



An AEP Company

BOUNDLESS ENERGY™

SRRTEP Committee Western AEP Supplemental Projects

September 25, 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

AEP Transmission Zone: Supplemental Buffalo, WV

Need Number: AEP-2019-AP033

Process Stage: Needs Meeting 9/25/2019

Process Chronology: Needs Meeting 9/25/2019

Supplemental Project Driver: Customer Service

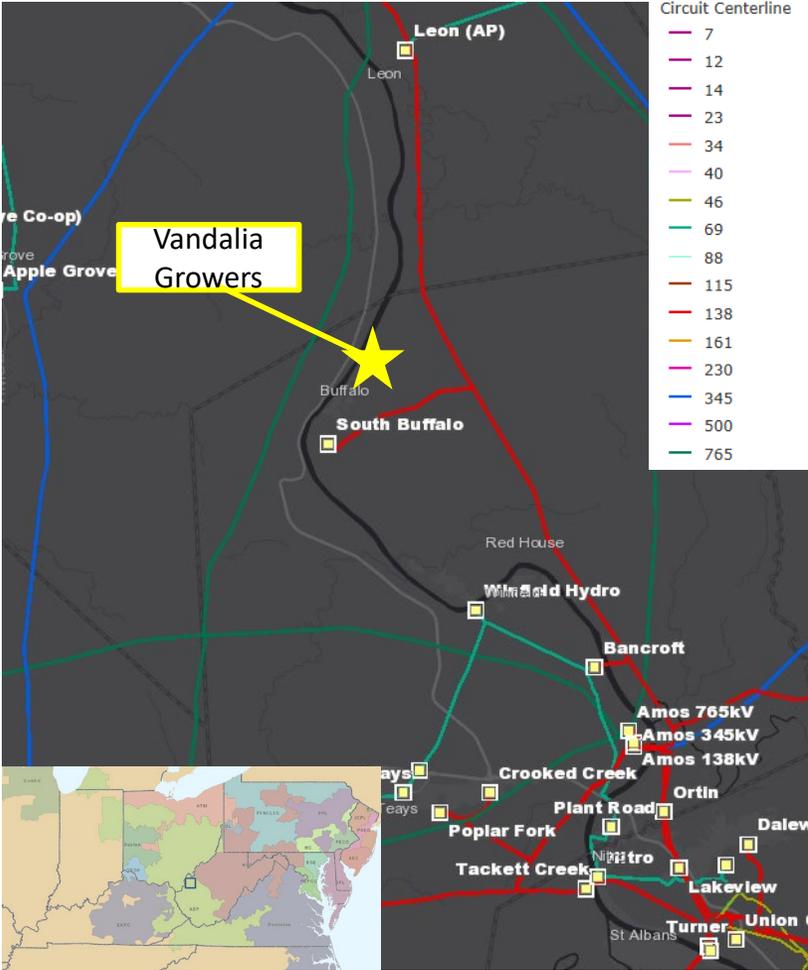
Specific Assumption References: AEP Connection

Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

Vandalia Growers has requested a new delivery point located near Buffalo, West Virginia. The projected peak load is 60 MVA.

Model: 2024 RTEP



AEP Transmission Zone: Supplemental Grayson County, VA

Need Number: AEP-2019-AP034

Process Stage: Needs Meeting 9/25/19

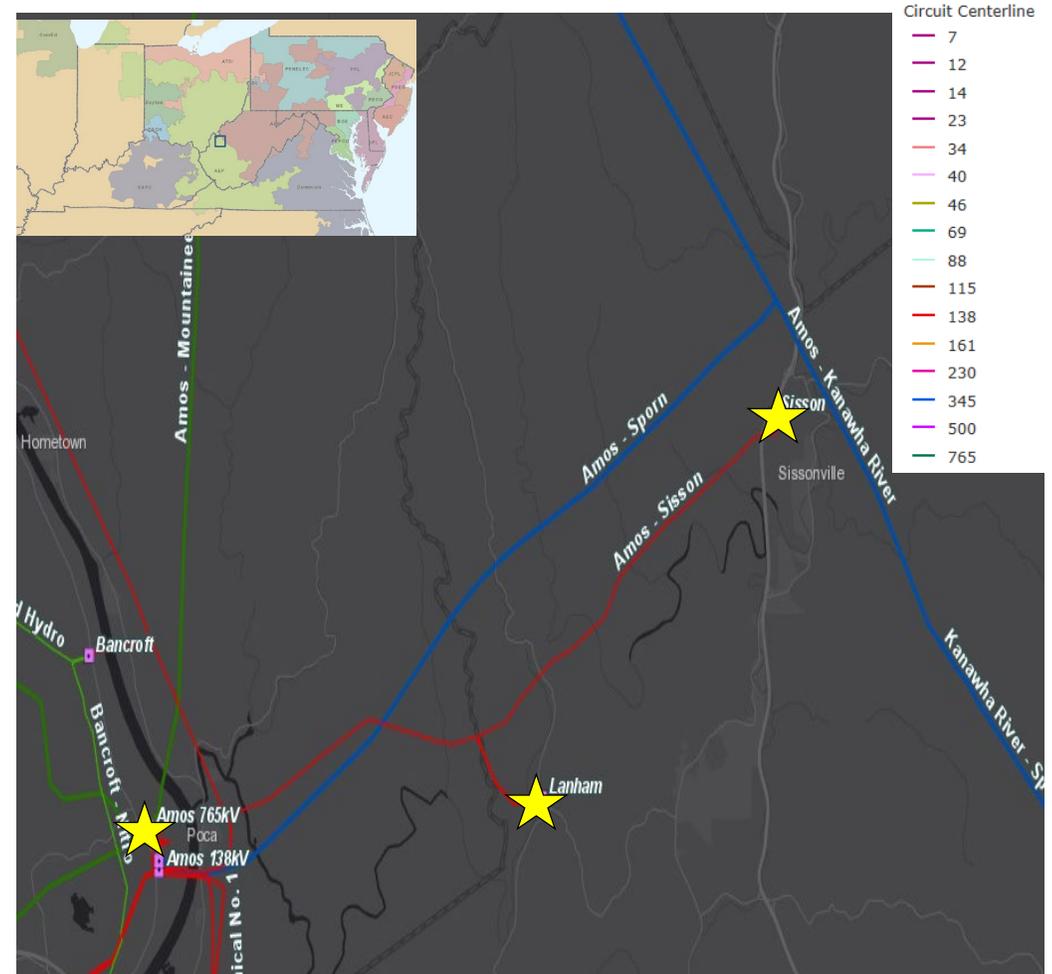
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

The Amos – Sisson 138 kV line is a 16 mile long radial line and maintenance cannot be performed due to length of outages required. Approximately 18 MVA is served out of Lanham and 25 MVA is served out of Sisson during winter peak conditions and will be dropped for outages on this circuit. Customers served out of the area are concerned and are requesting that we take necessary steps to ensure reliability.

Model: N/A



AEP Transmission Zone: Supplemental Kenna, WV

Need Number: AEP-2019-AP035

Process Stage: Needs Meeting 9/25/2019

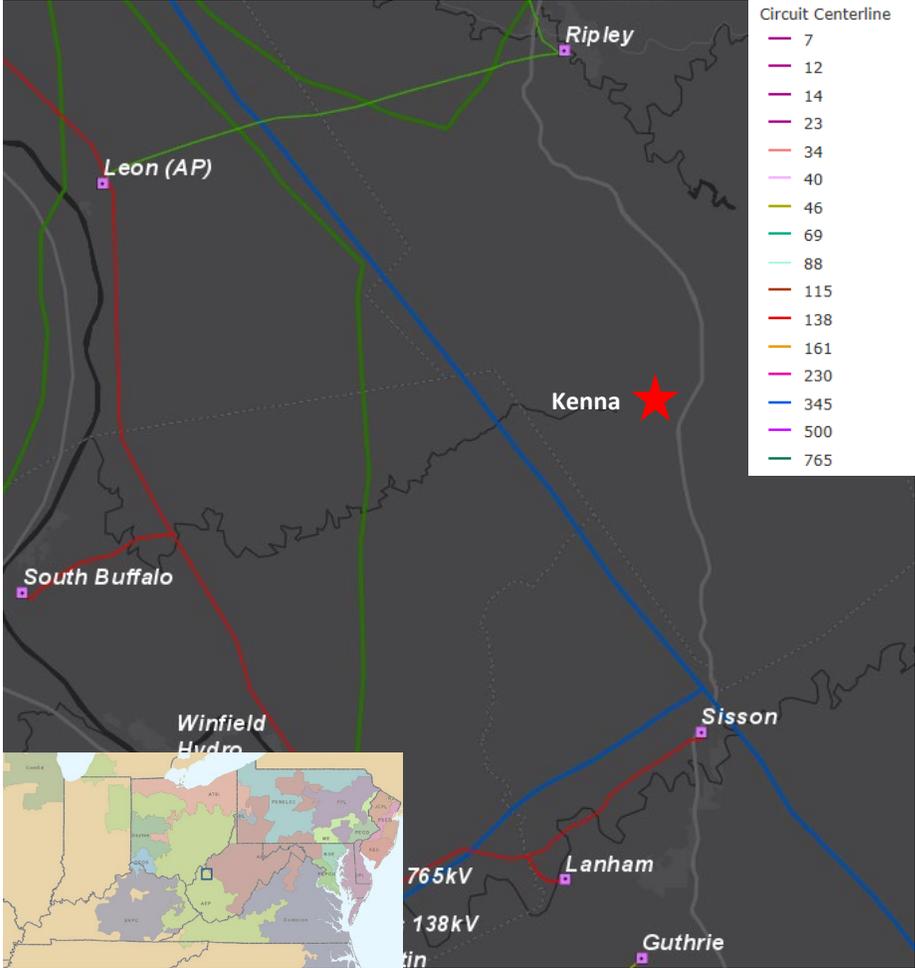
Supplemental Project Driver: Customer Service

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

Problem Statement:

APCO Distribution has requested a new distribution station located in Kenna, West Virginia. Winter projected load 18 MVA.

Model: 2024 RTEP



AEP Transmission Zone: Supplemental Patrick County, VA Area

Need Number: AEP-2019-AP036

Process Stage: Needs Meeting 9/25/19

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

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

Problem Statement:

The Floyd-Stuart 69 kV circuit (21.0 mi.) was originally built in 1939 consisting of wood pole structures and predominately 4/0 ACSR 4/1 overhead conductor. 88% of the wood poles are 1939 vintage. Core drilling shows significant loss of material in wood poles due to decay and woodpeckers. The overhead conductor and shield wires are greater than 65 years old, exceeding the recommended lifespan of these components. Between January 2014 and March 2019, 9 momentary and 2 permanent outages have occurred on this circuit. There are 52 open conditions mainly from woodpecker and wood rot.

Model: N/A



AEP Transmission Zone: Supplemental Patrick County, VA Area

Need Number: AEP-2019-AP037

Process Stage: Needs Meeting 9/25/19

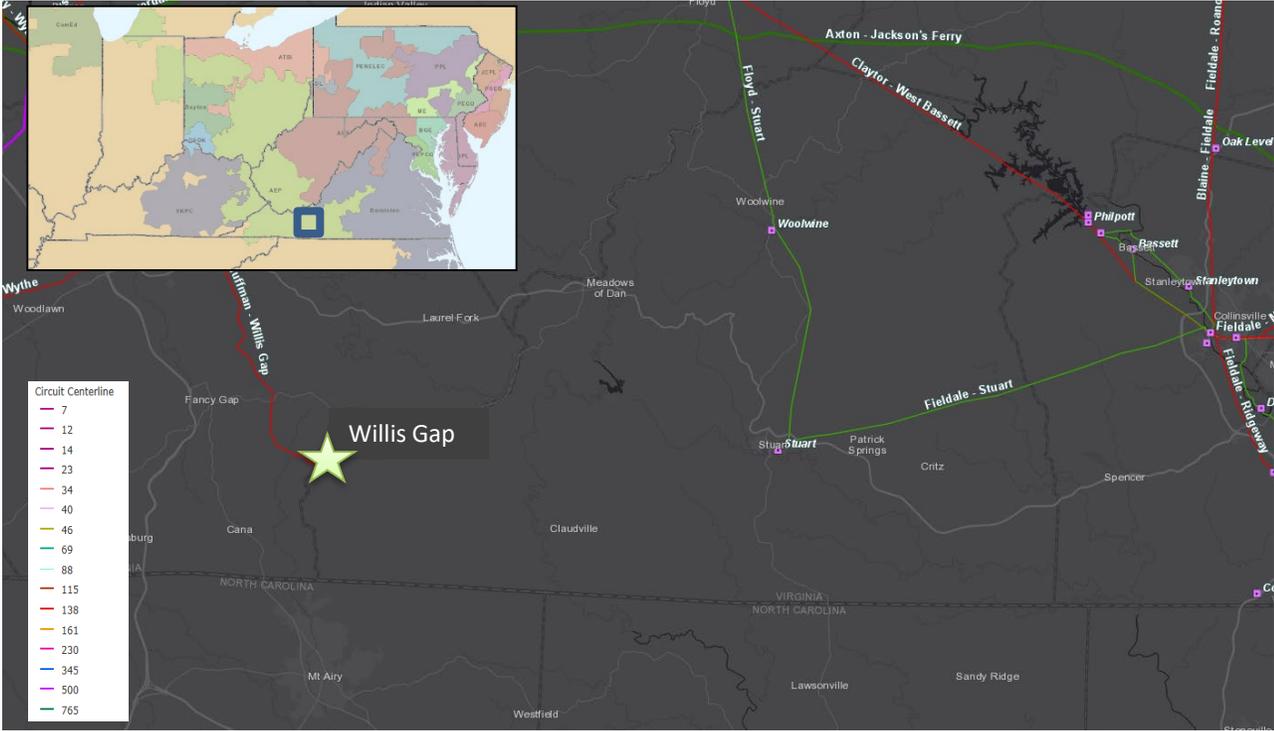
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Willis Gap station is served via a radial 14.5 mile, 138 kV line from Huffman Station and serves approximately 25 MVA of peak load. AEP is unable to take any outages of this circuit to perform necessary maintenance. Customers served in the area are concerned and are requesting that we take necessary steps to ensure reliability.

Model: N/A



AEP Transmission Zone: Supplemental Patrick County, VA Area

Need Number: AEP-2019-AP038

Process Stage: Needs Meeting 9/25/19

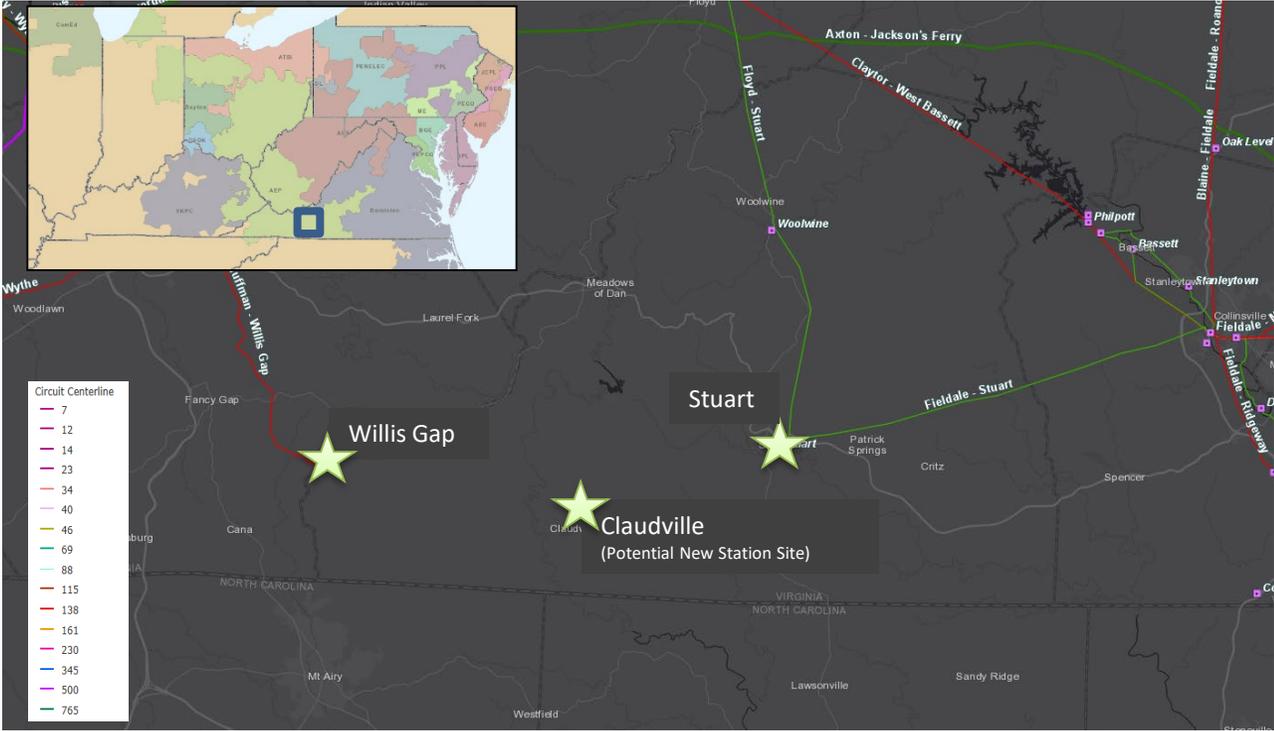
Supplemental Project Driver: Customer Service

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

Problem Statement:

Distribution has requested the need for a new Claudville Station located between the existing Willis Gap and Stuart stations in order to decrease the exposure to lengthy 34.5 kV distribution circuits fed from Willis Gap and Stuart stations. A new distribution station source will allow for the opportunity to establish two new 34.5 kV feeders by splitting up the Willis Gap/Ararat (174 line miles) and the Stuart/Carroll (267 line miles) distribution feeders. The Willis Gap 138/34.5 kV #1 distribution transformer is projected to be loaded to 28.4 MVA, or 101% of its 28.0 MVA capability by winter 2022-23.

Model: 2024 RTEP



AEP Transmission Zone: Supplemental Botetourt County, VA Area

Need Number: AEP-2019-AP039

Process Stage: Needs Meeting

Needs Presented: 9/25/19

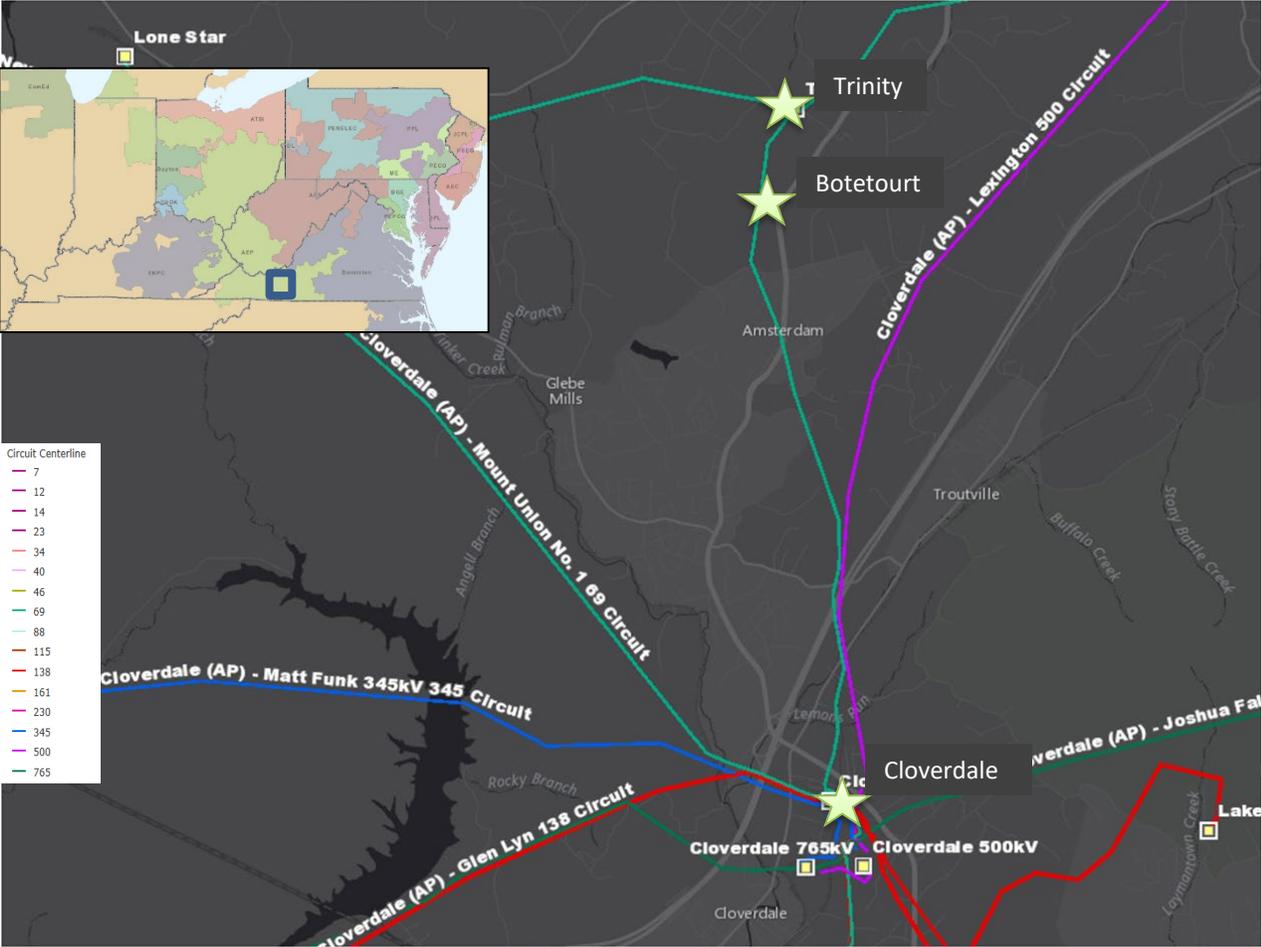
Supplemental Project Driver: Customer Service

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

Problem Statement:

Distribution requested a new station (Botetourt) south of Trinity Station to serve load currently fed from Trinity Station in order to prevent future thermal overload of the Trinity/Greenfield distribution feeder and the Trinity 138/12 kV #1 distribution transformer during projected peak loading conditions in 2022. Additional load growth in the area is also expected due to new industrial and commercial customers.

Model: 2024 RTEP



AEP Transmission Zone: Supplemental Roanoke, VA

Need Number: AEP-2019-AP040

Process Stage: Needs Meeting 9/25/19

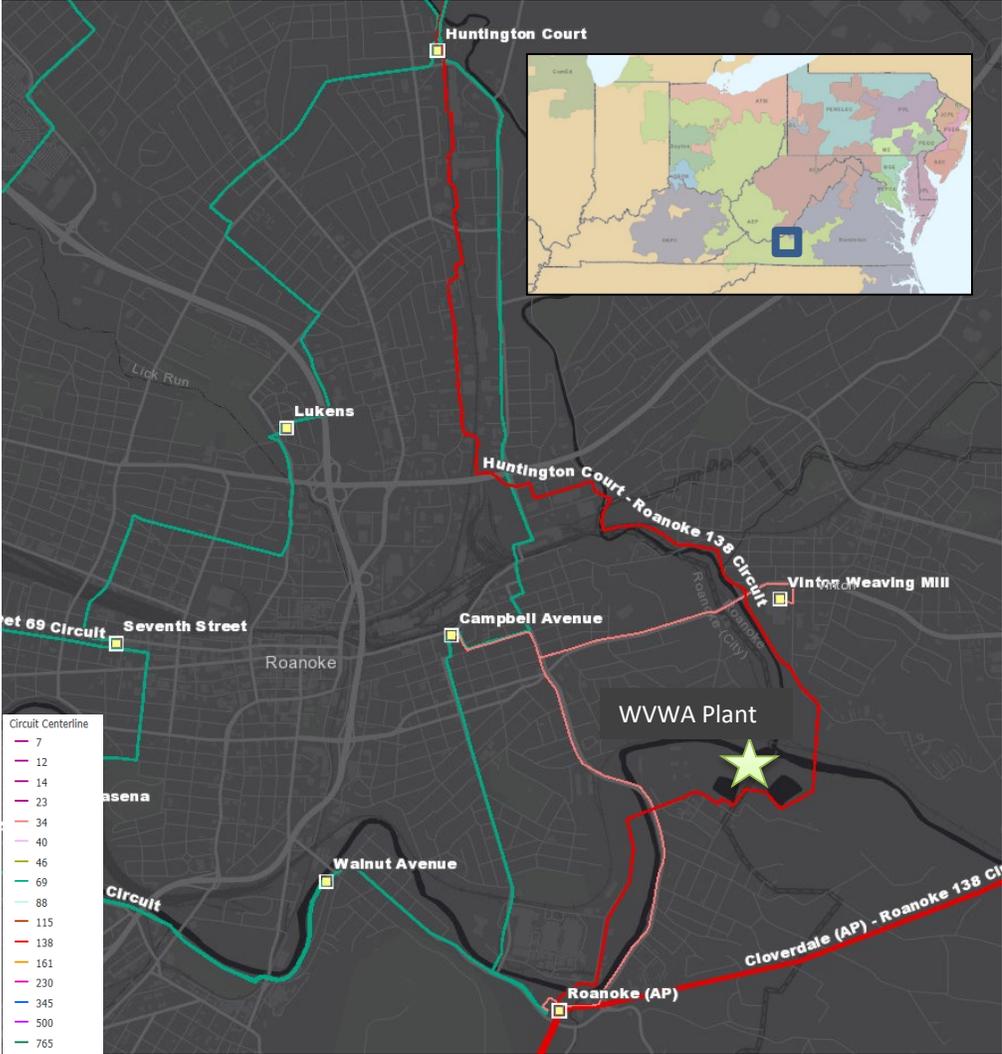
Supplemental Project Driver: Customer Service

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

Problem Statement:

Western Virginia Water Authority (WVWA) requested Transmission 138 kV service from AEP to serve approximately 7 MVA

Model: 2024 RTEP



AEP Transmission Zone M-3 Process South Bend, Indiana

Need Number: AEP-2019-IM034

Process Stage: Needs Meeting 09/25/2019

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

West Side 138kV Station

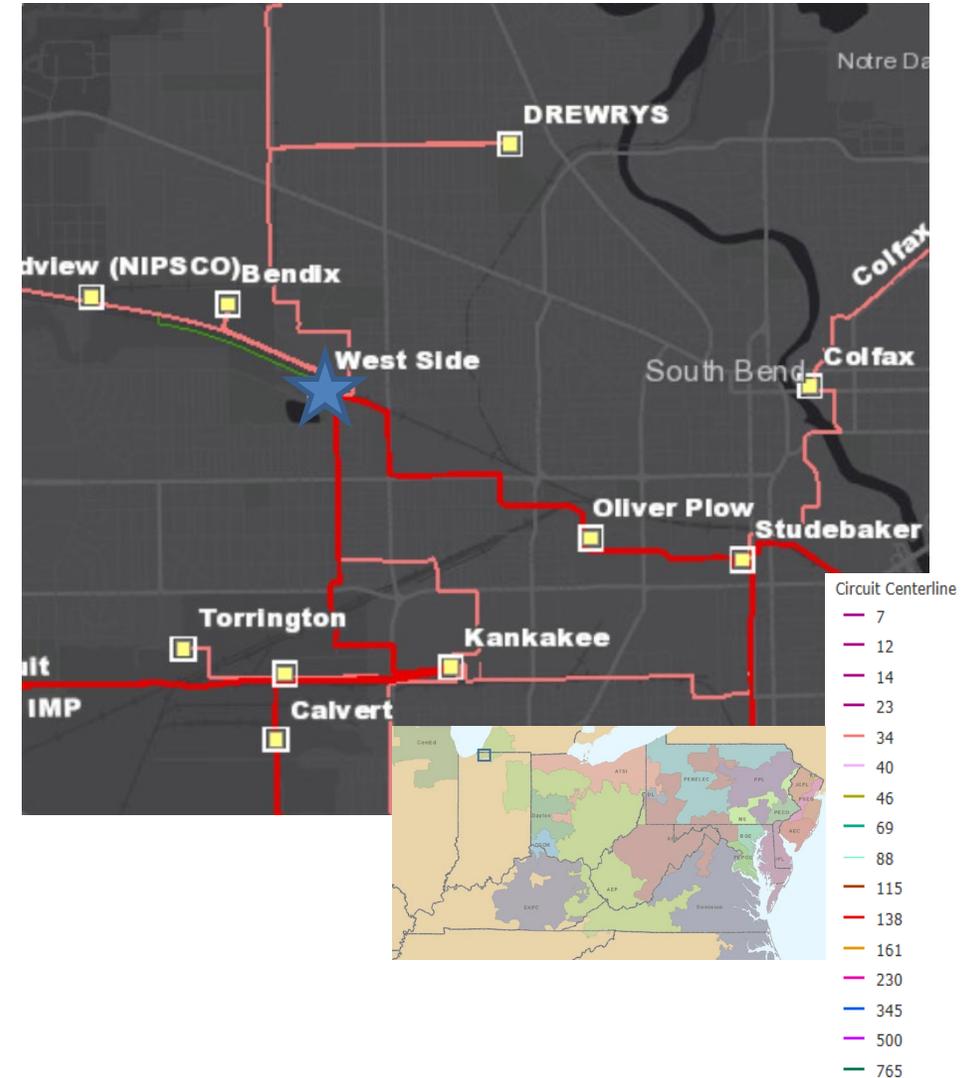
Three terminal line

Three-terminal lines are very challenging to protect/coordinate and mis-operation or switching error become much more significant.

Bus Tie Switch between the distribution transformers

Bus Tie Switch when operated without de-energizing the whole bus jeopardizes the Bus Differential Protection.

With no Bus Differential Protection the correct interrupting device wouldn't operate during fault scenarios, this can be dangerous for people working in the station.



AEP Transmission Zone M-3 Process Ross County, Ohio

Need Number: AEP-2019-OH049

Process Stage: Need Meeting 09/25/2019

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

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

Problem Statement:

- South Central Power is requesting a new 69 kV delivery point at Paint Creek to alleviate several highly loaded distribution circuits out of SCP's Anderson & Budd Co. stations.
- Peak load: 12MW (Winter)
- Requested ISD September 1, 2020

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Zanesville, OH

Need Number: AEP-2019-OH051

Process Stage: Need Meeting 09/25/2019

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

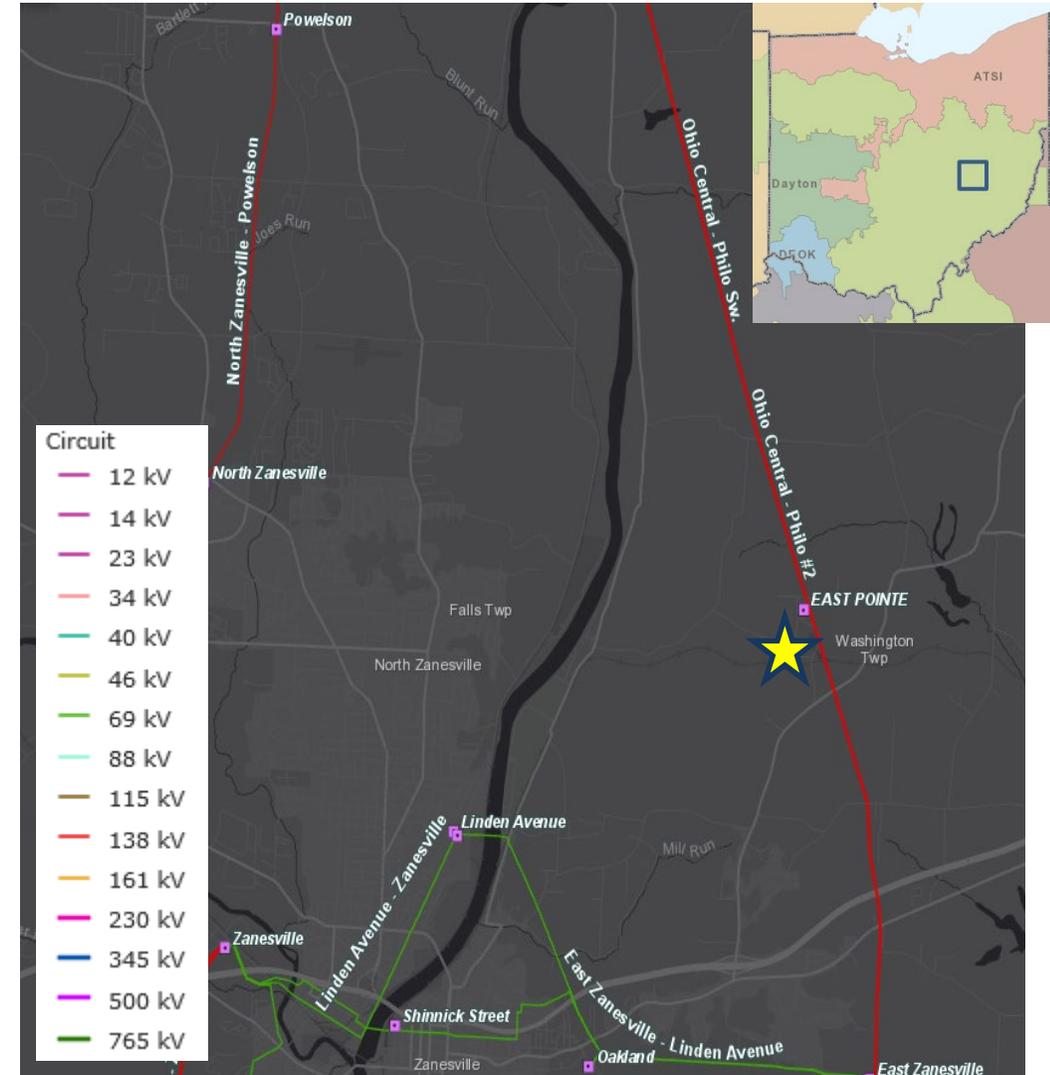
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

Customer Service:

- Peak load: 30MW
- A customer has requested new service on the Ohio Central – Philo #1 138 kV circuit.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Wood County, Ohio

Need Number: AEP-2019-OH052

Process Stage: Need Meeting 9/25/2019

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

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs

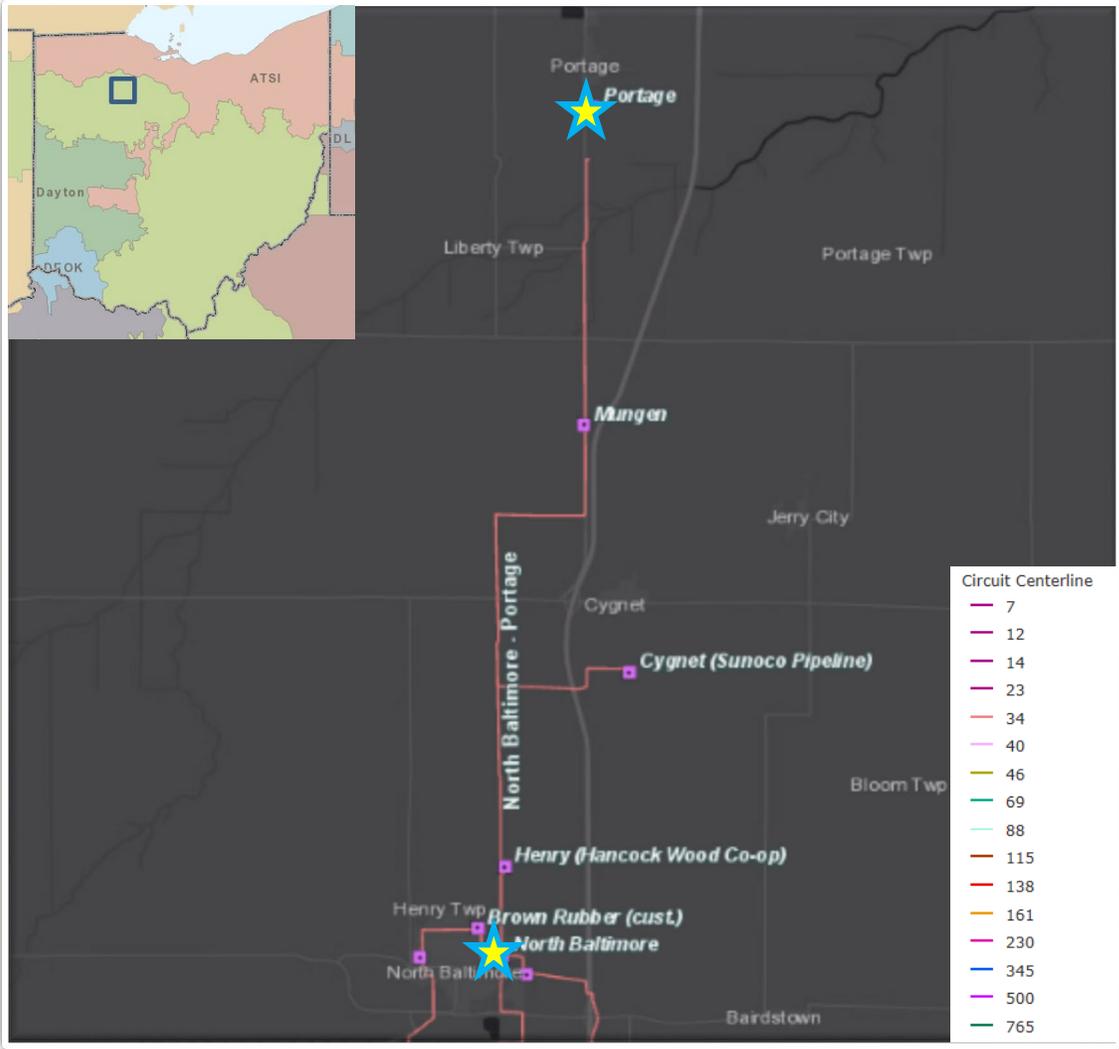
Problem Statement:

North Baltimore – Portage 34.5kV (1921)

- Length: 10.00 Miles
- Original Construction Type: Wood
- Conductor Types: 1/0 ACSR 6/1 (40%), 4/0 ACSR 6/1 (20%), 4/0 Copper 7 (30%), & 556,500 CM (10%)
- Momentary/Permanent Outages: 11 (last 5 years)
- CMI: 26,572 (AEP only)
- Total structure count: 325
- Number of open conditions: 24 “A” Conditions & 53 “B” Conditions
 - Open conditions include: (Damaged Insulators, Broken Shield Wires, Pole Rot, & Cracked Guys.)
- Unique structure count with open conditions: 55

Additional Info: Portage is radially fed from AEP’s North Baltimore station, Radial service severely restricts the ability to perform routine maintenance and restoration activities. The maintenance of radial transmission lines often requires costly temporary facilities or other labor-intensive measures involving energized work because a maintenance outage to such radial loads is generally not feasible.

Model: N/A



AEP Transmission Zone M-3 Process Findlay, Ohio

Need Number: AEP-2019-OH054

Process Stage: Need Meeting 9/25/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

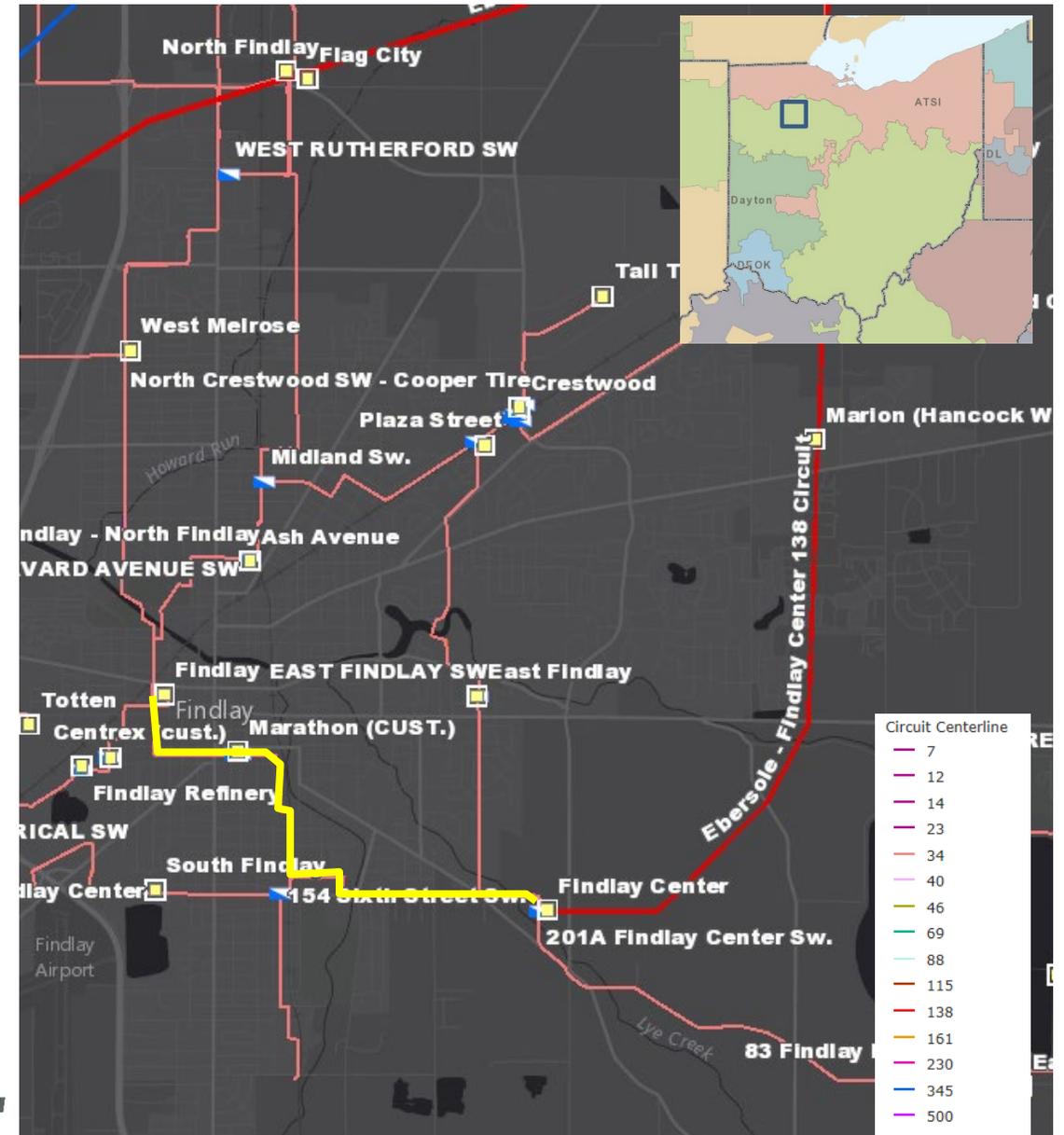
AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Findlay – Findlay Center Circuit (1934)

- Length: 3.43 miles
- Original Construction Type: Wood
- Original Conductor Type: 4/0 Copper 7
- Total structure count: 98
- Number of open conditions: 49
 - Open conditions include: damaged conductor, pole rot, insect damage, contaminated insulators
- Unique structure count with open conditions: 37
- Additional Info: N/A

Model: N/A



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 Roseville, Ohio

Need Number: AEP-2018-OH034

Process Stage: Solutions Meeting 09/25/2019

Previously Presented: Needs Meeting 10/28/2018

Supplemental Project Driver: Customer Service

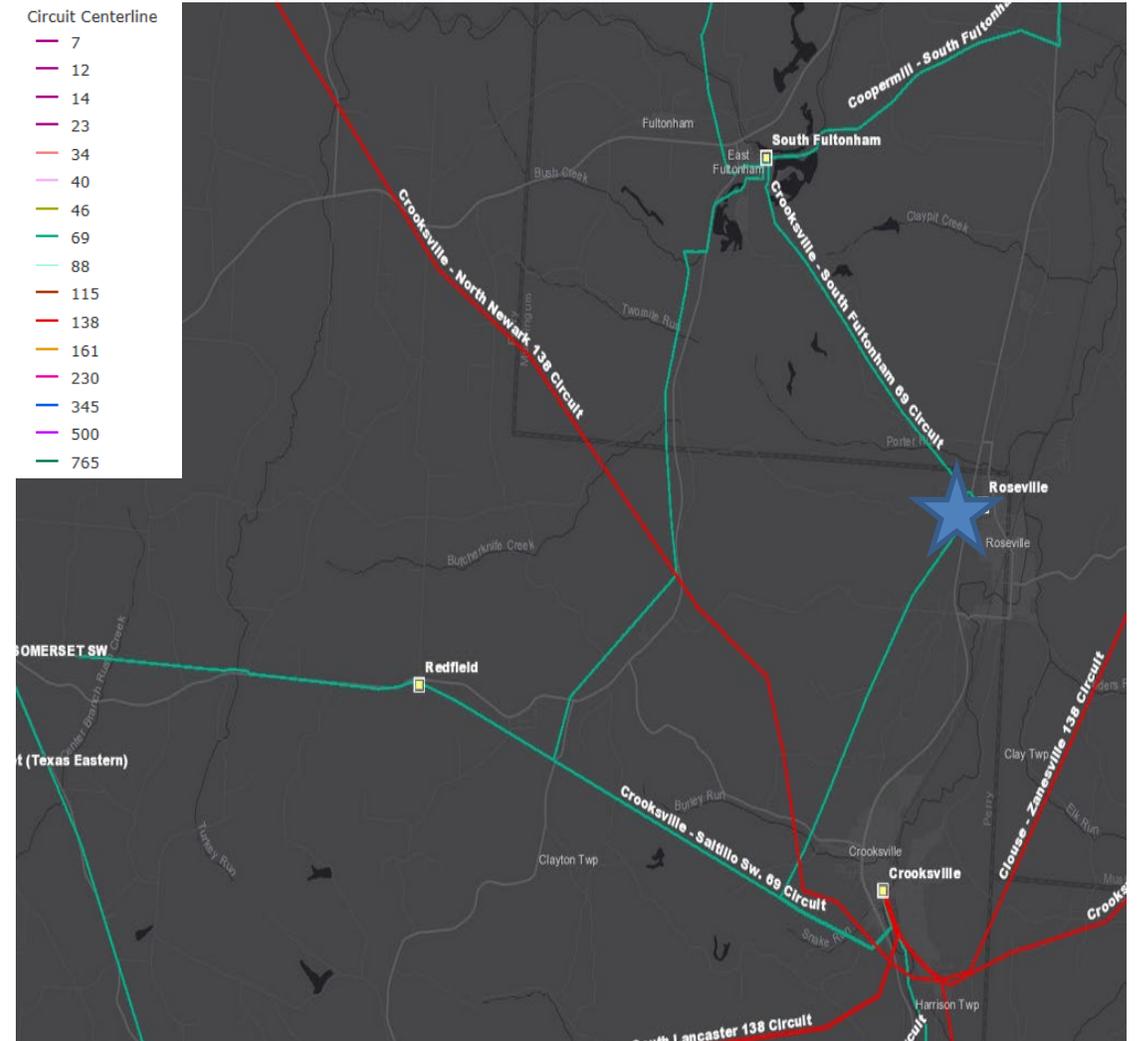
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- AEP Ohio has requested improved reliability at their Roseville 69 kV delivery point. The current load is 3.2 MVA with a projected load near 5.5 MVA. Currently for an outage at Roseville Station, the load cannot be transferred to an adjacent Station under peak conditions.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Roseville Station Upgrades

Need Number: AEP-2018-OH034

Process Stage: Solutions Meeting 9/25/2019

Proposed Solution:

- Rebuild approximately 0.5 miles of the existing West Roseville Switch - Roseville 69kV transmission tap to loop Roseville with 556.5 ACSR. **Estimated Cost: \$2.4M**
- Remove existing 69kV two way West Roseville Switch. **Estimated Cost: \$0.1M**
- Install two 2000 AMP SCADA Controlled MOAB's inside Roseville station. **Estimated Cost: \$1.0M**

Total Estimated Transmission Cost: \$3.5M

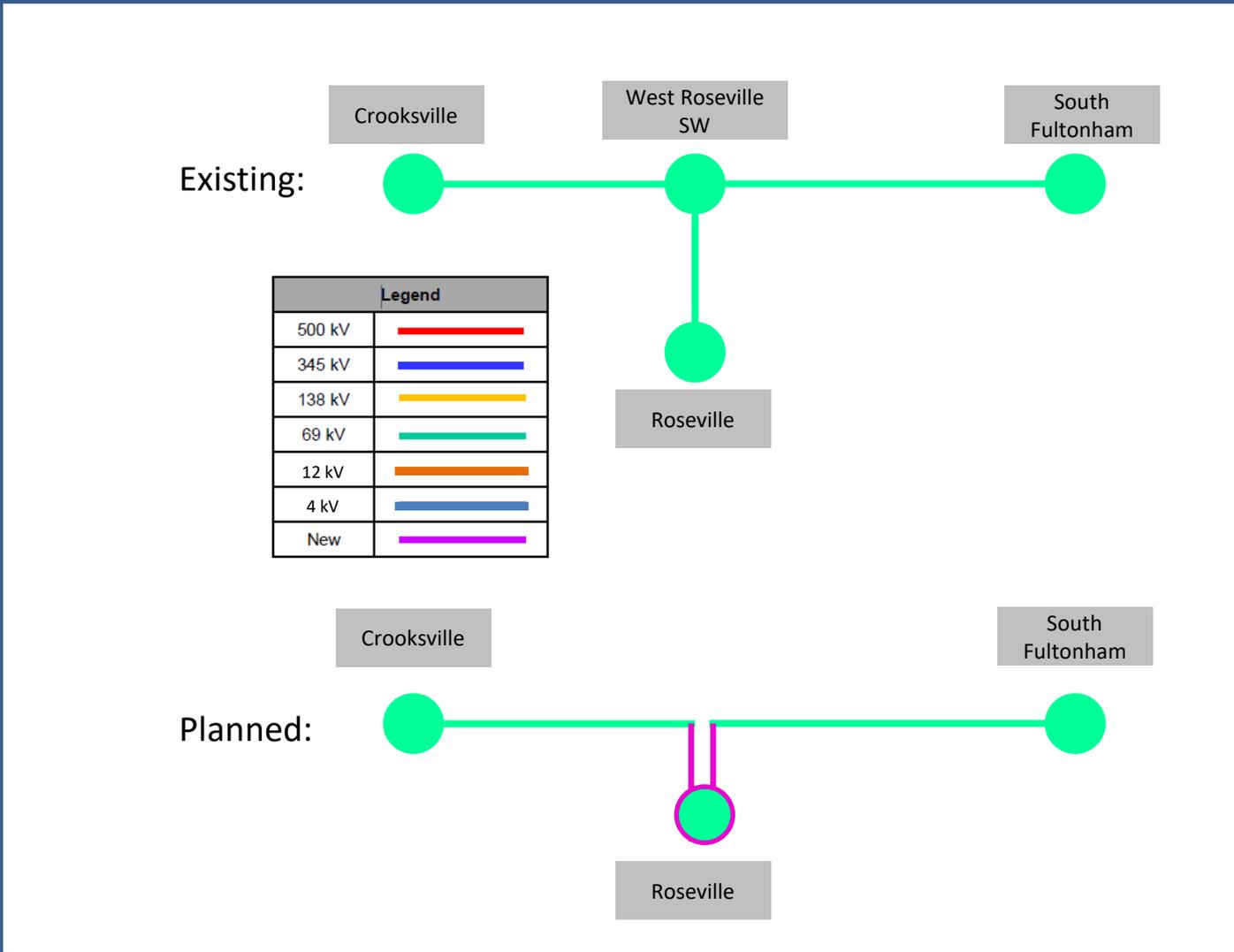
Ancillary Benefits: Improved reliability for AEP Ohio as requested.

Alternatives Considered:

Replace the West Roseville 69 kV Switch with a three way phase over phase switch. This solution would expose AEP Ohio to long outages during installation and for future maintenance of the switch. This load could not be transferred during peak conditions. Cost: \$1.05M

Projected In-Service: 4/19/2021

Project Status: Scoping



AEP Transmission Zone M-3 Process Bluffton Area Improvement Project

Need Number: AEP-2018-OH033

Process Stage: Solutions Meeting 09/25/2019

Previously Presented: Needs Meeting 1/11/2019

Supplemental Project Driver: Equipment/Material/Condition/Performance/Risk, Operational Flexibility and Efficiency.

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Equipment Material/Condition/Performance/Risk:

AEP's North Woodcock 138/69/34.5 kV, 50 MVA Transformer #1 (1966 vintage) is recommended for replacement due to dielectric strength breakdown, short circuit strength breakdown, and bushing damage. The 1200A/21kA, 69kV CB "A" (1966 vintage) and the 1200A/17kA, 34.5kV CB "E" (1952 vintage), are in need of replacement due to bushing damage, excess numbers of fault operations (143), and a lack of spare part availability.

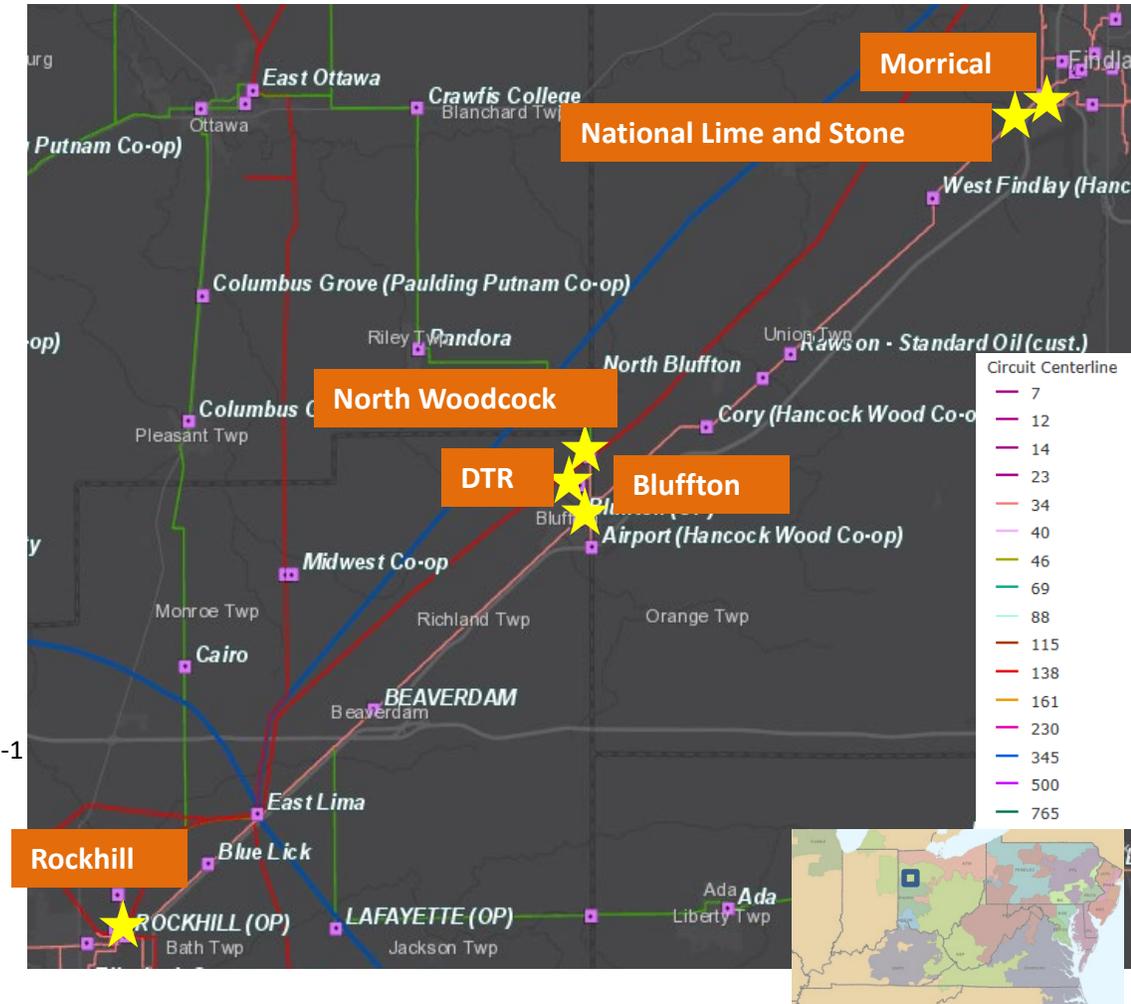
The Bluffton – Str. 97 line section (~10 miles) of the Bluffton – Rockhill 34.5 kV line (~14 miles) has 35 open conditions. Most of the wood poles on this circuit are pre 1980-vintage. This line has experienced 1 momentary and 1 permanent outages in the last 10 years. 0.93 miles of this 34.5 kV line section between Hancock Wood Airport Delivery Point - Bluffton Station is nearing it's thermal capacity under N-1-1 conditions.

The Morrillal – N. Woodcock 34.5 kV line has 77 open conditions. Half of the wood poles on this circuit are pre-1980 vintage. This line has experienced 16 momentary and 3 permanent outages in the last 10 years. The 0.64 mile 34.5 kV line section between Bluffton Station - Woodcock Switch is nearing it's thermal capacity under N-1-1 conditions.

Operational Flexibility and Efficiency:

Bluffton Sw 34.5 kV is currently N.O. (towards Woodcock). This switch is open to prevent thermal overloads on the 34.5 kV system (~17 miles) under N-1-1 conditions.

Hard taps currently exist for customers at both DTR and National Lime and Stone. Hard taps limit sectionalizing and often cause misoperations and over tripping



Need Number: AEP-2018-OH033

Process Stage: Solutions Meeting 09/25/2019

Potential Solution:

Build a new Boutwell 138/69/34.5kV Station as a three breaker ring bus cutting into the East Lima – New Liberty 138kV circuit. Install 138/69/34.5 90 MVA transformer. Install low side 69 kV bus and line breaker to feed line towards Lancers switch. **Estimated Cost: \$11.6M**

Cut in the East Lima-New Liberty 138 kV circuit and build to the new Boutwell station: **Estimated Cost: \$2.7M**

Construct a new 3.75 mile single circuit 69kV (34.5kV operated) line using 556 ACSR conductor connecting the Hancock Wood Airport delivery point with the new Boutwell Station. **Estimated Cost: \$8.1M**

Construct 1.5 miles of greenfield single circuit 69kV (34.5kV operated) line using 556 ACSR conductor from North Woodcock to the South Mt Cory – Woodcock Sw 69 kV line (34.5 kV Operated). **Estimated Cost: \$3.3M**

Rebuild the 1.7 mile, 34.5 kV line from Woodcock Sw to Bluffton to Airport as single circuit 69kV (34.5kV operated), using 556 ACSR conductor. **Estimated Cost: \$4.8M**

Rebuild 1.3 mile of existing 34.5 kV line as double circuit 69kV line to loop Beaverdam station into the Dolahard – East Lima 69kV circuit, using 556 ACSR conductor. **Estimated Cost:\$4.6M**

Retire portions of 34.5 kV line between Blue Lick & Beaverdam and Woodcock Sw & South Mt Cory buses. (12.3 miles) **Estimated Cost:\$11.4M**

At North Woodcock station, replace 138/69/34.5 kV transformer #1 with a new 90MVA bank. 138 kV circuit breakers (3000A 40 kA) will be installed on the line towards East Lima and the high side of transformer #1. 69 kV circuit breaker A will be replaced with a new 69 kV breaker (2000A, 40 kA). 34.5 kV circuit breaker E will be replaced with a new 69 kV circuit breaker E (2000A, 40 kA), operated at 34.5 kV. New 69 kV circuit breaker (2000A, 40 kA), operated at 34.5 kV, will be installed on the Morrical circuit. 34.5 kV grounding bank will be replaced and 34.5kV Cap Bank will be retired. **Estimated Cost: \$8.6M**

Install 1200A phase over phase switch (Lancers Switch) at the Airport delivery point. **Estimated Cost: \$0.5M**

Install 1200A phase over phase switch (Pirate Switch) at the DTR hard tap. **Estimated Cost: \$1.1M**

Install 1200A phase over phase switch (Fliprock Switch) at National Lime & Stone hard tap. **Estimated Cost: \$2.4M**

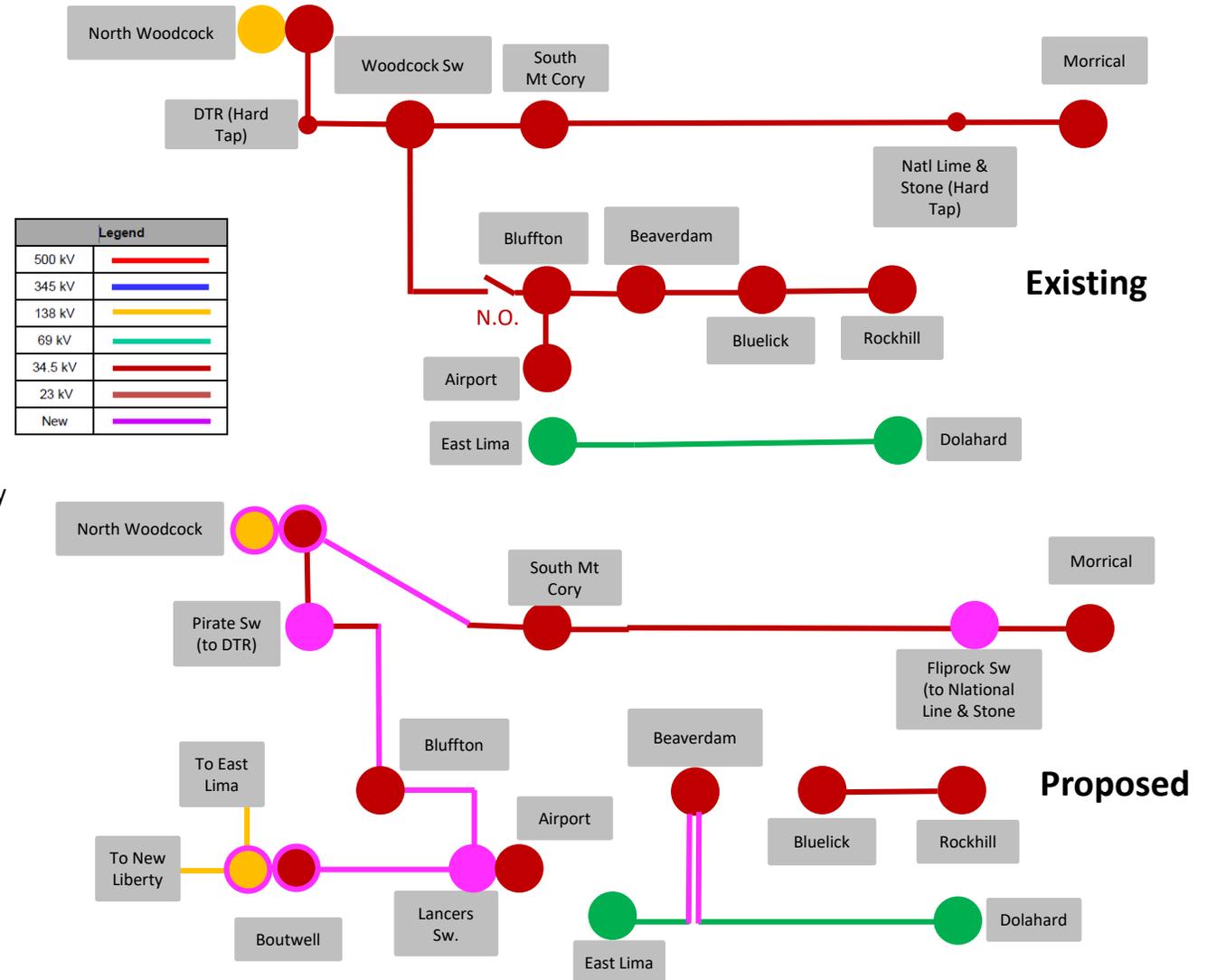
Retire Woodcock Switch. **Estimated Cost: \$0.1M**

Total Transmission Cost: \$59M

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SRRTEP-W – AEP Supplemental 09/25/2019

AEP Transmission Zone M-3 Process Bluffton Area Improvement Project

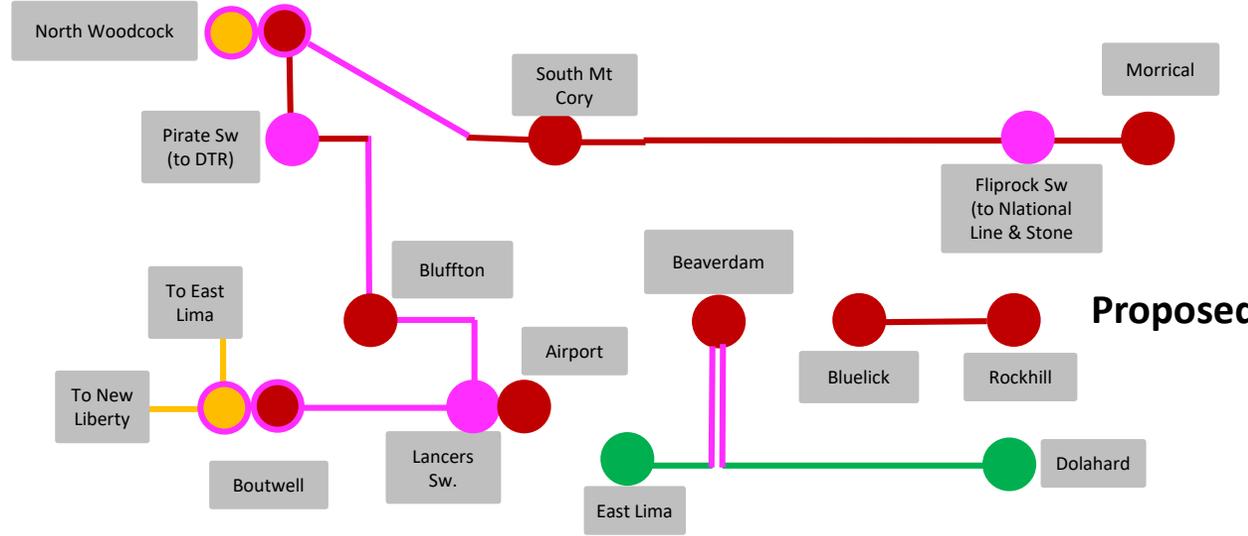
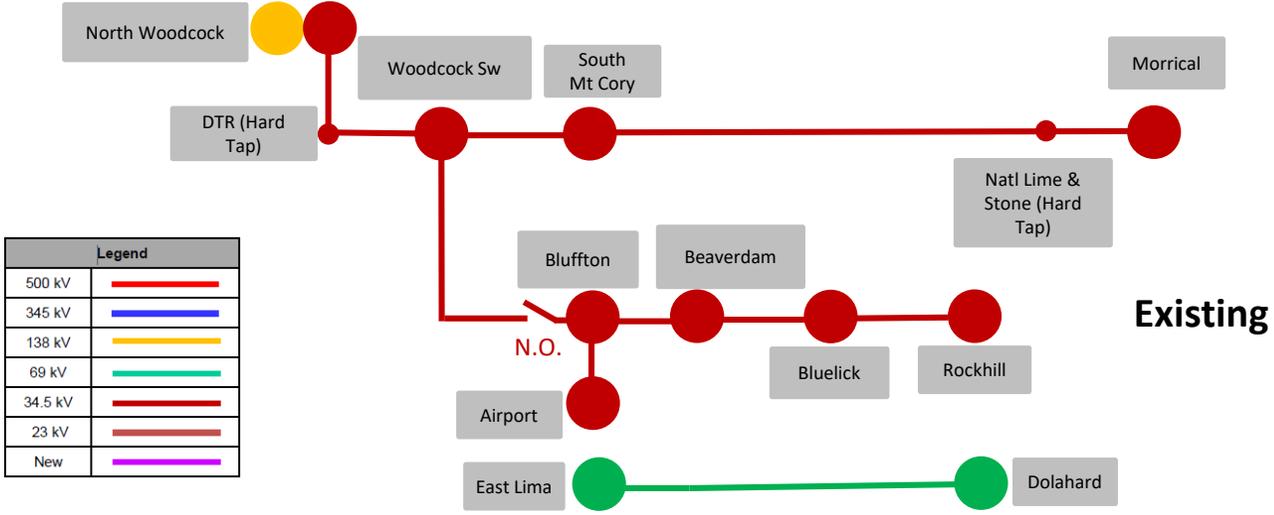


AEP Transmission Zone M-3 Process Bluffton Area Improvement Project

Alternatives Considered:

Rebuild 15 miles of 34.5 kV line from Rockhill to Bluffton. This upgrade still leaves the line in a radial configuration (due to Normally Open switch at Bluffton) and potential for customer outages and voltage concerns. Closing the N.O. switch at Bluffton will need rebuilding additional 15 miles of 34.5 kV line from Morrical to N. Woodcock due to thermal overload in case of the loss of the Rockhill and N. Woodcock sources. This configuration does not address the three terminal line at Woodcock Switch. This 30 mile line rebuild along with upgrades at North Woodcock and hard tap replacement, as explained in the preferred solution is much costlier and does not address all concerns. **Total Alternative Cost: \$86M**

Projected In-Service: 11/15/2022



Need Number: AEP-2018-IM012

Process Chronology: Needs Meeting 03/25/2019

Process Stage: Solutions Meeting 09/25/2019

Supplemental Project Driver: Equipment Condition/Performance/Risk

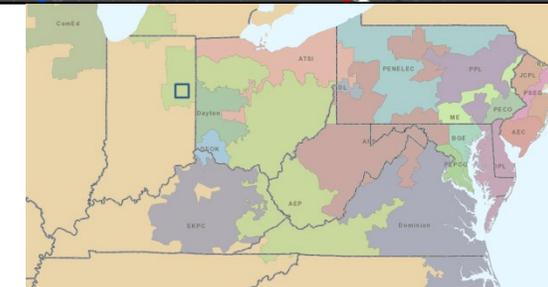
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Kline 69kV Station

- Breakers A, B & C 34kV
 - 1968 vintage GE FK Oil breakers
 - Fault operations: CB A(95), CB B(28) & CB C(15) – Recommended (10)
 - Oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require. Finding spare parts for these units is difficult or impossible, and these models are no longer vendor supported.
 - They also have Bushing Problem and High Moisture Reading
- Cap Switcher AA
 - 1989 vintage
 - Mark V type
 - Doesn't coordinate with AEP's standard relaying package
- Transformer #1 138/34kV
 - 1978 vintage
 - High levels of Carbon Dioxide
 - Interfacial tension is below the acceptable limit
 - Oil is severely aged
 - Accelerating aging of insulation
 - Transformer rusted due to leaking issues
 - Cooling system does not work.
 - Equipment condition concerns include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

AEP Transmission Zone M-3 Process Kline Station Rebuild, Indiana



AEP Transmission Zone M-3 Process Kline Station Rebuild, Indiana

Need Number: AEP-2018-IM012

Process Stage: Solutions Meeting 09/25/2019

Proposed Solution:

At Kline station, replace the 34.5 kV A, B & C line breakers and Transformer #1 138/69/34kV. Install a 138kV line breaker, a 138kV circuit switcher and a 34kV breaker. **Estimated Cost: \$7.1M**

At Virgil station, upgrade remote end relaying. **Estimated Cost: \$0.5M**

Reconfigure line entrance spans on the 138 kV side. **Estimated Cost: \$0.7M**

Reconfigure line entrance spans on the 34.5 kV side. **Estimated Cost: \$0.3M**

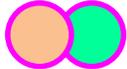
Alternatives Considered:

No Viable Alternates

Total Estimated Cost: \$8.6M

Projected In-Service: 05/07/2021

Project Status: Scoping



Kline

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

AEP Transmission Zone M-3 Process Franklin County Ohio

Need Number: AEP-2019-OH013

Process Stage: Solutions Meeting 09/25/2019

Previously Presented: Need Meeting 4/23/2019

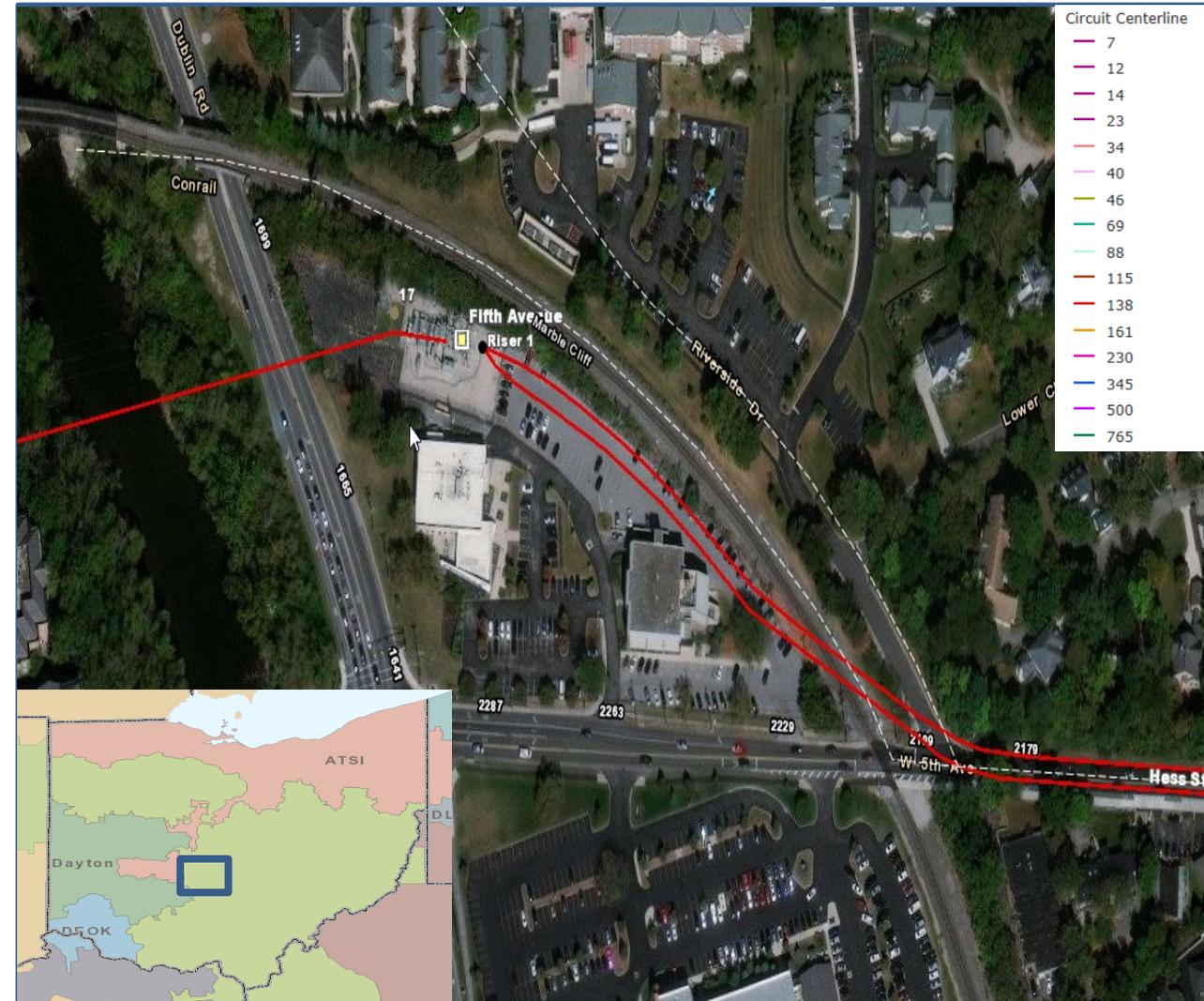
Supplemental Project Driver: Customer Service, Operational Flexibility

Specific Assumptions Reference: AEP Guidelines for Owner Identified Needs (AEP Assumptions slide 7, 8)

Problem Statement:

- AEP Ohio is requesting a new delivery point next to the existing Fifth Ave Station, which is being retired. This new delivery point will be able to accommodate existing load and future expansion.
- The existing Fifth Avenue Station is being removed due to asset renewal conditions and the fact that it cannot be expanded due to being land locked on all sides.
- This station has limited transferability, serves approximately 7,000 customers via a single transformer (22 MVA of load on the tertiary winding), and is located in an urban environment.
- 13/16 relays at Fifth Ave are Electro Mechanical type. These relays have limited spare part availability, lack vendor support, have no SCADA ability, and lack fault data collection.
- The RTU at this Station has a high failure rate, lacks spare parts, and no longer provides load data.
- AEP Ohio has identified several of the feeders served out of this Station that are expected to exceed their capacity with the load growth in the area.

Model: N/A



AEP Transmission Zone M-3 Process Franklin County Ohio

Need Number: AEP-2019-OH013

Process Stage: Solutions Meeting 09/25/2019

Proposed Solution:

- Extend the Wilson – Hess 138kV to the new 138kV bus at Fifth Avenue station and install fiber between Fifth Ave and Hess. **Estimated Cost \$1.1M**
- At Fifth Avenue, install new 138kV bus work in ring bus configuration. Install 2-138kV breakers and associated switches on new bus work rated at 3000A/63kA. **Estimated Cost \$2.9M**
- Remote end work at Wilson Road station. **Estimated Cost \$0.5M**
- Remote end work at Hess station. **Estimated Cost \$0.6M**

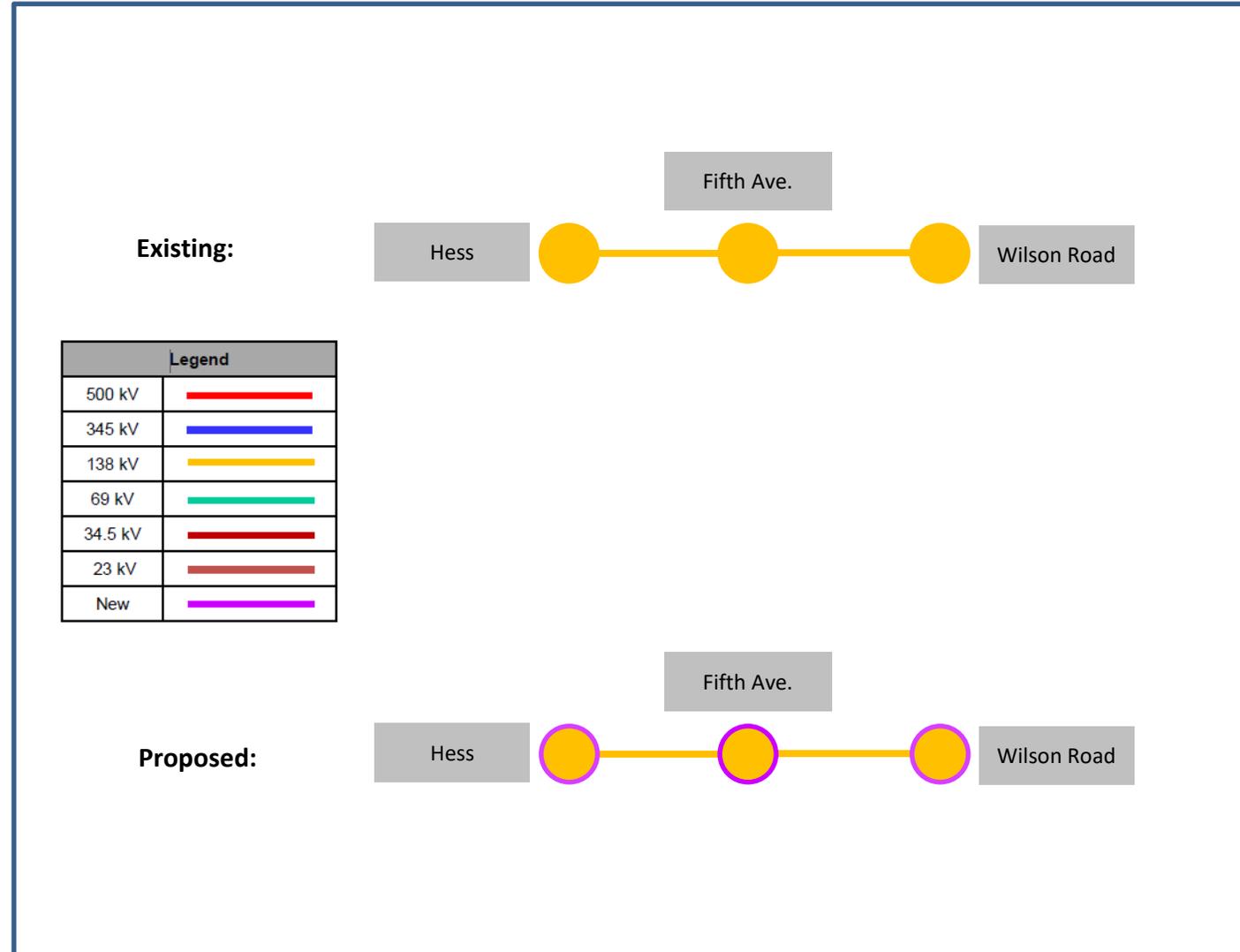
Total Estimated Transmission Cost: \$5.1M

Alternatives Considered:

No viable cost-effective transmission alternative was identified.

Projected In-Service: 06/01/2021

Project Status: Engineering



AEP Transmission Zone M-3 Process Western Columbus/Beatty Area

Need Number: AEP-2019-OH036

Process Stage: Solutions Meeting 09/25/2019

Previously Presented: Needs Meeting 06/17/2019

Supplemental Project Driver: Equipment Condition, Operational Flexibility, and Customer Service

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8); AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Model: Summer 2023 RTEP

Problem Statement:

Hilliard Station 69kV:

69 kV Circuit breakers 61, 62, and 63

- CF-48 type oil breakers. (1967, 1967, 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 the breakers have experienced 15, 21, and 31 fault operations respectively. The manufacturer’s recommendation for this type of breaker is 10.

Relaying

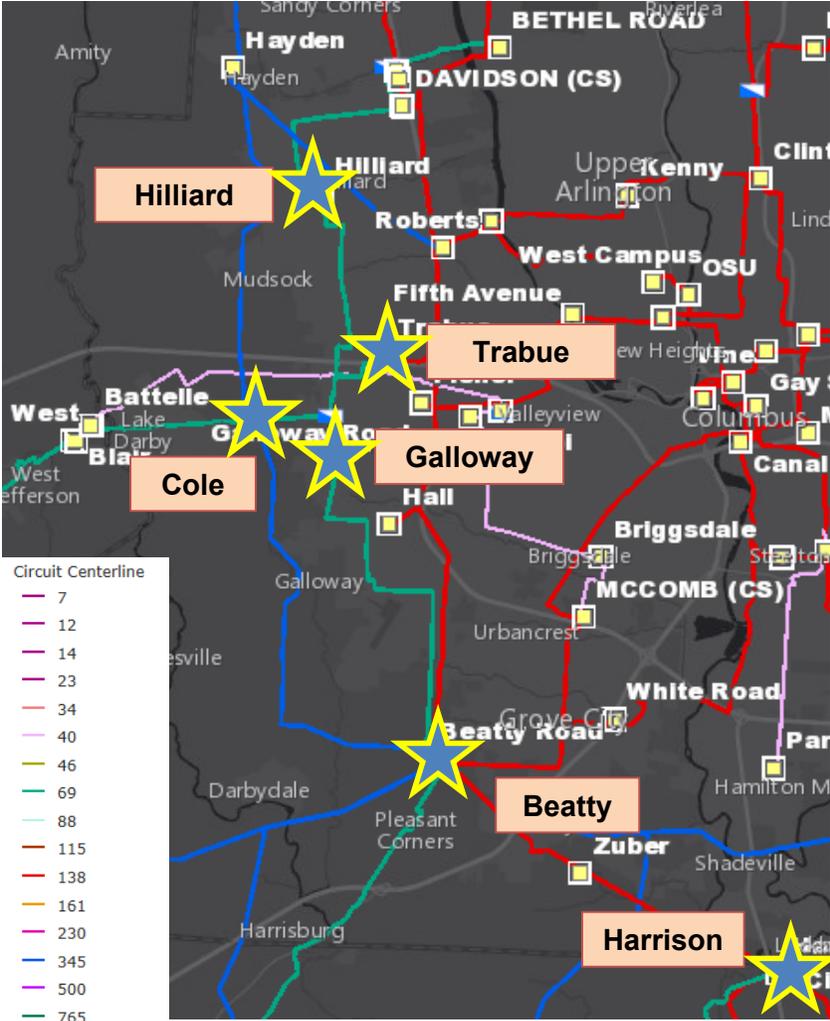
- 105 of the 119 relays are electromechanical relays. EM relays have limited spare part availability, a lack vendor support, no SCADA functionality, and no fault data collection ability.

Station Structures

- The structure steel is deteriorating due to rust and the foundation supporting the steel shows severe cracking.

69/13.2 kV Transformer #1 and #2

- AEP Ohio Distribution Transformers 1 & 2 are protected by high speed ground switch MOABs.



AEP Transmission Zone M-3 Process Western Columbus/Beatty Area

Continued from previous slide...

Beatty Station:

69 kV Circuit breakers 63, 64, and 65

- FK type oil breakers. (1965, 1966, and 1965 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 5, 34, and 6 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.

138/69 kV Transformers #1 and #2

- Showing signs of deterioration. Both are experiencing short circuit strength breakdown (due to the amount of through fault events) and dielectric strength breakdown with a history and overheating and stray gassing.
- Transformers 1 & 2 are in the same 138kV zone of protection causing both to experience an outage whenever there is a fault in that zone.

345/138 kV Transformer #4

- Showing signs of deterioration. Experiencing short circuit strength breakdown (due to the amount of through fault events), dielectric strength breakdown, and bushing damage.

138/13 kV Transformer #5

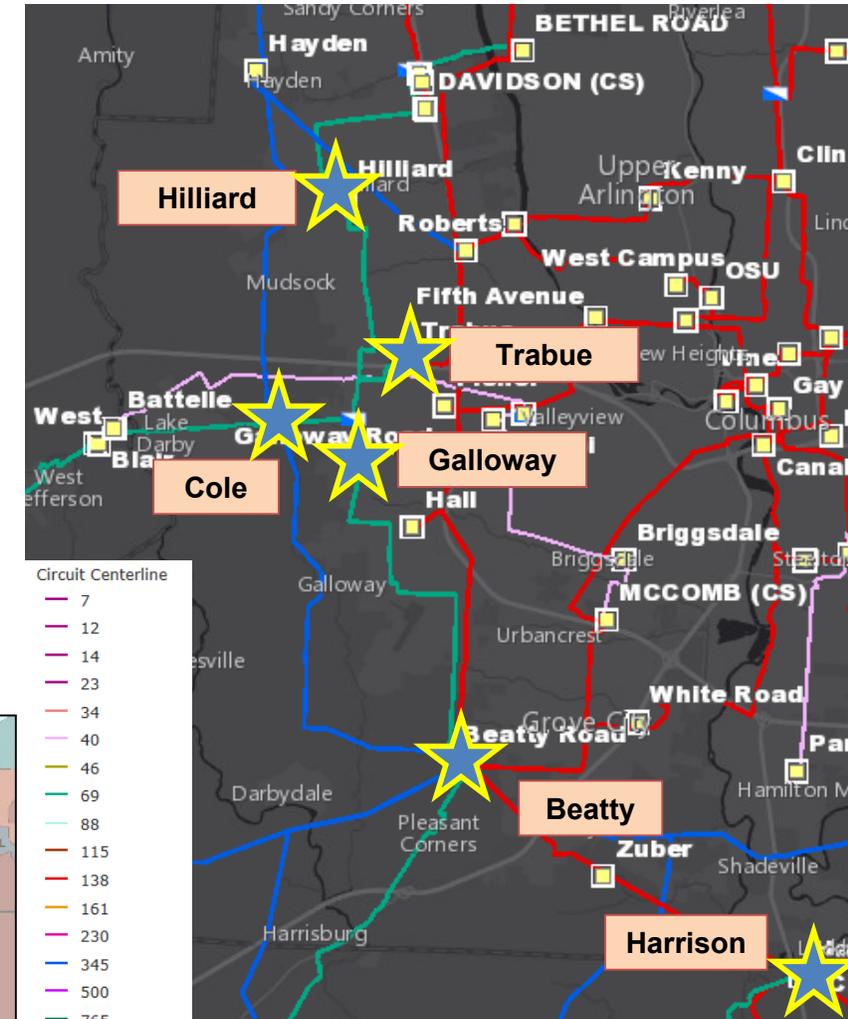
- Currently directly connected via a MOAB to the 138 West Bus at Beatty Station

138/13 kV Transformer #6

- Currently directly connected via a ground switch MOAB scheme to the 138 East Bus at Beatty Station

138kV McComb line

- Connected via a partial breaker string resulting in line outage with an outage of the east bus, including those caused by outage of Transformer #6.



AEP Transmission Zone M-3 Process Western Columbus/Beatty Area

Continued from previous slide...

Cole Station 138/13kV:

- AEP-Ohio has requested a new 138/13kV delivery point at Cole station.

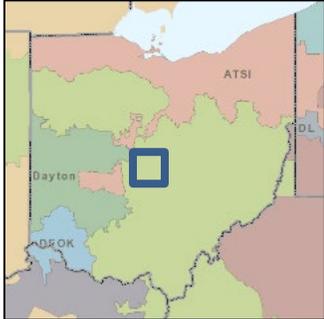
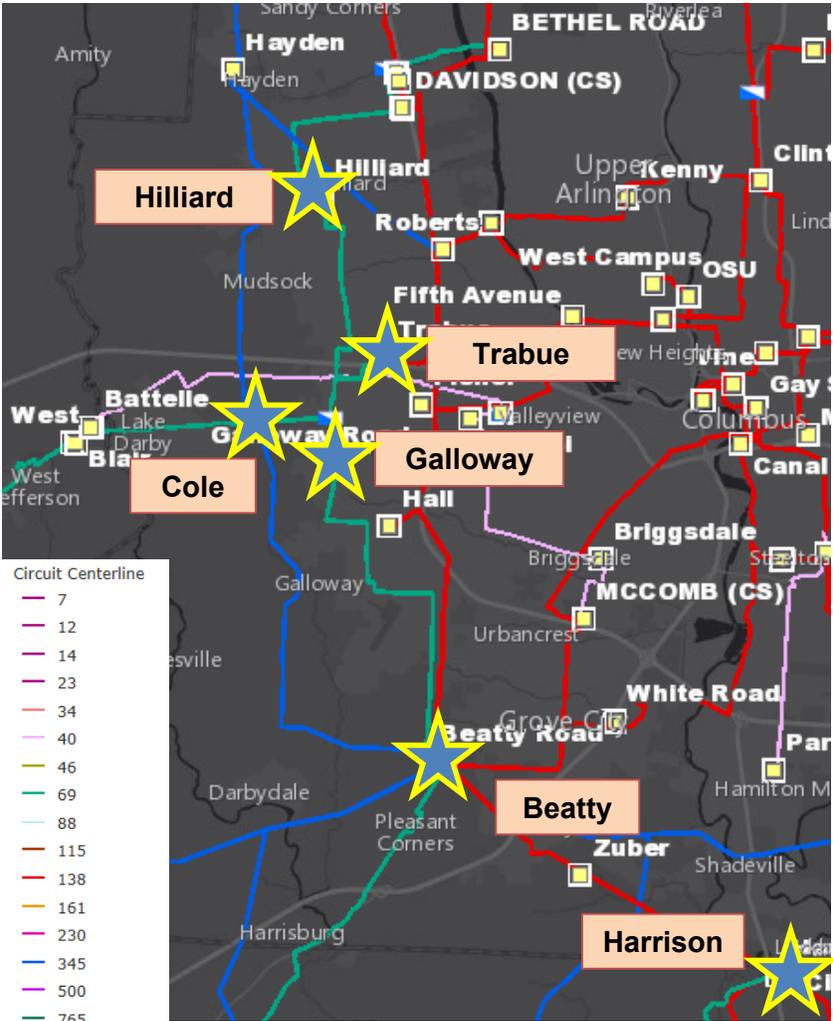
Trabue Station:

- More than two dissimilar zones of protection in the 138 kV yard (transformer, line, and bus)
- AEP-Ohio has requested sectionalizing to separate two distribution transformers to improve reliability.
- 60 of the 86 relays are electromechanical relays. EM relays have limited spare part availability, a lack vendor support, no SCADA functionality, and no fault data collection ability.

Blair – Galloway 69 kV circuit:

Line section between Galloway station and Structure 26 (~1.0 miles)

- Wood pole line with structures and conductor dating back to 1968.
- 19 open structure conditions including rotted and split poles.



AEP Transmission Zone M-3 Process Western Columbus/Beatty Area

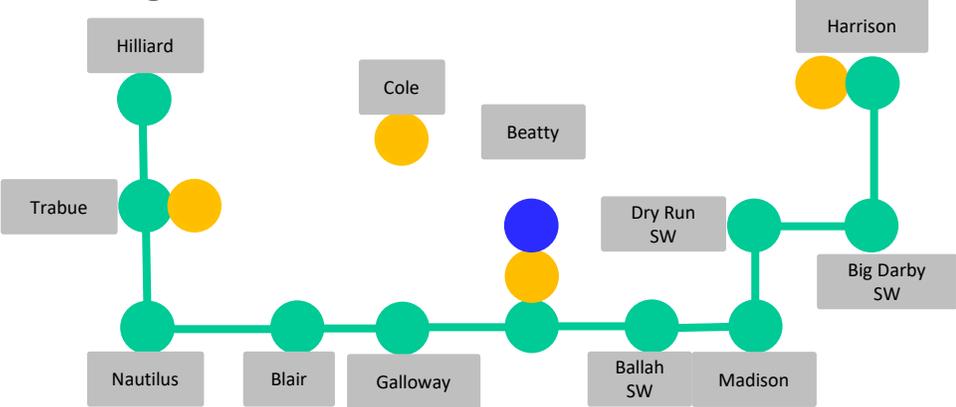
Need Number: AEP-2019-OH036

Process Stage: Solutions Meeting 09/25/2019

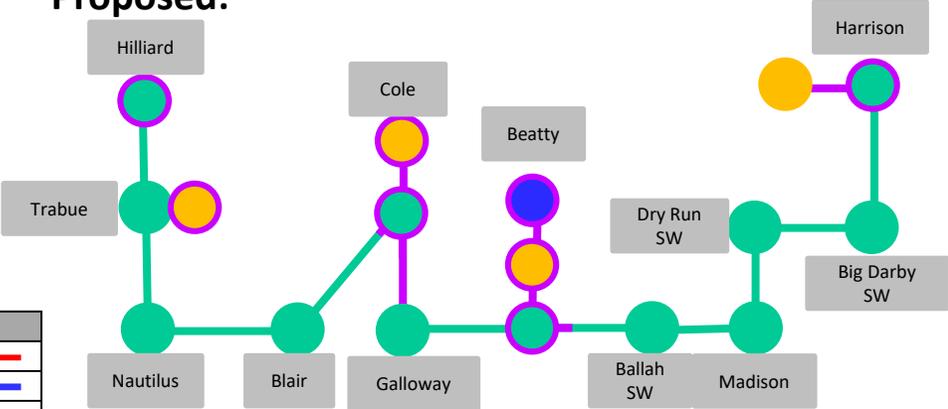
Proposed Solution:

- Rebuild and relocate approx. 1.5 miles between Blair and Galloway to avoid a neighborhood along the existing line path. **Estimated Cost: \$5.9M**
- Relocate Ballah/Madison 69kV line exit to new Beatty 69kV yard. **Estimated Cost: \$0.6M**
- Tie in Cole 138/69kV Station (new 69kV yard) between Blair and Galloway. **Estimated Cost: \$0.8M**
- At Beatty station, replace the 450MVA 345/138kV XF w/ 675MVA unit and retire the low side reactor. Replace 1-50MVA 138/69kV XF with a 90MVA unit and retire 2nd 138/69kV 50MVA XF. Replace 1-138 3,000A 50kA CB 6W with 4,000A 63kA. Install 4-138kV 3,000A 63kA CB's. Rebuild 69kV bus as ring bus, replacing 3 of 4 69kV 1,200A 20kA CB's w/ 2,000A 40kA CB's. The 4th CB will be retired. **Estimated Cost: \$22.6M**
- At Cole station, install a new 138/69kV 90MVA XF. Install 2-138kV 3,000A 63kA CB's with bus work to connect proposed 138/69kV XF. Install 2-138kV 3,000A 63kA CB's with bus work to connect AEP-Ohio's requested 138/13kV delivery point. Install three new 69kV 2,000A 40kA CB 's in a ring configuration. **Estimated Cost: \$10.7M**

Existing:



Proposed:



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



AEP Transmission Zone M-3 Process Western Columbus/Beatty Area

Proposed Solution Continued:

- At Trabue station, install three new 138kV 3,000A 40kA CB's and associated relaying. Install a new 138kV 14.4MVAR capacitor with switcher. **Estimated Cost: \$4.3M**
- At Hilliard station, upgrade 69kV capacitor to 28.8MVAR. Replace 3-69kV 1,200A 21kA CB's with 2,000A 40kA CB's. Replace two sets of high speed ground switch/MOABs XF protection with circuit switchers. **Estimated Cost: \$3.2M**
- ~~– At Harrison station, replace the 138/69kV 56MVA XF with a 90MVA unit. Replace 3-69kV CB's with 2,000A 40kA units. Install a new 69kV 14.4MVAR capacitor with switcher. **Estimated Cost: \$7.8M**~~
Work previously covered under s1493.4
- Galloway remote end relaying. **Estimated Cost: \$0.3M**
- Roberts remote end relaying. **Estimated Cost: \$0.5M**
- Fisher remote end relaying. **Estimated Cost: \$0.6M**
- Blair remote end relaying. **Estimated Cost: \$0.3M**
- Nautilus remote end relaying. **Estimated Cost: \$0.3M**

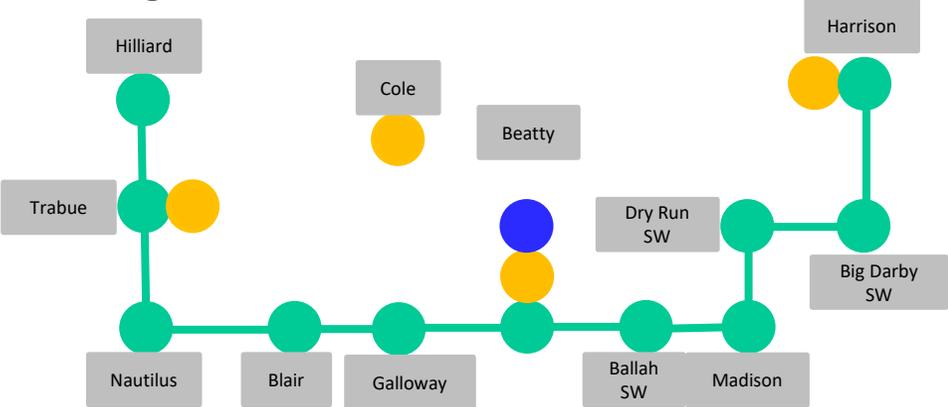
Ancillary Benefits: This project will split the 138/69 sources between Beatty and Cole stations. Currently the two 138/69 kV transformers located at Beatty are switched together but can be restored if one transformer is out. Keeping two separate transformers in the area keeps this flexibility in place.

Alternatives Considered:

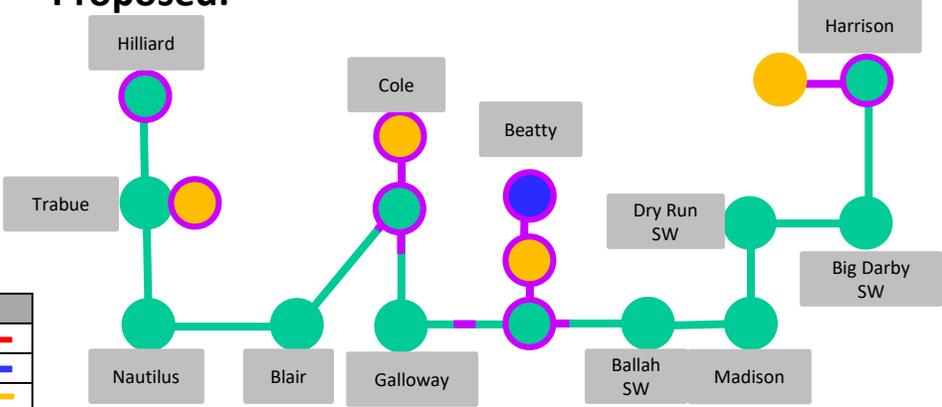
Replacing and keeping both 138/69 kV transformers at Beatty station rather than moving one of the banks to Cole station was evaluated. Significant re-routing and reconfiguration of the 138 kV lines and 138 kV bus at Beatty would have been required in order to accommodate a 2nd transformer due to constructability/outage requirements. Because of this, the solution to move one of the transformers to Cole was chosen with the added benefit of diversifying the 138 kV sources into the 69 kV network.

Total Estimated Transmission Cost: ~~\$57.9M~~ 50.1M
Projected In-Service: 05/31/2022

Existing:



Proposed:



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

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

9/11/2019 – V1 – Original version posted to pjm.com

9/16/2019 – V2 – Slide #22 and 23, Changed AEP-2019-IM012 to AEP-2018-IM012

– Slide #17 and 18, Changed AEP-2019-OH010 to AEP-2018-OH034

11/11/2019 – V3– Slide #19, Updated AEP-2018-OH033 Needs to be the same description as in

1/11/2019 Needs presentation

– Slides #30, Changes reflected in the slides