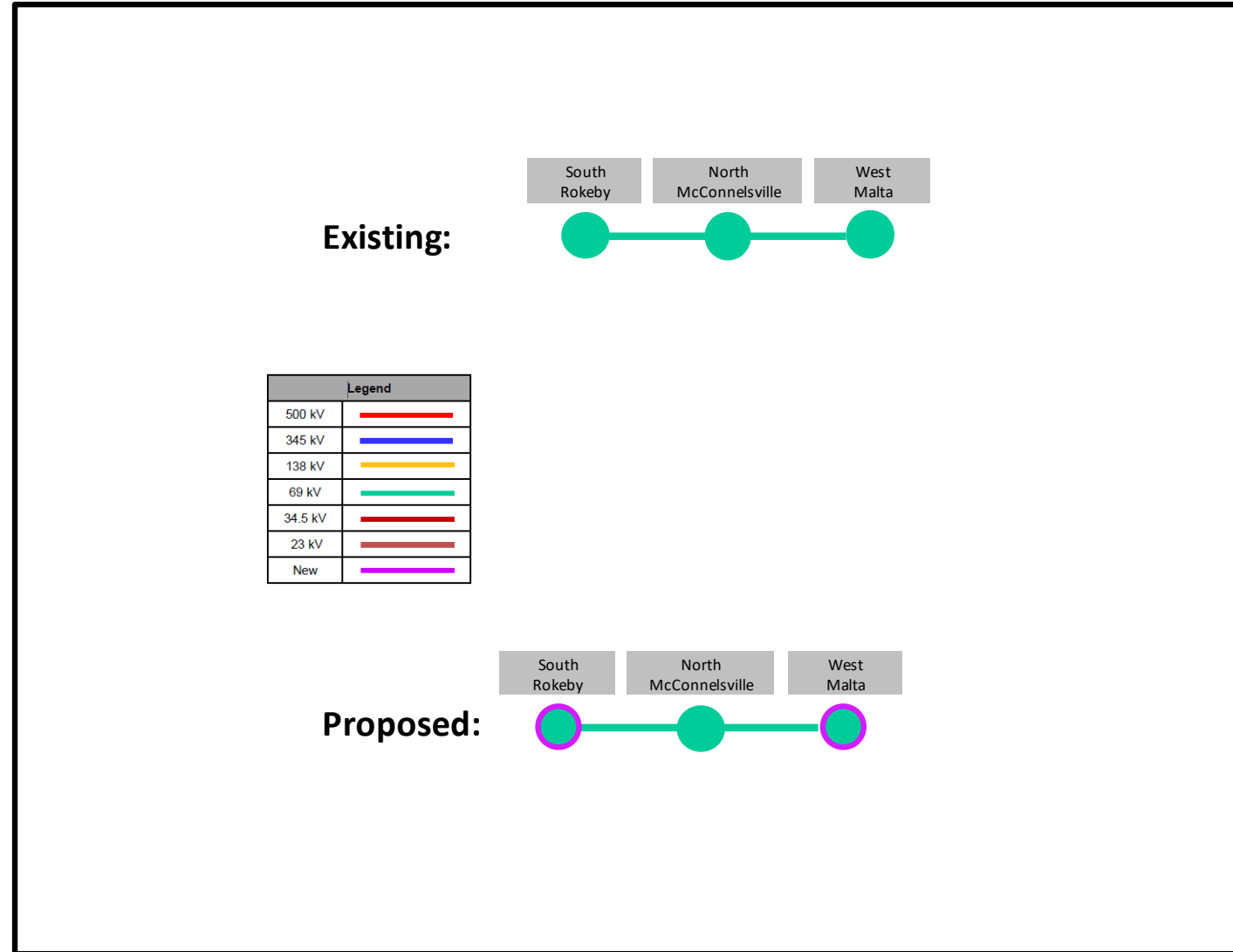
Total Estimated Transmission Cost: \$2.56M

Alternatives Considered:

- Build a greenfield 69/12 kV station to replace West Malta in a in and out configuration with 69 kV SCADA controlled switches on the Muskingum – South Rokeby 69 kV circuit. Considering the availability of space in the existing station location and the increased cost, this option was eliminated. Estimated Cost: \$3.5M

Projected In-Service: 12/10/2022

Project Status: Scoping



AEP Transmission Zone M-3 Process Philo-Howard 138kV Line Rebuild

Need Number: AEP-2020-OH034

Process Stage: Solutions Meeting 5/21/2021

Previously Presented: Need Meeting 6/19/2020

Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs.
Please reference needs materials on pre-1930s era Lattice Lines.

Problem Statement:

Line

Philo – Howard 138kV (vintage 1929):

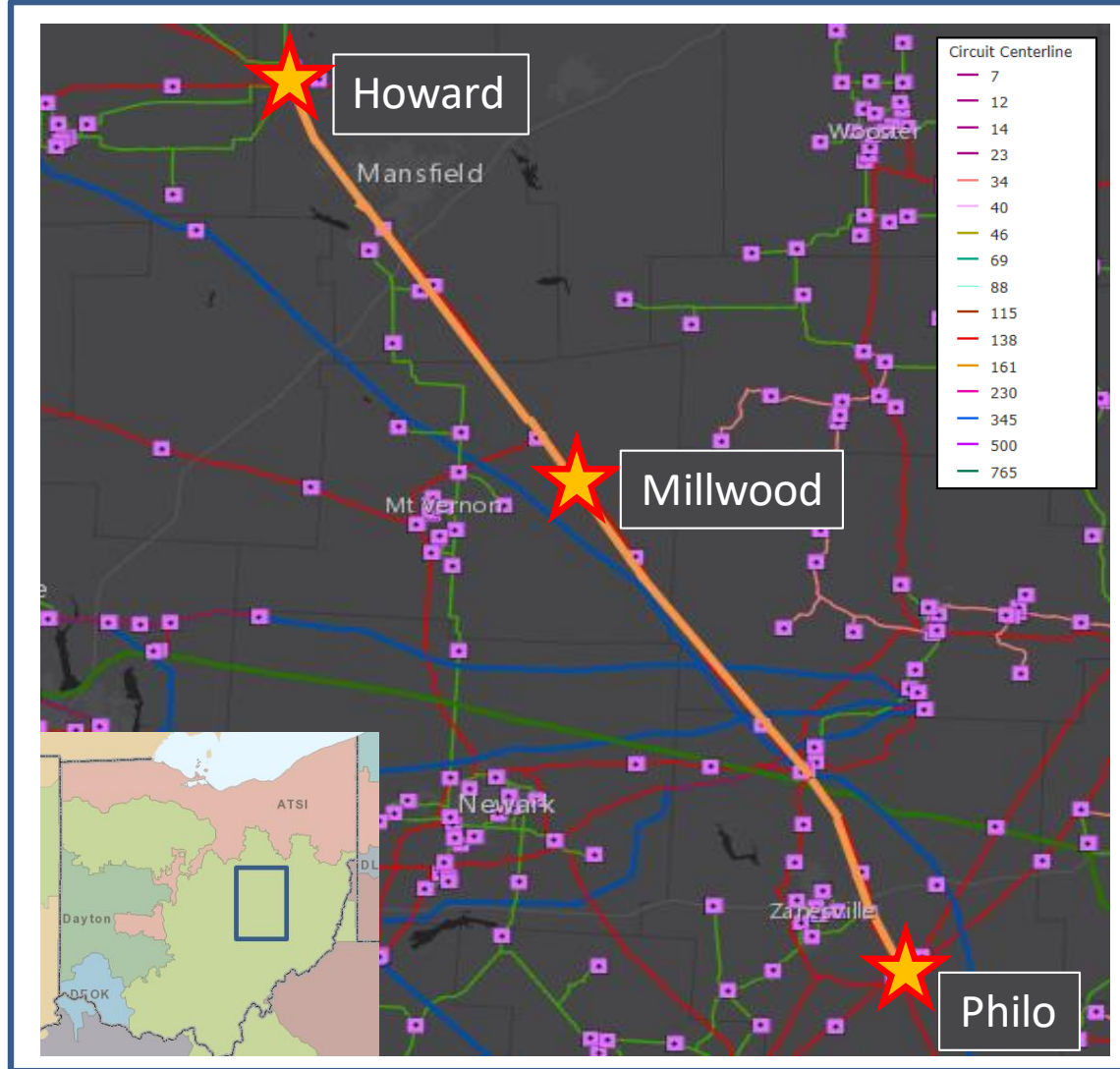
The Philo –Howard 138 kV transmission line asset serves 60 MVA of load consisting of four AEP substations and three non-AEP substations; the line asset is operated as double-circuit.

LINE CHARACTERISTICS

- Length of Line: 81.15 Miles
- Original install date: 1929
- Total structure count: 404, 398 dating back to original installation.
- Conductor Type: 556,500 CM ACSR 18/1 (Osprey) and 556,500 CM ACSR 26/7 (Dove)

CONDITION / PERFORMANCE / RISK ASSESSMENT:

- Momentary/Permanent Outages and Duration: 35 total outages: 28 (Momentary), 7 (Permanent).
- 5 Year CMI: 2,667,652
- Number of open Structure, Conductor, and Hardware conditions: 149
 - Conditions include broken conductor strands, burnt insulators, along with broken/damaged lattice members and hardware.
- Structures with at least one open condition: 55
- The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP’s pre-1930’s steel lattice tower line presentation.



Need Number: AEP-2020-OH034

Process Stage: Solutions Meeting 5/21/2021

Proposed Solution:

Rebuild from Howard to Ohio Central as 138kV double-circuit (64 miles), using 795 ACSR conductor. Note that the approx. 0.5 mile 138kV line segments outside Ohio Central station will not be rebuilt, as they are newer and in better condition; connect these existing T-line segments to the rebuilt Philo-Howard line asset. **Estimated Cost: \$142.26 Million**

Rebuild from Ohio Central to Philo as 138kV single-circuit (19 miles), using 795 ACSR conductor. The existing Ohio Central-Philo #2 138kV circuit will be retired. Update both terminal stations to account for the retired circuit. **Estimated Cost: \$43.45 Million**

At Millwood station, retire the 138kV flip-flop switching scheme, including the 2- 138kV switches. Install 2 new 138kV switches and replace the 138kV through-path risers & bus. Reconfigure the 138kV T-line entrances. **Estimated Cost: \$1.32 Million**

At West Trinway station, replace 138kV through-path risers & bus. **Estimated Cost: \$0.12 Million**

Modify 138kV protective relay settings at Philo, Culbertson, Ohio Central, Academia, North Bellville, North Lexington, and Howard stations. **Estimated Cost: \$0.69 Million**

Total Estimated Transmission Cost = \$187.84 Million

Alternatives Considered:

1. Complete the proposed solution above, but retain the 138kV double-circuit between Ohio Central-Philo. This would have added approximately \$4.4 Million to the total cost. However, there wasn't a need for the 2nd 138kV circuit, so the more cost effective solution is to rebuild as single circuit for these segments. **Alternative Cost = \$192.24 Million**
2. Due to the multitude of stations served along the 83-mile Philo-Howard 138kV pathway, significant T-line retirement wasn't feasible. There is a need to retain redundancy on this line route, due to the double-circuit extension to Academia, along with the goal of not downgrading customer reliability in the future.

Projected In-Service: 6/1/2028 (project will have staggered in-service dates, due to lengthy mileage)

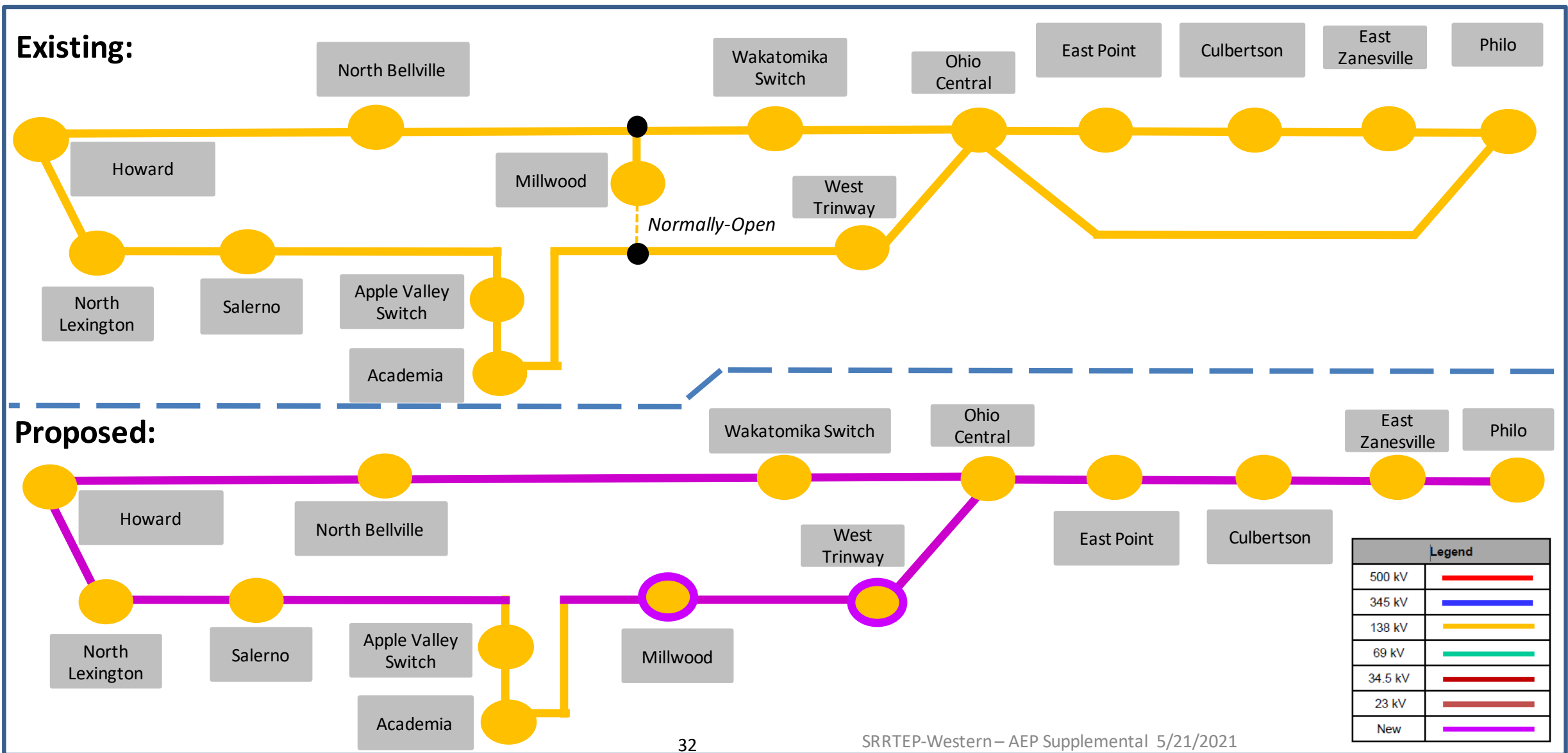
Project Status: Scoping

Model: 2025 PJM RTEP Model, with latest approved AEP Supplemental projects added

Need Number: AEP-2020-OH034

Process Stage: Solutions Meeting 5/21/2021

AEP Transmission Zone M-3 Process Philo-Howard 138kV Line Rebuild



Need Number: AEP-2019-OH041

Process Stage: Solutions Meeting 05/21/2021

Previously Presented: Need Meeting 10/16/2020

Project Driver:

Equipment Material/Condition/Performance/Risk

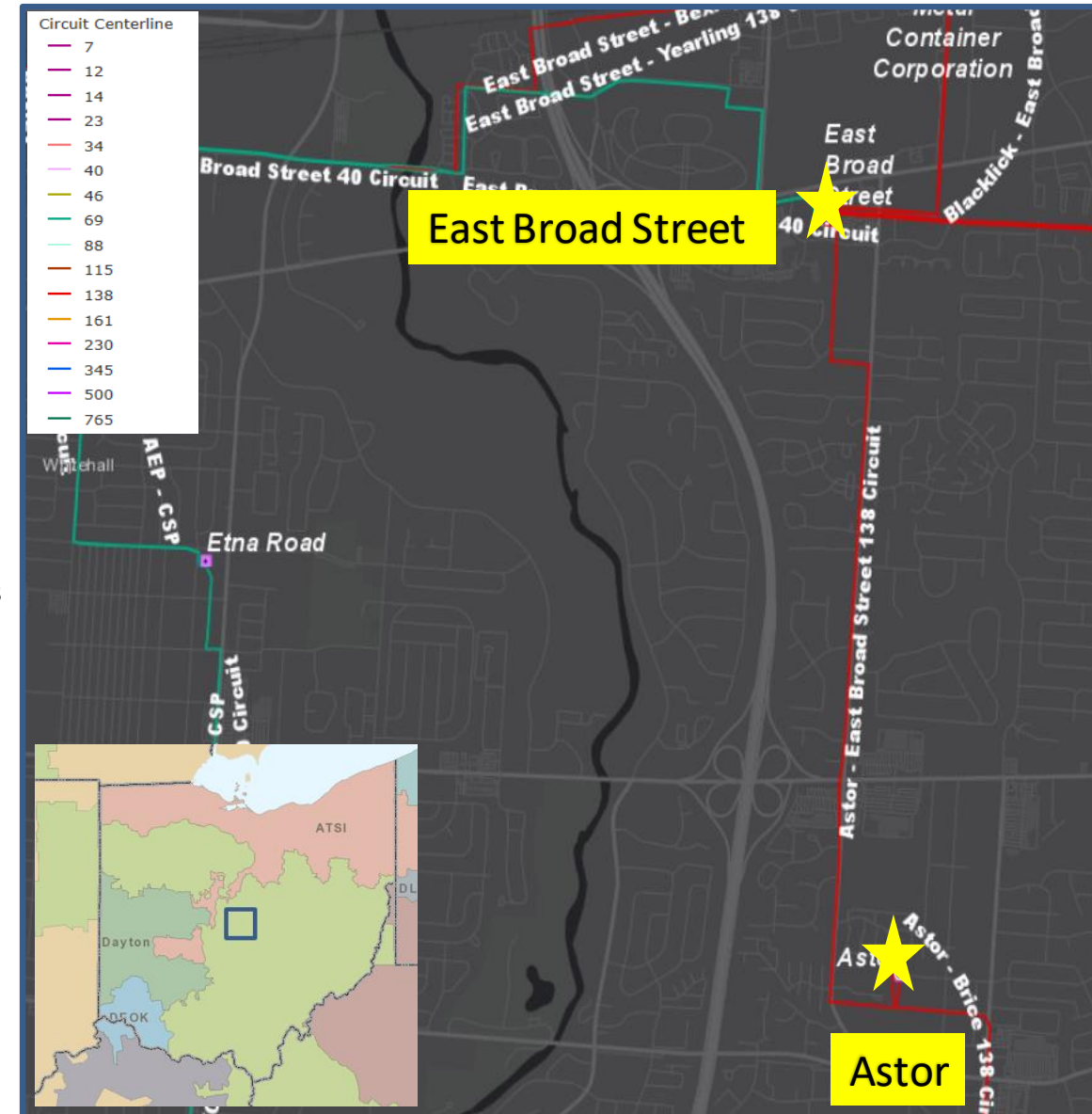
Specific Assumption Reference:

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

Problem Statement:

Astor – East Broad Street 138 kV Single Circuit (2.75 miles)

- From 2015 – 2020 this circuit has experienced 2 momentary and 4 permanent outages resulting in 671K CMI.
- The circuit currently has 54 open conditions on 30 structures (out of 55 total structures) which includes pole damage, rot top, rotted/spit poles, and missing ground lead wires.
- 12 structures have been replaced at different times from 1970 to 2011; remaining are wood poles from 1955.
- The circuit conductor span was primarily installed in 1974 of 636,000 CM ALUM/1350 37 (Orchid 2.75 miles). There are also two spans of 795,000 CM ACSR/AW 26/7 (Drake)
- An Engineering and Field Assessment was conducted in 2019 and found the following issues:
 - The majority of structures do not meet 2017 NESC Grade B loading criteria
 - The majority of structures do not meet the current AEP structural strength
 - The majority of structures do not meet the current ASCE structural strength requirements
 - The phase to ground clearance of the typical structure supporting the average span length fails to meet current clearance requirements



Need Number: AEP-2019-OH041

Process Stage: Solutions Meeting 05/21/2021

Proposed Solution:

- Rebuild of the Astor – East Broad 138 KV circuit, approximately 2.75 miles in length; with 477KCM ACSS **Estimated Cost: \$9.5M**
- Astor 138 kV Station: Remote end work including replacing the line surge arresters, relay settings, and line termination. **Estimated Cost: \$0.1M**
- East Broad 138 kV Station: Remote end work including relay settings and line termination. **Estimated Cost: \$0.02M**

Total Estimated Cost: \$9.62M

Alternatives Considered:

The line traverses and serves a highly congested urban area in Central Ohio. High temp conductor was utilized to try and minimize the impact of structures to surrounding community. Considering the location of the stations and existing line that serves the area, no other viable alternatives to address the issues on this transmission line were identified.

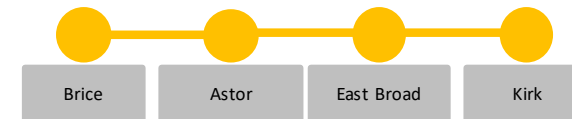
Projected In-Service: 06/30/2025







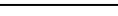
Project Status: Scoping

Model: N/A

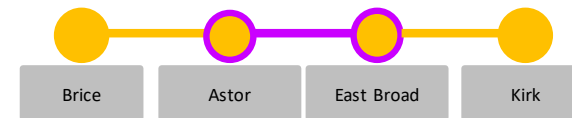
Bubble Diagram

Existing:



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

Proposed:



Need Number: AEP-2021-OH002

Process Stage: Solution Meeting 5/21/2021

Previously Presented: Need Meeting 01/15/2021

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

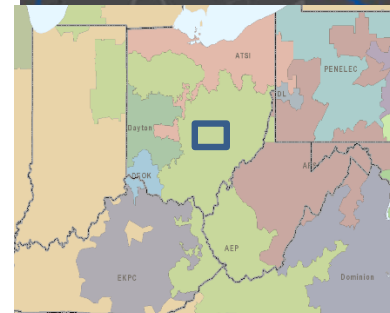
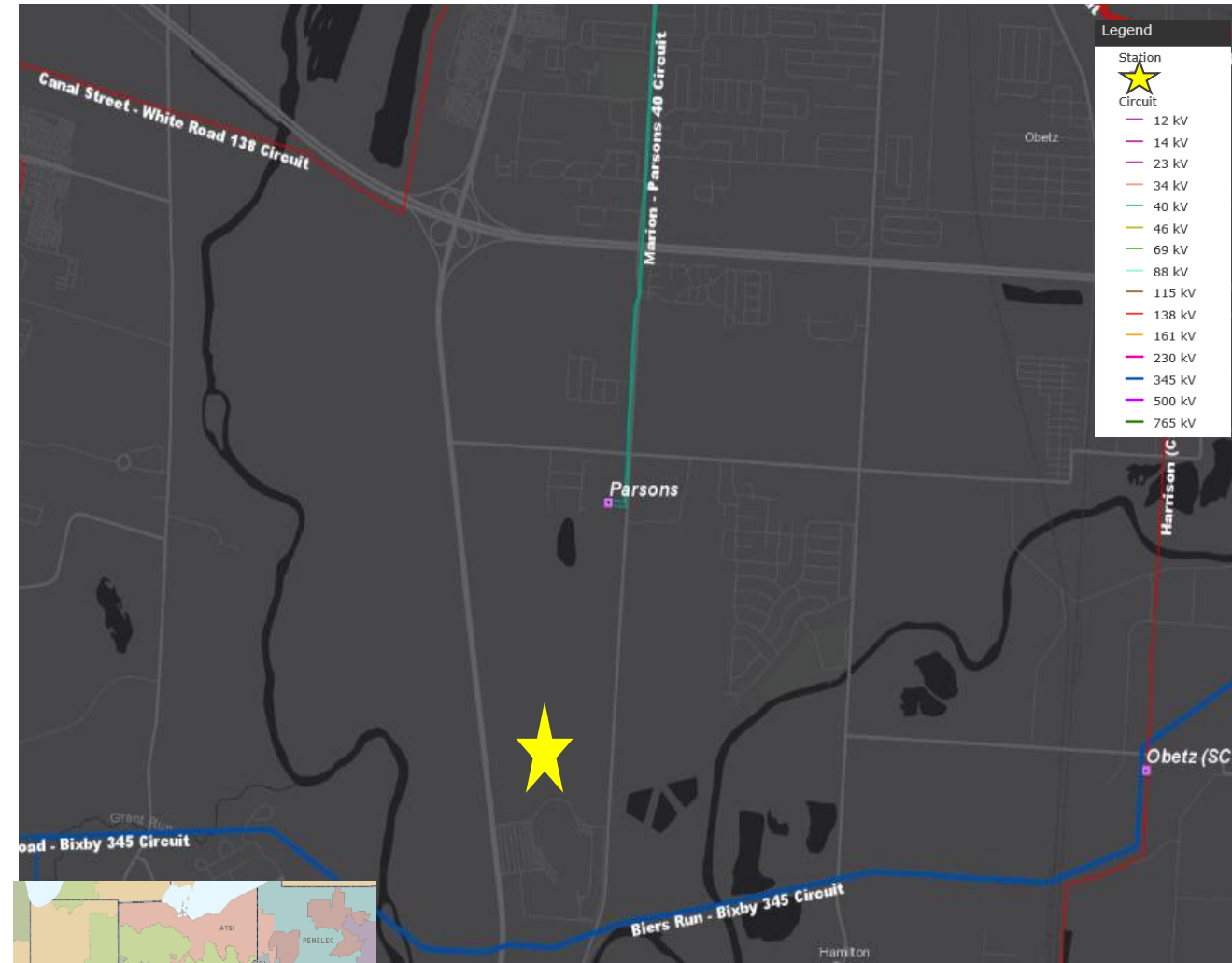
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

Customer Service:

- A customer has requested transmission service just south of AEP's existing Parsons Station in Lockbourne, OH.
- The customer has indicated an initial peak demand of 100 MW with an ultimate capacity of up to 675 MW at the site.

Model: 2025 RTEP



Need Number: AEP-2021-OH002

Process Stage: Solutions Meeting 05/21/2021

Proposed Solution:

- **Cyprus 138 kV Station:** Establish a greenfield ten-breaker 138kV (63 kA) laid out as breaker and a half station on property provided by the customer south of AEP’s Parsons station. Install 138 kV retail metering towards Customer station. **Estimated Cost: \$ 14.22M**
- **Cyprus – Cyprus (Customer) 138 kV #1:** Build ~0.3miles of double circuit 138kV line using 795 ACSR conductor. Extend fiber cable & install redundant fiber cable for relaying and communication to the customer station. One circuit will serve customer’s first building, second circuit will be partially constructed to be utilized for future second building to customer’s redundancy requirements. **Estimated Cost: \$ 0.96M**
- **Cyprus – Cyprus (Customer) 138 kV #2:** Build ~0.3miles of double circuit 138kV line using 795 ACSR conductor. Extend fiber cable & install redundant fiber cable for relaying and communication to Customer Station. One circuit will serve customer’s first building, second circuit will be partially constructed to be utilized for future second building due to customer’s redundancy requirements. **Estimated Cost: \$ 0.0M (Fully Reimbursable)**
- **White Road 138 kV:** Upgrade line to fiber relaying and remote end work. **Estimated Cost: \$ 0.46M**
- **Canal Street 138 kV:** Upgrade line to fiber relaying and remote end work. **Estimated Cost: \$ 0.53M**

Total Estimated Cost: \$ 16.17M

Ancillary Benefits: The scope of work associated with s2342 establishes the 138 kV lines from Canal Street and White Road to feed Parsons station. This project will tap the new lines to provide service to the customer and then continue on to feed Parsons station as proposed in s2342. AEP will only build the site out to serve the initial 100 MW. Any future load growth and required upgrades will be developed as agreements are signed by the customer to expand their operations. Further, AEP is investigating any potential cost savings by relocating the Parsons station site to be included in the Cyprus construction. Any changes in scope to s2342 that results from this will be re-presented.

Alternatives Considered:

Constructing and operating Cyprus station initially as a ring laid out as a breaker and a half configuration was considered, but not chosen after taking into account the customer’s anticipated build out schedule. There would have been approximately \$1M in incremental costs to convert the station from ring to breaker and a half as part of the second build out. In addition to the incremental cost, the conversion would have exposed the customer served out of Cyprus along with the customers served from Parsons to extended periods of radial service during construction due to the required physical layout of the station as an initial ring bus. AEP Ohio has limited to zero ability to pick up the ~3,700 distribution customers out Parsons in the event of an outage of the station.

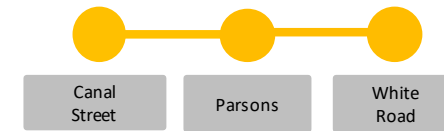
Projected In-Service: 12/1/2022 (07/31/2022 for customer portions)

Project Status: Scoping

Model: RTEP 2025

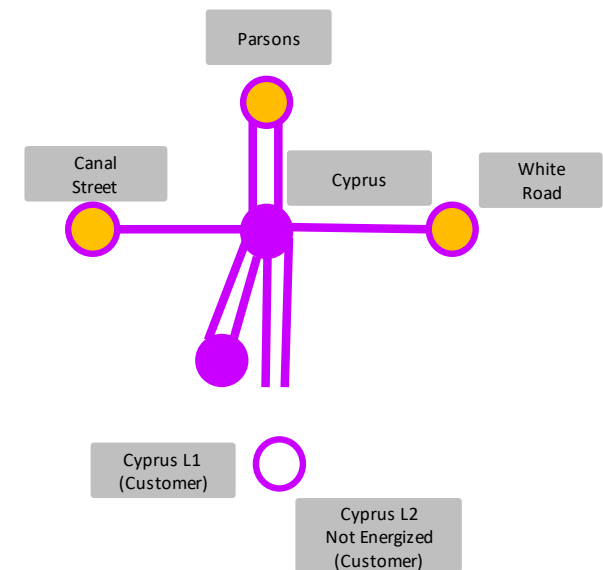
Bubble Diagram

Existing:



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

Proposed:



Need Number: AEP-2021-OH005

Process Stage: Solutions Meeting 05/21/2021

Previously Presented: Need Meeting 02/17/2021

Project Driver:

Customer Service

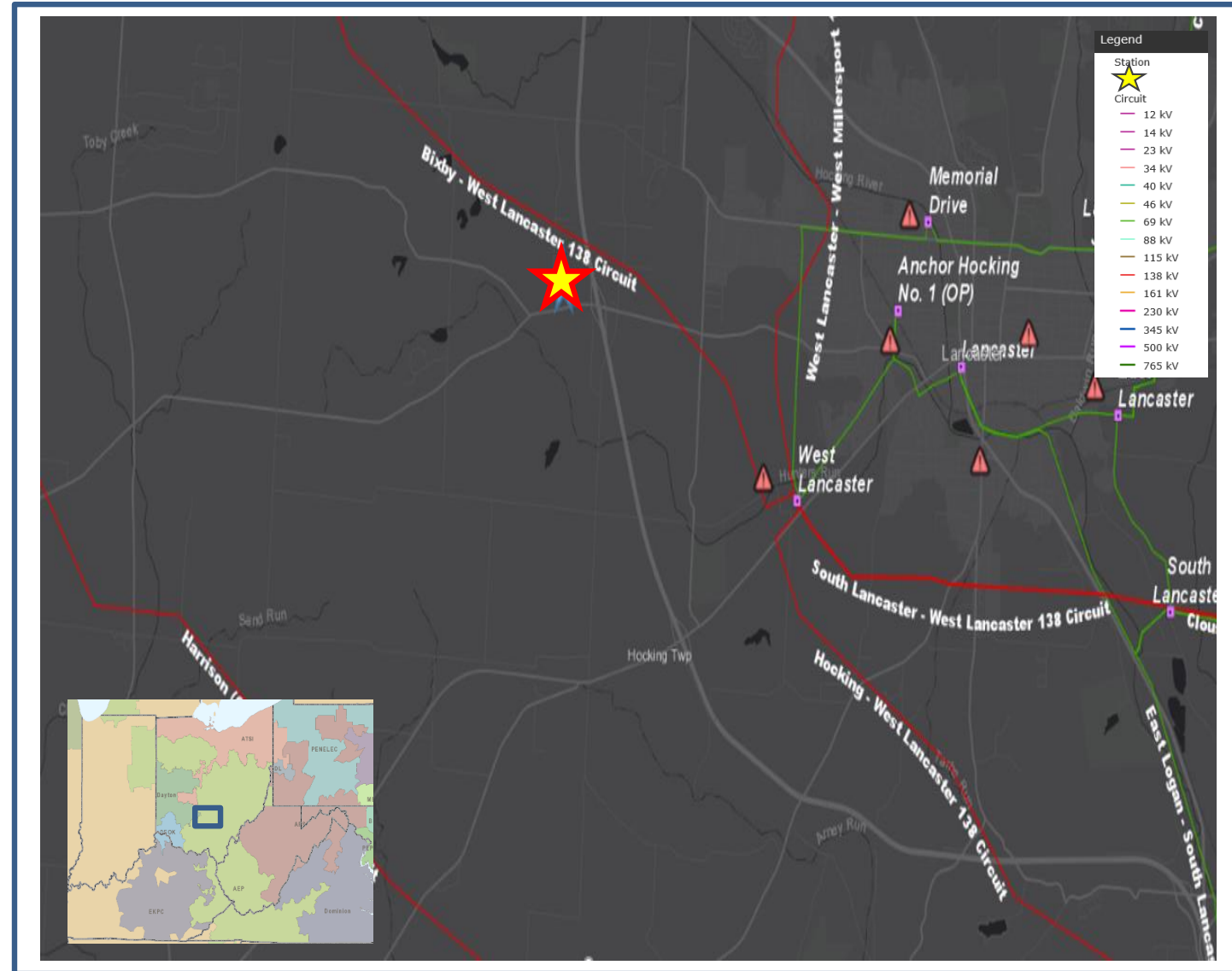
Specific Assumption Reference:

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

Problem Statement:

Customer Service:

- A customer has requested transmission service near AEP's existing Bixby – West Lancaster 138 kV circuit in Lancaster, OH.
- The customer has indicated an initial peak demand of 100 MW with the potential for an ultimate capacity of up to 300 MW at the site.



AEP Transmission Zone M-3 Process Lancaster Customer Project

Need Number: AEP-2021-OH005

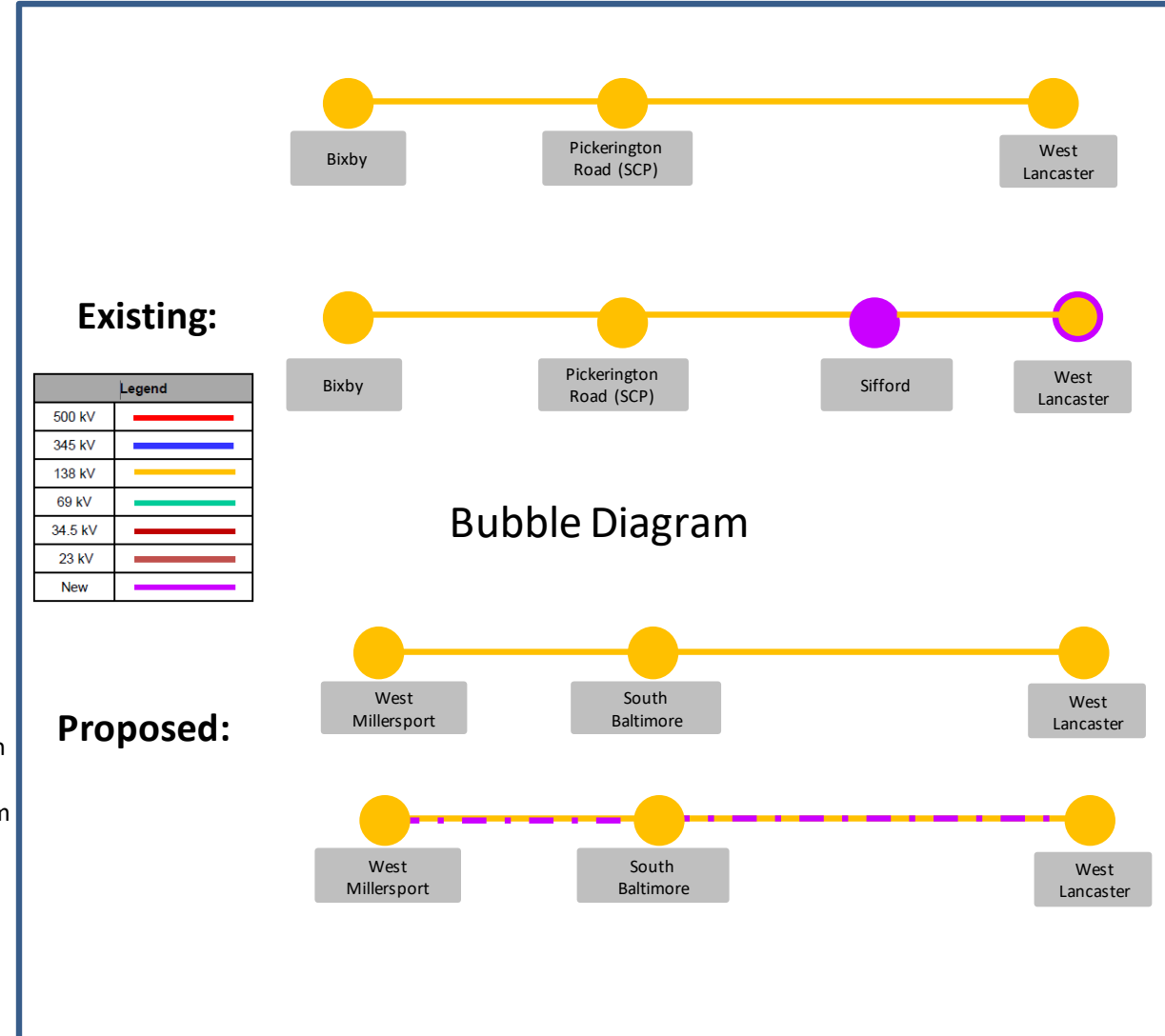
Process Stage: Solutions Meeting 05/21/2021

Proposed Solution:

- **Sifford Station:** Construct a greenfield 138 kV Station served from the existing Bixby to West Lancaster 138 kV circuit to serve the customer facilities. Station includes installation of six 138 kV, 40 kA, 3000 A circuit breakers laid out in a breaker-and-half arrangement. Retail metering will also be needed. **Estimated Cost: \$7.0M**
- **West Lancaster – Bixby 138 kV Circuit:** A couple dead end structures will be installed to bring the West Lancaster – Bixby circuit into the new Sifford station. **Estimated Cost: \$0.8M**
- **Sifford – Ruble #1 138 kV Feed A:** Install 138 kV line extension from AEP’s Sifford station to serve the customer’s station located just south of the Sifford station. **Estimated Cost: \$0.285M**
- **Sifford – Ruble #1 138 kV Feed B:** Install a second 138 kV line from AEP’s Sifford station to serve the customer’s station located just south of the Sifford station to meet customer’s redundancy requirements at the site. **Estimated Cost: \$0M (reimbursable)**
- **West Lancaster Station:** Upgrades will be needed on the existing relays at West Lancaster Station towards Sifford to ensure proper coordination. **Estimated Cost: \$0.03M**
- **Bixby Station:** Upgrades will be needed to the existing relays at Bixby Station towards Sifford to ensure proper coordination. **Estimated Cost: \$0.03M**
- **West Millersport – West Lancaster 138 kV Sag Study Mitigation:** The new customer will increase loading on the existing West Millersport – West Lancaster 138 kV circuit. Multiple structure and distribution crossing issues will be mitigated on the line in order to allow the line to operate to its conductor’s designed maximum operating temperature. **Estimated Cost: \$1.5M**

Total Estimated Cost: \$9.645M

Continued on next slide.



AEP Transmission Zone M-3 Process Lancaster Customer Project

Need Number: AEP-2021-OH005

Process Stage: Solutions Meeting 05/21/2021

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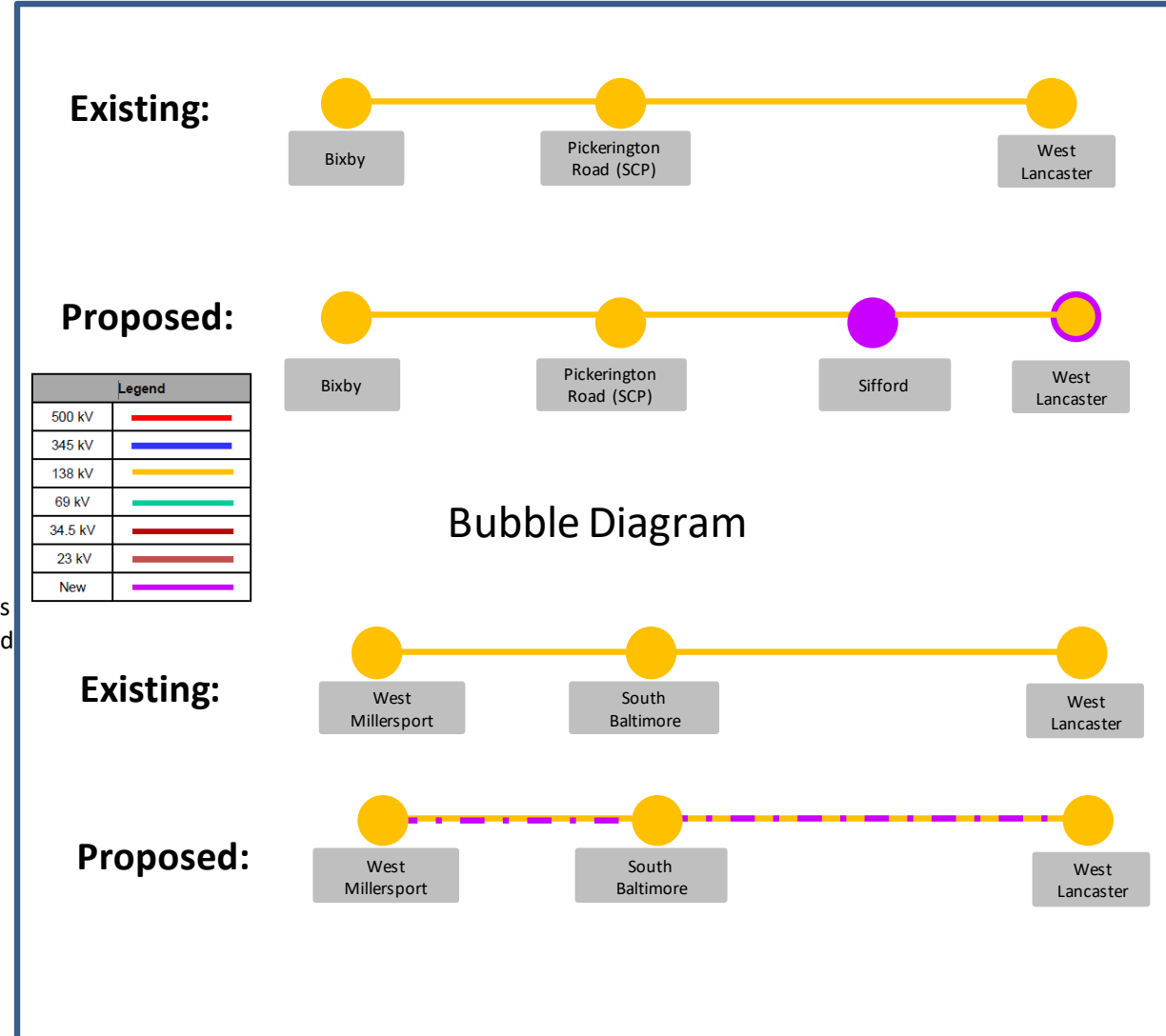
Alternatives Considered:

Constructing and operating Sifford station initially as a ring laid out as a breaker and a half configuration was considered, but not chosen after taking into account the customer’s anticipated build out schedule. There would have been approximately \$0.7M in incremental transmission line and station costs to physically accommodate a station layout that would have ensured the customer’s building feeds were electrically separated per their requirements. Installation of the two additional 138 kV breakers as part of the initial build out eliminates the need for this work at a similar cost, while also establishing the breakers that would be required as part of the customer’s build out of their anticipated second building at the site (additional 100 MW). Any future load growth and required upgrades will be developed as agreements are signed by the customer to expand their operations.

Projected In-Service: 5/30/2022

Project Status: Scoping

Model: 2025 RTEP



Appendix

High Level M-3 Meeting Schedule

Assumptions	Activity	Timing
	Posting of TO Assumptions Meeting information	20 days before Assumptions Meeting
	Stakeholder comments	10 days after Assumptions Meeting
Needs	Activity	Timing
	TOs and Stakeholders Post Needs Meeting slides	10 days before Needs Meeting
	Stakeholder comments	10 days after Needs Meeting
Solutions	Activity	Timing
	TOs and Stakeholders Post Solutions Meeting slides	10 days before Solutions Meeting
	Stakeholder comments	10 days after Solutions Meeting
Submission of Supplemental Projects & Local Plan	Activity	Timing
	Do No Harm (DNH) analysis for selected solution	Prior to posting selected solution
	Post selected solution(s)	Following completion of DNH analysis
	Stakeholder comments	10 days prior to Local Plan Submission for integration into RTEP
	Local Plan submitted to PJM for integration into RTEP	Following review and consideration of comments received after posting of selected solutions

Revision History

5/10/2021 – V1 – Original version posted to pjm.com

5/13/2021 – V2– Slide #38 and #39, updated solution for AEP-2021-OH005

5/19/2021 – V3– Slide #26 and #27, Remove the AEP-2020-IM007 solution

5/21/2021 – V4– Slide #3, Corrected the new scope

5/24/2021 – V5– Slide #4, Corrected the subtitle of the slide

5/25/2021 – V6– Slide #8, Corrected the Need number from AEP-2020-IM007 to AEP-2021-IM007