PJM Western Sub-Regional RTEP Committee
AEP Supplemental Upgrades

May 20, 2019

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-2019-AP014

Process Stage: Needs Meeting 5/20/2019

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

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

Problem Statement:

Turner 46kV CB-O

- One of only six remaining of the 72EPB-20-12 model on the AEP system.
- These model types have historically exhibited bad gas leaks, bushing failures, and CT cores getting wet.
- Since 2015, there have been 25 documented malfunction records on this unit in regards to low SF6 gas levels.

Turner 138/69 kV Bank #5

- Recently de-rated due to the loss of a cooling pump that cannot be replaced.
- This unit could experience an increasing number of overheating events with the potential to cause damage to internal components
- Moisture content has been rising for a number of years but more severely over the past 11.
- The rise in moisture content correlates to a significant drop in dielectric strength and rising power factor level for the oil.
- All three high side bushings are of the Type U design that have extensive manufacturer alerts related to catastrophic failures.

Turner GND Bank #7

- Ethane concentrations in this unit increased drastically in 2018, CO2 levels have increased in 2018 as well. The relative gas concentrations are indicative of numerous overheating events.
- Decreasing interfacial tension since 2002, this transformer has likely developed sludge in the oil from deteriorating internal components. The presence of this sludge is likely what is impairing proper oil circulation and contributing to the number of overheating events.
- Increase in moisture levels, correlating with an increased power factor and also indicative of oil degradation.

The current station configuration has each bank located on a 138kV Bus with only a MOAB on the high side. A transformer fault on any of the transformer banks will cause a momentary outage of one of the 138kV Buses.

Turner Station Control House

- Has asbestos and lead paint and existing water leaks.
- Steps leading up to control house are hazardous to anyone entering station.

Currently, 61 of the 95 relays (64% of all station relays) are in need of replacement at Turner Station

- There are 55 of the electromechanical which have significant limitations with regards to fault data collection and retention.
- There are 5 ABB DPU microprocessor type relays.
  - ABB DPU relays pose a safety risk to persons performing breaker operation because the DPUs are mounted directly on the circuit breaker without a delay for opening and closing the breaker.
- An additional microprocessor is an RFL that utilizes obsolete firmware and is no longer vendor supported.

Need Number: AEP-2019-AP015

Process Stage: Needs Meeting 5/20/2019

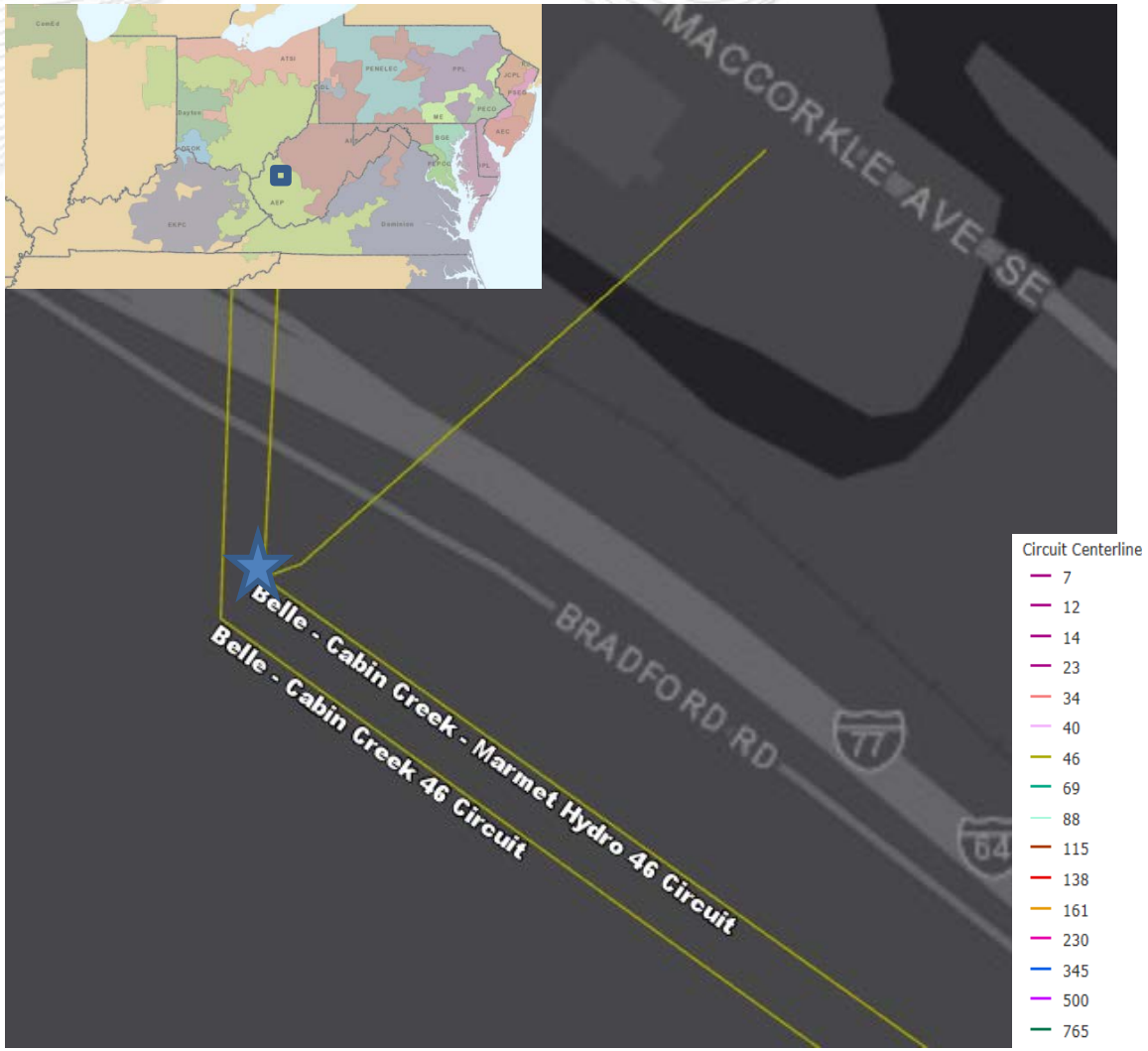
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

A customer station is currently served off a hard tap on the Belle – Cabin Creek – Marmet Hydro 46 kV circuit.

- Hard taps are difficult to maintain due to required outages or temporary jumper configurations in lieu of a switch.
- Hard taps can also result in extended outages to customers due to the inability to sectionalize faulted facilities.



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

Need Number: AEP-2019-AP018

Process Stage: Need Meeting 05/20/2019

Supplemental Project Driver:

Equipment Material/ Condition/Performance/Risk, Operational Flexibility and Efficiency

Specific Assumption References:

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

Problem Statement:

Speedway 138 kV Tap

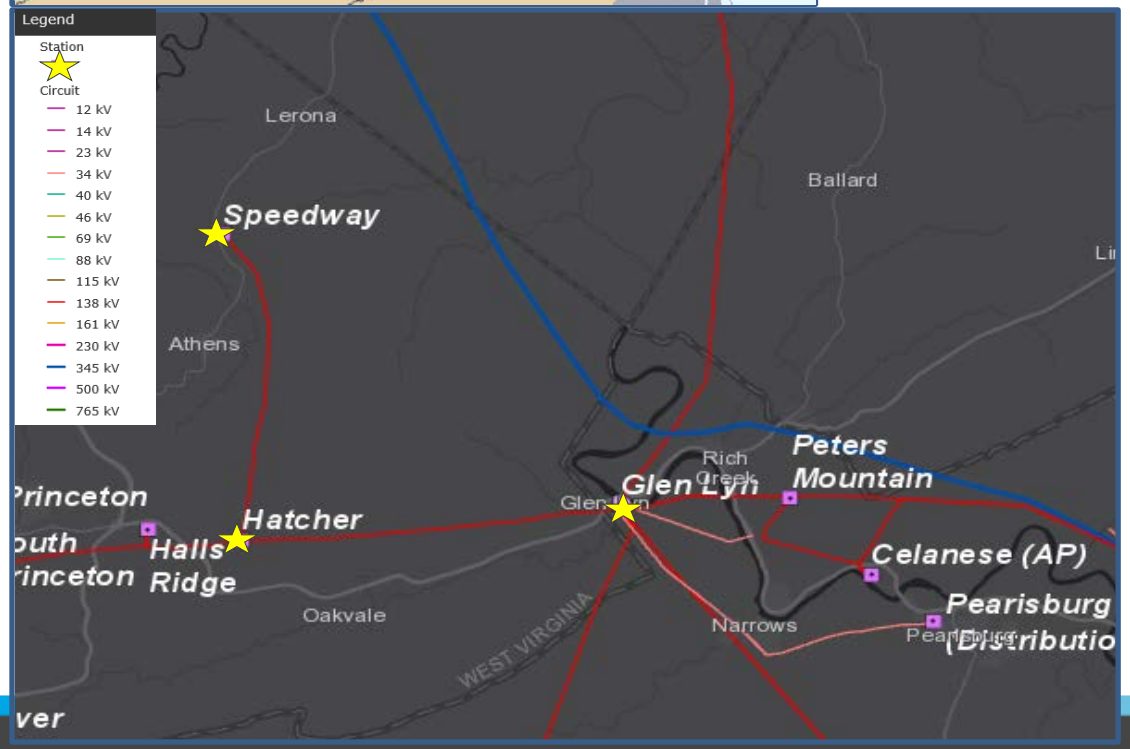
- There are 34 open conditions associated with the 1960s wood structures that comprise the 7.3 mile Speedway Tap that serves Speedway station. These conditions include damage due to woodpecker holes, damaged poles, and corroded cross-arms.

Glen Lyn – Hatcher 138 kV Line Section

- The Glen Lyn – Hatcher 138 kV line section utilizes double circuit lattice structures and conductor installed during the 1920s. The structures, conductor, hardware, and insulators on the line are displaying issues associated with their age.

Speedway Station

- Speedway station is currently radially served off the ~7.3 mile Speedway 138 kV Tap.
- Speedway station has 20 MW of nontransferable load (25 MW peak).



AEP Transmission Zone M-3 Process
Sullivan County, Kingsport, Tennessee

Need Number: AEP-2019-AP019

Process Stage: Need Meeting 05/20/2019

Supplemental Project Driver:

Equipment Material/ Condition/Performance/Risk

Specific Assumption References:

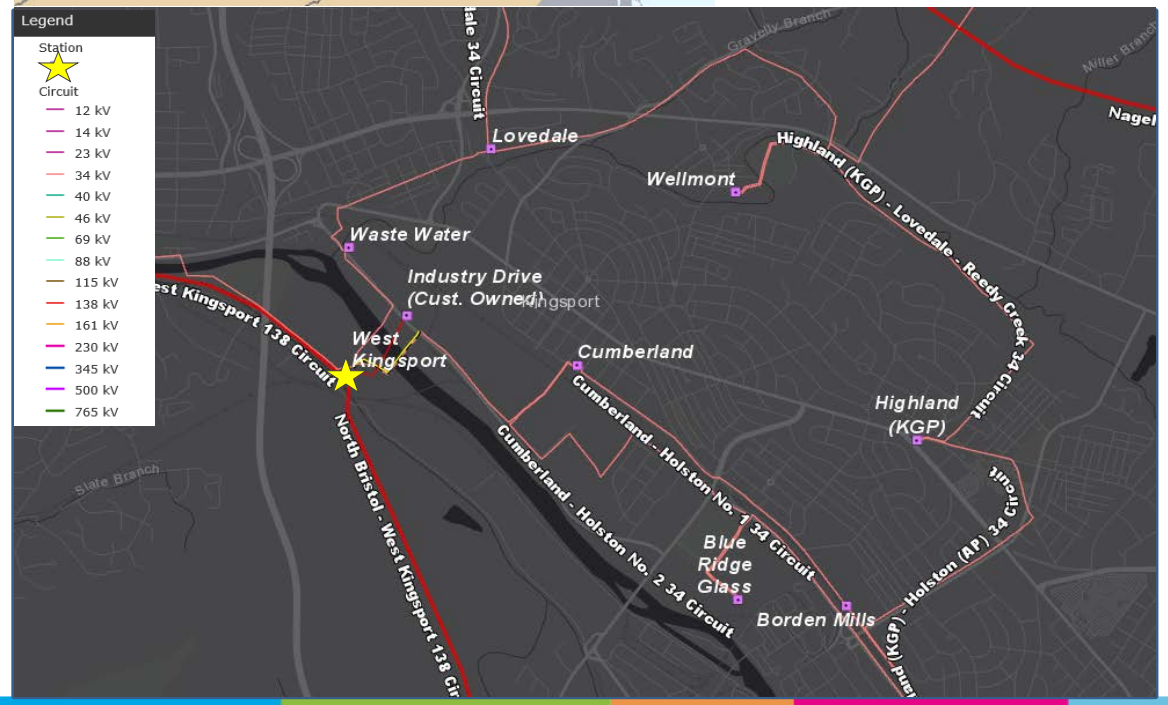
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

West Kingsport 34.5 kV

34.5 kV Circuit breakers A, C, and F

- FK type oil breakers. (1955, 1955, and 1966 vintage)
- These are oil breakers that are difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers.
- Other drivers include damage to bushings and an excessive number of fault operations exceeding the manufacturer's recommendations.
- Have experienced 26, 26, and 21 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.



AEP Transmission Zone M-3 Process
Sullivan County, Kingsport, Tennessee

Need Number: AEP-2019-AP020

Process Stage: Need Meeting 05/20/2019

Supplemental Project Driver:

Equipment Material/ Condition/Performance/Risk

Specific Assumption References:

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

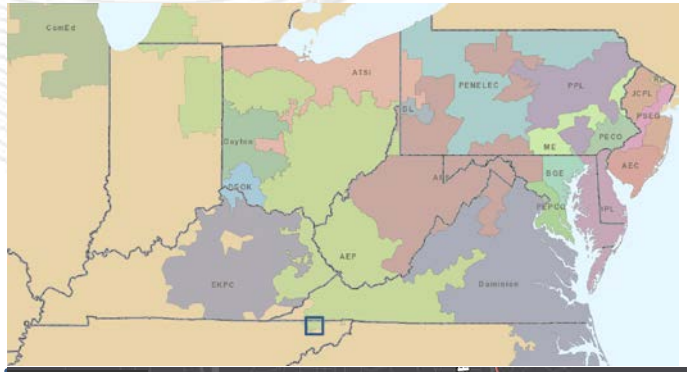
Problem Statement:

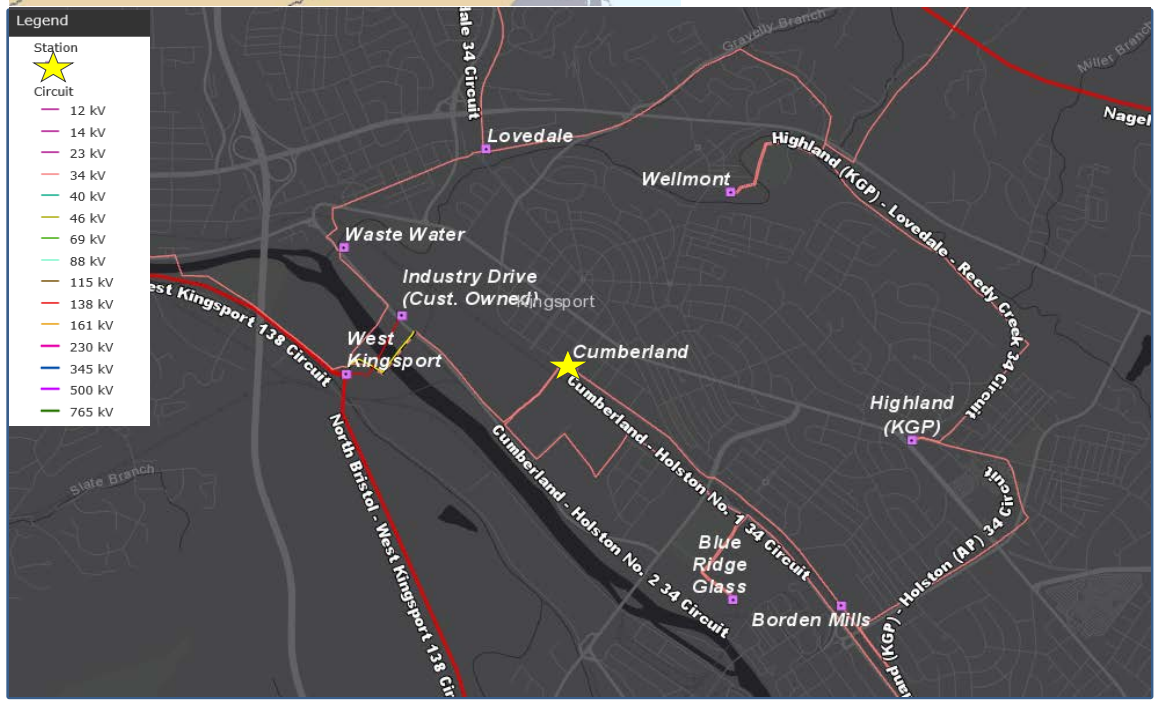
Cumberland Station

34.5 kV Circuit breakers A, B, and N

- FK type oil breakers. (1956, 1956, and 1954 vintage)
- These are oil breakers that are difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers.
- Other drivers include damage to bushings and an excessive number of fault operations exceeding the manufacturer's recommendations.
- Have experienced 40, 34, and 15 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.

- S&C Circuit Switcher 'AA'
  - No gas monitor, sister units on the AEP system have a history of gas loss, interrupter failures, and operating mechanism failures.





AEP Transmission Zone M-3 Process
Sullivan County, Kingsport, Tennessee

Need Number: AEP-2019-AP021

Process Stage: Need Meeting 05/20/2019

Supplemental Project Driver:

Equipment Material/ Condition/Performance/Risk, Operational Flexibility and Efficiency

Specific Assumption References:

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

Problem Statement:

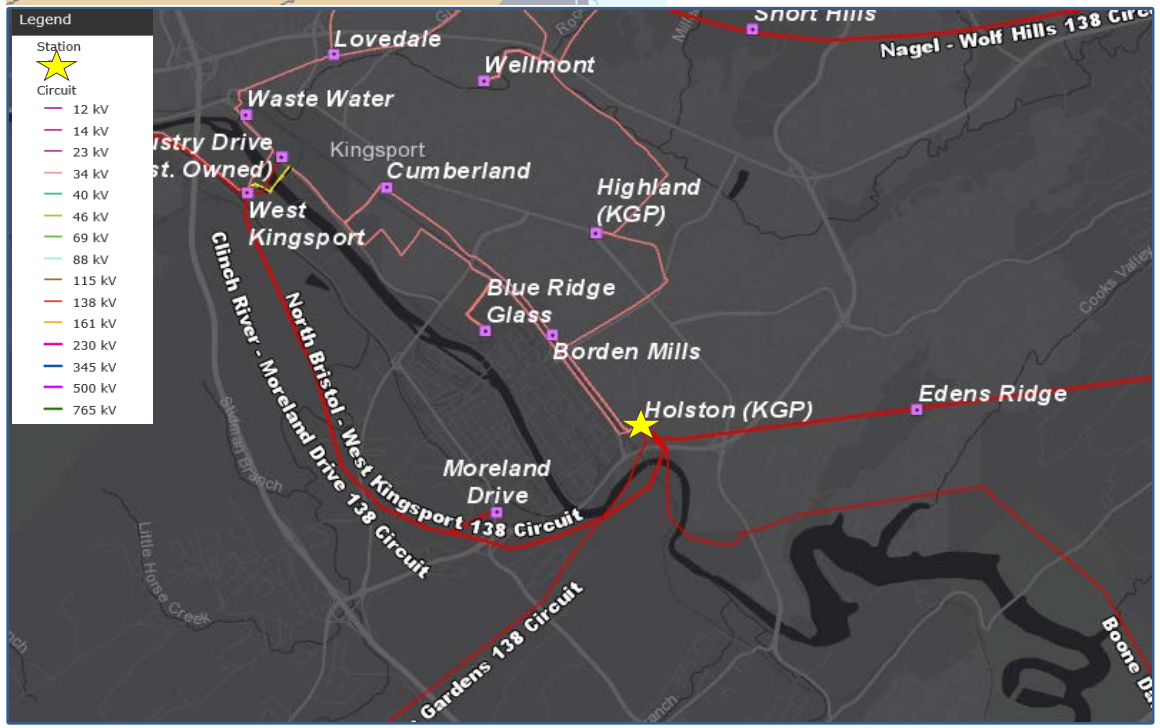
Holston Station

138/34.5 kV Transformer #1

- Manufactured in 1979.
- Showing signs of dielectric breakdown (insulation), accessory damage (bushings/windings), and short circuit breakdown (due to through faults).
- Currently tied directly to 138 kV bus #1 via a MOAB on high side.

34.5/23-2.4 kV Transformer #8 (GND Bank)

- Manufactured in 1954.
- Showing signs of dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).



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Holston Station

Capacitor switchers ‘BB’ and ‘CC’

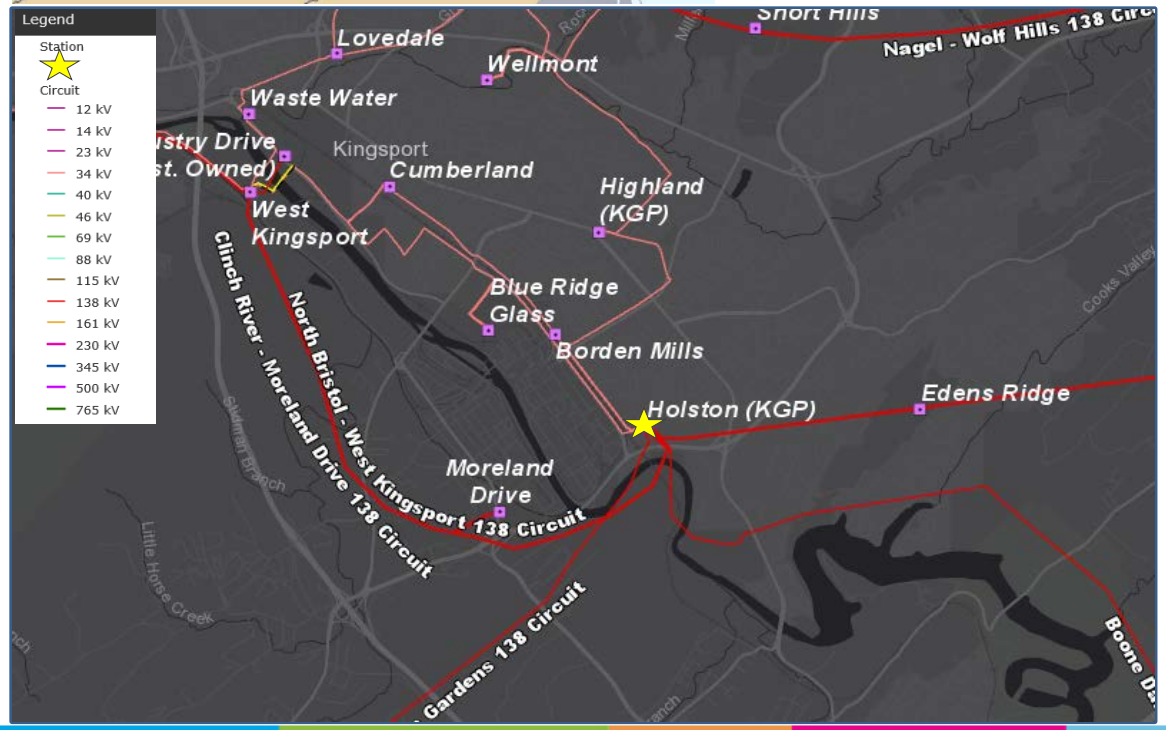
- Capacitor switchers ‘BB’ and ‘CC’ at Holston station are Mark V model which no longer support modern relaying packages.
- Mark V’s have been historically prone to mechanism failures and are being replaced system wide where possible.

34.5/23-2.4 kV Transformer #9 (GND Bank)

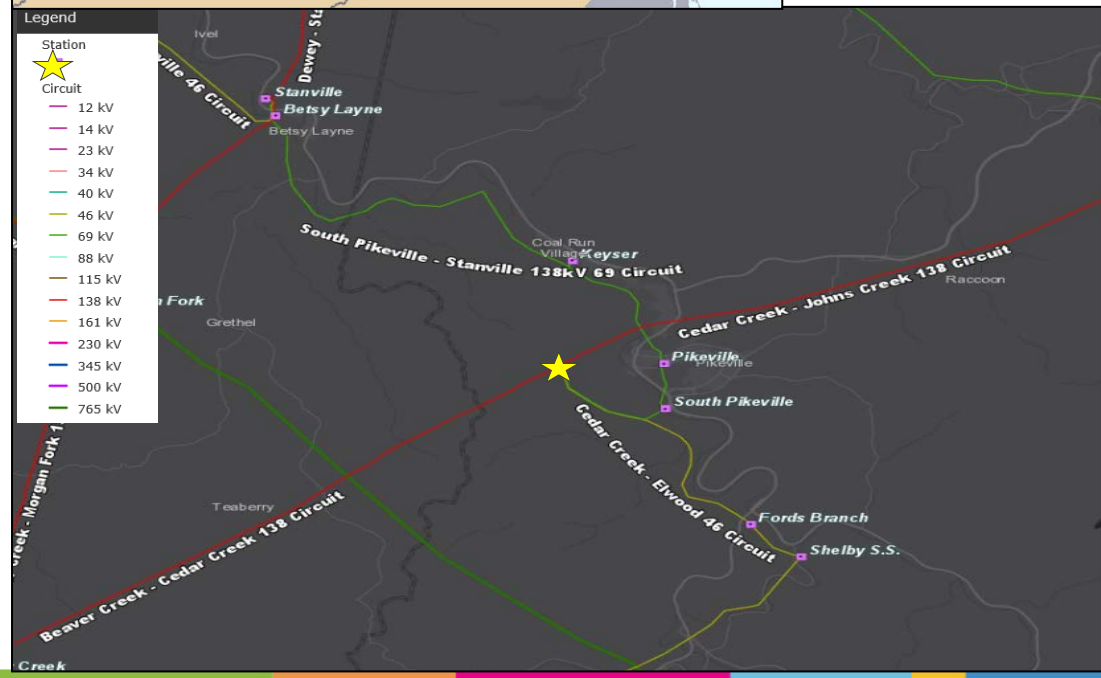
- Manufactured in 1953.
- Showing signs of dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).

34.5 kV Circuit breakers E, F, and U

- FK type oil breakers. (1959, 1955, and 1950 vintage)
- These are oil breakers that are difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers.
- Other drivers include damage to bushings and the breakers have experienced 2,19, and 7 fault operations respectively. The manufacturer’s recommendation for this type of breaker is 10.



AEP Transmission Zone M-3 Process
Pike County, Kentucky



Need Number: AEP-2019-AP022

Process Stage: Need Meeting 5/20/2019

Supplemental Project Driver: Customer Service, Operational Flexibility

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

AEP Kentucky Power Distribution has requested a new distribution service out of the existing Cedar Creek Station located in Pikeville, Kentucky. Winter projected load is 12.5 MVA.

Need Number: AEP-2019-OH022

Process Stage: Need Meeting 05/20/2019

Supplemental Project Driver:

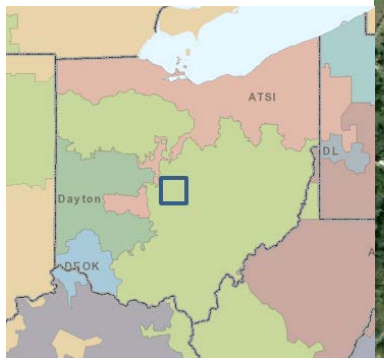
Customer Service

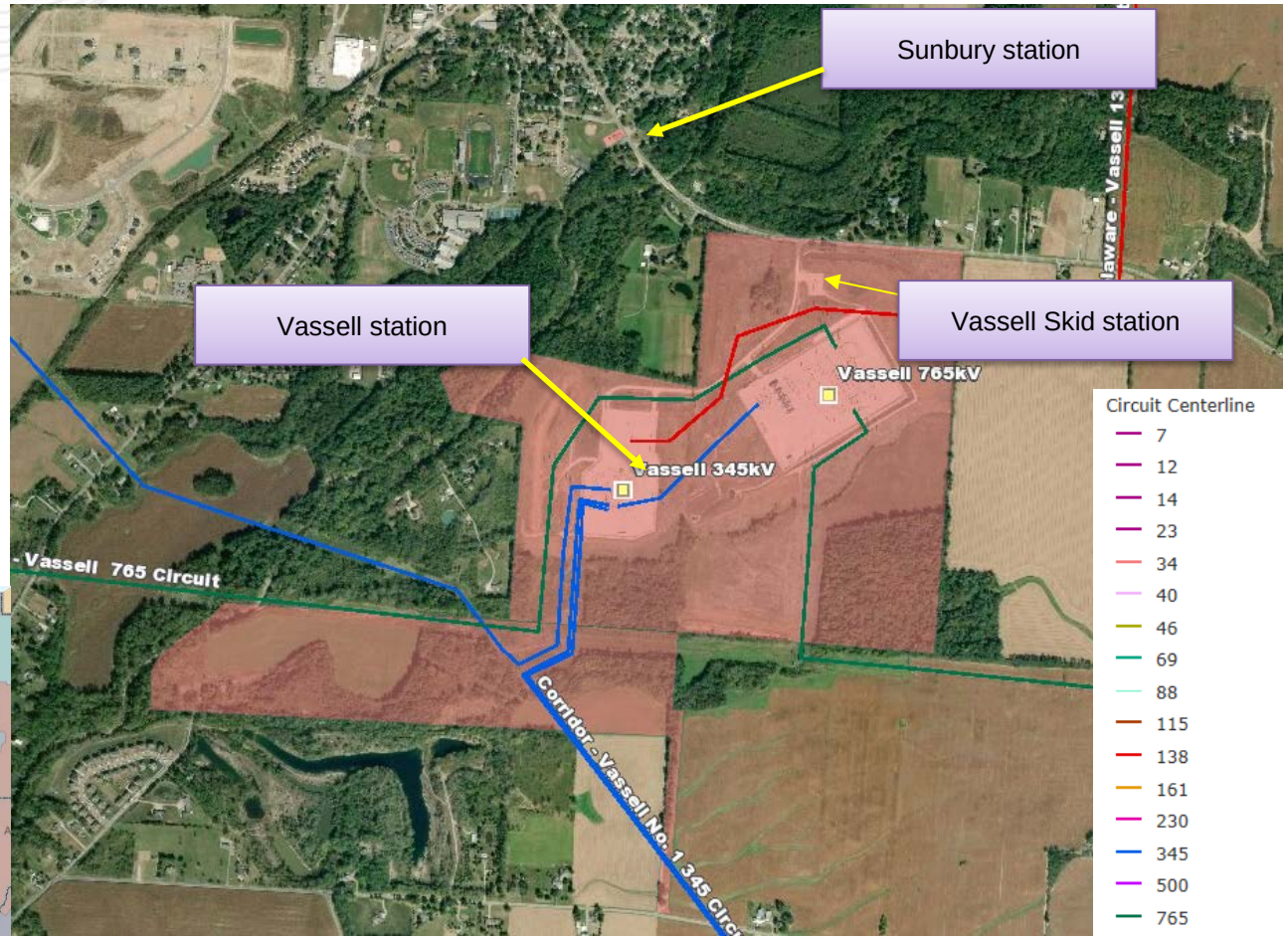
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 7)

Problem Statement:

Transformation at the 34.5/13kV Sunbury station failed leading to the immediate need to install a 138/13kV skid station at Vassell station to continue serving customer load. AEP-Ohio has requested to remove the existing temporary skid station outside Vassell station and to replace it with a new 138kV delivery point installation at Vassell station.





AEP Transmission Zone M-3 Process
Beaver, OH

Need Number: AEP-2019-OH023

Process Stage: Needs Meeting 05/20/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk and Operational Flexibility and Efficiency

Specific Assumption References:

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

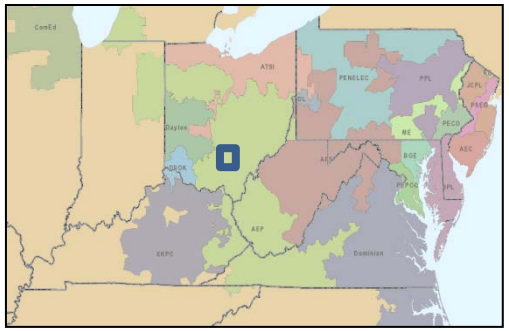
Problem Statement:

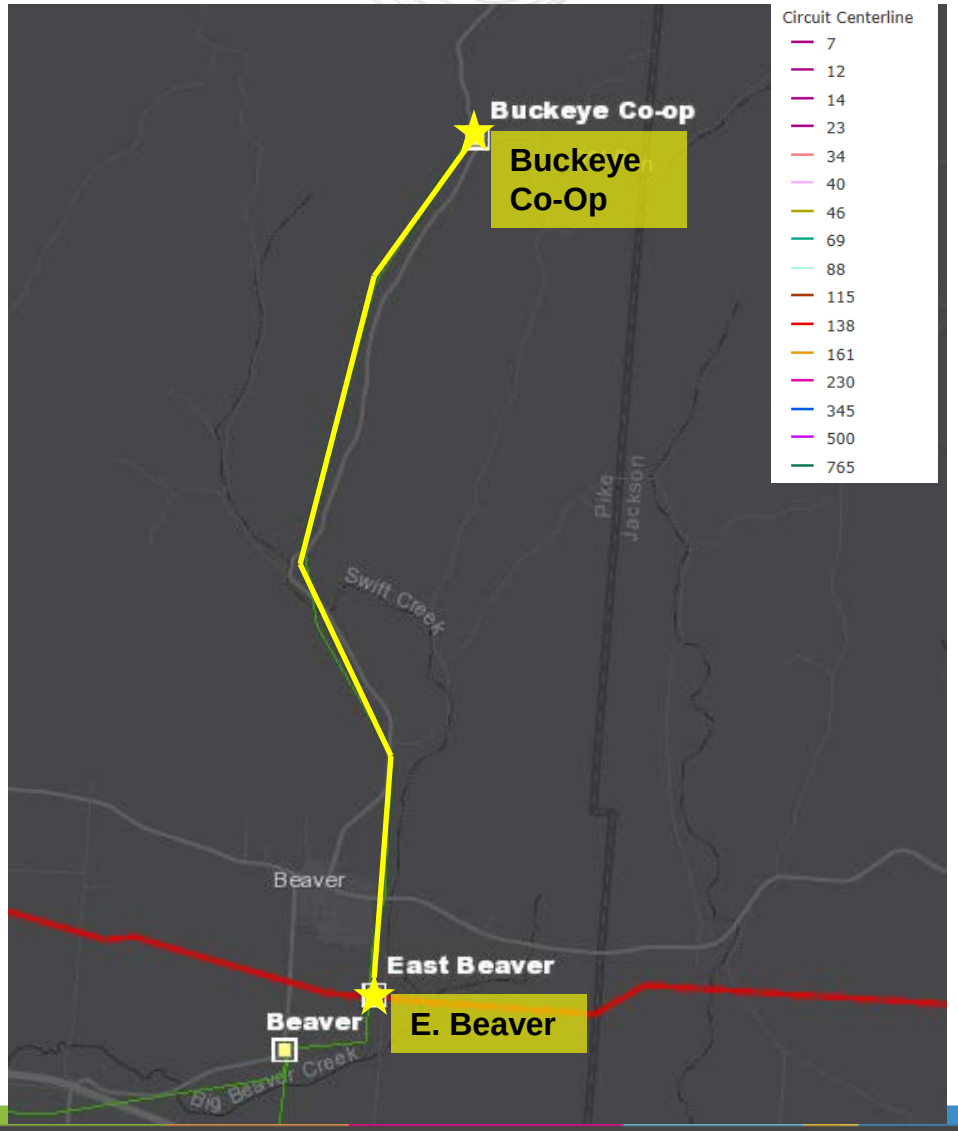
Equipment Material/Condition/Performance/Risk:

The East Beaver – Buckeye Co-Op 69 kV line was built in 1952. 60 out of the 71 wood pole structures on this 4.5 mile line are original. There are currently 26 open A conditions on this line, including heavy rot and woodpecker & insect damage.

Operational Flexibility and Efficiency

Currently, the East Beaver 138/69 kV Station has more than 2 dissimilar zones of protection (bus, line, and transformer).

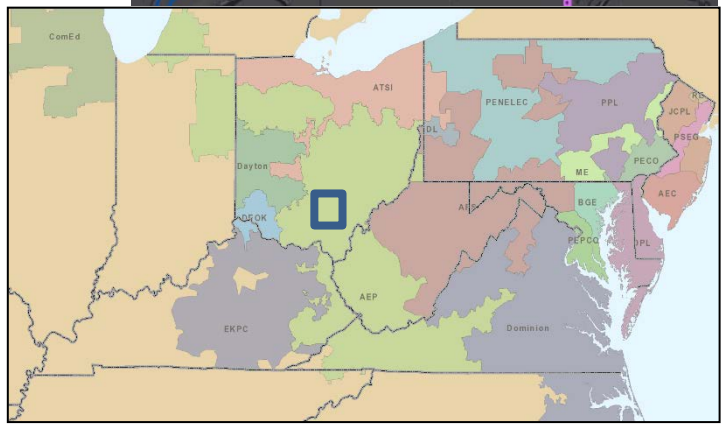




AEP Transmission Zone: Supplemental
Hillsboro-Millbrook Park

Need Number: AEP-2019-OH024
Process Stage: Needs Meeting 05/20/2019
Supplemental Project Driver: Equipment Condition
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- The 1943 Hillsboro – Millbrook Park 138 kV circuit (~52 miles) is wood pole construction and has 1,342 open conditions.
- The majority (93%) of the original conductor (vintage 1944 & 1948) is 477 MCM (26/7) ACSR and is still in-service.
- Half of the wood pole structures from the 1940's are still in-service; the remaining are a mixture from 1960's – 1980's.
- There are additional concerns with the shielding, grounding, and hardware along this 52 mile long line.
- Sinking Springs is in a remote part of AEP's service territory making manual switching difficult.
- Originally installed in 1942-1943 timeframe. 98% of the line is on wood structures.
- Age Profile:
    - 53% from 1940's; 4.4% from 1960's; 13% from 1970's; 27% from 1980's; 2.6% from 2000's



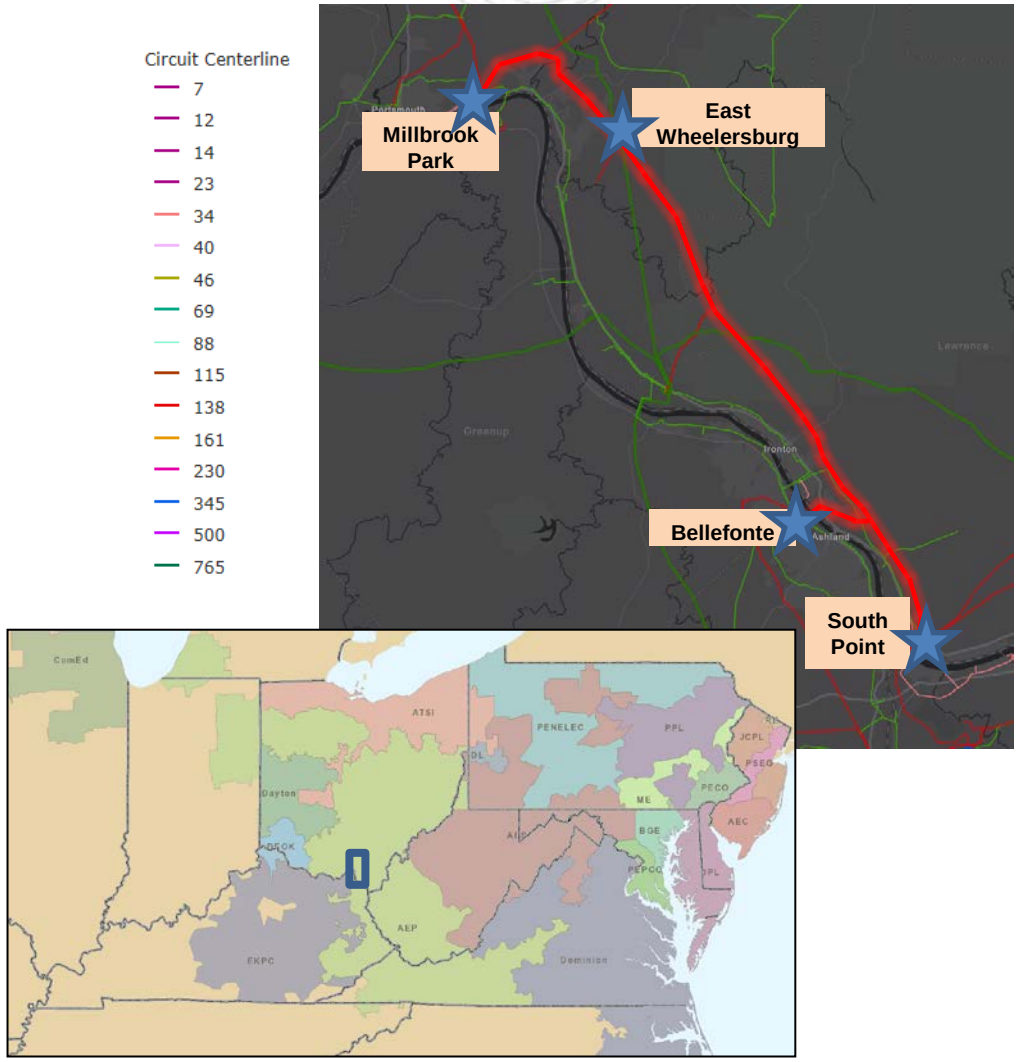
AEP Transmission Zone: Supplemental
Millbrook Park-South Point

Need Number: AEP-2019-OH025
Process Stage: Needs Meeting 05/20/2019
Supplemental Project Driver: Equipment/Material/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- The South Point – Portsmouth 138 kV double circuit is 34.7 miles and the Bellefonte 138 kV Extension is 4 miles in length.
- The conductor is primarily 397.5 ACSR (167 MVA).
- The South Point-Portsmouth line was originally constructed in 1929, with the majority of the structures and conductor being original.
- There are 45 open conditions on the line, including conductor issues, burnt/broken insulators, and loose/broken conductor hardware.
- Insulators of this vintage have shown heightened failure rates.

In general, several issues impact 1920 lattice tower lines:

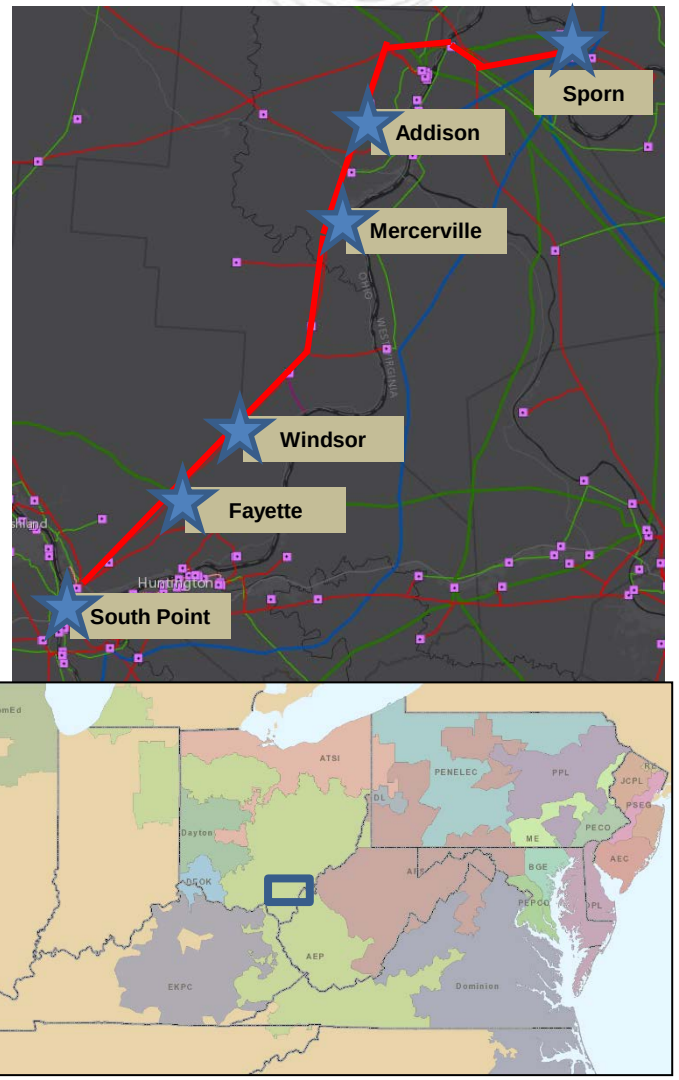
- The steel conductor attachment plates have significant wear resulting in a loss of 50% of its strength.
- The cross arm hanger tension members are single mode of failure elements that are deteriorated and undersized due to the original design criteria.
- Lattice towers of this vintage do not meet current design requirements for wind and ice loading.
- Foundations are undersized for modern wind loading.
- Towers are beginning to show corrosion.



AEP Transmission Zone: Supplemental Gallia County

Need Number: AEP-2019-OH026
Process Stage: Needs Meeting 05/20/2019
Supplemental Project Driver: Operational Flexibility
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs
Problem Statement:

- The 58-mile South Point – Sporn 138 kV double circuit line has four delivery points that are connected via hard taps. The hard taps complicate restoration activities and extend outages.
- The four Buckeye Coop delivery points are at Mercerville, Windsor, Fayette and Addison. These stations are in a remote part of AEP's service territory, which makes outage restoration activities more difficult and resulting in longer outages.
- Over the last five years these delivery points have accumulated 1,348,755 CMI.



AEP Transmission Zone M-3 Process
Canton, Ohio

Need Number: AEP-2019-OH0027

Process Stage: Needs Meeting 05/20/2019

Supplemental Project Driver:

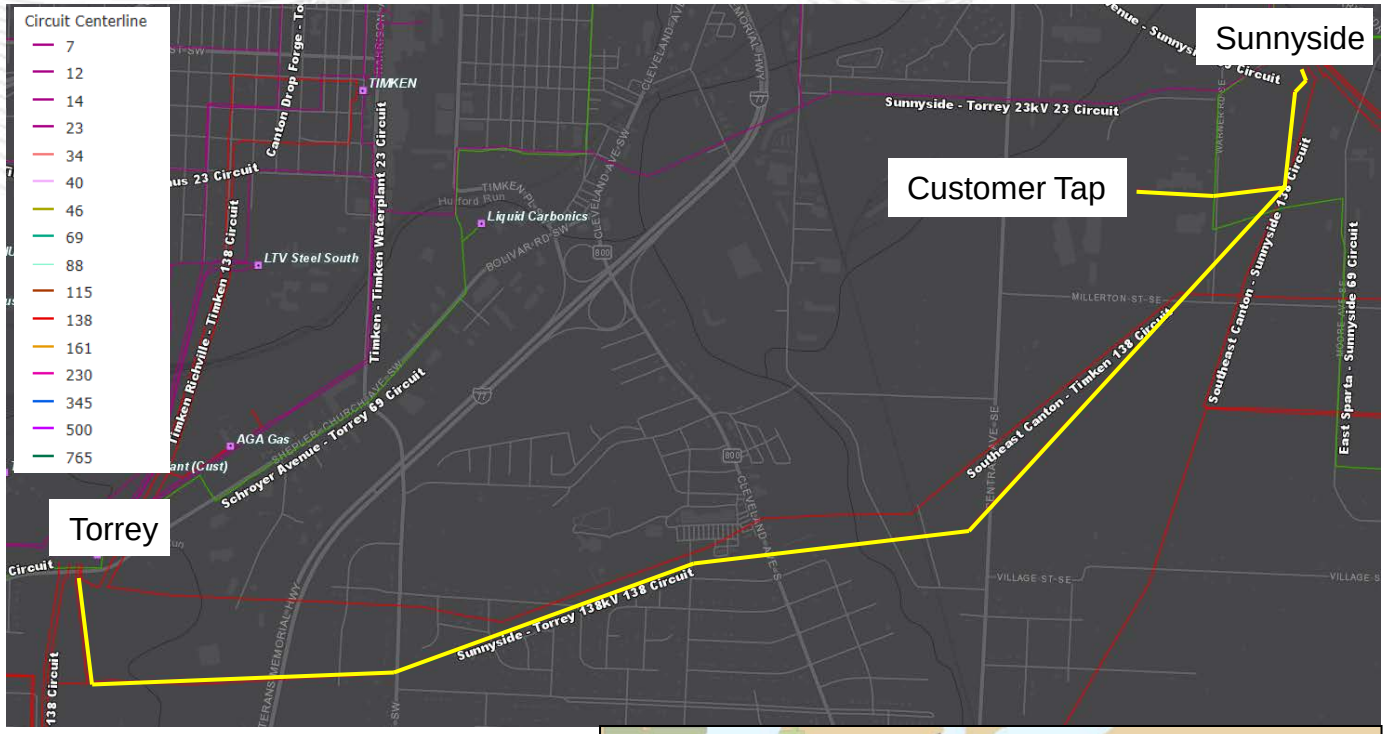
Equipment/Material/Condition/Performance/Risk

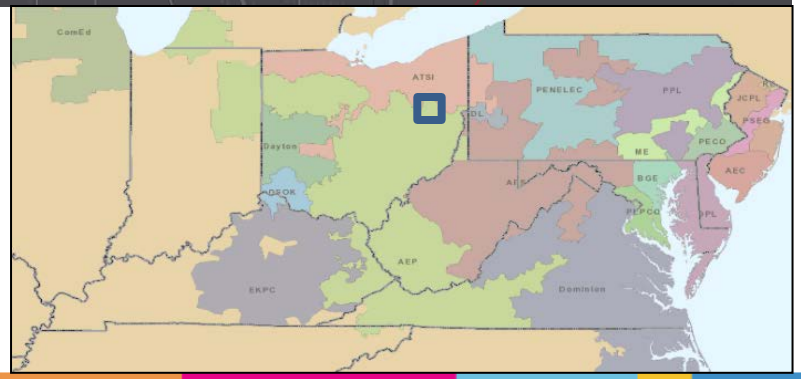
Specific Assumption References:

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

Problem Statement:

- The majority (94%) of the Sunnyside-Torrey 138 kV line (4.3 miles) is comprised of steel lattice towers built in 1918, with the remaining 6%, dating back to 1954.
- The conductor is original vintage (1918), consisting of 6-wired 200 MCM copper & 250 MCM copper.
- Note that the 0.3-mile customer tap was built in 2007 and is in adequate condition.





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
Clifford-Scottsville, VA Area

Need Number: AEP-2019-AP004

Process Stage: Solutions Meeting 5/20/2019

Previously Presented: Needs Meeting 2/20/2019

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

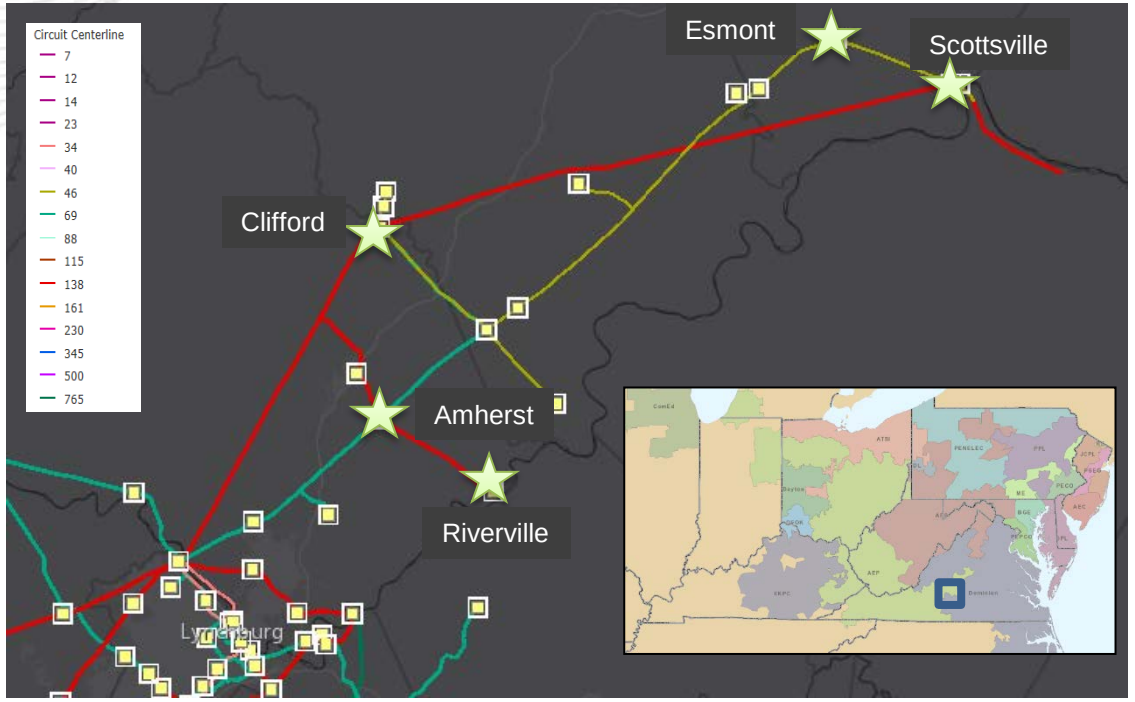
Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

The Amherst-Clifford 69 kV circuit (13.9 mi.) consists primarily of 1960 wood pole structures with 4/0 ACSR overhead conductor and currently has 26 open conditions including rot top, woodpecker damage, split poles, broken insulators and damaged shield wire. Over the 2015-2018 time frame there were 5 momentary outages which occurred during lightning and wind events due to the lack of shield wire on half of the circuit, exposing it to a higher probability of forced momentary and permanent lightning induced outages.

The Clifford-Scottsville 46 kV circuit (45.5 mi.) consists primarily of 1926 wood pole structures with 4/0 ACSR overhead conductor and currently has 93 open conditions including rot top, rot heart and woodpecker/insect damage. Over the last recorded 3 year period, 6 permanent outages were observed. Also, only 16% of the line has shielding, mainly on the tap sections.

Riverville station serves a large industrial customer (Grief Brothers Corporation) consisting of approximately 45 MW from a radial 138 kV line served from Boxwood S.S. located between Clifford and Reusens. This radial line is approximately 9.2 miles long, leaving a large amount of load exposed to a variety of single contingency events.



AEP Transmission Zone M-3 Process
Lynchburg, VA Area

Need Number: AEP-2019-AP009

Process Stage: Solutions Meeting 5/20/2019

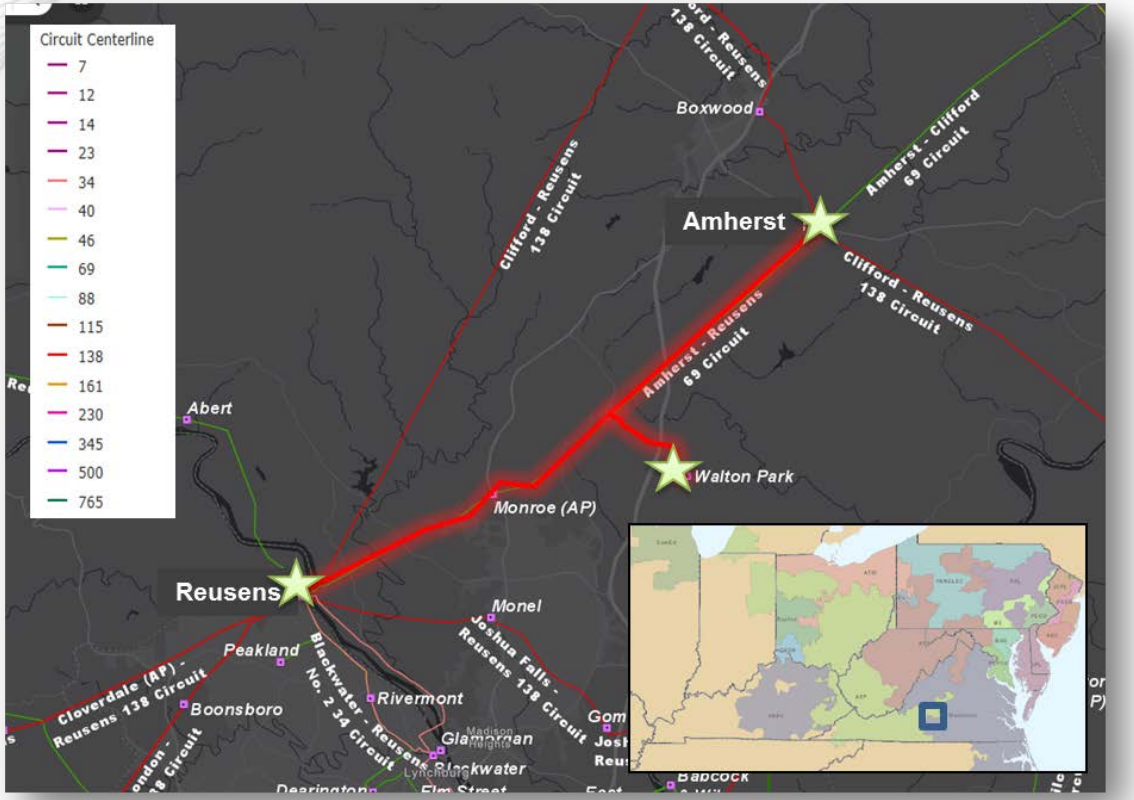
Previously Presented: Needs Meeting 3/25/2019

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

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

Problem Statement:

The 14.2 mile long Amherst-Reusens 69 kV circuit was originally constructed in 1946 using wood pole structures with the lack of shielding on most (98%) of the circuit. Within the last 3 years it has experienced 33 momentary outages and 3 permanent outages with an average outage duration of 78.4 hours. The circuit currently has 26 open conditions. The majority (84.1%) of overhead conductor consists of 4/0 ACSR, also from 1946.



Clifford-Scottsville

Need Number: AEP-2019-AP004, AEP-2019-AP009

Process Stage: Solutions Meeting 5/20/2019

Potential Solution:

The Monroe-Amherst 69 kV (10 mi.) and Esmont-Scottsville 46 kV (6 mi.) lines will be rebuilt to address age, condition and performance issues.

$39 M

Amherst-Clifford 69 kV, majority of the Clifford-Scottsville 46 kV, the Reusens– Monroe 69 kV and Riverville radial load will be addressed as part of the overall Clifford-Scottsville area baseline solution. The scope of work addressing these facilities includes retirement of Amherst-Clifford 69 kV and Clifford-Scottsville 46 kV circuits and construction of new 138 kV lines from Joshua Falls-Riverville (~10 mi.) and Riverville-Gladstone (~5 mi.). Associated station equipment will be installed at Riverville and Joshua Falls to accommodate the new 138 kV circuits.

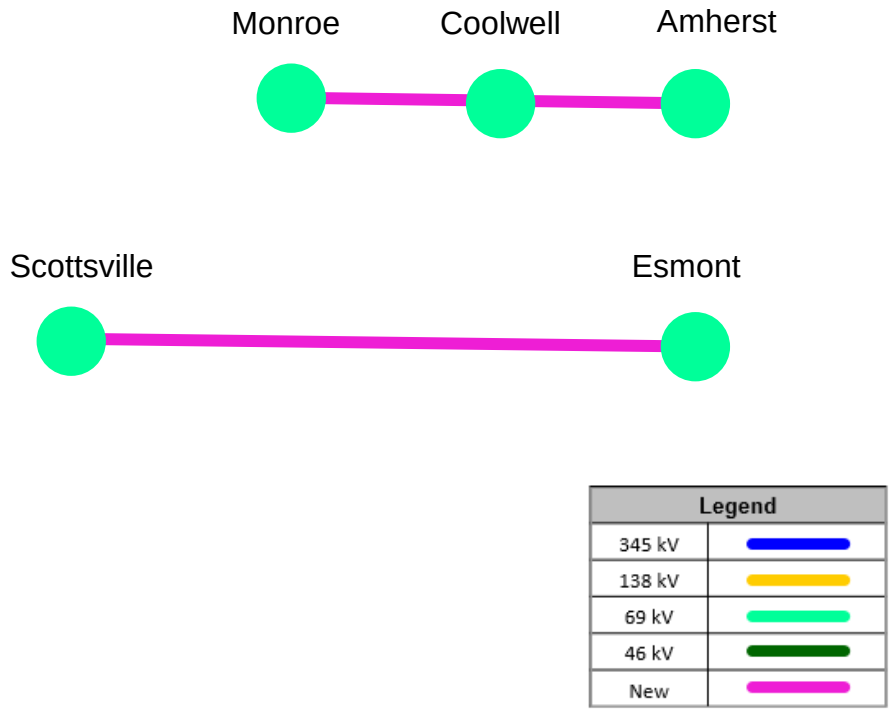
Alternatives Considered:

Install a 138 kV breaker at Clifford on the line side of the 138/46 kV T#3. Replace Scottsville 138/46 kV T#5 with a 75 MVA unit. Rebuild ~36 miles of the 44 mile Clifford-Scottsville 46 kV circuit (excluding taps to Gladstone and Shipman) to 69 kV standards using 795 ACSR conductor. Increase the size of the capacitor banks at Clifford from 3.6 MVAr to 9.6 MVAr and at Scottsville from 3.6 MVAr to 5.4 MVAr. Rebuild 14 mile Amherst-Reusens 69 kV circuit and 7 miles of the Amherst-Clifford 69 kV circuit. Construct new 138 kV line from Joshua Falls-Riverville (~10 mi.) Install required station upgrades at Joshua Falls and Riverville to accommodate the new 138 kV circuit.

(Includes original baseline solution cost $86 M)

$190 M

Projected In-Service: 10/1/2022

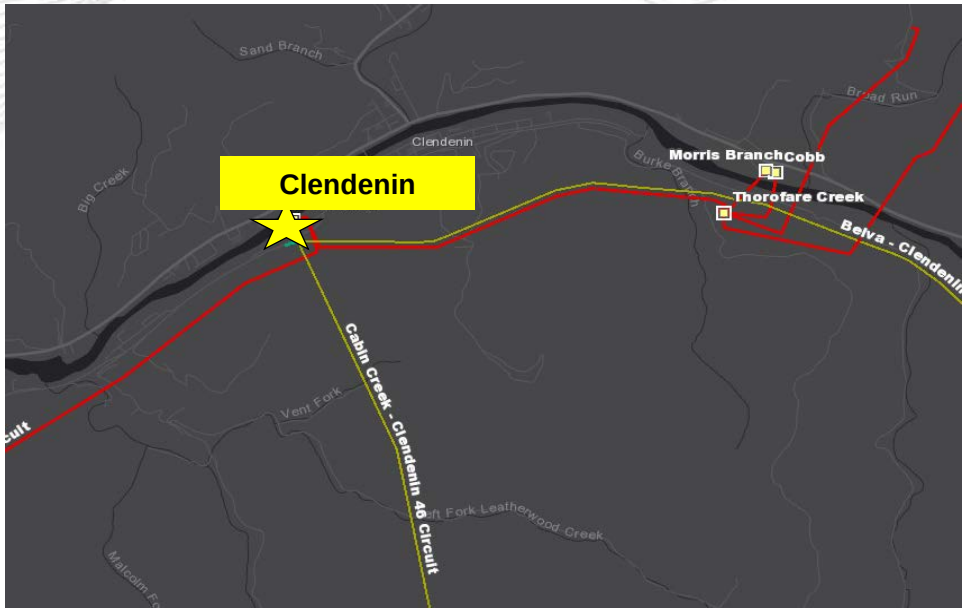


Need Number: AEP-2018-AP005
Process Stage: Solutions Meeting 5/20/2019
Process Chronology: Needs Meeting 10/26/2018

Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

On Thursday, June 23, 2016, sustained heavy rain caused severe flooding along the Elk River in West Virginia. The flood waters engulfed much of the town of Clendenin, including Clendenin Station, which sustained significant damage. Clendenin station lies well under the FEMA 100 year flood plain.



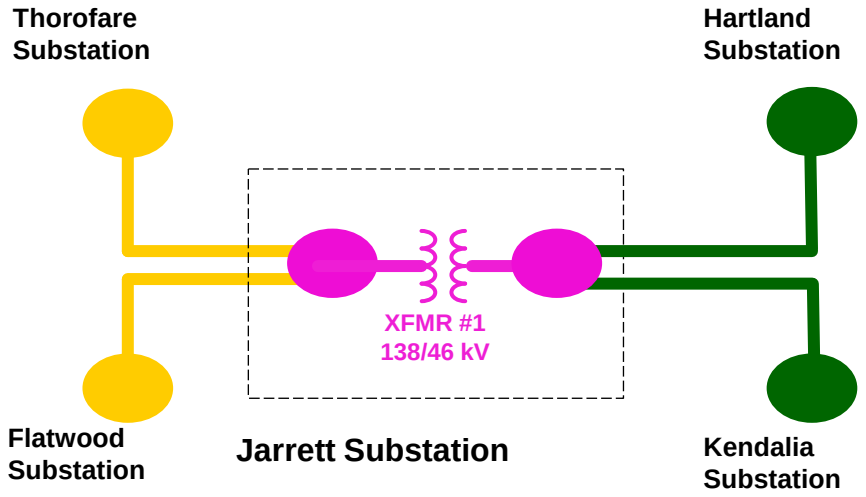
Need Number: AEP-2018-AP005

Process Stage: Solution Meeting 5/20/2019

Potential Solution:
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. Estimated Trans. Cost: $21.3M

Alternatives Considered:
1. Rebuild the station on the existing site by elevating the land above the flood plain and installing floodwalls. Based on feedback from Environmental, a floodwall is not possible on this site due to foundation concerns at the site. This alternative was not pursued due to the continued risk of flooding at the existing location
2. Rebuild the station on the adjacent property by elevating the land and installing floodwalls. This alternative was not pursued due to the station site still being located in the floodplain and the continued risk of flooding.

Projected In-Service: 8/26/2021



Legend	
345 kV	
138 kV	
69 kV	
46 kV	
New	

AEP Transmission Zone M-3 Process
Blackhawk – Dillonvale Rebuild Project

Need Number: AEP-2019-OH002

Process Stage: Solutions Meeting 5/20/2019

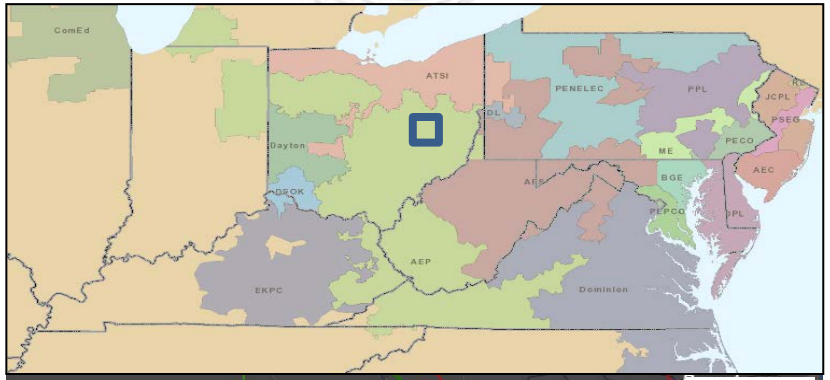
Previously Presented: Needs Meeting 2/20/2019

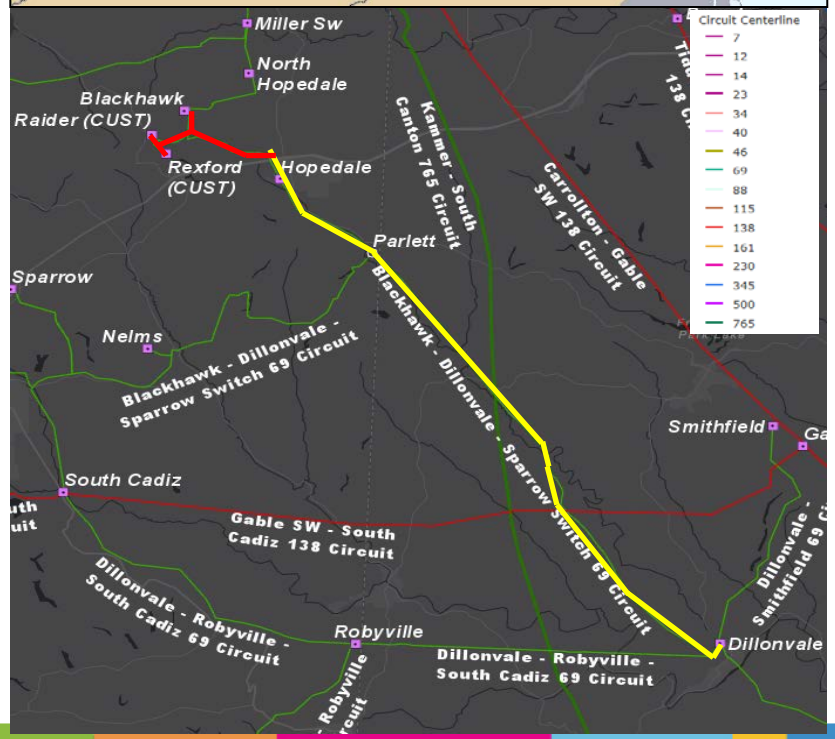
Supplemental Project Driver: Equipment/Material/Condition/Performance/Risk.

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

Problem Statement:

Equipment Material/Condition/Performance/Risk:
The Blackhawk-Dillonvale-Sparrow 69 kV line was originally constructed in 1918 and approximately 30% of the wood structures are still from 1918. More than half of the structures are of pre-1980 vintage and are affected by heavy rot and woodpecker & insect damage through the years. 70% of the conductor is from 1926 or prior and is starting to show signs of tensile-related failures. There are 180 open A conditions on this line. Sections of the Blackhawk-Parlett line (Blackhawk Extension, Raider Extensions and Rexford Extension) have been recently rebuilt to 138 kV standards. (Shown in Red)





AEP Transmission Zone M-3 Process
Blackhawk – Dillonvale Rebuild Project

Need Number: AEP-2019-OH002
Process Stage: Solutions Meeting 5/20/2019

Potential Solution:

Rebuild the 9.3 mile, Dillonvale – Parlett 69 kV line, using 795 ACSR conductors. Estimated Cost: $31.8M

Rebuild 2.5 mile section of 69 kV line from Parlett to Blackhawk, using 795 ACSR conductors. Estimated Cost: $8.0M

Rebuild ~2 mile section of the Blackhawk-N. Hopedale-Miller Sw 69 kV circuit, using 795 ACSR conductors. Estimated Cost: $6.8M

Retire the 0.12 mile radial line from Rose Valley Sw. Estimated Cost: $0.1M

At Hopedale 69 kV station, install new H-Frame for T-line termination and 69kV line disconnect GOABs (40 kA, 1200A). Estimated Cost: $0.5M

At North Hopedale switch, replace the switch with a new phase-over-phase switch (40 kA, 1200A) Estimated Cost: $0.5M

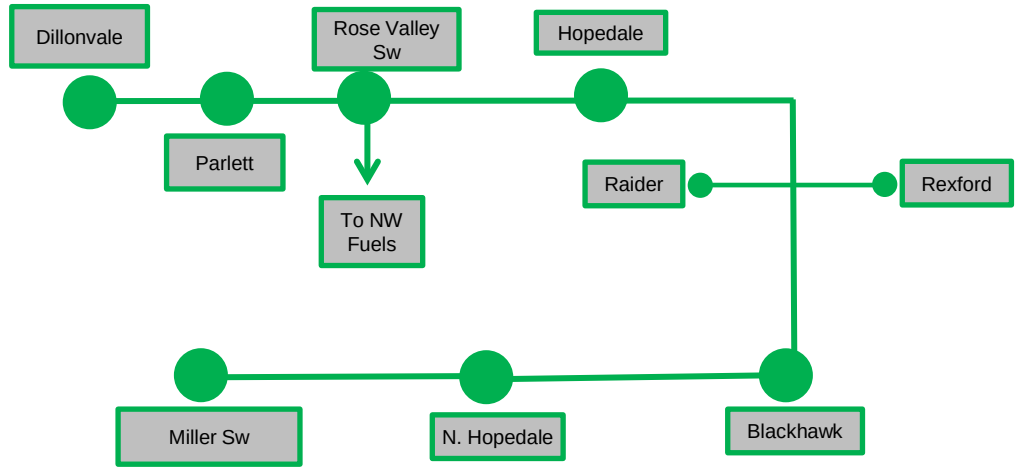
Retire the switch at Rose Valley. Estimated Cost: $0.2M

Total Estimated Transmission Cost: $47.9M

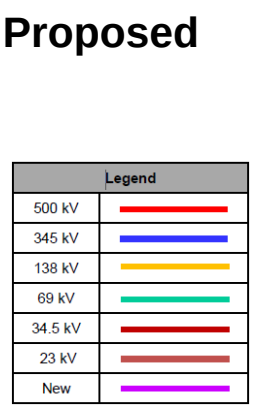
Alternatives Considered: No viable cost-effective alternates could be identified.

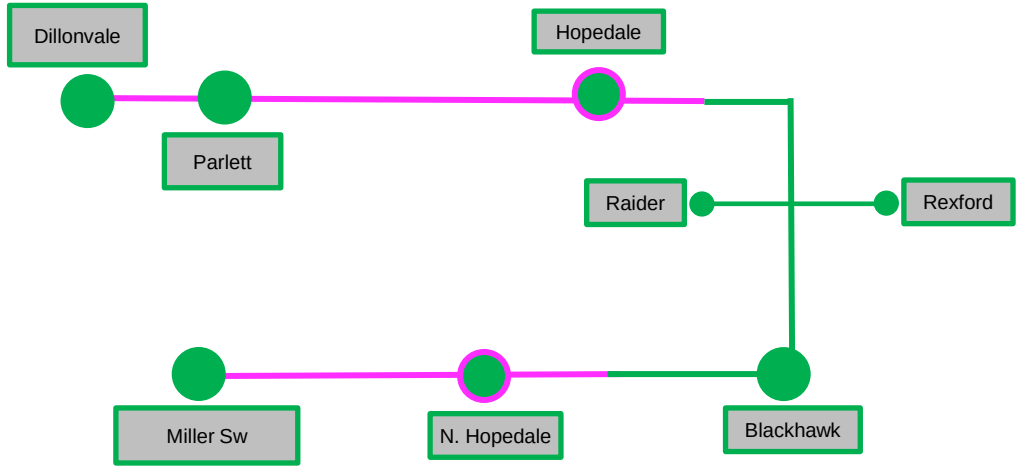
Projected In-Service: 11/15/2022

Existing



Proposed





AEP Transmission Zone: M-3 Process
Meigs County/Coolville, Ohio

Need Number: AEP-2019-OH008

Process Stage: Solutions Meeting 05/20/2019

Previously Presented: Needs Meeting 03/25/2019

Supplemental Project Driver:

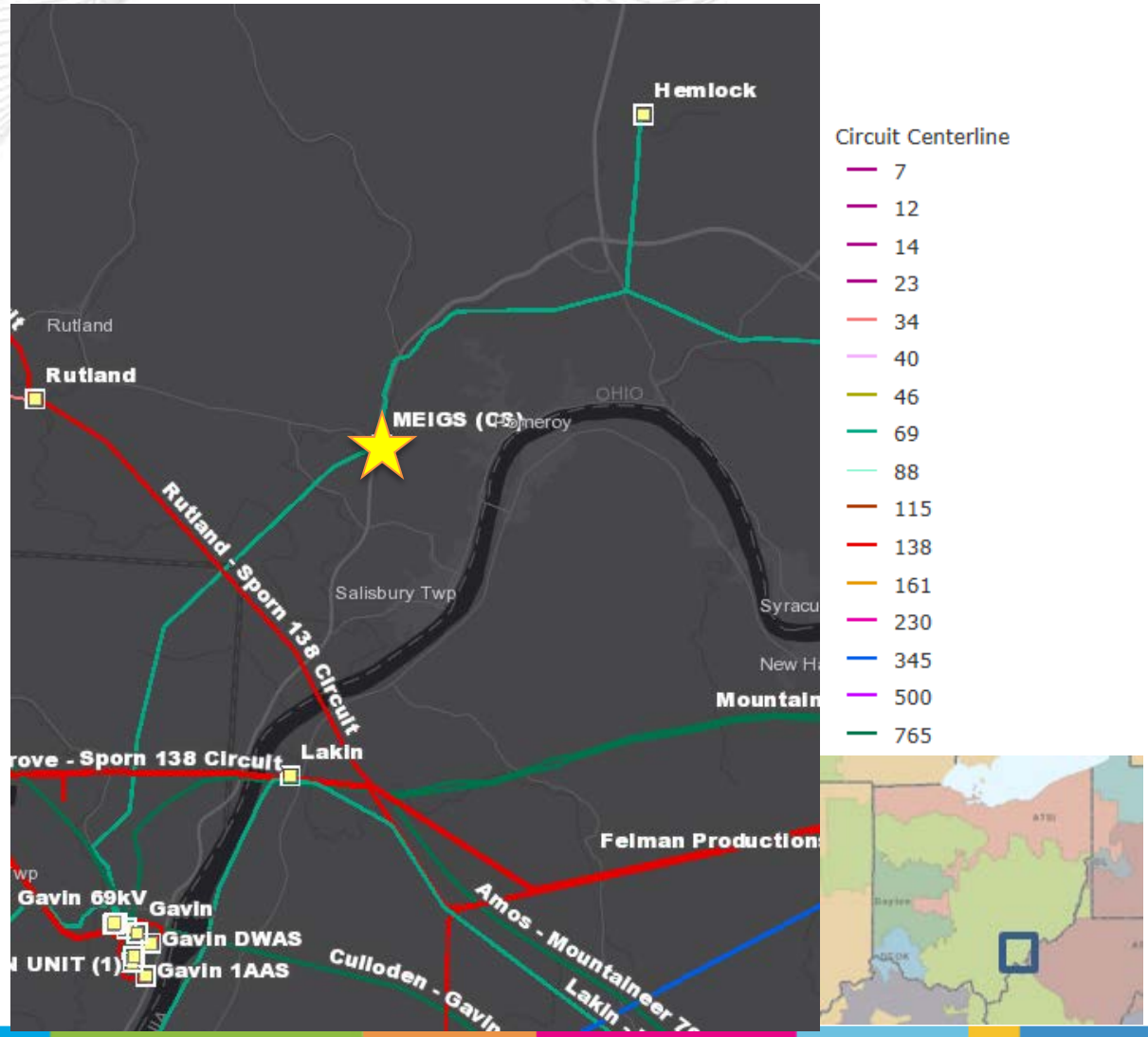
Equipment Material/Condition/Performance/Risk

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- Meigs 69kV CB “1” is a vintage (1954) oil-filled circuit breaker. Oil breakers are difficult to maintain due to oil handling requirements and risk of oil spills during maintenance and failures. This model (G.E. FK-439-69-1000-4) is also recommended for replacement due to reliability issues, lack of vendor support, and lack of spare part availability. In addition, this CB has exceeded the manufacturers recommended number of fault operations: CB 1 (20).



AEP Transmission Zone: M-3 Process
Meigs County/Coolville, Ohio

Need Number: AEP-2019-OH008

Process Stage: Solutions Meeting 05/20/2019

Potential Solution:

- Replace Meigs CB-1 with a new 69kV 2000A/40kA breaker.

Estimated Cost: $0.33M

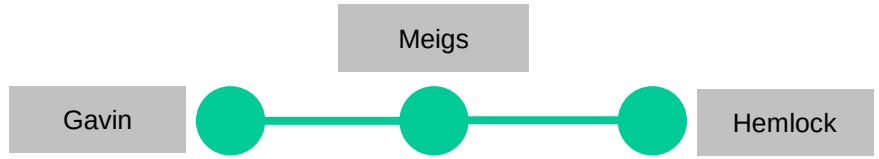
Alternatives Considered:

- No viable cost-effective transmission alternative was identified

Projected In-Service: 06/30/2022

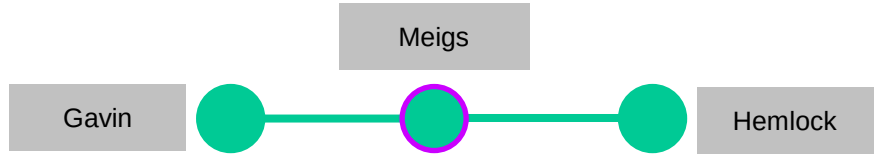
Note: This project will be constructed in parallel with the Gavin-Meigs overload solution project. A separate solution will be submitted for the Coolville radial portion of the need when completed.

Existing:



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

Proposed:



AEP Transmission Zone M-3 Process
Muncie, Indiana

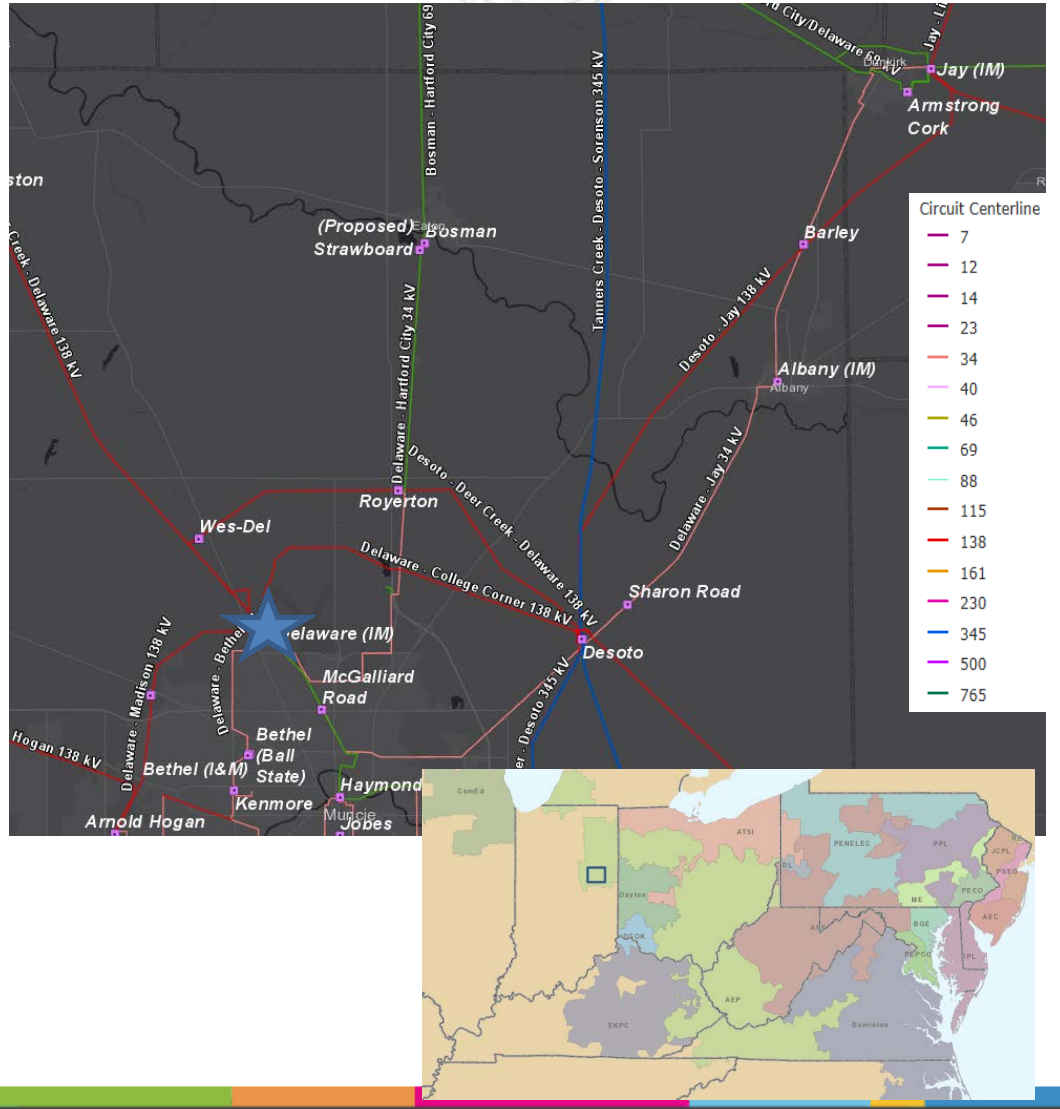
Need Number: AEP-2018-IM020
Process Stage: Solutions Meeting 5/20/2019
Previously Presented: Needs Meeting 10/26/2018
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Delaware Station
- Breakers “C”, “H”, “I”, “L”, “M” and “N”
  - 1963-1971 FK oil breakers without oil containment
  - Fault Operations: CB C(6) CB H(27) CB I(50) CB M(57)– Recommended(10)

Delaware – Haymond
- 1948 wood 5 circuit construction
- 3/0 Copper
- 22 open A conditions
- 13 open B conditions

Delaware – Jay
- 1920’s Vintage wood crossarm construction
- 1/0 Copper conductor
- 100 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- 55 open A conditions
- 33 open B conditions
- 556,661 CMI

Barley Station
- AEP Distribution has requested a new delivery point off of the 138kV line near Barley station.

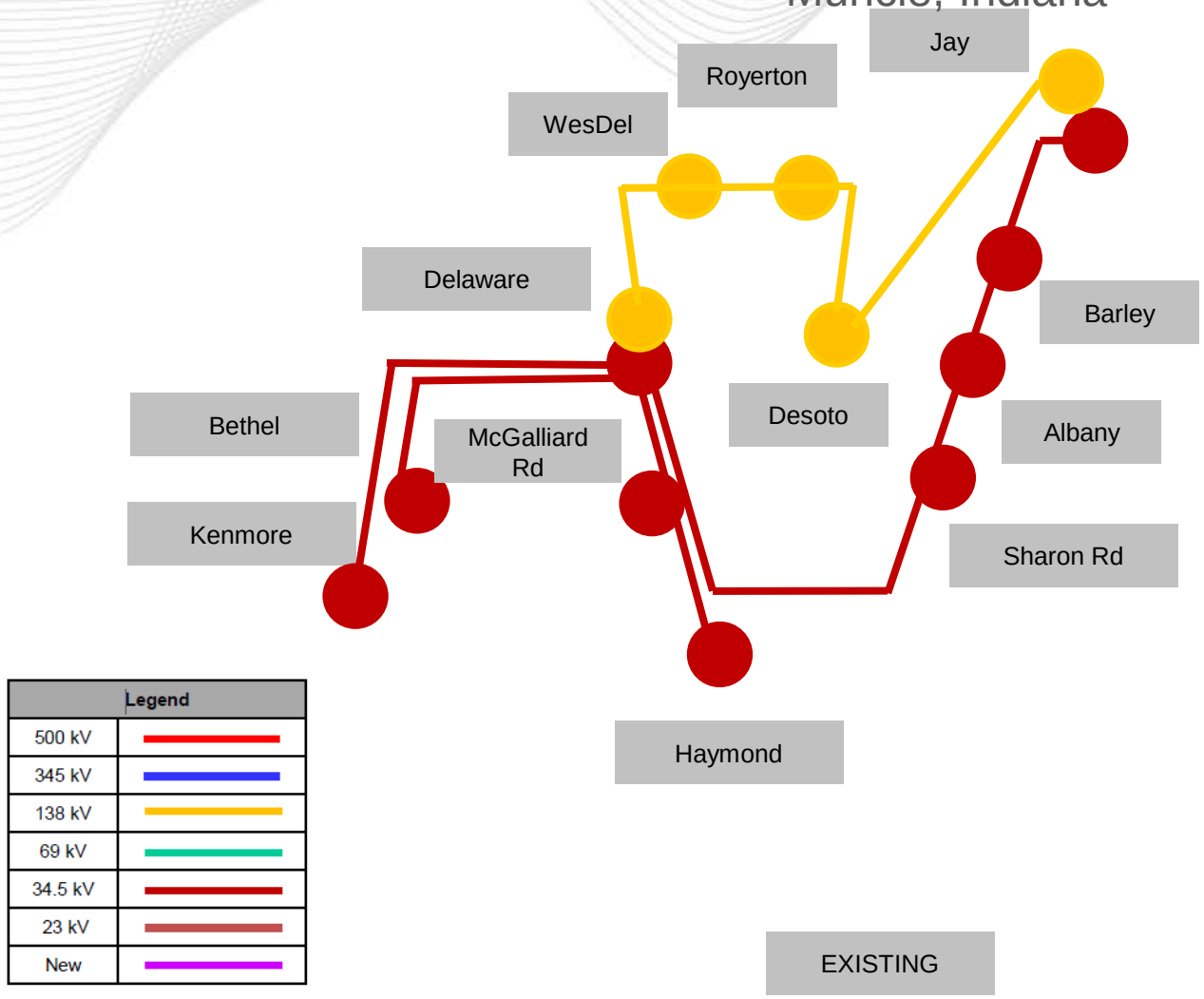


AEP Transmission Zone M-3 Process
Muncie, Indiana

Need Number: AEP-2018-IM020
Process Stage: Solutions Meeting 5/20/2019

Proposed Solution:

Delaware – Jay 34.5kV line
Retire the Delaware – Jay ~20 mile 34.5kV line.
Cost: $4.6M
Delaware – Haymond 34.5kV line
Rebuild the 2.5 miles from Delaware to a point near Centennial Road using 556.5 ACSR (south of the road the line is newer construction).
Cost: $6.5M
Desoto – Jay 138kV line
Work required to remove, reterminate and reconfigure this line to allow for the Perch Extension connection
Cost: $2.1M
Perch Extension 138kV line
Install the new ~1 mile perch Extension in order to connect the new station to the Desoto – Jay 138kV line.
Cost: $3.6M
Delaware 138/34.5kV station
Rebuild the 34.5kV voltage class as a ring bus by installing 3 new 69kV rated breakers and reusing exiting breakers “N” “G” and “D”
Cost: $5.9M



AEP Transmission Zone M-3 Process
Muncie, Indiana

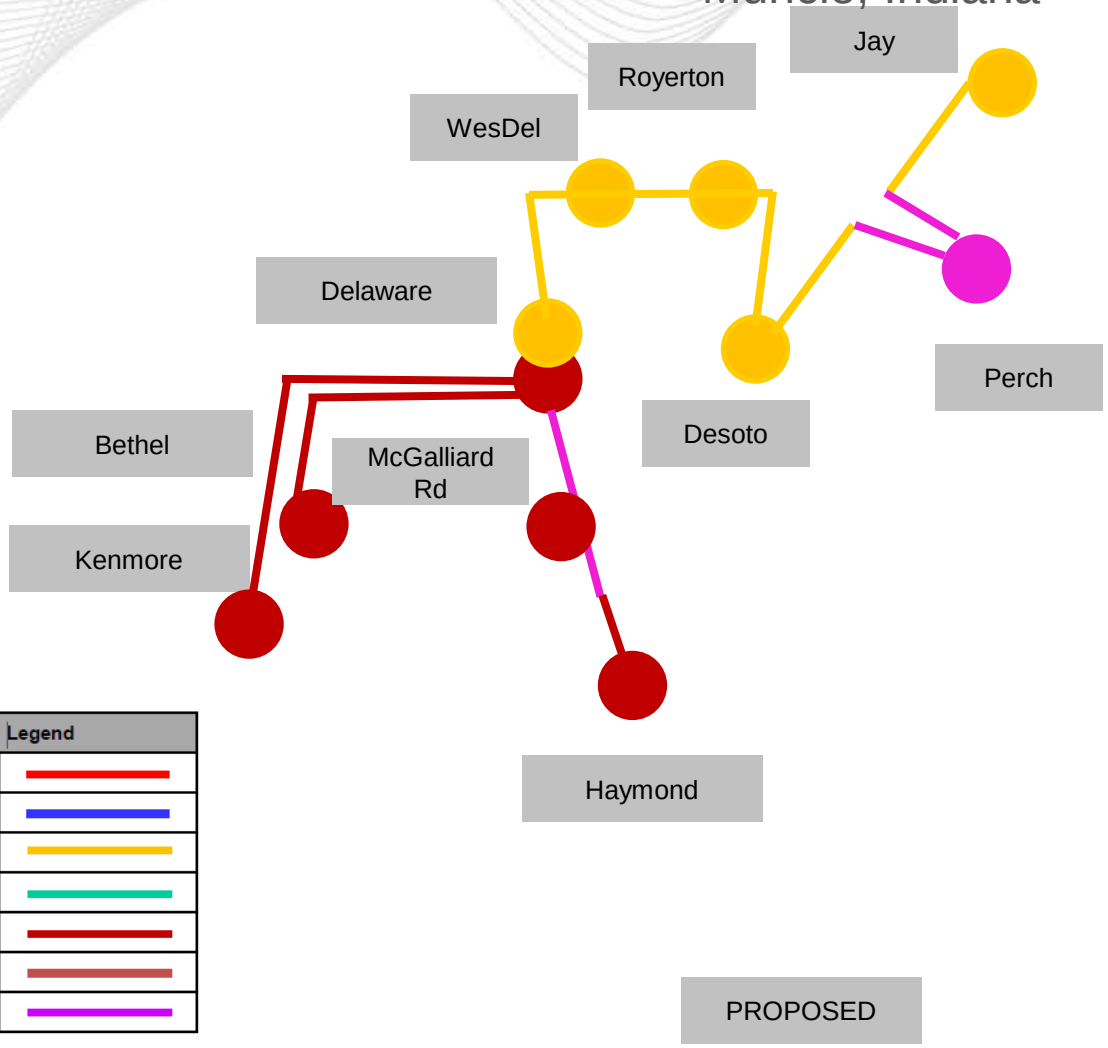
Need Number: AEP-2018-IM020
Process Stage: Solutions Meeting 5/20/2019

Proposed Solution (con't):
Jay 138/69/34.5kV station
Retire all 34.5kV equipment at this station
Cost: $.3M
Perch 138kV Station
Install the new in and out to 138kV Perch station with two MOABs to allow retirements of the Delaware-Jay 34.5kV line. Perch will pick up loads from retiring Sharon Road, Barley, and Albany stations.
Cost: $1.7M

Alternatives:
No cost viable alternates were identified

Total Estimated Transmission Cost: $24.3M
Projected IS Date: 12/10/2021
Project Status: Scoping

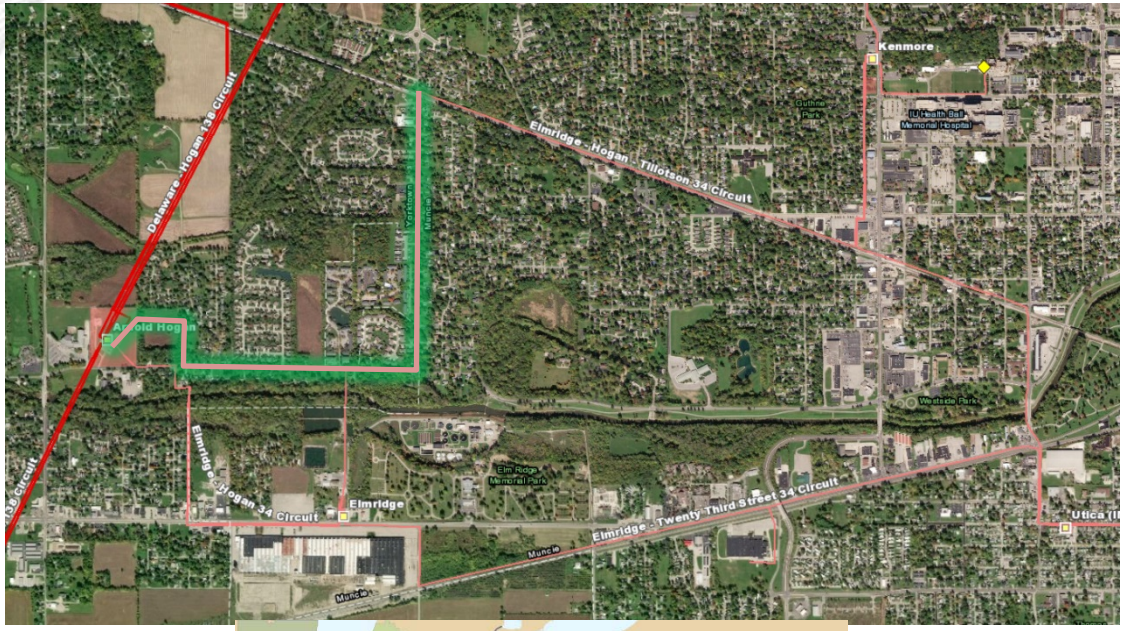
NOTE: Delaware 34.5KV station: Breaker "L" is addressed by B3103.3; Breaker "N" failed and was replaced in 2018.

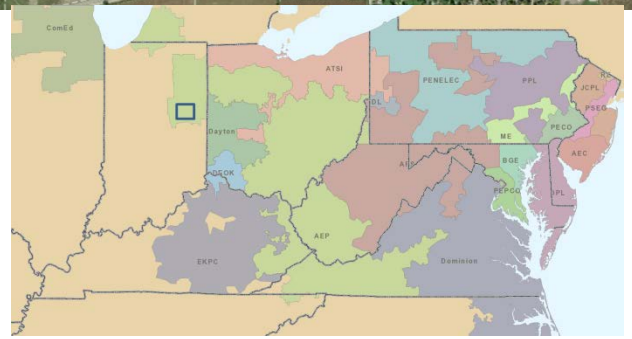


AEP Transmission Zone: Supplemental
Arnold Hogan - Kenmore

Need Number: AEP-2018-IM021
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs Meeting 10/26/2018
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Arnold Hogan – Kenmore 34.5kV

- 1930's and 1960's vintage construction
- 3/0 copper and 336.4 ACSR conductor
- 15 of the 47 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- Majority of current and past maintenance concerns relate to integrity of structures and crossarms

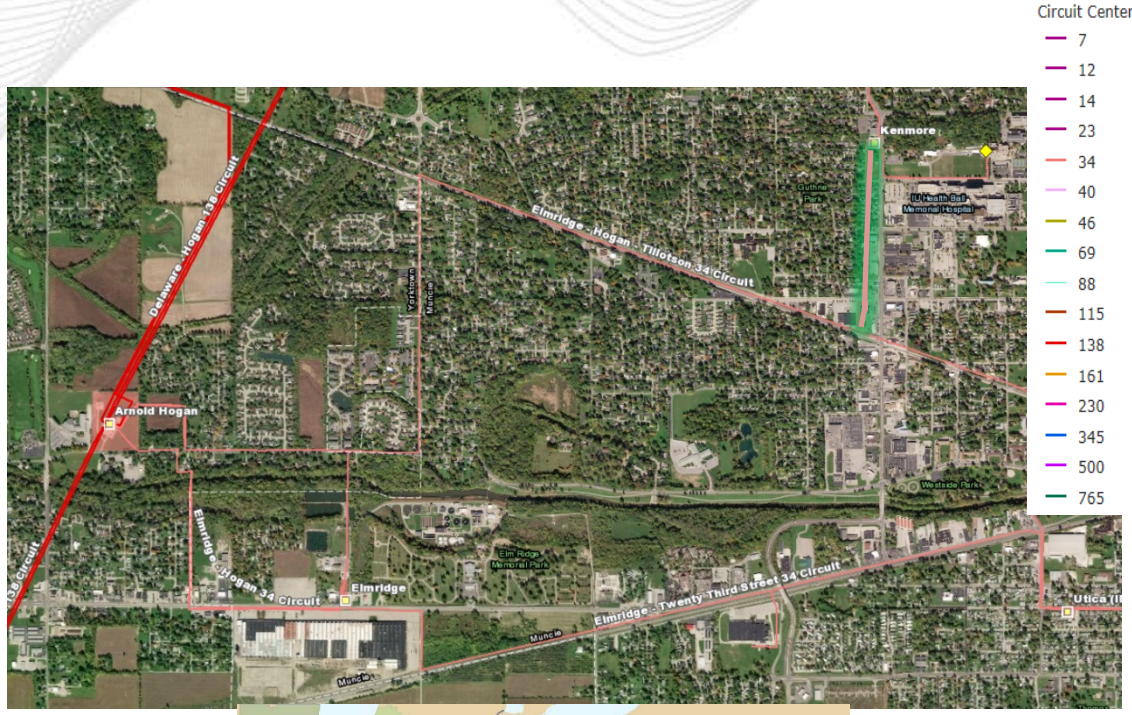


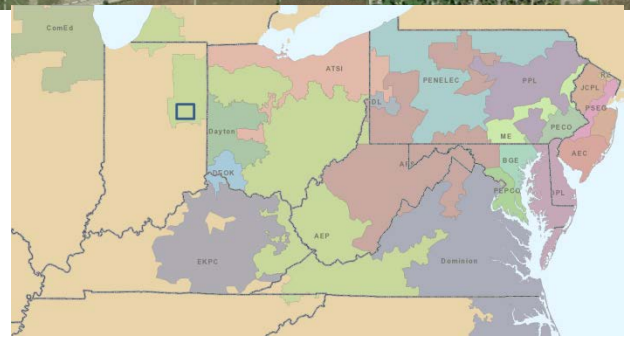


AEP Transmission Zone: Supplemental
Arnold Hogan - Kenmore

Need Number: AEP-2019-IM026
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Kenmore – 23rd street (Section is .53 miles) 34.5kV

- Section has been identified as having multiple physically overloaded structures and must be addressed.



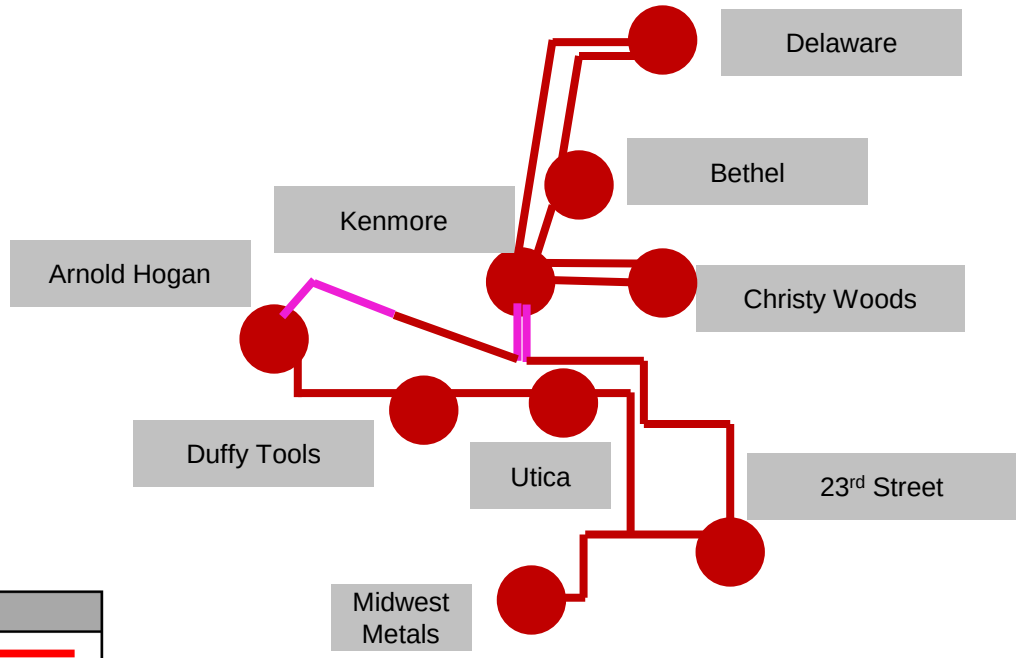


AEP Transmission Zone: Supplemental
Arnold Hogan - Kenmore

Need Number: AEP-2019-IM026 & AEP-2018-IM021
Process Stage: Solution Meeting 5/20/2019
Potential Solution:

Arnold Hogan – Kenmore 34.5kV (West Section):
Rebuild 1.3 miles in the clear from structure 1 to structure 47 utilizing double circuit 34.5kV line (69 rated) with only the north side strung. New conductor will be 556.5 ACSR
Cost: $6.2M

Arnold Hogan – Kenmore 34.5kV (East Section):
Rebuild the .5miles from STR 80 to Kenmore as underground construction. New conductor will be 1750KCMILL CU XLPE.
Cost: $9.5M



Alternatives:
Rebuild greenfield section as single circuit.
While this would be cheaper in the short run, in talking to our local customers, the end goal of this system is to eventually feed both south bound lines from Kenmore into Hogan station. Building the line as double circuit now will give us the ability to retire the single circuit portions of the Kenmore – 23rd Street line in the future.

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

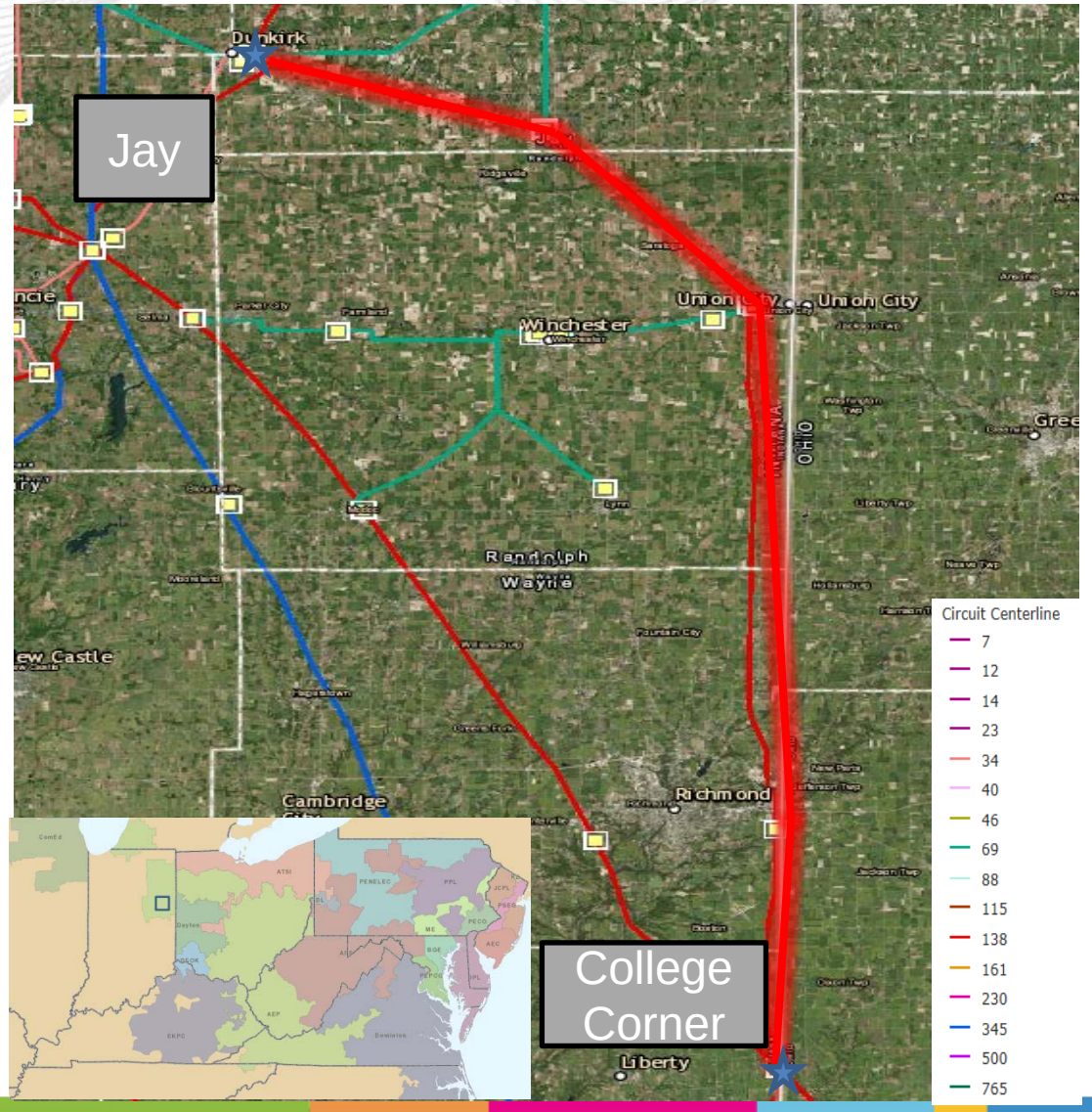
Total Estimated Transmission Cost: $15.7M

Projected IS Date: 06/01/2022

AEP Transmission Zone: Supplemental
Jay – College Corner

Need Number: AEP-2018-IM018
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs Meeting 1/11/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Jay – College Corner 138kV line

- 1941 & 1951 vintage wood H frame line
- Non-standard EHS Steel Shield Wire
- The most recent 6-year inspection showed 91 open conditions (A:52 B:39) with the majority being structural issues.
- In the past 10 years 97 structures have had to have active maintenance on them. This trend is expected to increase as the structures and conductor age.
- In the past 5 years AEP has experienced 13 scheduled outages and 2 forced momentary outages.



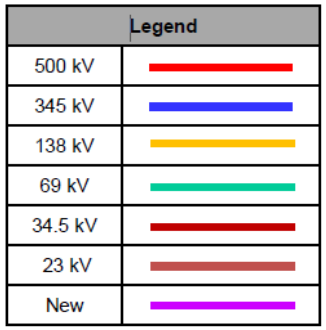
Need Number: AEP-2018-IM018
Process Stage: Solutions Meeting 5/20/2019

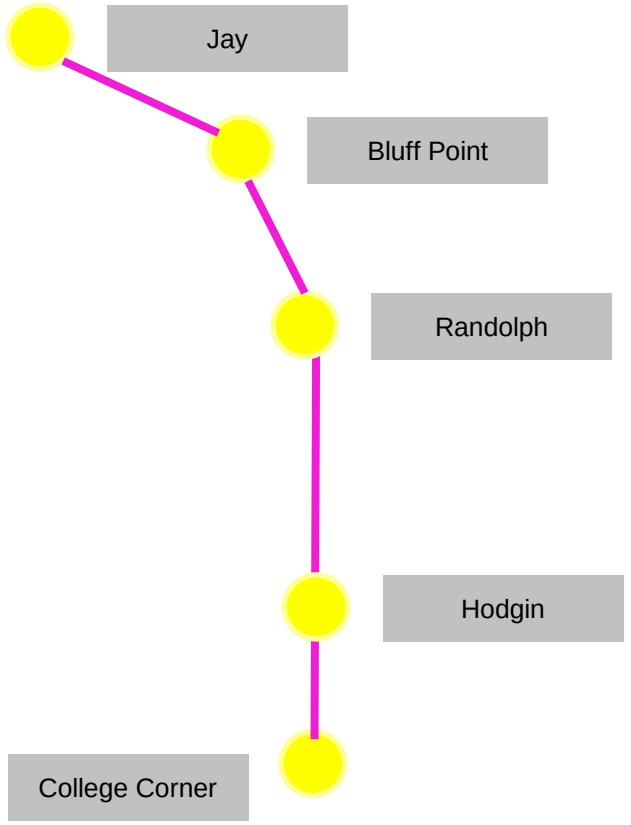
Potential Solution
College Corner – Jay 138kV line
Rebuild the 62 mile College Corner – Jay 138kV line as single circuit 138kV. New conductor will be 795 ACSR
Cost: $113.5M

Total Estimated Transmission Cost: $113.5M

Alternates Considered
No viable transmission alternatives identified.

Projected IS Date: 12/01/2023

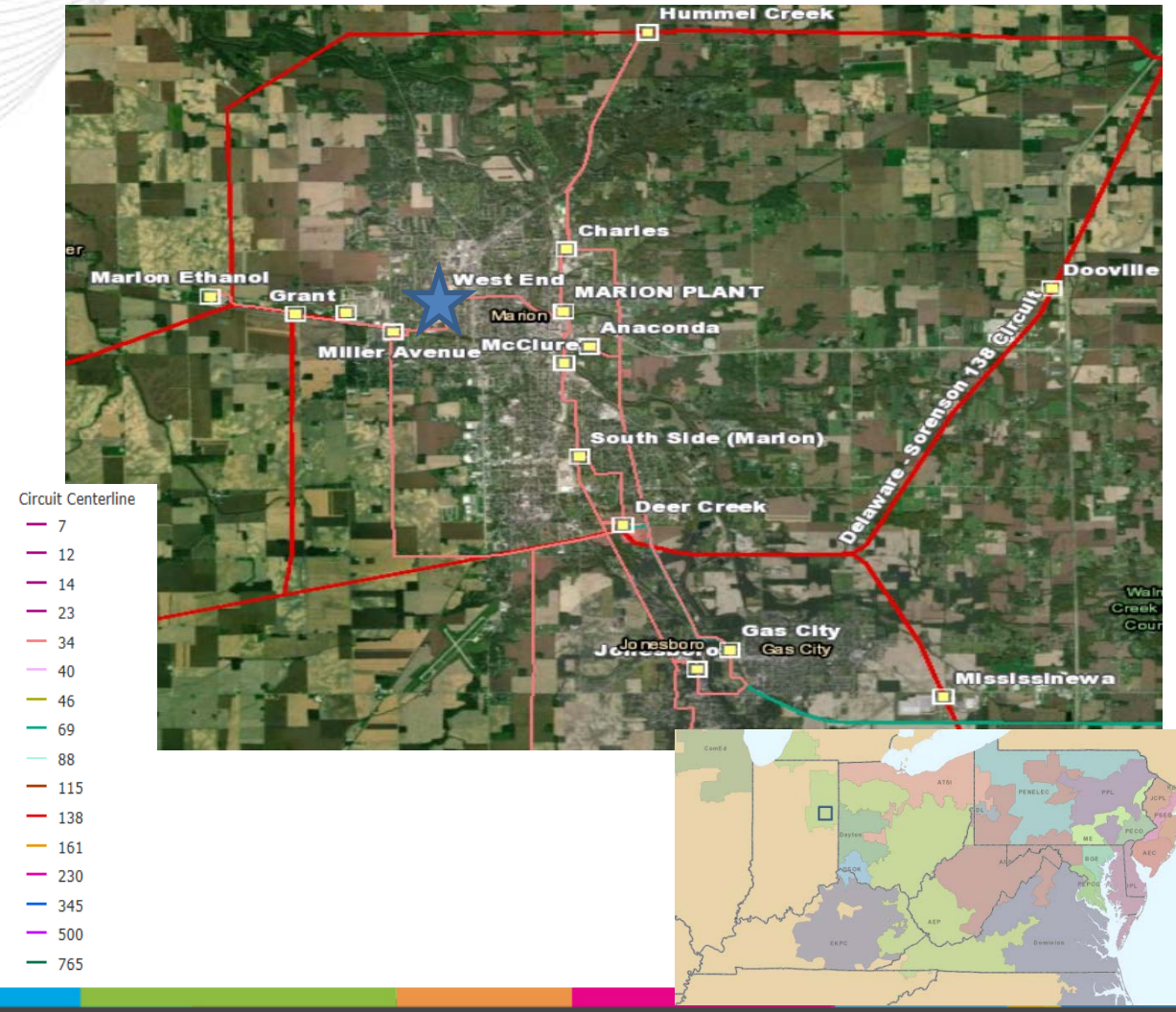




AEP Transmission Zone M-3 Process
West End Rebuild

Need Number: AEP-2019-IM011
Process Stage: Solutions Meeting 05/20/2019
Previously Presented: Needs Meeting 04/23/2019
Supplemental Project Driver: Customer Request
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 7)
Problem Statement:
West End 34.5kV station

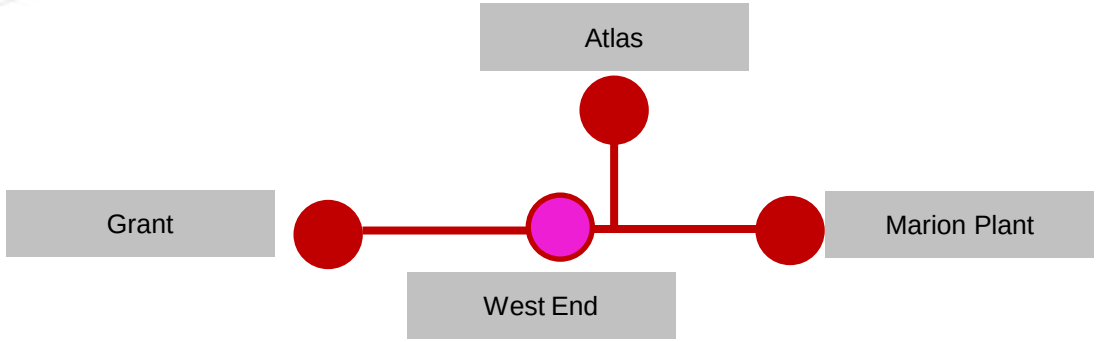
- AEP I&M Distribution is rebuilding and reconfiguring their West End Station to address aging equipment and capacity concerns.



Need Number: AEP-2019-IM011
Process Stage: Solutions Meeting 05/20/2019
Proposed Solution:
West End 34.5kV station:
Rebuild the through-path of this station to accommodate the distribution work required.

Alternatives:
No cost effective viable alternates were identified.

Total Estimated Transmission Cost: $1.2M
Projected IS Date: 11/03/2020



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

AEP Transmission Zone M-3 Process
Trump Switch

Need Number: AEP-2019-OH003

Process Stage: Solutions Meeting 05/20/2019

Previously Presented: Needs Meeting 2/20/2019

Supplemental Project Driver:

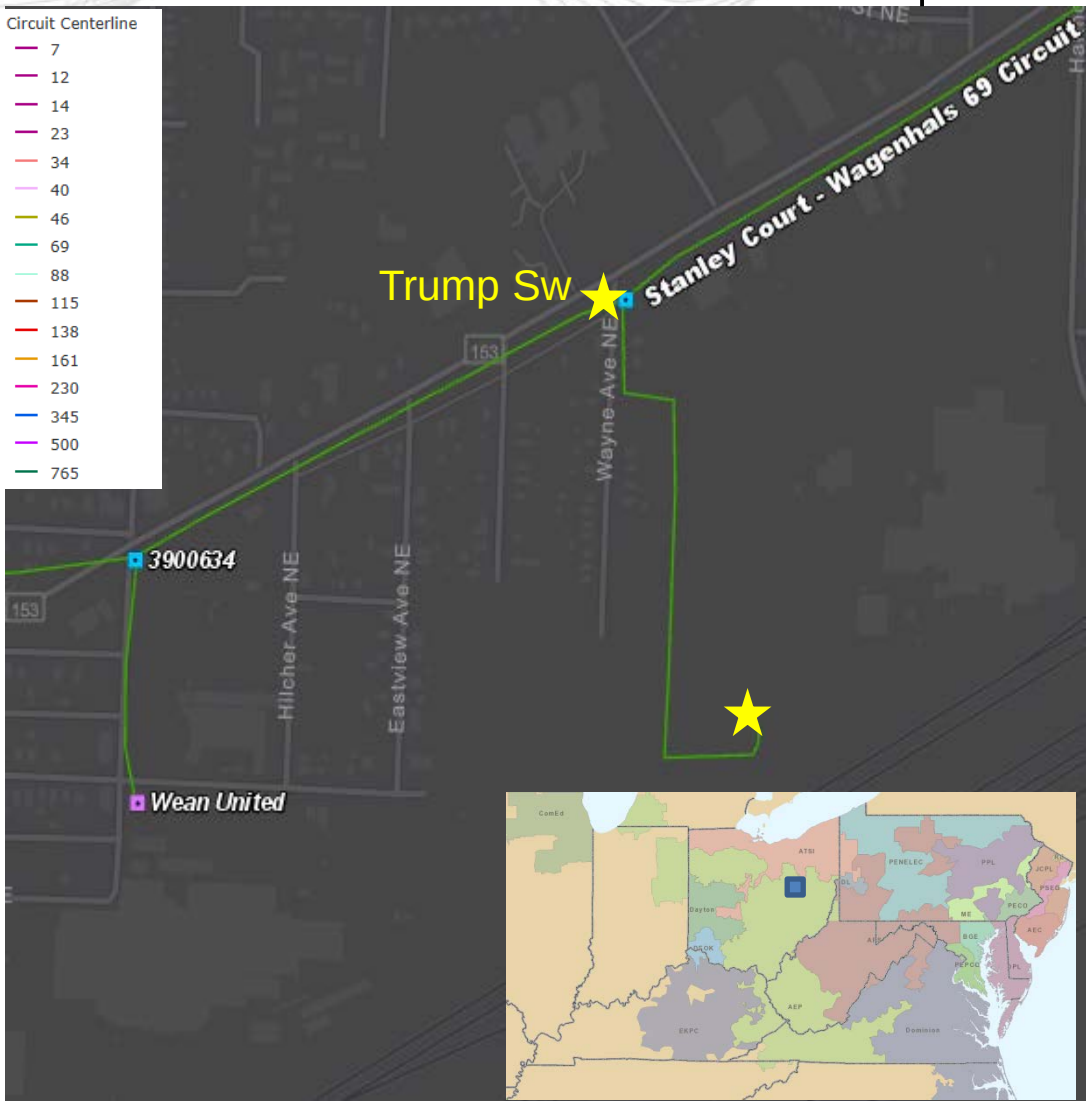
Customer Request

Specific Assumption References:

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

Problem Statement:

Customer wants to install a 2nd 69/12 kV transformer to support increase in load. Customer indicated January 1, 2019 is the only outage window they have for this upgrade.



Need Number: AEP-2019-OH003

Process Stage: Solutions Meeting 5/20/2019

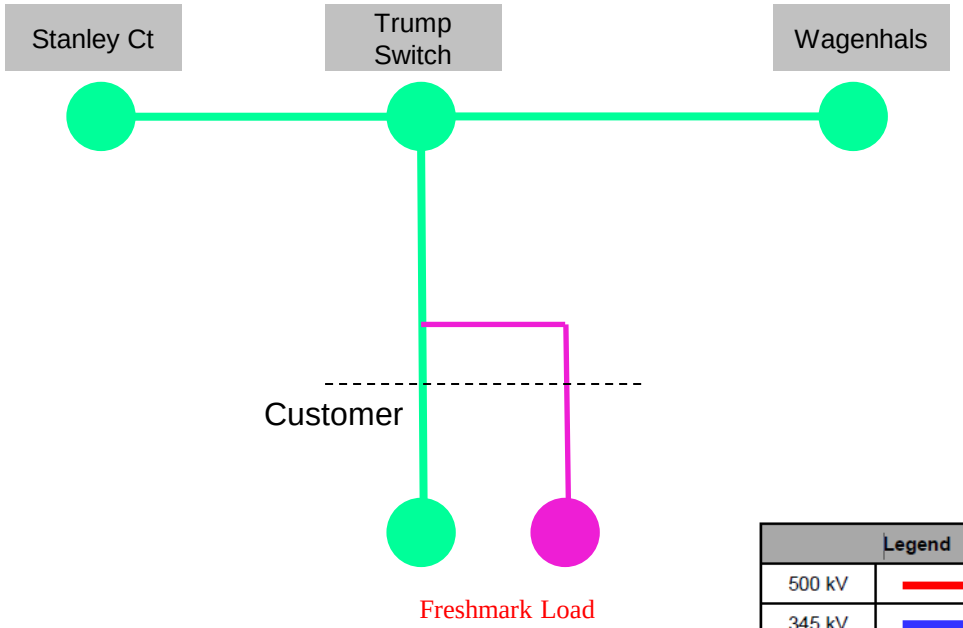
Potential Solution: AEP will provide a second 69 kV feed to the customer by tapping the existing Trump Switch – Freshmark line and installing two pole structures. The customer will build a new 69 kV line from AEP's structures to the new customer owned transformer.

Cost: $186.6 k

Alternatives Considered:

No viable cost-effective transmission alternative was identified

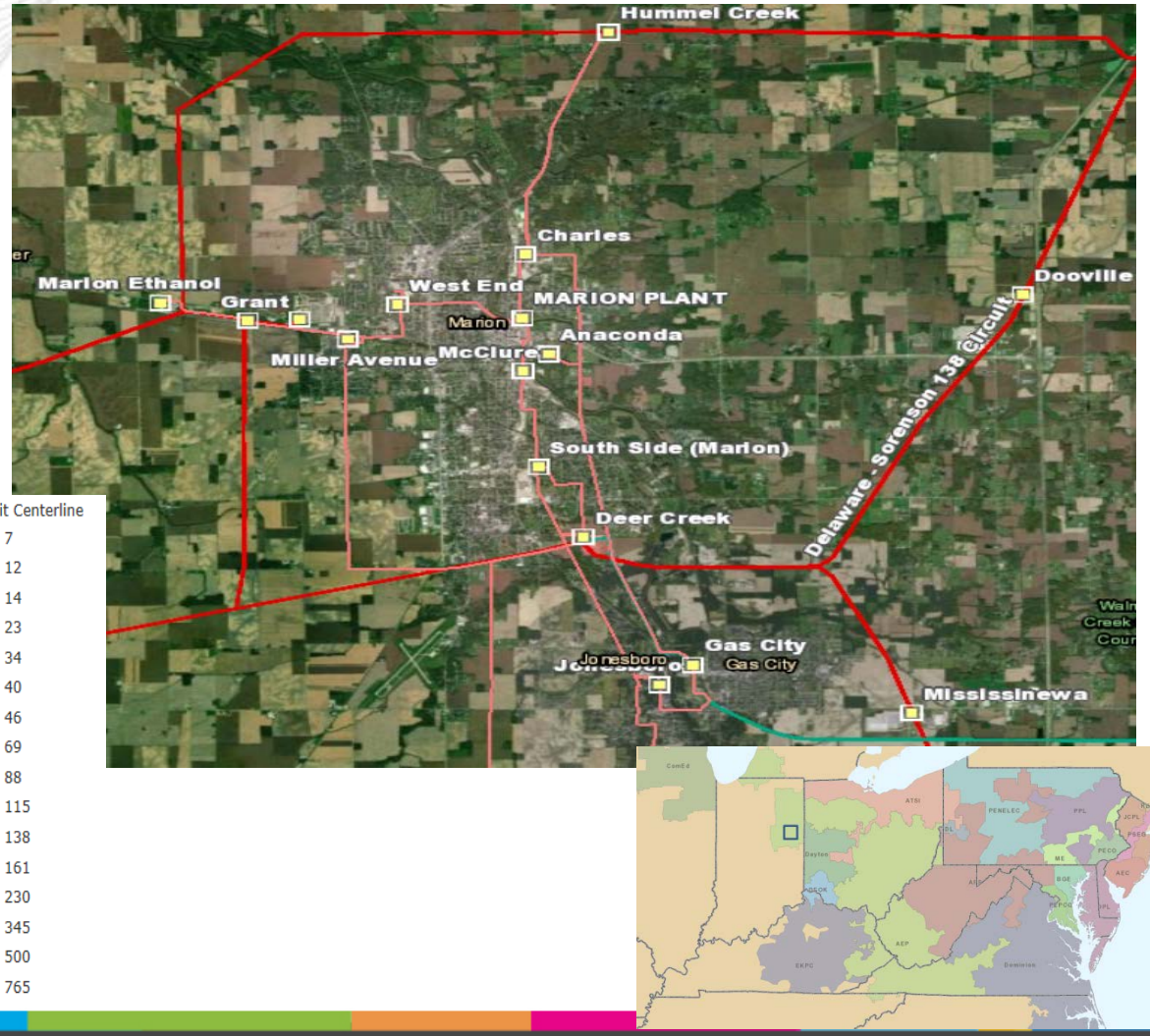
Projected In-Service: 1/1/2019



AEP Transmission Zone: Supplemental Western Marion Area Improvements

Need Number: AEP-2018-IM017
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs meeting 1/11/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Deer Creek 34.5kV

- Breakers “K”, “F”, “M”, “H”, “V”, “W”
  - 1949-62 vintage FK oil breakers without containment
  - Fault Operations: CB K(9) CB F(1) CB M(17) CB H(16) CB V(5) CB W(1) -Recommended(10)
  - CB W is over the recommended amount of switching operations.



AEP Transmission Zone: Supplemental Western Marion Area Improvements

Need Number: AEP-2018-IM017
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs meeting 1/11/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Deer Creek – Miller Ave 34.5kV (6.1 Miles)

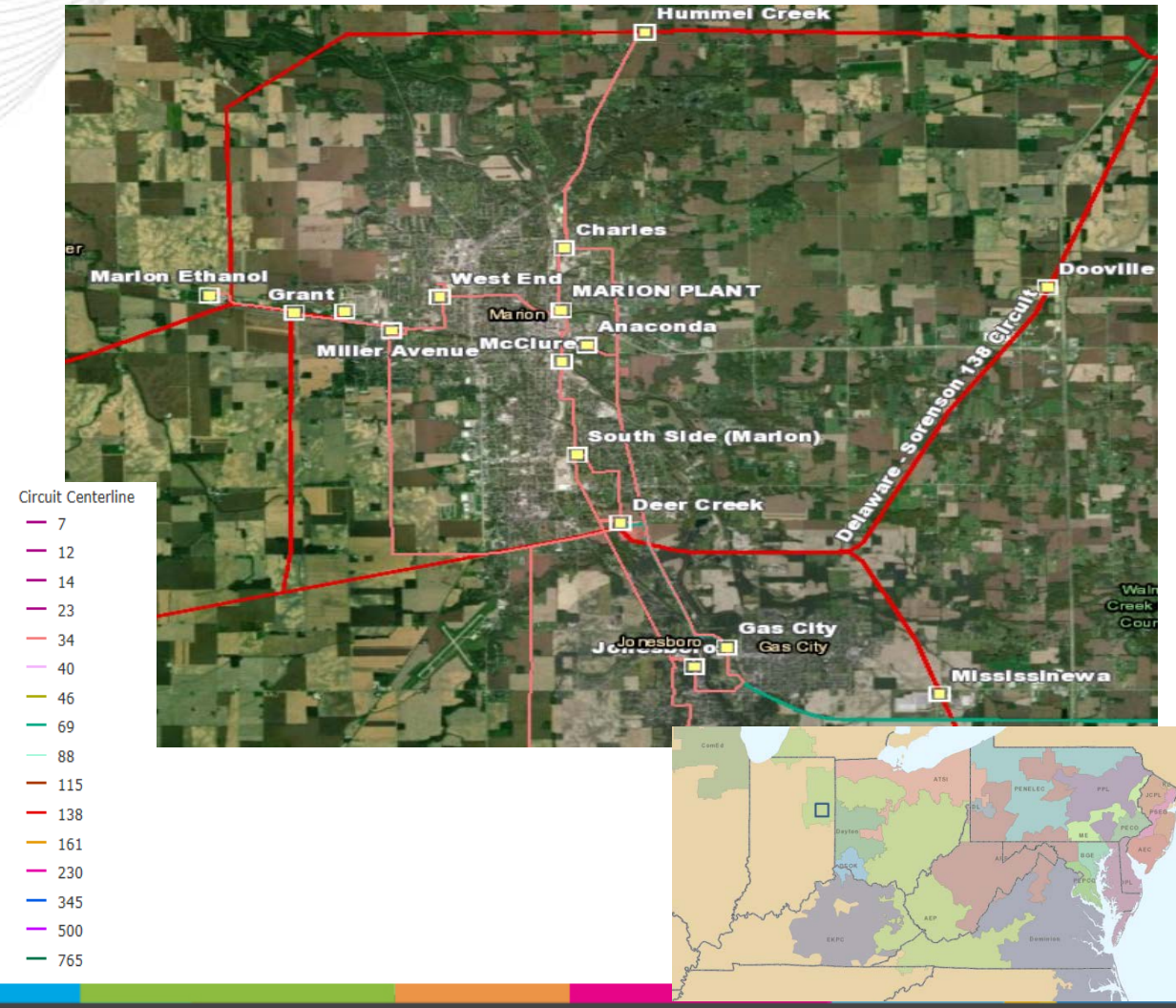
- 1952 wood crossarm construction (age based on age of station)
- 3/0 copper
- Subject to 15 open B conditions
- Subject to 13 open A conditions
- In the past 10 years, 37 structures have had active maintenance performed. This is expected to increase as line ages.

Grant – West End 34.5kV (2.1 Miles)

- 1950 wood crossarm construction (age based on age of West End station)
- Legacy Cap and Pin type insulators
- Subject to 5 open conditions
- In the past 10 years, has had to have 65 open conditions addressed

Deer Creek – Marion 34.5kV (3.6 Miles)

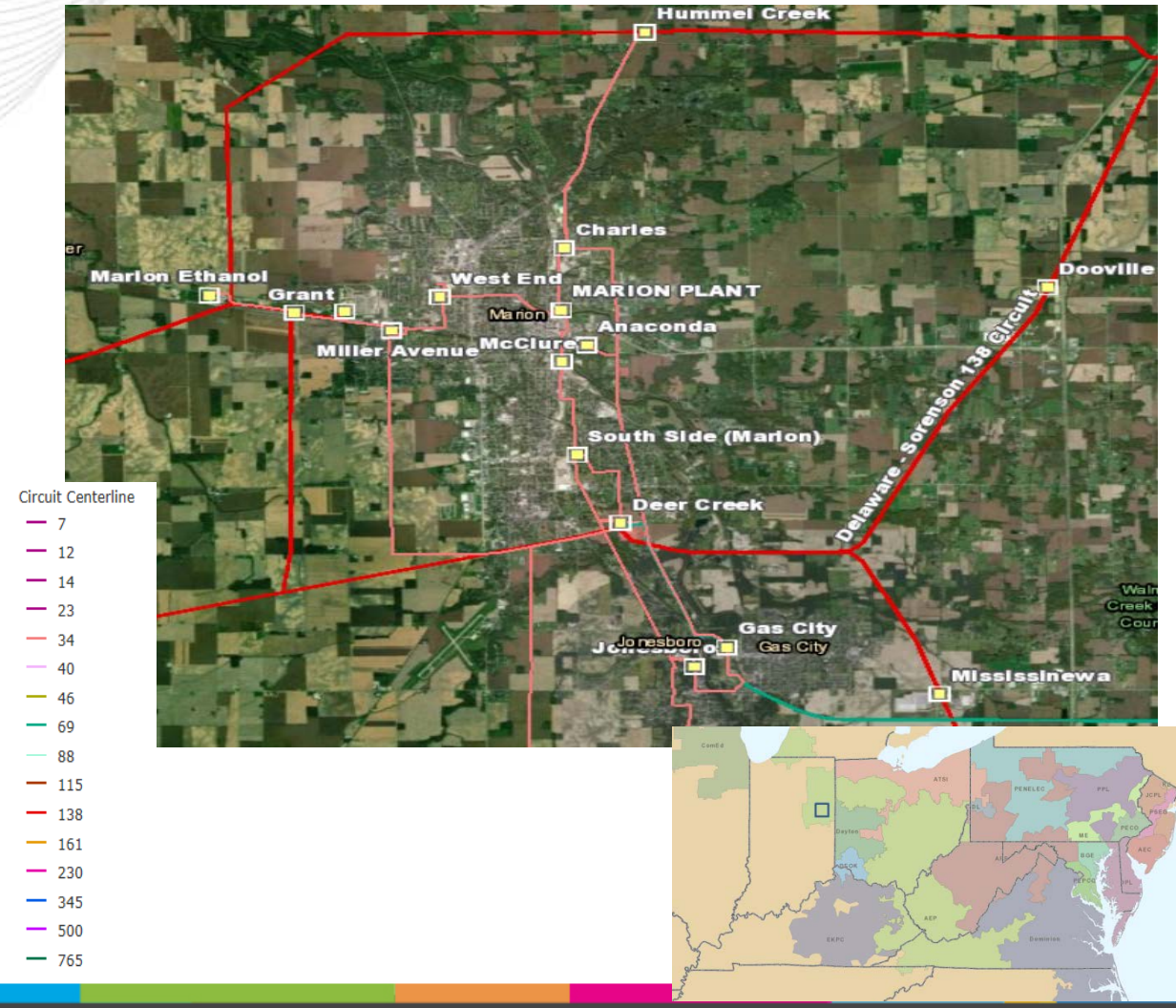
- 1949 wood crossarm construction (age based on age of Deer Creek breaker)
- Legacy Cap and Pin type insulators
- Subject to 5 open conditions
- In the past 10 years, has had to have 26 open conditions addressed



AEP Transmission Zone: Supplemental Western Marion Area Improvements

Need Number: AEP-2018-IM017
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs meeting 1/11/2019
Supplemental Project Driver: Operational Flexibility and Efficiency
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Deer Creek – Marion Plant 34.5kV

- 4 MOABs in series



AEP Transmission Zone: Supplemental Western Marion Area Improvements

Need Number: AEP-2018-IM017
Process Stage: Solutions Meeting 5/20/2019
Potential Solution:

West End – Grant 34.5kV line
Rebuild the Grant – West End 34.5kV 2.2 mile line using 556.5 ACSR
Cost: $4M

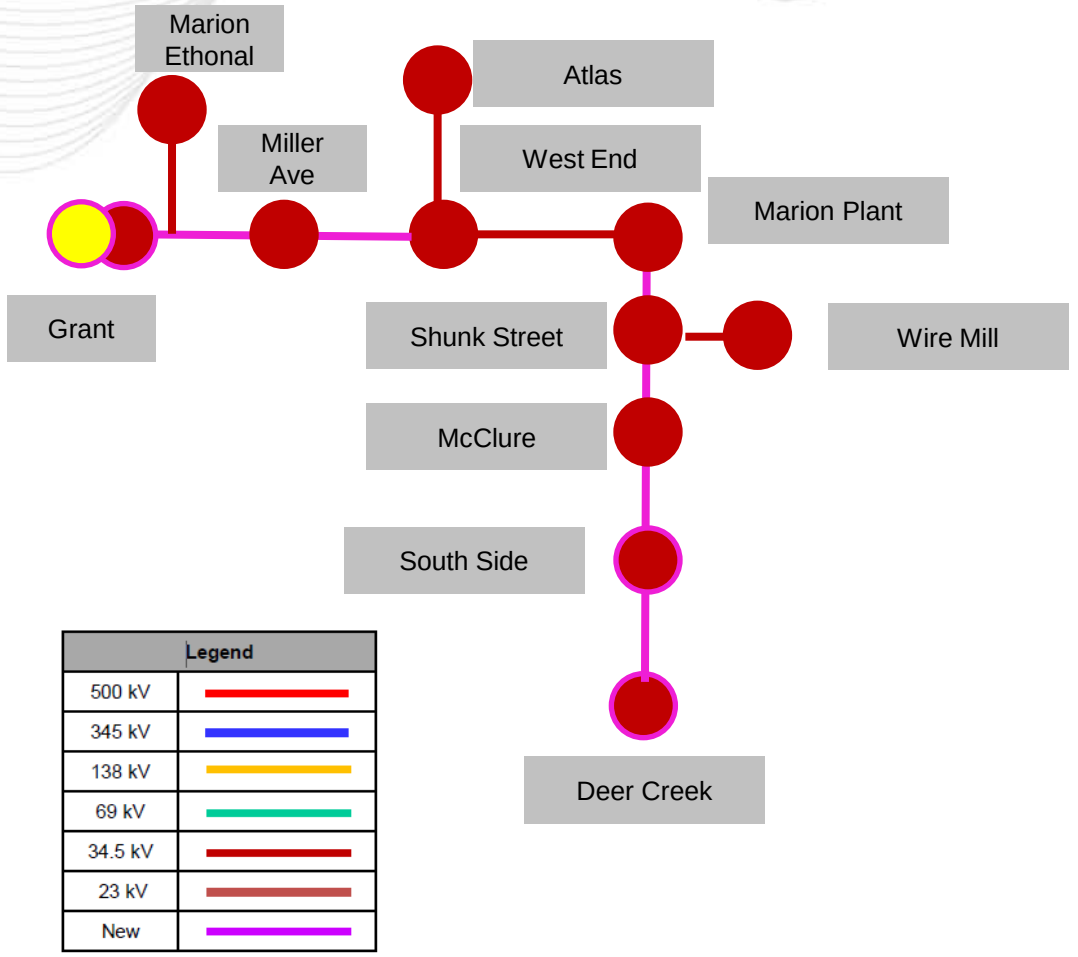
Deer Creek – Miller Ave 34.5kV line
Retire the Deer Creek – Miller Ave 34.5kV line
Cost: $0.6M

Deer Creek – Marion Plant 34.5kV line
Rebuild the Deer Creek – Marion Plant 34.5kV 3.5 mile line using 556.5 ACSR
Cost: $9M

Deer Creek East Tap 34.5kV line
Retire the Deer Creek East34.5kV line
Cost: $0.3M

Atlas Tap 34.5kV line
Re-route the Atlas Tap into West End station
Cost: $0.5M

Deer Creek 138/69/34.5kV station
Retire 34.5kV breakers 'H', 'F', 'K' and 'V'.
Retire the 34.5kV cap banks.
Install the old 69kV rated breaker "J" toward South Side station. Re-use breakers "A" and "E" from South Summitville to replace breaker "M" and "W" at Deer Creek.
Cost: $2M



AEP Transmission Zone: Supplemental Western Marion Area Improvements

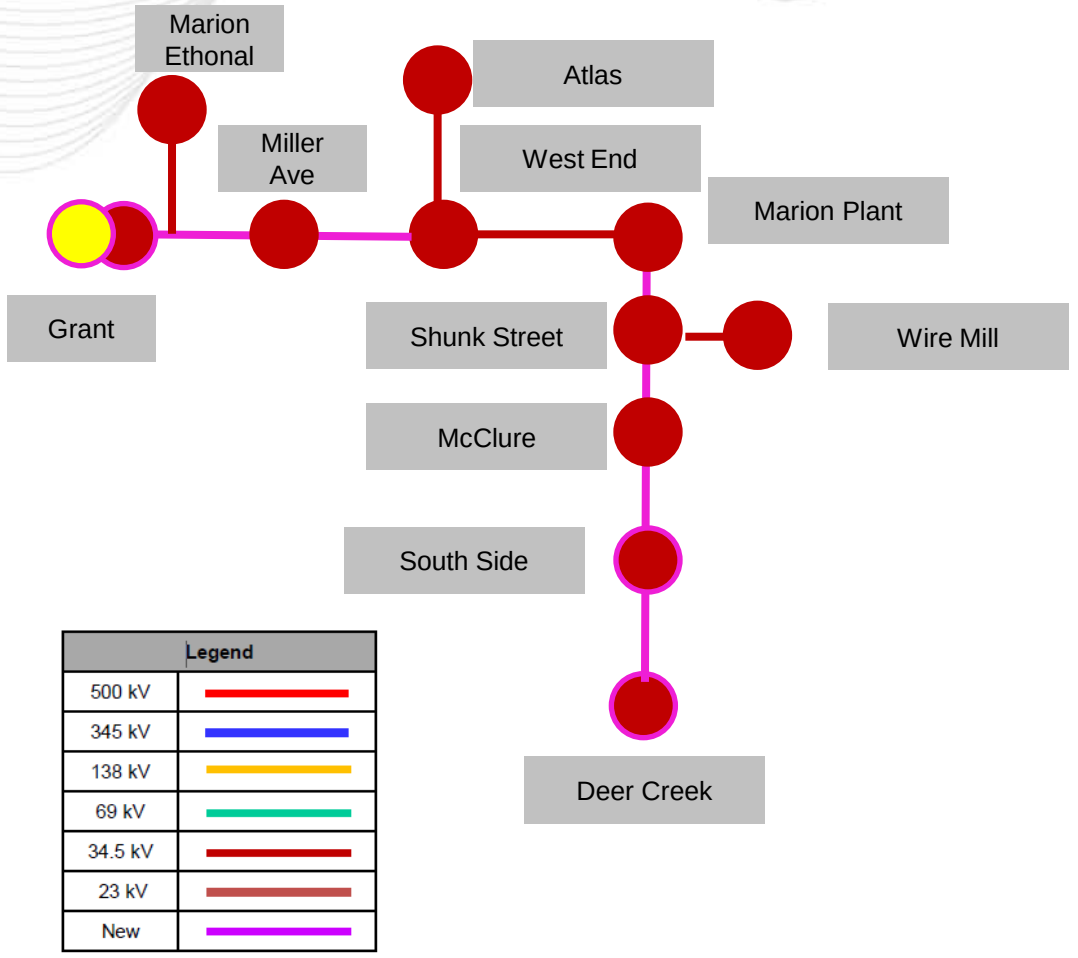
Need Number: AEP-2018-IM017
Process Stage: Solutions Meeting 5/20/2019
Potential Solution:

South Side 34.5kV station
Install a 69kV rated breaker toward Marion Plant
Cost: $1.3M

Grant 138/34.5kV station
Install a 14.4 Mvar 138kV Cap Bank at Grant station and a 138kV high side circuit switcher
Cost: $1.3M

Alternatives Considered:
No viable transmission alternatives.

Total Estimated Transmission Cost: $19.5M
Projected IS Date: 06/01/2022



AEP Transmission Zone: Supplemental
Jay – Allen Area

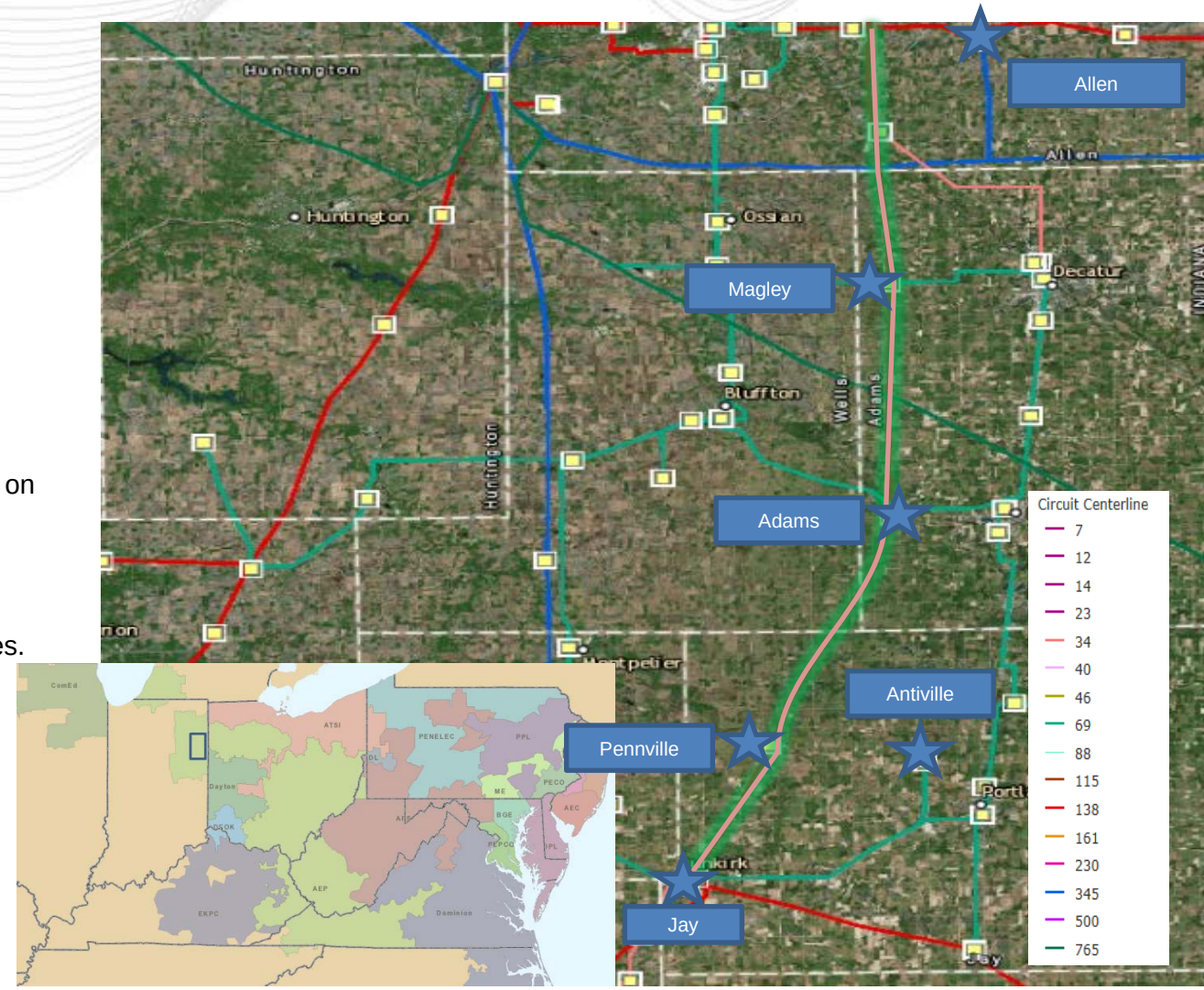
Need Number: AEP-2019-IM008
Process Stage: Solution Meeting 5/20/2019
Previously Presented: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Jay – Lincoln 138kV line

- The Jay to Lincoln Line is a 1953 wood pole, H-Frame line with 94% of its original structures.
- Currently 95 structures have at least one open condition, which relates to 22% of the structures.
- Out of the 108 open conditions relating to structure, 28 deal with the pole and crossarm specifically.
- Out of the 130 closed conditions related to structure, 85 dealt with the pole or crossarm. Due to the type of construction, we will continue to see pole and crossarm related issues on this line.
- In addition, TFS currently has 13 poles identified for replacement.

Decatur – Berne 69kV line

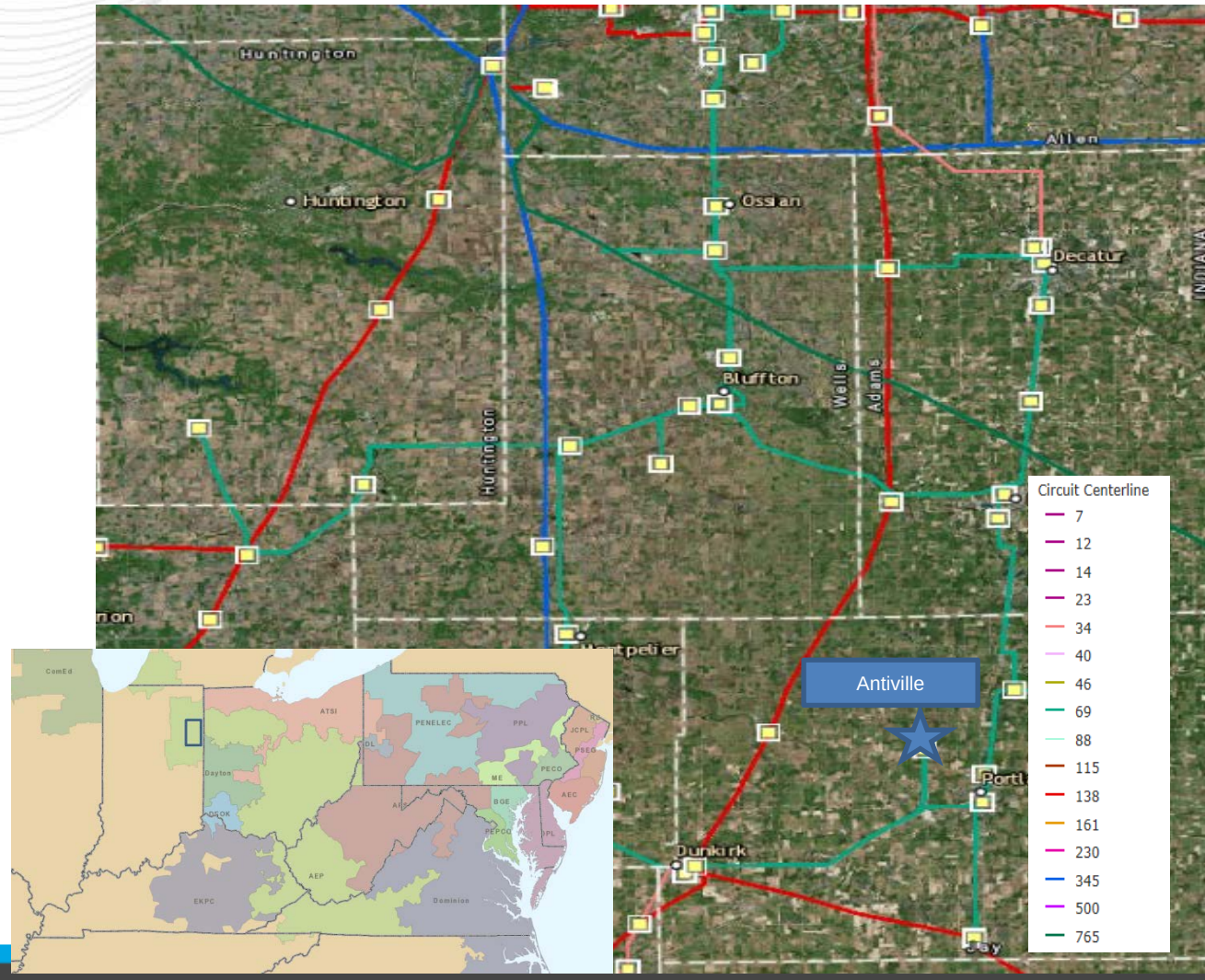
- 1966 vintage wood pole line
- This line is currently subject to 95 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.



AEP Transmission Zone: Supplemental Jay - Lincoln

Need Number: AEP-2019-IM008
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 7)
Problem Statement:
Antiville

- Potential economic developments have not materialized due to system load and reliability imitations.



AEP Transmission Zone: Supplemental Jay-Allen Area

Need Number: AEP-2019-IM008
Process Stage: Solution Meeting 5/20/2019
Potential Solution:

Antiville 69kV station
Rebuild the station's throughpath to allow for connection to the new Jay – N. Portland 69kV line.
Cost: $0.4M

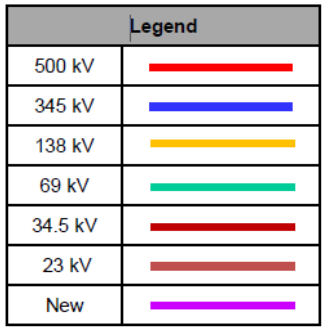
Antiville 69kV Tap
Retire the 69kV Antiville radial tap line.
Cost: $0.3M

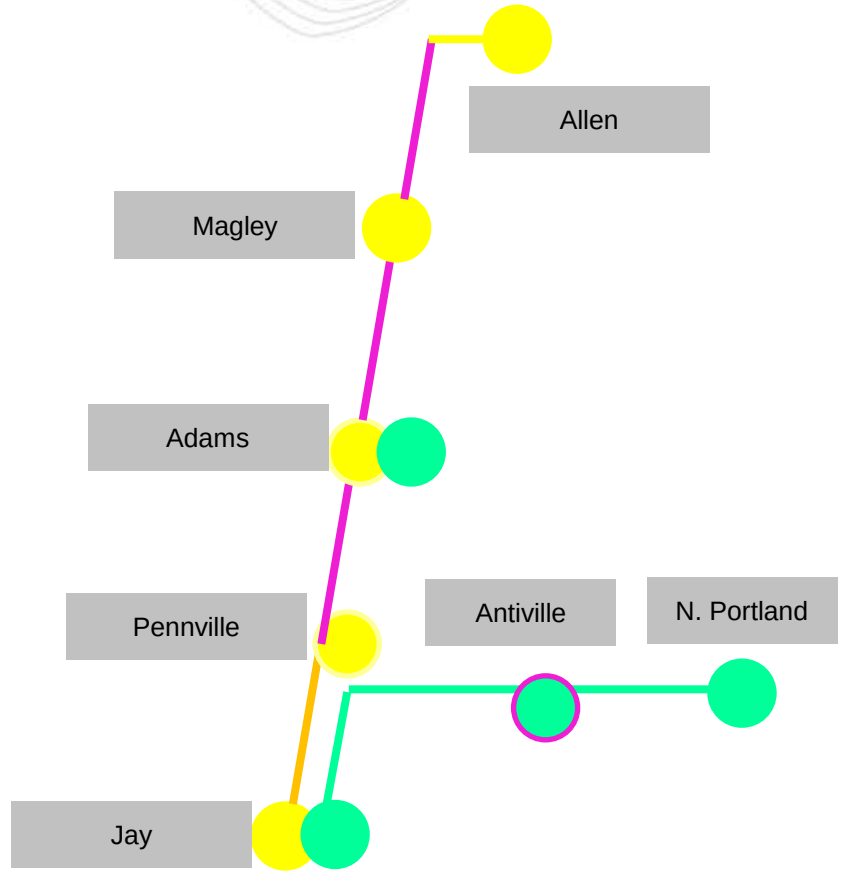
Pennville – Allen 138kV line:
Rebuild the ~38.5 mile Jay – Allen 138kV line from Pennville to the juncture west of Allen station. This line is a single circuit 138kV line using 795 ACSR
Cost: $70.3M

Total Estimated Transmission Cost: $71.0M

Projected IS Date: 06/01/2022

NOTE: The need for Decatur – Berne 69kV line is solved by B3209





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

5/10/2019 – V1 – Original version posted to pjm.com

5/13/2019 – V2 – Update footers for all slides

– Slide #26, Change Need Meeting Date to 3/25/2019

– Slide #40-42, Change Need Meeting Date to 1/11/2019

– Slide #29,30,34,35, Change Solution Meeting Date to 5/20/2019

5/15/2019 – V3 – Slide #28, update the problem statement for Delaware Station

– Slide #28, update the solution description for Delaware Station

– Slide #30, Add note

5/16/2019 – V4 – Slide #25, update the problem statement

– Slide #47, Add note

5/17/2019 – V5 – Slide #21, update map and change Monroe – Reusens to Monroe – Amherst, change Amherst –Monroe to Reusens - Monroe

5/22/2019 – V6 – Slide #14, Add age profile in the Problem Statement