SRRTEP Committee Western
AEP Supplemental Projects

December 18, 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
Martin County, Kentucky

Need Number: AEP–2019-AP047

Process Stage: Needs Meeting 12/18/2019

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

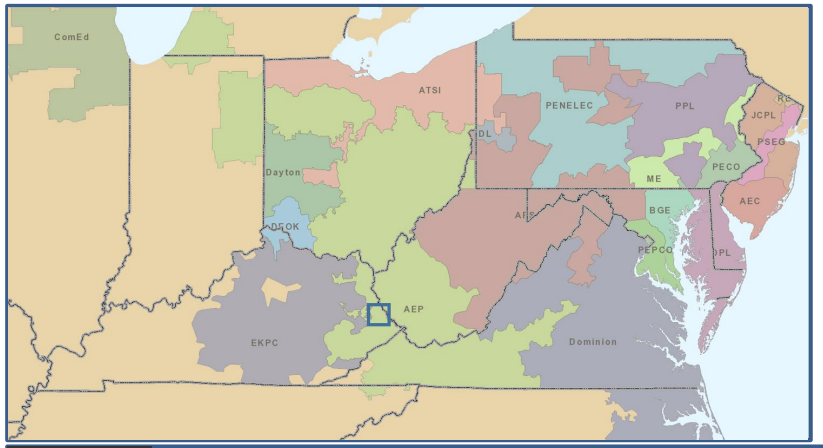
Specific Assumption References:

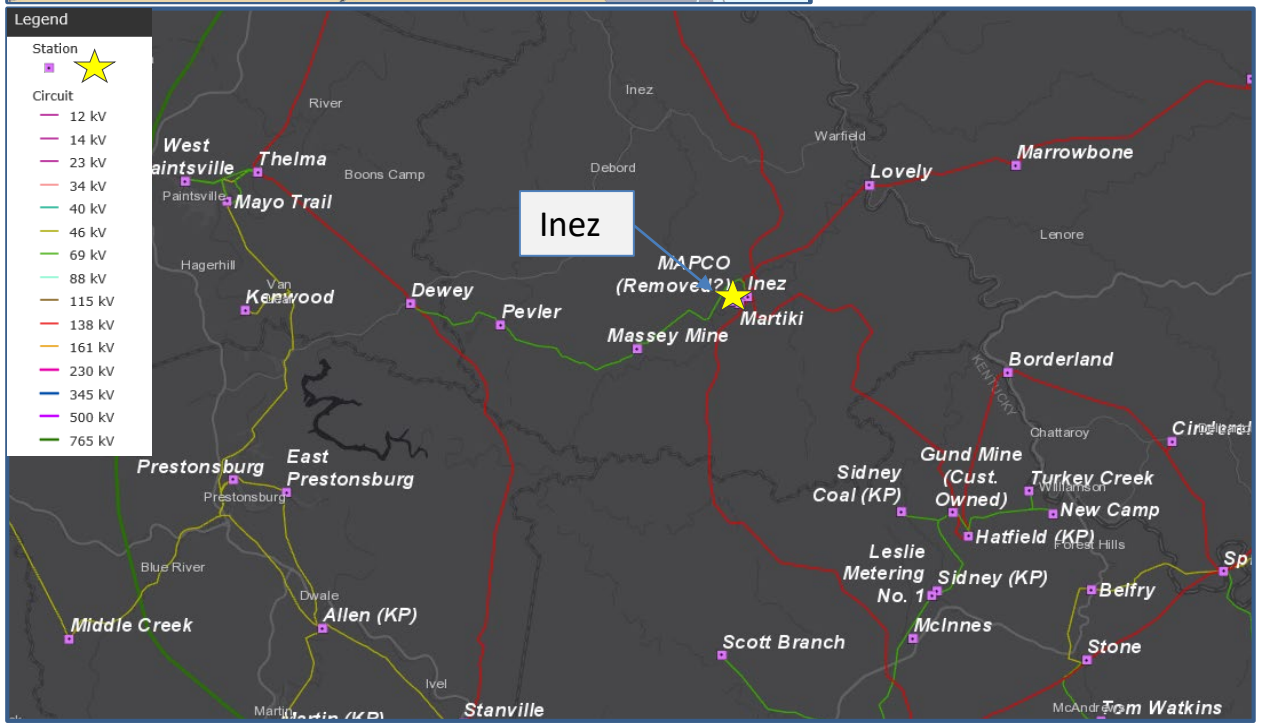
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Model: N/A

Problem Statement:

- The 138/69kV-13.09kV TR1 is 1967 vintage and has seen significant increases in moisture levels and power factor which indicate a rise in concentrations of harmful particles within the oil. The Short Circuit strength is decreased due to the age of this unit's insulation materials. As the insulating paper ages, it becomes brittle allowing for increased susceptibility to short circuit faults causing failure of the main tank. The transformer has numerous observed oil leaks including fluid leaking from the internal wiring.
- The four 138kV circuit breakers, B, B2, C and C1, are 1990's vintage SF6, type breakers. The circuit breakers have experienced the following fault operations: CB B (38), B2 (22), C (99), and C1(70). CB-B had 52 leaks reported in malfunction records related to low SF6 gas levels. CB-B2 had 24 and CB-C1 had 10 reported SF6 leaks.
- Inez Substation currently deploys 105 relays to ensure the adequate protection and operation of the substation. Currently, 71 of the 105 relays (68% of all station relays) are in need of replacement due to obsoleteness. 61 are of electromechanical type, six are static type, and four are disontinued microprocessor relays.

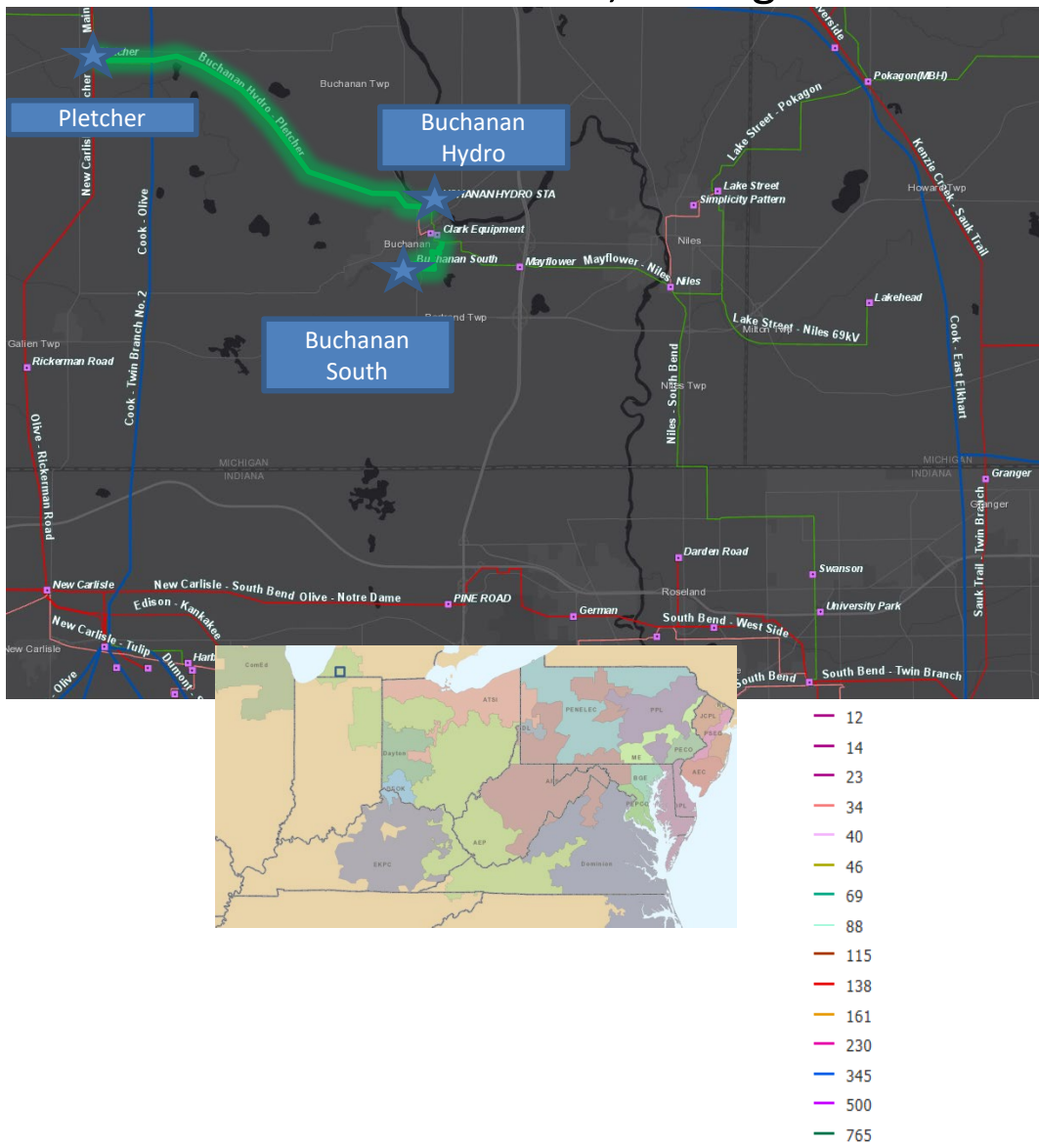




AEP Transmission Zone M-3 Process
Niles, Michigan Area

Need Number: AEP-2019-IM047
Process Stage: Needs Meeting 12/18/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Pletcher – Buchanan 69kV line
1963 wood crossarm style line with 48 open conditions across its ~8.4 miles



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

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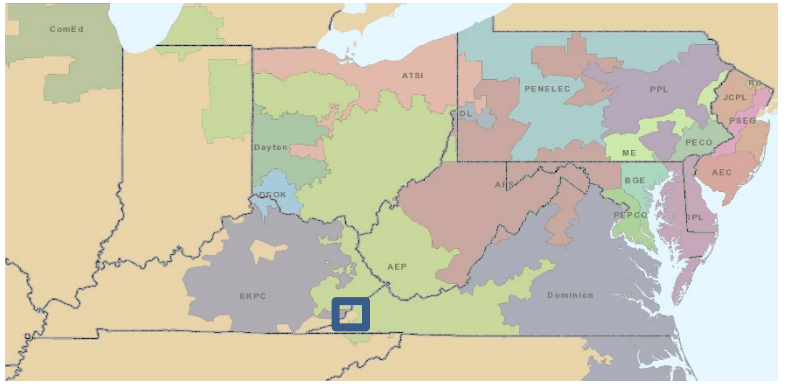
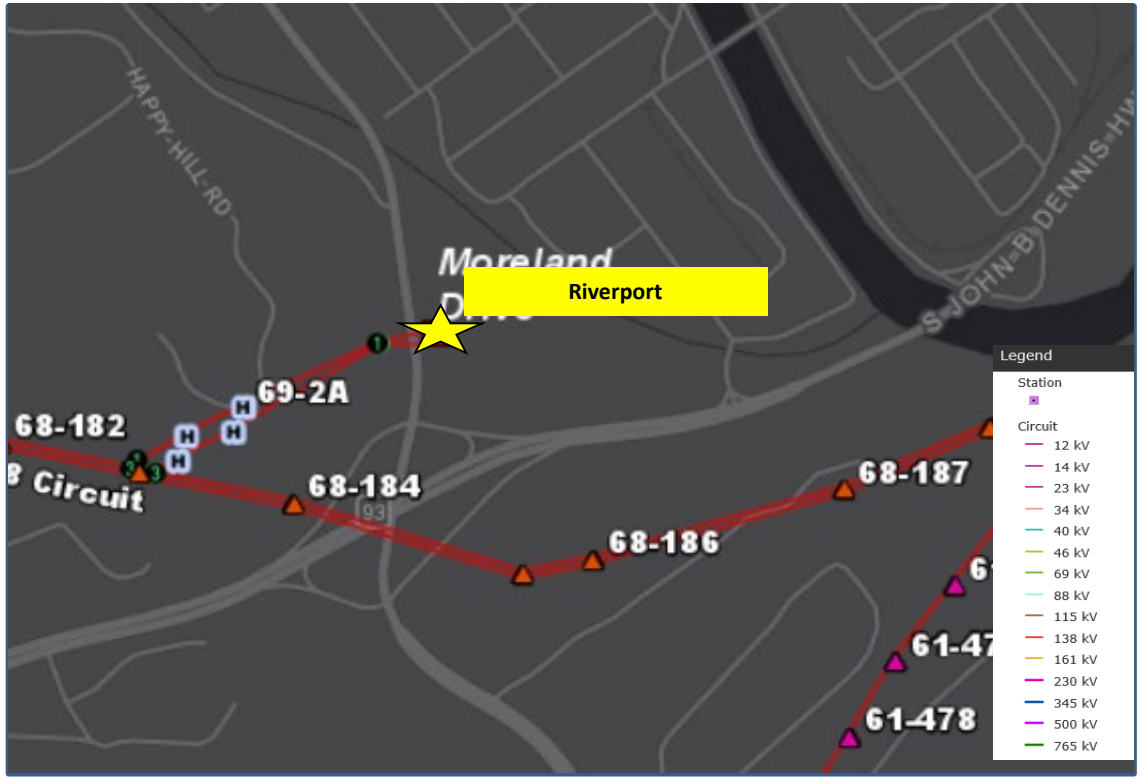
AEP Transmission Zone M-3 Process
Sullivan County, Tennessee

Need Number: AEP-2019-AP041
Process Stage: Solutions Meeting 12/18/2019
Process Chronology: Needs Meeting 10/25/2019
Supplemental Project Driver: Customer Service
Specific Assumption References: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)
Problem Statement:
Eastman Chemical in coordination with Air Products, has requested a new point of service for their planned new facilities at Moreland Drive. The projected peak demand of 47 MW for service to Eastman Chemical.





AEP Transmission Zone M-3 Process
Sullivan County, Tennessee

Need Number: AEP-2019-AP041
Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

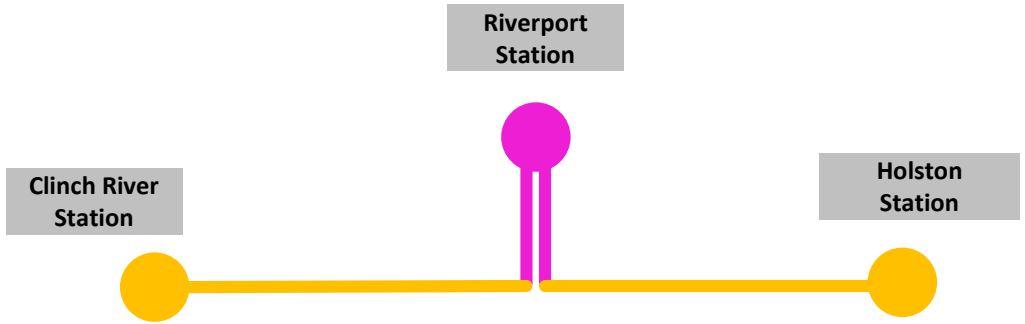
Construct a new 138kV station in a four breaker ring bus utilizing four 138kV 3000A 40kA breakers and 138kV metering to the Eastman facilities. Construct a double circuit line (~0.2 miles) to the new Riverport station by tapping both the Clinch River – Moreland Drive 138kV and Holston – Moreland Drive 138kV circuits off of the Air Products Loop 138kV asset.

Estimated Cost: $10.5M

Alternatives Considered:

Expand the existing Moreland Drive station. Eastman's outage requirements make this alternative not viable.

Projected In-Service: 12/1/2020
Project Status: Scoping



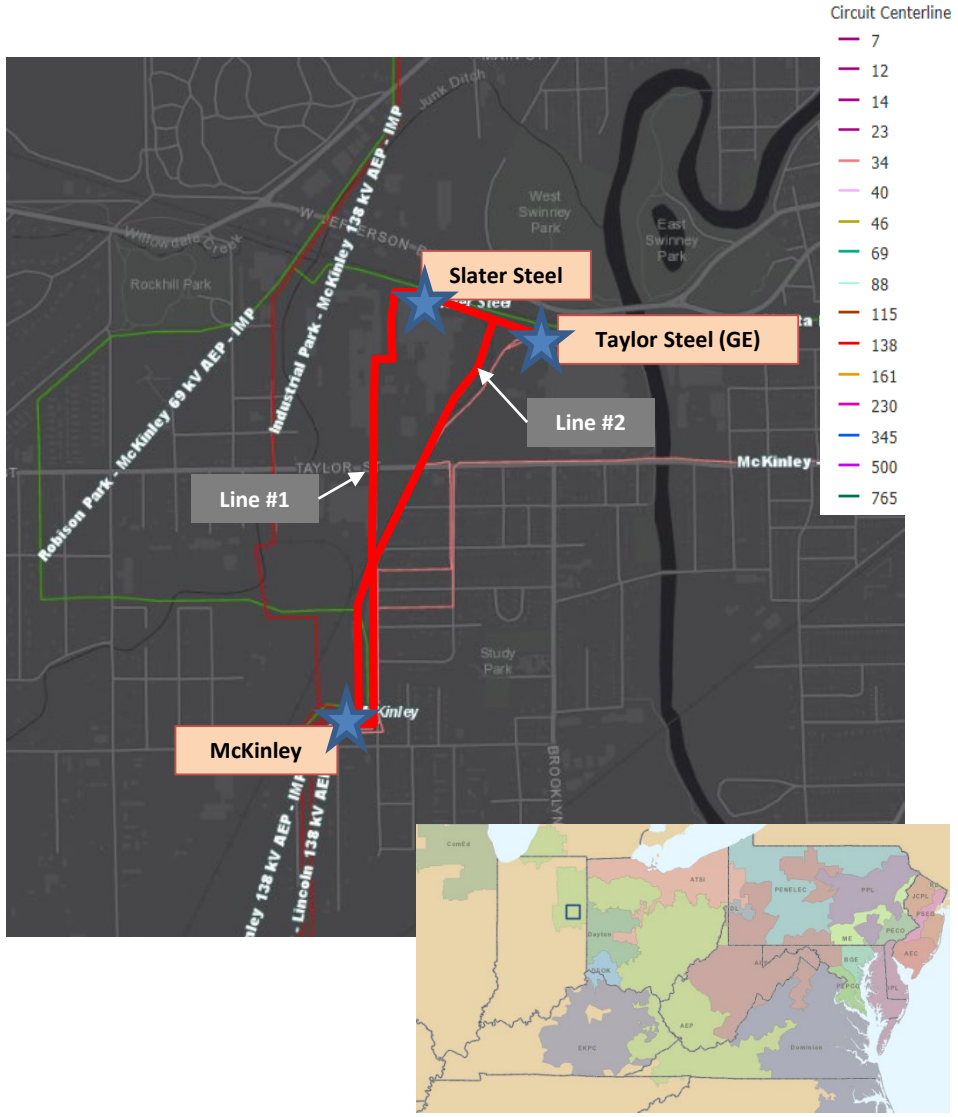
Legend	
345 kV	
138 kV	
69 kV	
46 kV	
New	

AEP Transmission Zone: Supplemental McKinley Area Improvements

Need Number: AEP-2019-IM018
Process Stage: Solution Meeting 12/18/19
Previously Submitted: Needs Meeting 11/22/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

1. McKinley – General Electric Taylor West 34kV Line (~0.9 Miles)
- 1956 vintage wood pole, crossarm construction
- There are currently 9 open conditions on this line.
- Open conditions include: Damaged and rotted structures, stolen ground lead wires and broken knee/vee brace.

2. McKinley – Slater Steel 34kV Line (~0.98 Miles)
- 1967 vintage wood pole, crossarm construction
- There are currently 4 open conditions on this line.
- Open conditions include: Broken, missing, or stolen ground lead wires.

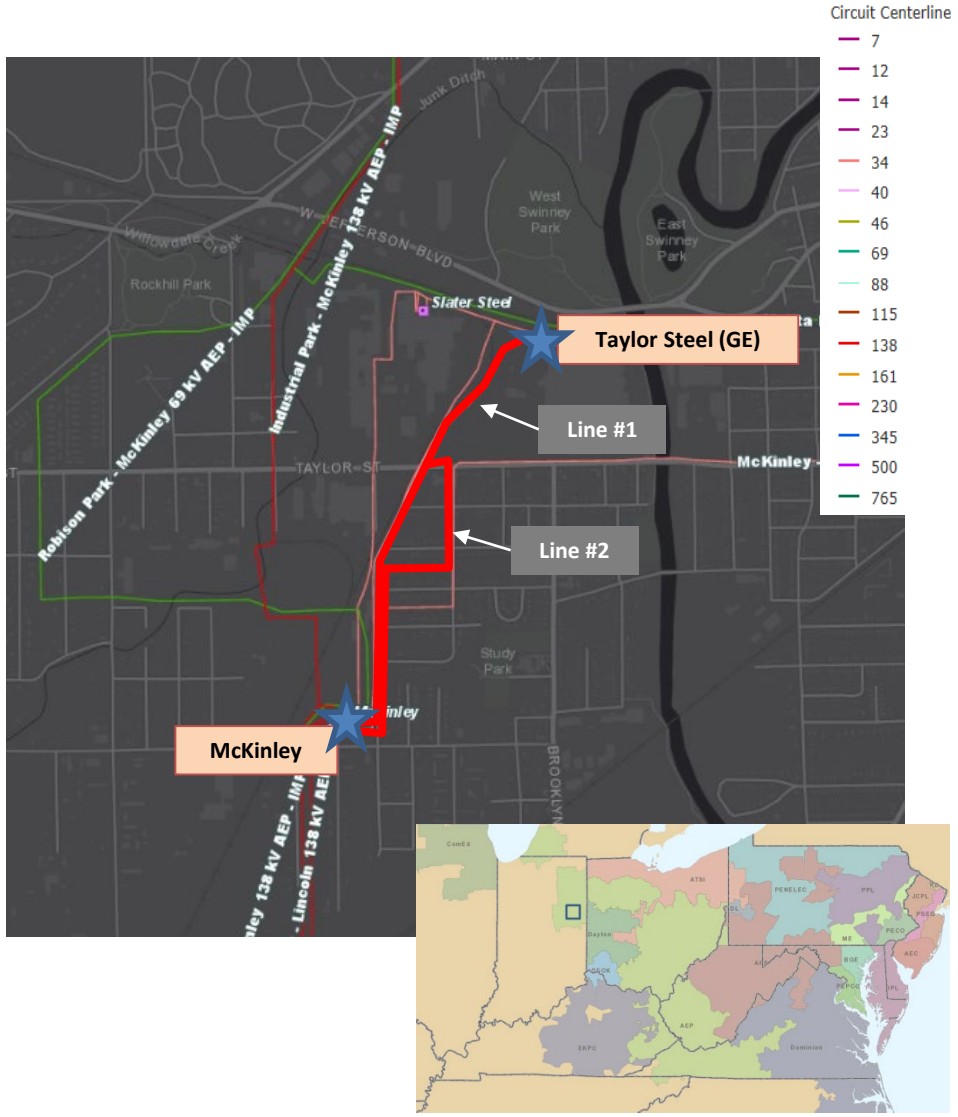


AEP Transmission Zone: Supplemental McKinley Area Improvements

Need Number: AEP-2019-IM018
Process Stage: Solution Meeting 12/18/19
Previously Submitted: Needs Meeting 11/22/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

1. McKinley – Taylor General Electric Line 34kV Line (~0.9 Miles)
- 1956 vintage wood pole, crossarm construction
- There are currently 3 open conditions on this line.
- Open conditions include: Split pole and stolen ground lead wires.

2. McKinley – General Electric Taylor East 34kV Line (~0.7 Miles)
- 1960 vintage wood pole, crossarm construction
- There are currently 9 open conditions on this line.
- Open conditions include: Damaged, split or rotted structures.

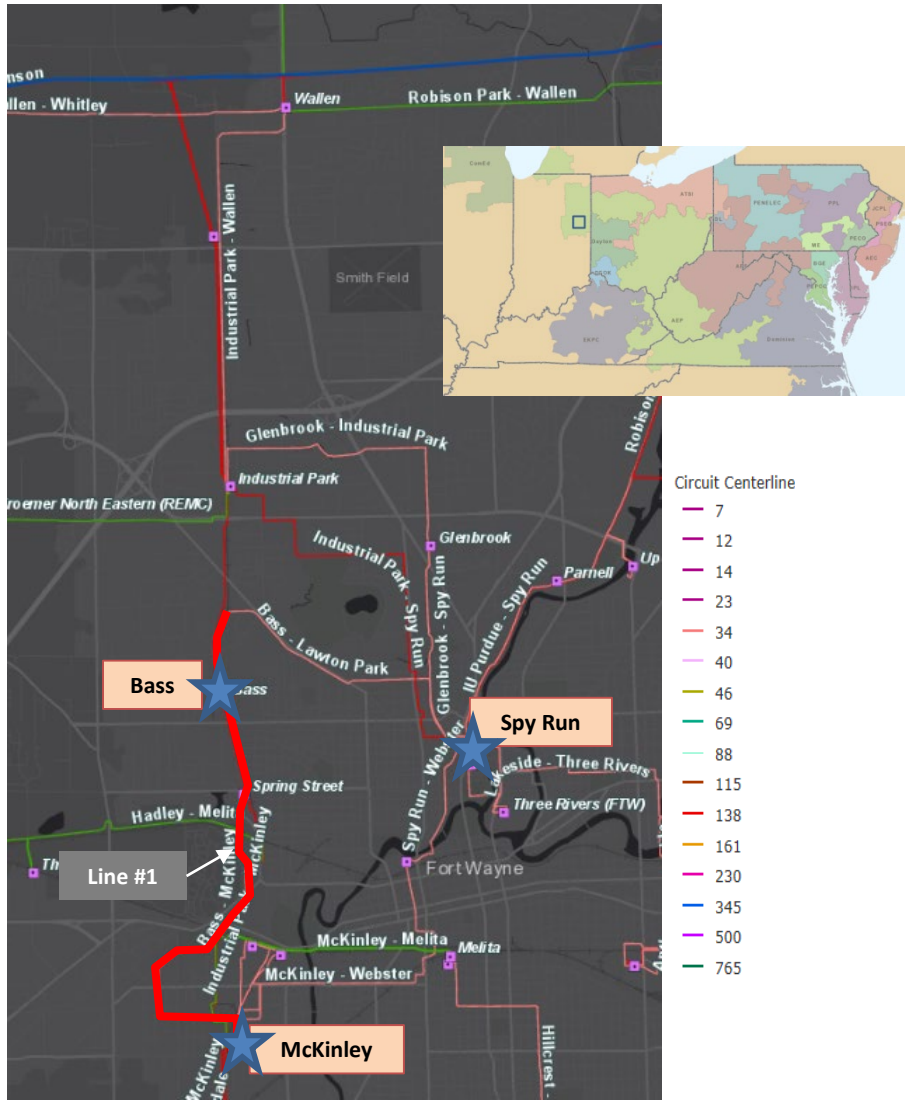


AEP Transmission Zone: Supplemental McKinley Area Improvements

Need Number: AEP-2019-IM018
Process Stage: Solution Meeting 12/18/19
Previously Submitted: Needs Meeting 11/22/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

1. Bass – McKinley 34.5kV (~3.5 Miles)

- 1930 vintage steel single circuit lattice construction.
- There are currently 4 open conditions on this line.
- Six wired Copper conductor with copper weld shield wire. Copper conductors become brittle with age and Copper weld conductor has long been obsolete



AEP Transmission Zone: Supplemental McKinley Area Improvements

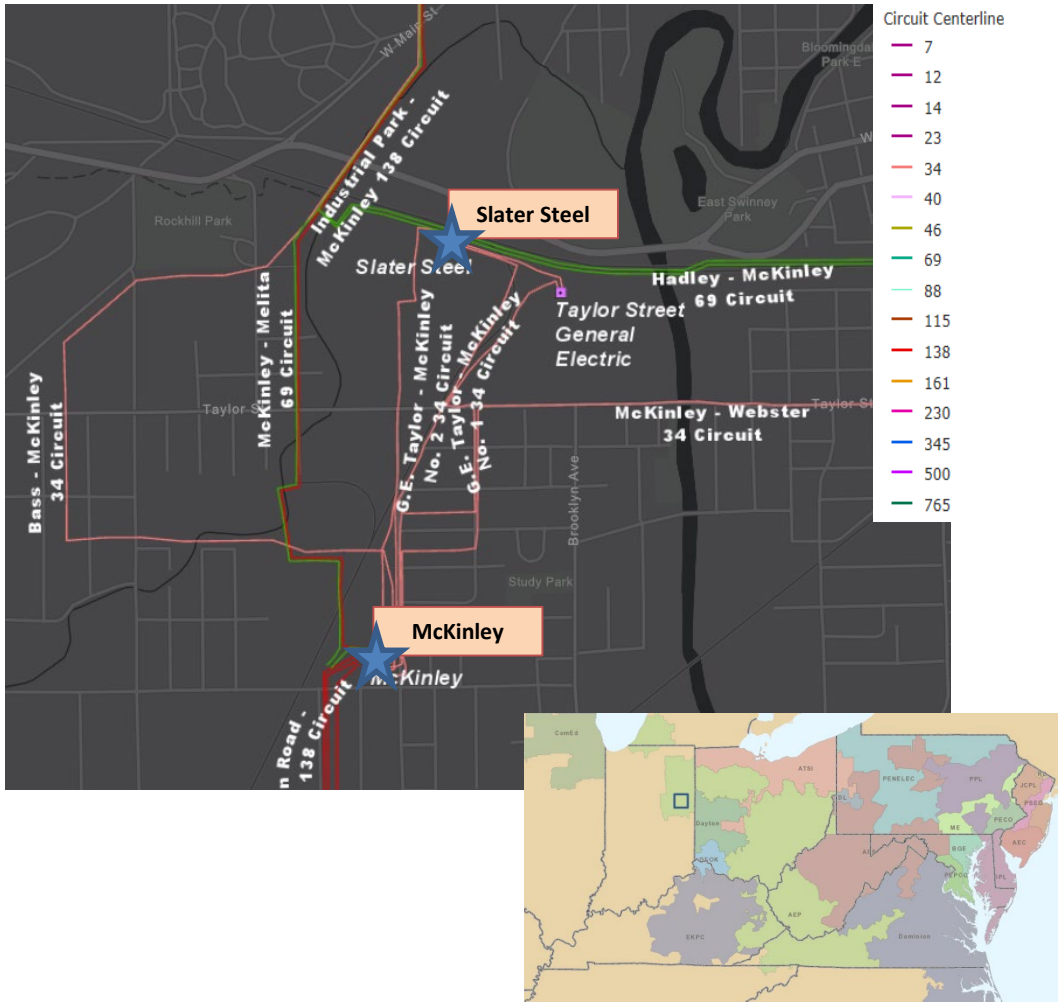
Need Number: AEP-2019-IM018
Process Stage: Solution Meeting 12/18/19
Previously Submitted: Needs Meeting 11/22/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

McKinley 138/69/34.5kV station

- Breakers F,J,K & M 34kV
  - 1956 vintage FK Oil breakers which have been known to fail violently.
- Breaker DD 34kV
  - 1962 vintage FK Oil breakers which have been known to fail violently.
- 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

Slater Steel 34kV station

- Unmaintained customer-owned 34 kV switching facilities inside Slater Steel Station.
- Concerns about employees safety while switching in the customer station



AEP Transmission Zone: Supplemental McKinley Area Improvements

Need Numbers: AEP-2019-IM018
Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

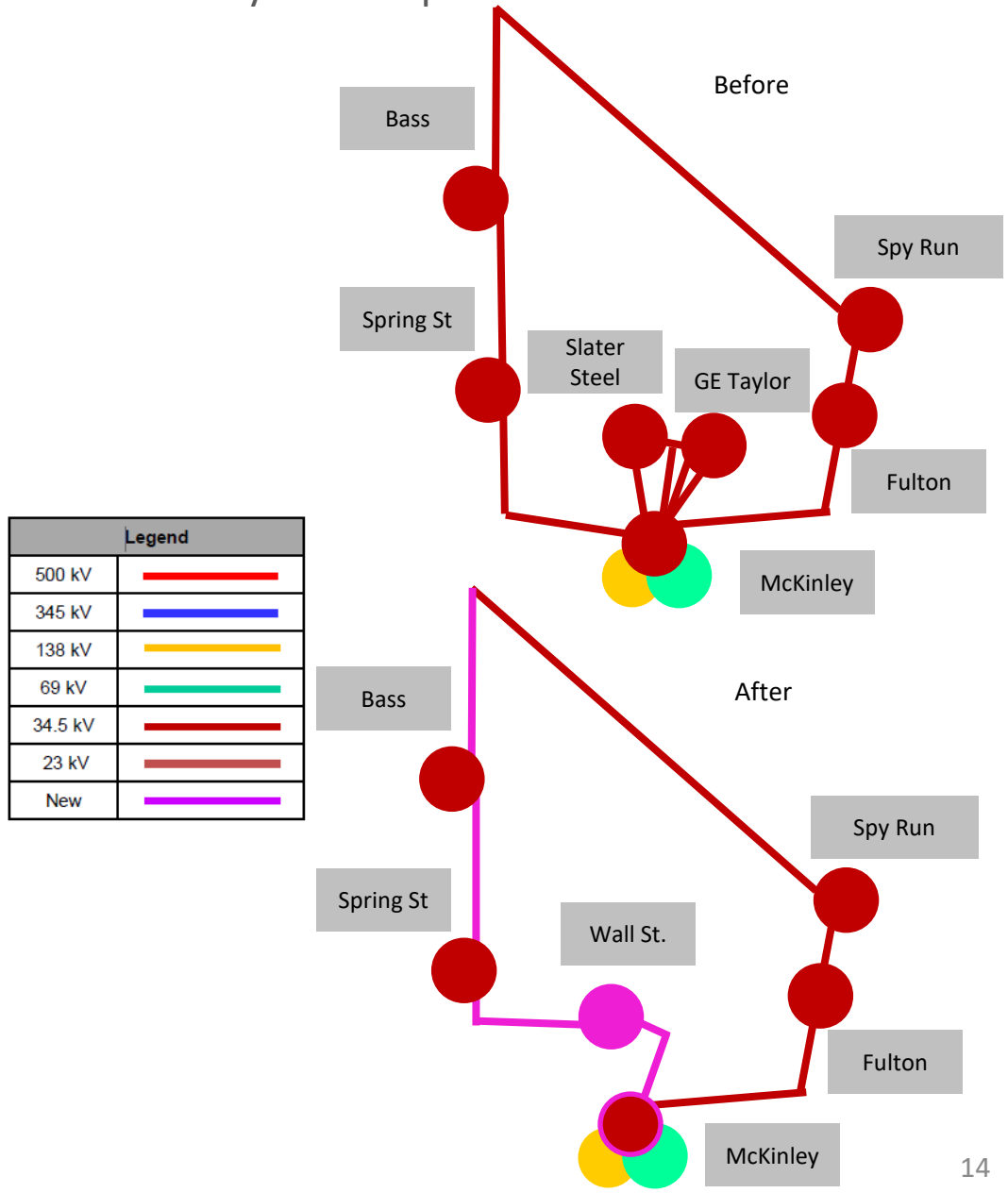
Slater Steel & GE Taylor 34.5kV Feeds:
Retire the McKinley – General Electric Taylor West 34kV Line; McKinley – Slater Steel 34kV Line; McKinley – Taylor General Electric 34kV Line and the McKinley – General Electric Taylor East 34kV and in their place build a single ~1 mile 34.5kV feed from McKinley – Slater Steel. As a note, the customer has retired their GE Taylor station so it no longer requires a feed.
Estimated Cost: $2.8M

McKinley – Spy Run 34.5kV:
Rebuild approximately 4.5 miles of the McKinley – Spy Run circuit, including a line section approximately 2.7 miles long to feed Slater Steel station.
Estimated Cost: $6.7M

Wall Street 34.5kV station:
Install a new PoP switch to feed Slater Steel station.
Estimated Cost: $.5M

McKinley 138/69/34.5kV station:
Retire 34.5kV CB's "J", "M", "F", "K", and "DD". Consolidate the 34.5kV voltage class into a single bus and relocate the 69kV line exit into the station yard. Install a high side circuit switcher.
Estimated Cost: $3.7M

Total Estimated Transmission Cost: $13.6M

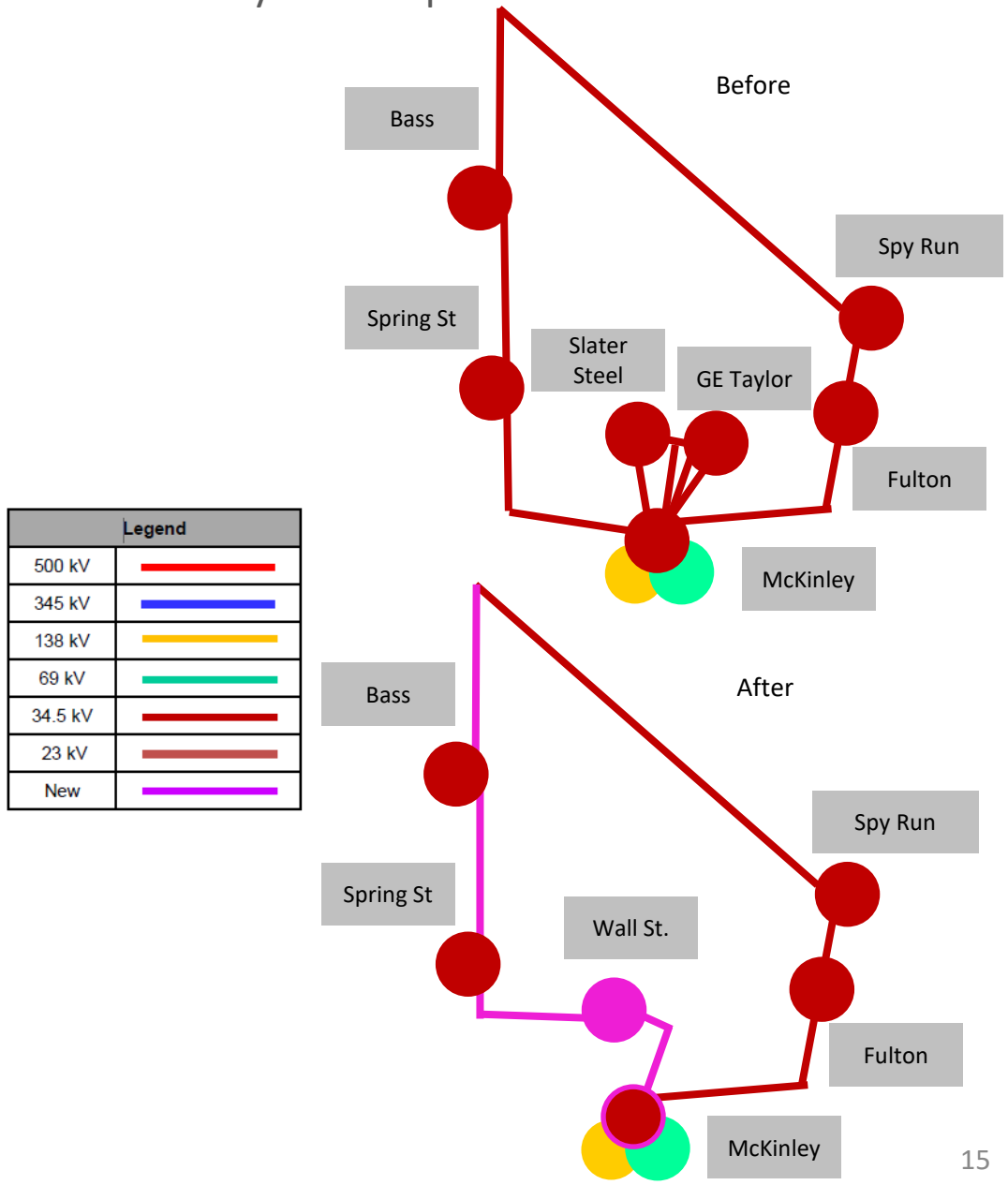


AEP Transmission Zone: Supplemental McKinley Area Improvements

Need Numbers: AEP-2019-IM018
Process Stage: Solutions Meeting 12/18/2019

Alternatives Considered:
Alternative 1:
Rebuild the lines as is.
Due to the load reduction in this area and the higher capacity of the new transmission lines, AEP was able to address the needs with a single line exiting McKinley station.
Estimated Cost: $19.4M.

Projected In-Service: 05/16/2022
Project Status: Scoping



AEP Transmission Zone: Supplemental
Hillcrest – Adams 69kV rebuild

Need Number: AEP-2019-IM030
Process Stage: Solutions Meeting 12/18/2019
Process Chronology: 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:

Hillcrest – Bluffton 69kV line

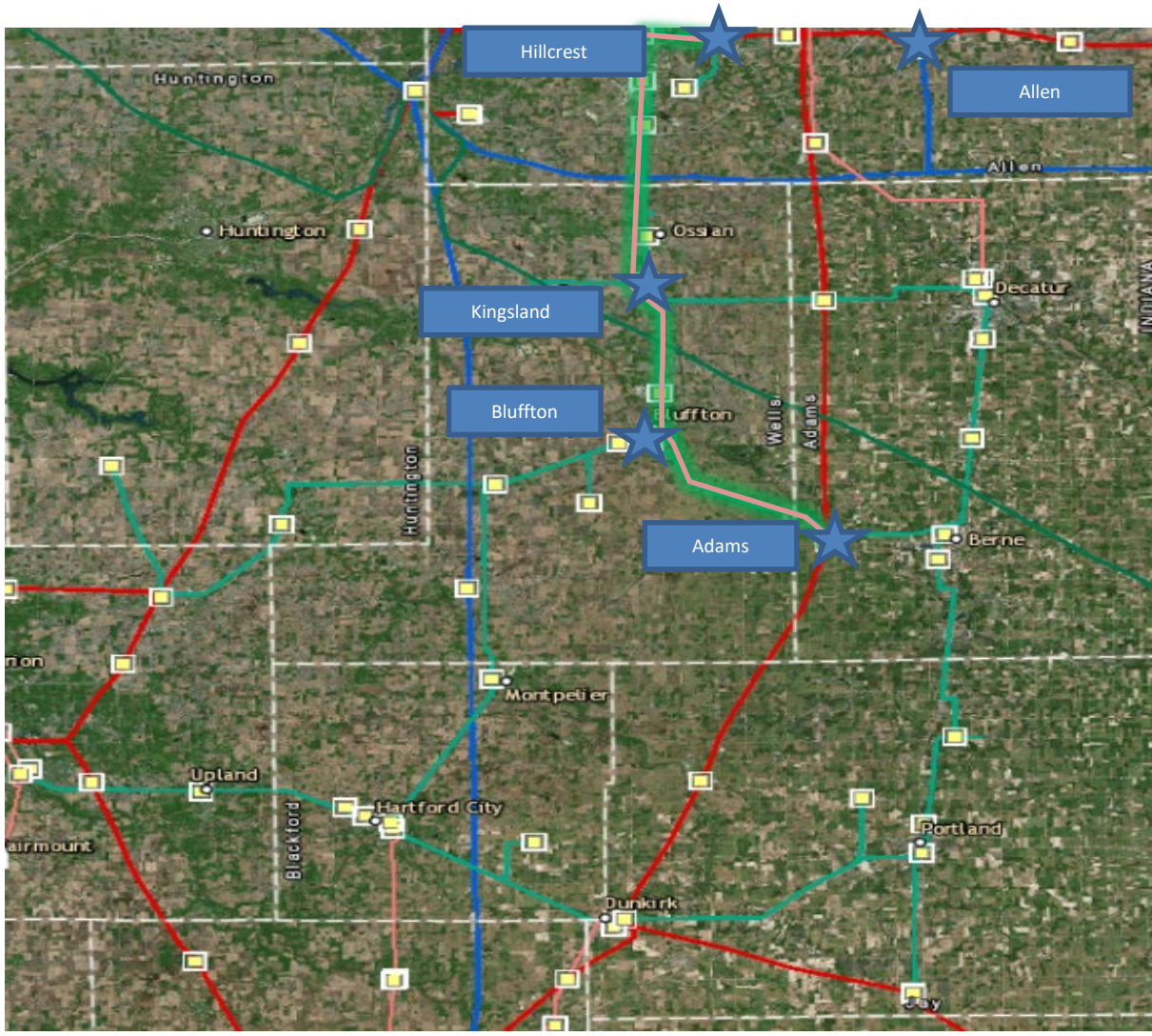
- 1964 vintage wood pole line
- This line is currently subject to 155 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.

Adams – Bluffton 69kV line

- 1957 vintage wood pole line
- This line is currently subject to 32 open conditions with the majority being rotting structural issues. This trend is expected to increase as the structures and conductor age.

Kingsland 69kV station

- Breakers “A” and “B”
    - 1969 vintage Oil breaker
    - Fault Operations: A(31) B(27) – Recommended(10)



AEP Transmission Zone: Supplemental
Hillcrest – Adams 69kV rebuild

Need Number: AEP-2019-IM030
Process Stage: Solutions Meeting 12/18/2019
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 8)
Problem Statement:

WVPA/Heartland Industrial Park 1 (Pleasant station)

- WVPA/Heartland has requested a new 138kV delivery point to feed a new industrial park.
- 2 industrial customers are already building on this site with room for further expansion. This load growth further constrains an already constrained 69kV network

WVPA/Heartland Industrial Park 2 (Ossian station)

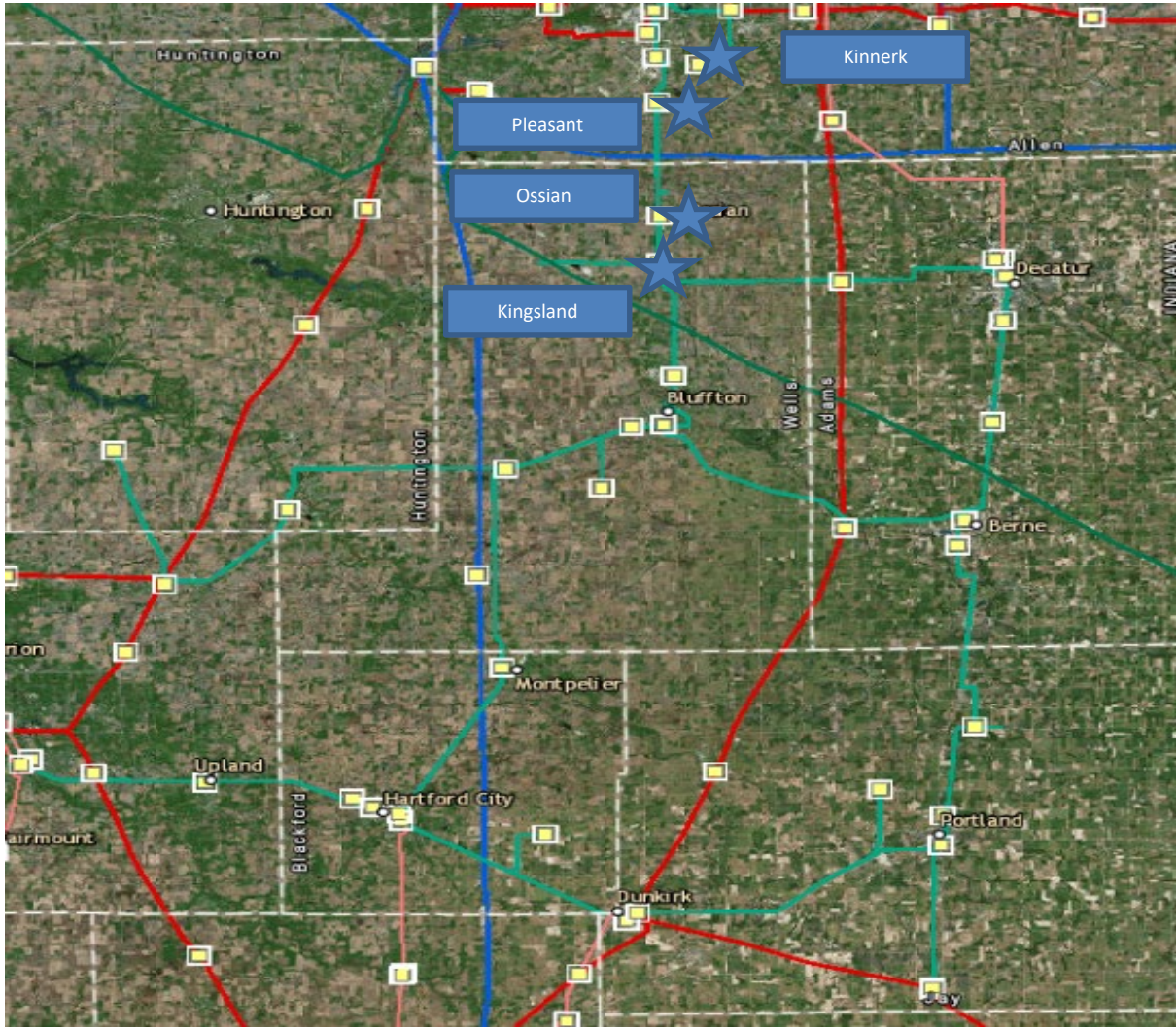
- WVPA/Heartland has target this area for industrial development.
- Potential economic developments have not materialized due to system load limitations.

Kinnerk (WVPA/Heartland station)

- Customer has made an offer to upgrade this station to 138kV in order to enable to connect 138kV to the Pleasant and Ossian industrial parks.

Kingsland (I&M Distribution)

- I&M Distribution has indicated a want to move toward 138kV at this facility due to the expected load growth in the industrial park north of this station.



AEP Transmission Zone: Supplemental
Hillcrest – Adams 69kV rebuild

Need Number: AEP-2019-IM030
Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Rebuild the ~9.5 miles of the Kingsland – Bluffton – Adams circuit as 6-wired 138kV design structures. **Estimated Cost: $28.5M**

Build ~4.5 mile greenfield from Uniondale station to Ossian station. **Estimated Cost: $8M**

Rebuild the Bluffton – Hillcrest 69kV line as the ~26 mile Bluffton to Pleasant circuit as 6-wired 138kV design structures. **Estimated Cost: $67.1M**

Build the ~3.3 mile Pleasant to Kinnerk circuit as 6-wired 138kV design structures. **Estimated Cost: $9.6M**

Install one 138kV rated POP switch to feed Kinnerk's load. **Estimated Cost: $0.4M**

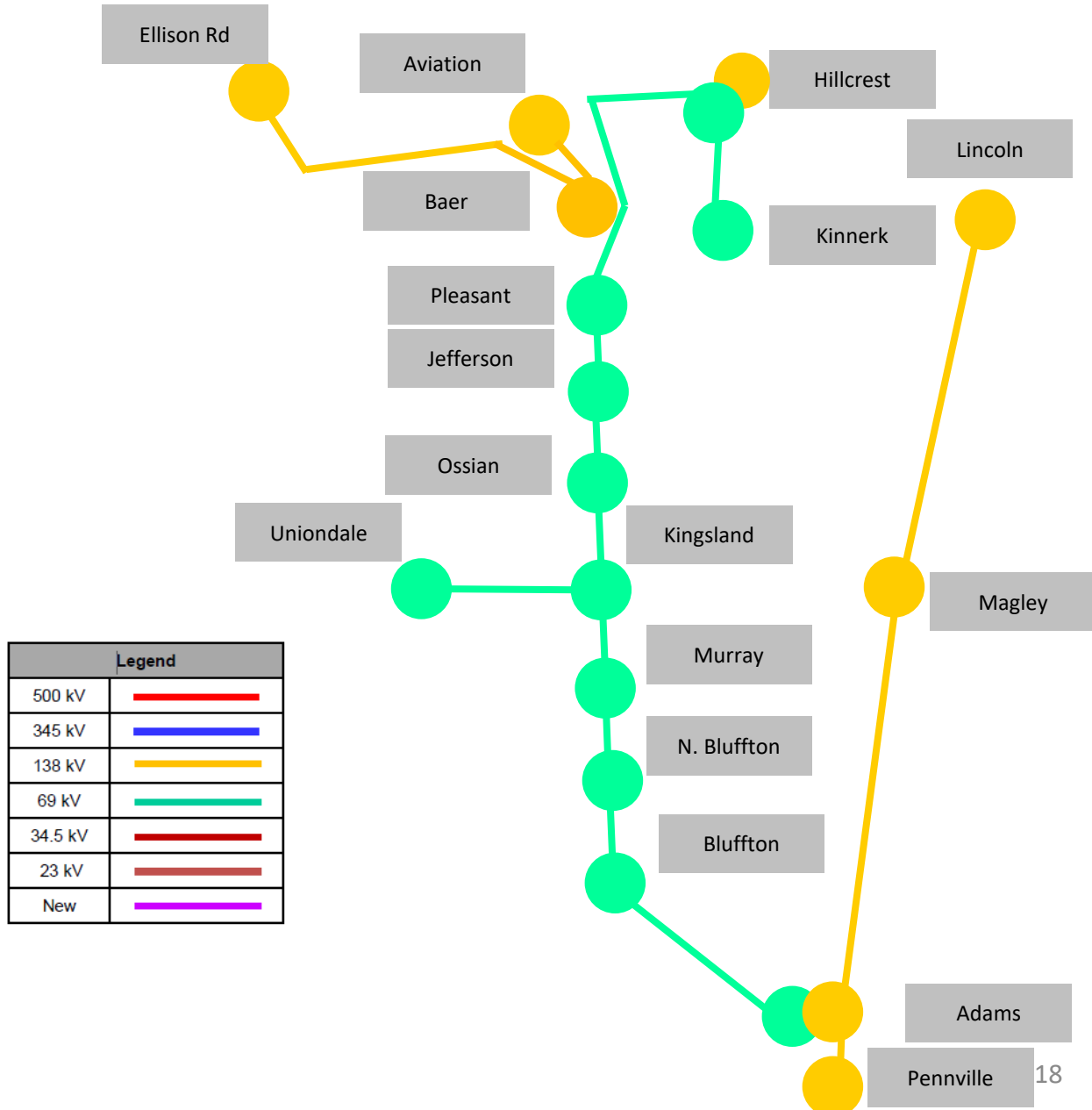
Replace 2 69kV CB's toward Bluffton and Pleasant at Kingsland. **Estimated Cost: $1.6M**

Install the new 69kV switch called Skips Place to feed the Uniondale load. **Estimated Cost: $0.3M**

Install 69kV switch called Thiele to feed Kinnerk load. **Estimated Cost: $0.6M**

Remove CB "F" at Hillcrest station. **Estimated Cost: $0.1M**

Total Estimated Transmission Cost: $116.2M



AEP Transmission Zone: Supplemental
Hillcrest – Adams 69kV rebuild

Need Number: AEP-2019-IM030
Process Stage: Solutions Meeting 11/22/2019

Alternatives Considered:

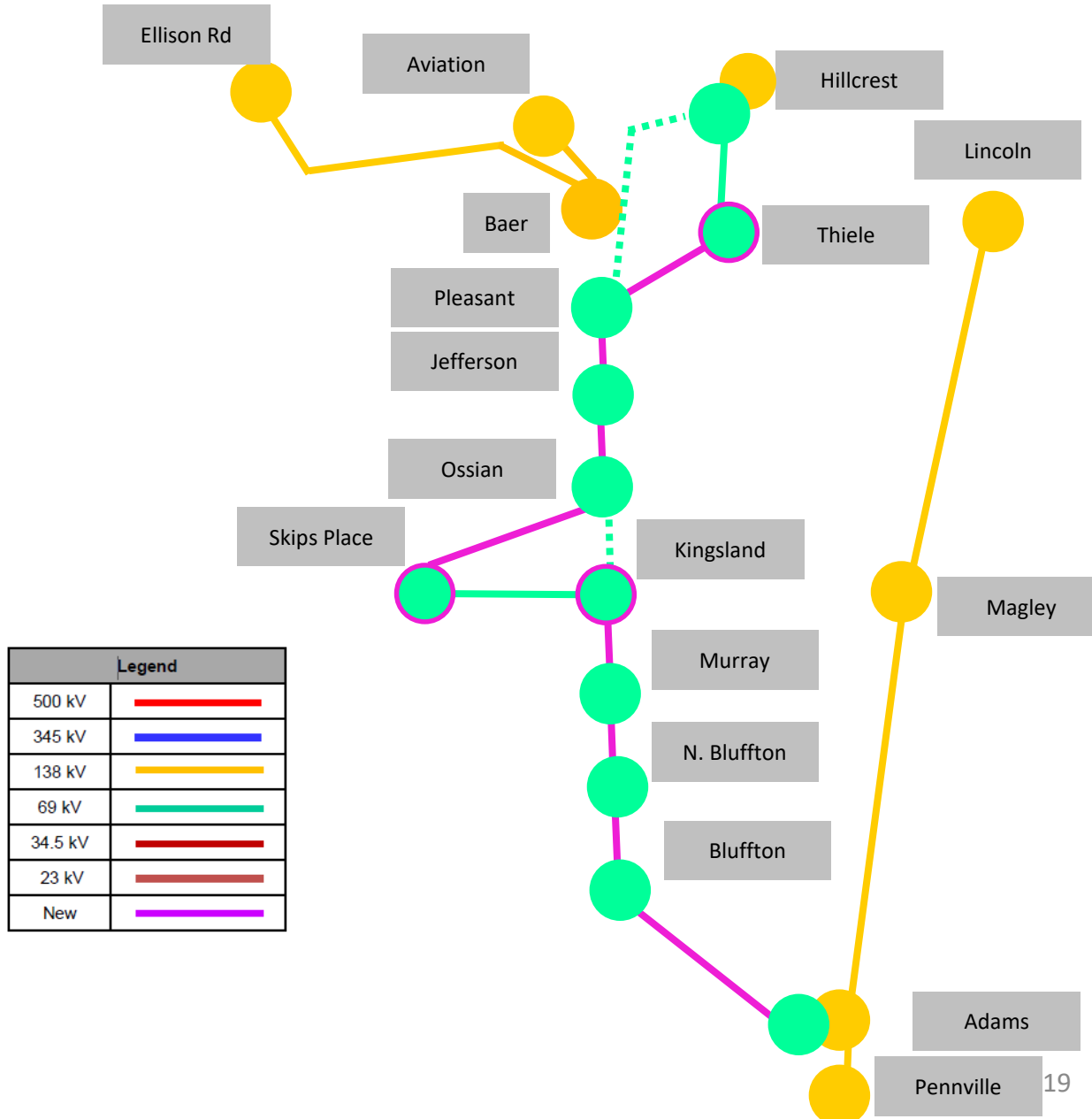
1. Build the Hillcrest – Adams line at 69kV double circuit. While this would solve any current and immediate future load growth issues in the Bluffton – Hillcrest region, it wouldn't provide the benefit of connecting a 3rd 138kV source to Adams station, wouldn't help support the surrounding 69kV network and would stop large spec loads from being able to connect to this area easily. For this reason, the minimal cost benefit, and since the area already has a portion built to 138kV, this alternate was not chosen.

2. Build the Hillcrest – Adams line at 138kV single circuit. This would mean that in order to upgrade the line to 138 in the future, every delivery point on this line would need a step down transformer. For this reason, this option was not chosen.

Ancillary Benefits:

Kinnerk and Uniondale will be de-radialized which improves their service and allows AEP to maintain lines.

Projected In-Service: 10/01/2023
Project Status: Scoping



AEP Transmission Zone M-3 Process
Jackson, Ohio

Need Number: AEP-2018-OH012

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Needs Meeting 10/28/2018

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

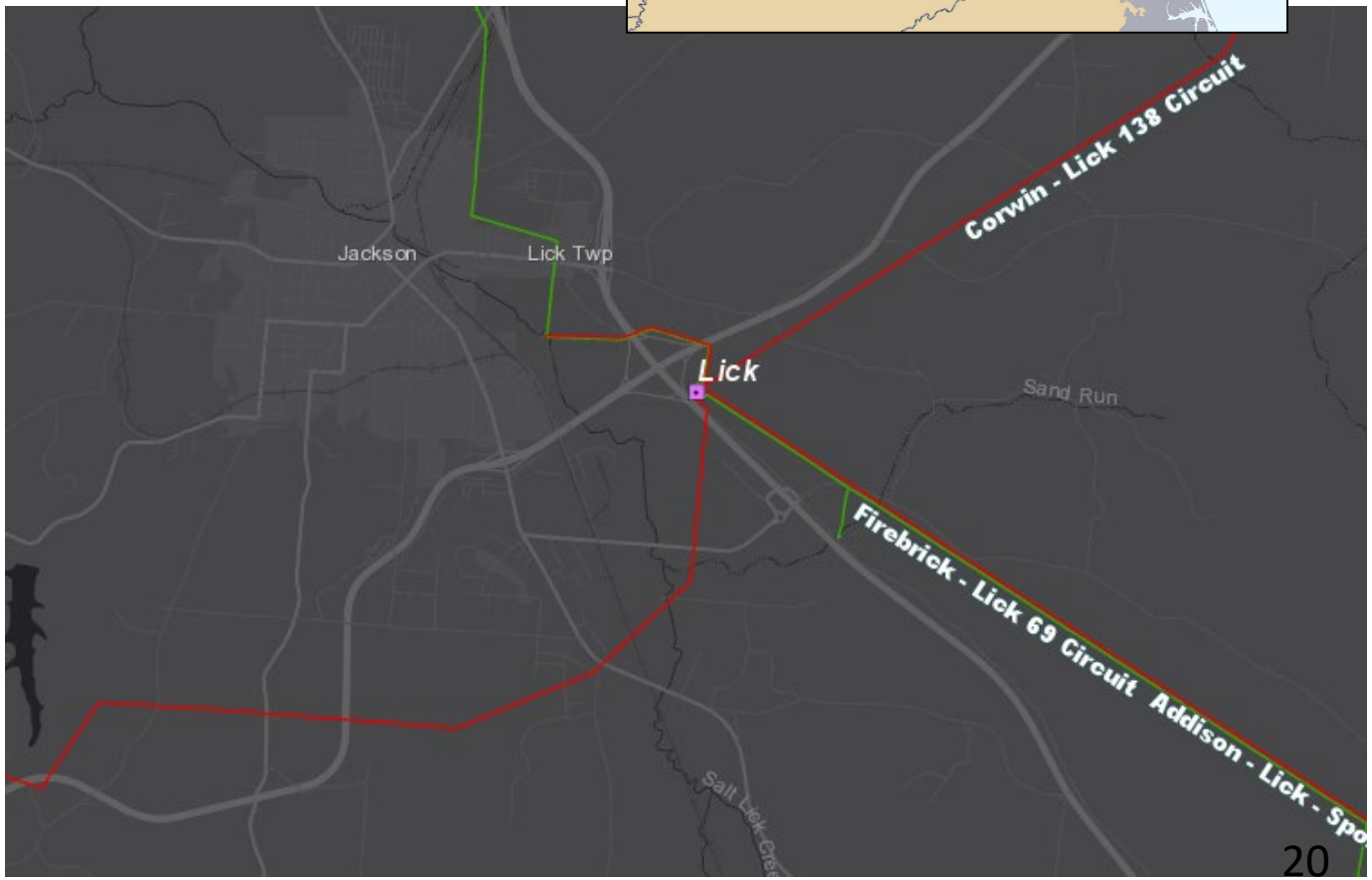
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

At Lick substation there are six 69 kV circuit breakers with condition issues. CB's 61,62, 65, 66, 67, and 69 are oil type breakers that were manufactured between 1956 - 1967. There is a potential for oil spills during routine maintenance and fault operations. In addition, spare parts are difficult to obtain. The breakers' fault operation counts are as follows: {61-126, 62-11, 65-26, 66-8, 67-19 and 69-4}. For most of these breakers, the number of fault operations exceed the manufacturers recommended number of 10.

There are three 138/69 kV, 18 MVA transformers at Lick. T#1 is a Westinghouse transformer manufactured in 1956. Transformers #2 and #3 are both GE transformers manufactured in 1950. All three transformers have maintenance issues with their LTCs and have significant oil leaks. In addition, loss of two of the transformers can load the remaining transformers tertiary winding above it's rating.



AEP Transmission Zone M-3 Process
Lick Station Rebuild

Need Number: AEP-2018-OH012

Process Stage: Solutions Meeting 12/18/2019

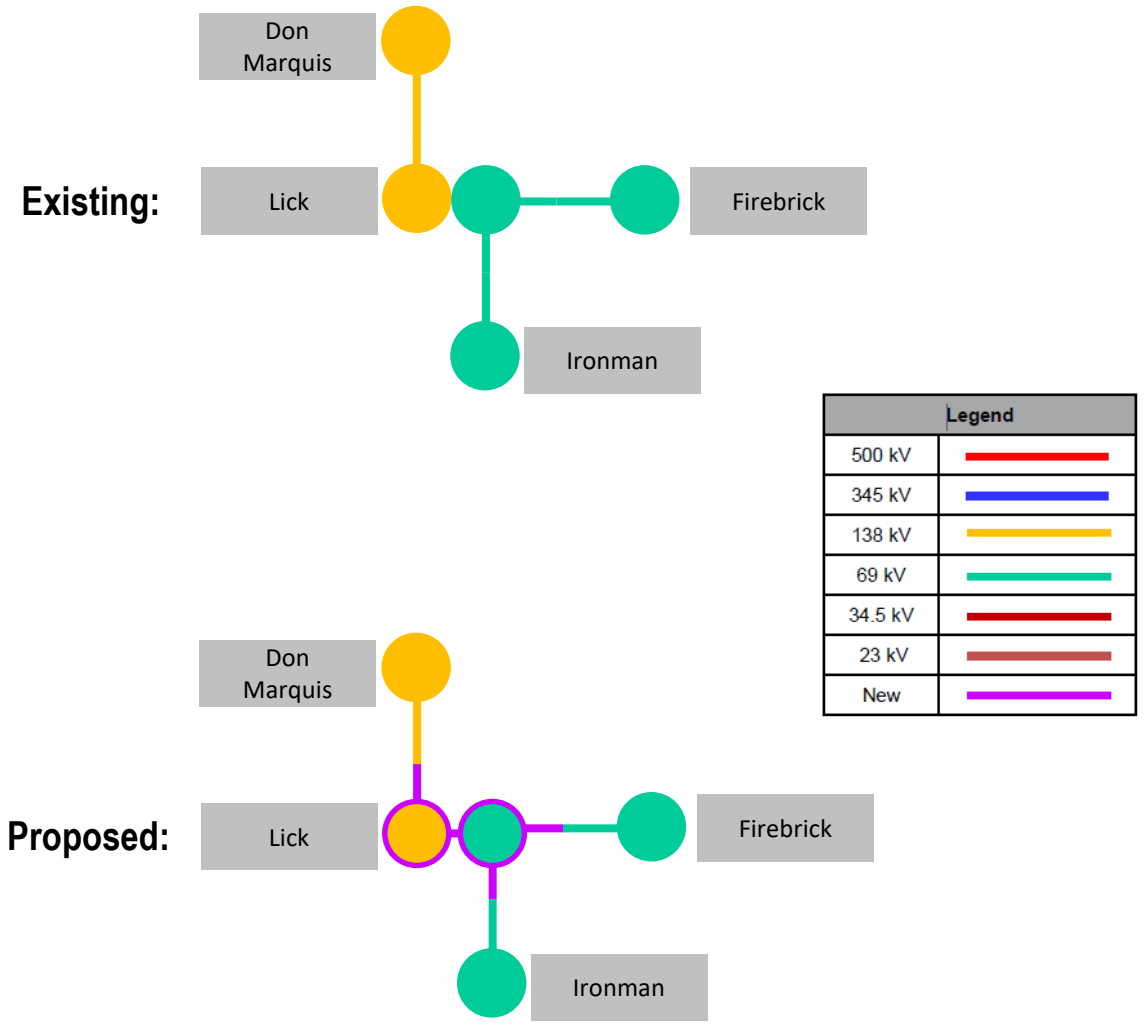
Proposed Solution:

- At Lick station, replace the three existing 138/69-12kV transformers with two 138/12 kV transformers and one 138/69 kV transformer. The 69 kV bus will be rebuilt in the clear within the station due to constructability concerns. Three 69kV 40kA, 3000A CBs will be installed on the low side of transformer and 69 kV line exits. An additional 138kV 40kA, 3000A CB will be added at the station to separate the 138 kV circuits towards the City of Jackson and Don Marquis. **Estimated Cost: $8.3M**
- Relocate the Don Marquis – Lick 138 kV circuit associated with the station work at Lick. **Estimated Cost: $0.7M**
- Relocate the Firebrick – Lick 69 kV circuit associated with station work at Lick. **Estimated Cost: $0.8M**
- Relocate the Ironman – Lick 69 kV circuit associated with station work at Lick. **Estimated Cost: $0.5M**

Total Cost: $10.3M

Projected In-Service: 02/15/2021

Project Status: Scoping

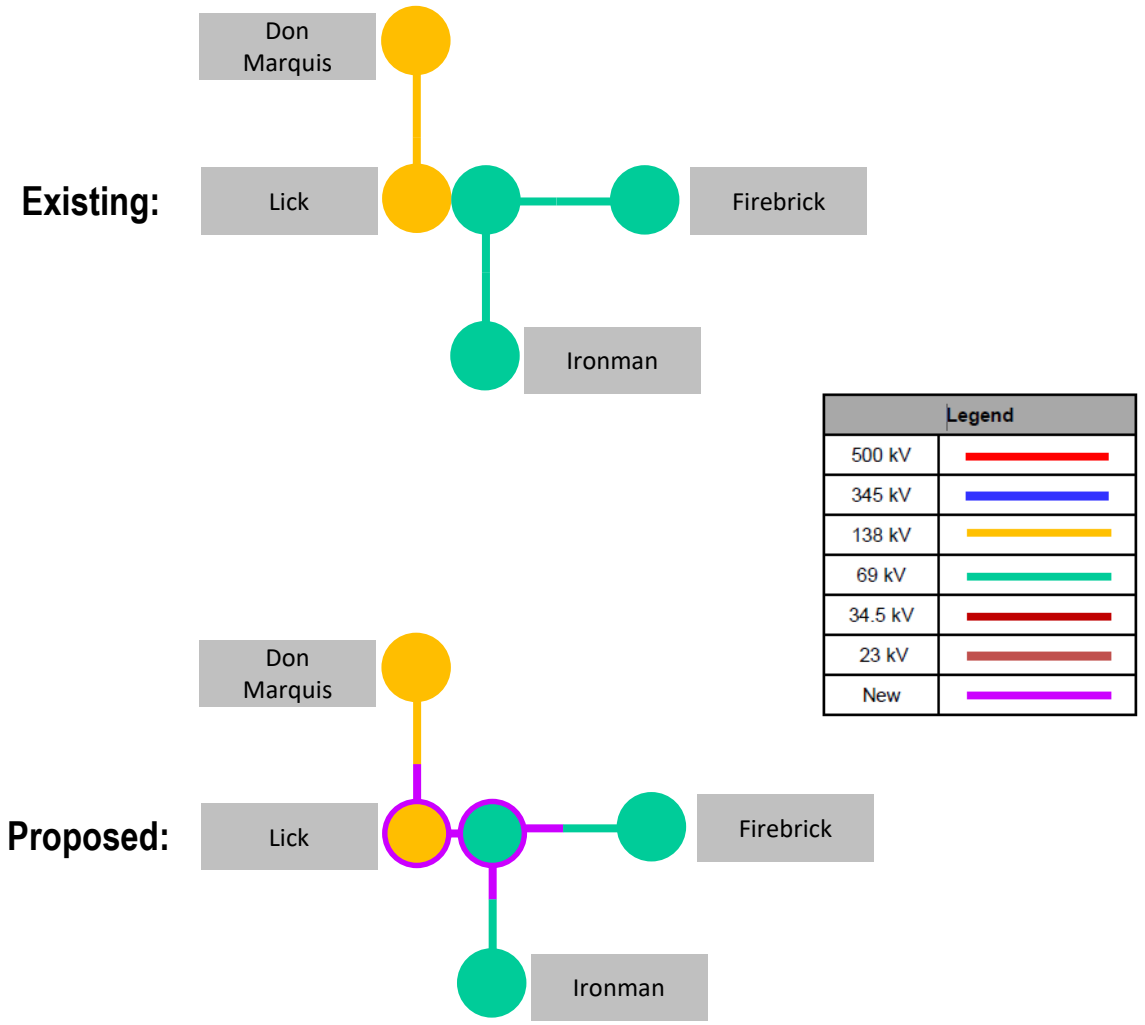


AEP Transmission Zone M-3 Process
Lick Station Rebuild

Alternatives Considered:

Alternate #1

An alternate design was considered to build a new Greenfield 69kV yard adjacent to the Lick station with a 138 kV feed from the Lick 138 kV bus. The solution was simpler from a constructability standpoint, but complicated by limited space availability. There is a microwave tower just to the east of the station. The City of Jackson substation is on the north side. There is a highway on the south side. In addition, the transmission line exits are all crowded on the north and east sides. The additional costs would be to relocate the Firebrick and Sporn lines along with moving the cell tower. The estimated increase in cost for these changes from the proposed solution would be $3-4M.



AEP Transmission Zone M-3 Process
Findlay, Ohio

Need Number: AEP-2019-OH007
Process Stage: Solutions Meeting 12/18/2019
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:

Findlay Center Station:

- 34.5 kV CB's A, B, C, and D are oil type breakers (vintage 1962). Many of these breakers have exceeded the manufacturers recommended number of fault operations (10): " A "(37), "B "(7),"C" (6), and "D" (39).
- 34.5 kV cap switcher AA is a MARK-V model (2004) which has been identified for replacement due to lack of spare parts, operational and reliability concerns, and maintenance issues.

Findlay Station:

- 34.5 kV CB's A, B, D, and E are oil type breakers (vintage 1953– 1955). Many of these breakers have exceeded the manufacturers recommended number of fault operations (10): "A"(20), "B" (33), "D" (41), and "E" (3).
- 34.5 kV cap switcher AA is a VBM model (1988) which has been identified for replacement due to lack of spare parts, operational and reliability concerns, and maintenance issues.

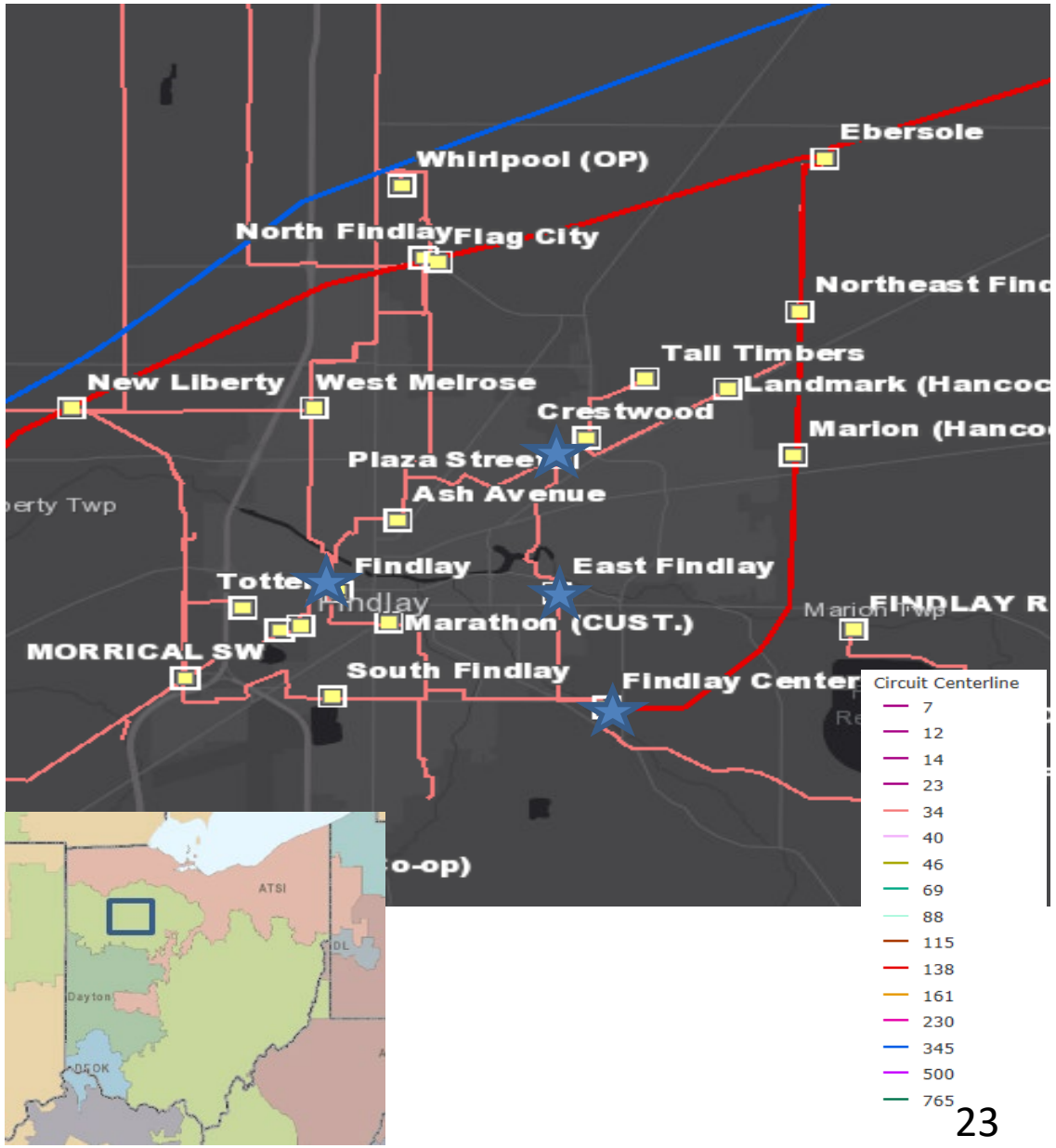
Plaza Street Station:

- 34.5 kV CB A is an oil type breaker (vintage 1948). This breaker has exceeded the manufacturers recommended number of fault operations (10): "A" (13).

East Findlay Station:

- The three-way switch (1958) has ongoing difficulties maintaining proper alignment of switches. The insulators are cap-and-pin type which often physically failing during switching operations.

**Oil breaker maintenance is difficult due to the oil handling requirements and there is a risk for oil spills during failures and maintenance. These breakers are FK model breakers that have historical reliability concerns and lack of spare part availability.



AEP Transmission Zone M-3 Process
Findlay, Ohio

Need Number: AEP-2019-OH054

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Needs Meeting 09/25/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

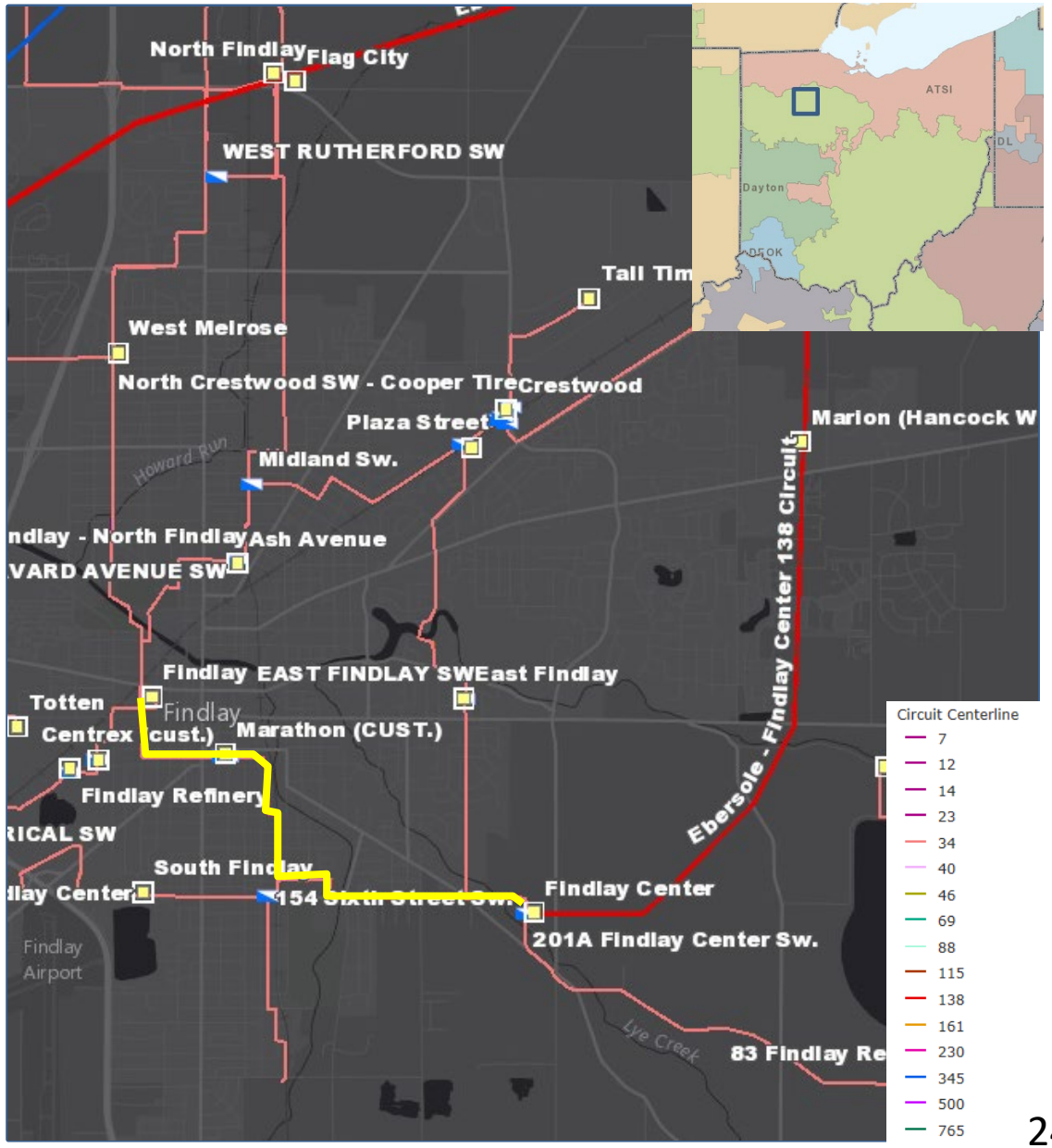
Problem Statement:

Line:

Findlay – Findlay Center Circuit (1934)

- Length: 3.43 miles
- Original Construction Type: Wood (87% - Pre 1964, 10% - 1965-1974, 3% - 2012)
- Original Conductor Type: 4/0 Copper 7 (97% -Pre 1957, 3% - 2012)
- 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: 2023 RTEP Summer



AEP Transmission Zone M-3 Process
Findlay, Ohio

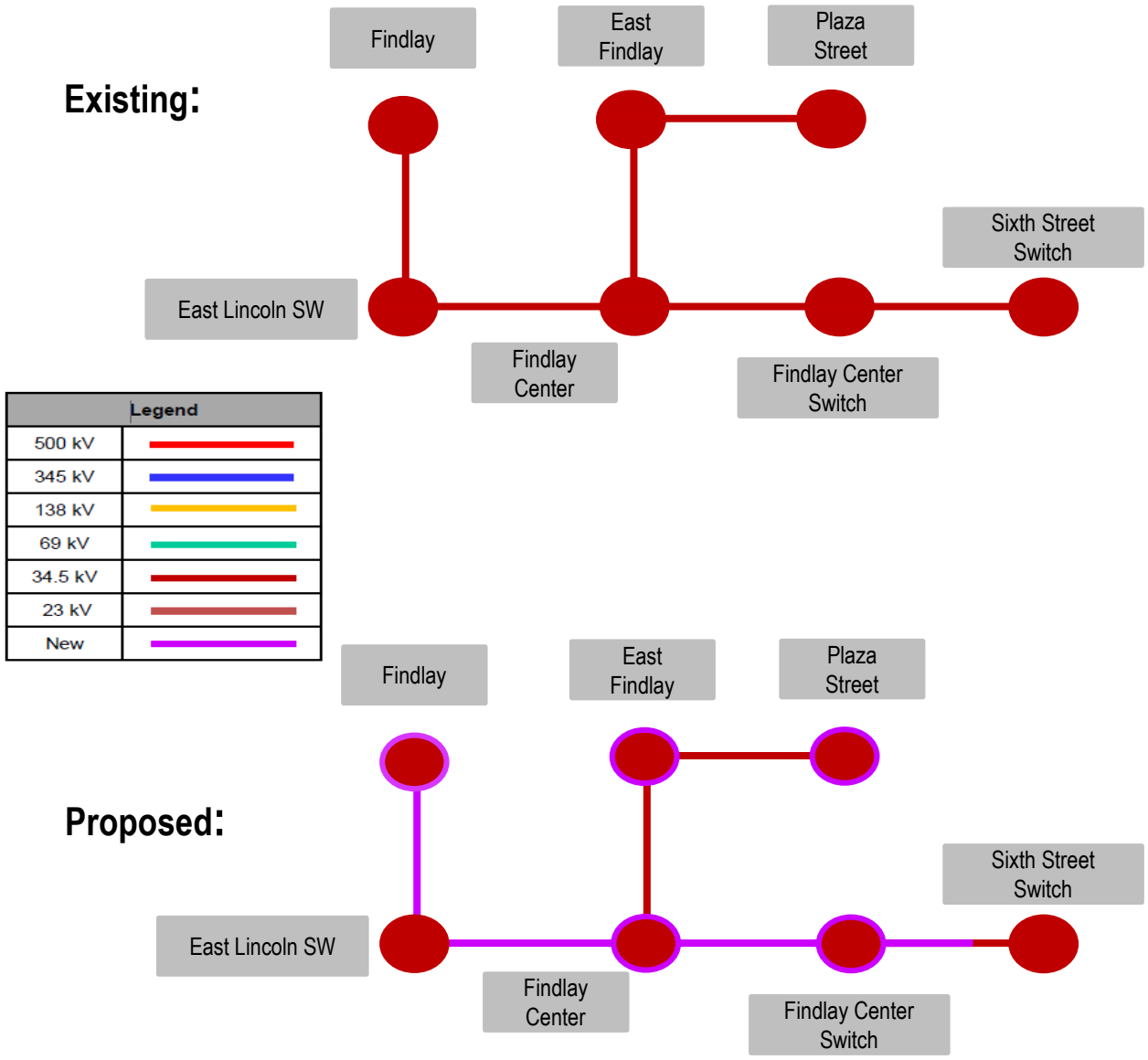
Need Number: AEP-2019-OH007 & AEP-2019-OH054
Process Stage: Solutions Meeting 12/18/2019
Potential Solution:

- At Plaza Street station, replace 34.5kV CB-A with 69kV (2000A / 40kA) and remove CB-A bypass switch. **Estimated Cost: $1.3M**
- At Findlay station, replace CB's A, B, D, E with 69kV breakers (2000A / 40kA) and replace Circuit Switcher AA with 69kV (2000A / 25kA). **Estimated Cost: $4.0M**
- At Findlay Center station, replace CB's A, B, C, D with 69kV breakers (2000A / 40kA), add an additional 69kV breaker (2000A / 40kA) and change bus to ring configuration, and replace Circuit Switcher AA with 69kV (1200A / 25kA). **Estimated Cost: $5.0M**
- At Findlay Center Sw, replace two-way switch with three-way 69kV POP switch. **Estimated Cost: $0.3M**
- At East Findlay, replace existing switch with three-way 69kV POP switch. **Estimated Cost: $0.6M**
- At South Findlay station, perform remote end relay work. **Estimated Cost: $0.5M**
- Rebuild 1.8 mile Findlay – Fifth Street 34.5 kV line asset, partially underground for 0.8 miles due to urban construction environment with the remaining mile overhead. **Estimated Cost: $15.1M**
- Rebuild 1.6 miles of double circuit section of the New Liberty – Findlay Center 34.5 kV line asset. **Estimated Cost: $8.6M**
- Replace 4 structures on double circuit section of New Liberty – Findlay 34.5 kV line asset. **Estimated Cost: $1.3M**

Total Estimated Cost: $36.7M

Alternatives Considered:
No viable cost effective alternatives.

Projected In-Service: 06/01/2021
Project Status: Scoping



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AEP Transmission Zone M-3 Process
Bucyrus, Ohio

Need Number: AEP-2019-OH016

Process Stage: Solutions Meeting 12/18/2019

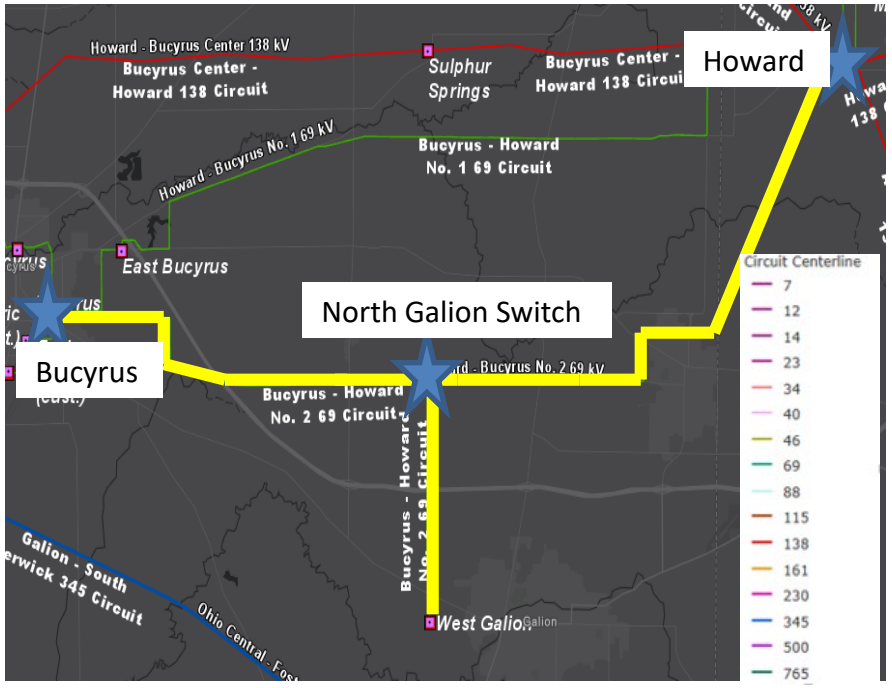
Previously Presented: Needs Meeting 4/23/2019

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

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- The Bucyrus-Howard No.2 69kV circuit was originally constructed in 1919 with wood structures and copper conductor (#1 CU and 3/0 CU). 84% of the line still utilizes the original 1919 copper conductor.
- Some structures have been replaced over the years; however, they have been like for like wood pole replacements.
- The circuit has had 38 forced operations in the last 11 years of which 7 have been permanent and resulted in 54 hours of down time. 2 out of the 7 outages have been caused by conductor failures, the most recent of which resulted in 188,000 CMI.
- There are currently 144 open conditions along the 23 mile long line.
- Age profile (16% - Pre 1940's, 10% - 1950's, 14% - 1960's, 28% - 1970's, 12% - 1980's, 12% - 1990's; 8% - 2000's)
- 2% Steel; 98% Wood.



AEP Transmission Zone M-3 Process
Bucyrus, Ohio

Need Number: AEP-2019-OH016

Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Rebuild the Bucyrus-Howard #2 circuit (approx. 25 miles) utilizing 556 ACSR conductor. As part of the rebuild the existing North Galion switch will be retired and the line will be rerouted to provide looped service to West Galion station.

Estimated Cost: $51.9M

Work at West Galion will be required to terminate the additional 69 kV feed at the station.

Estimated Cost: $0.8M

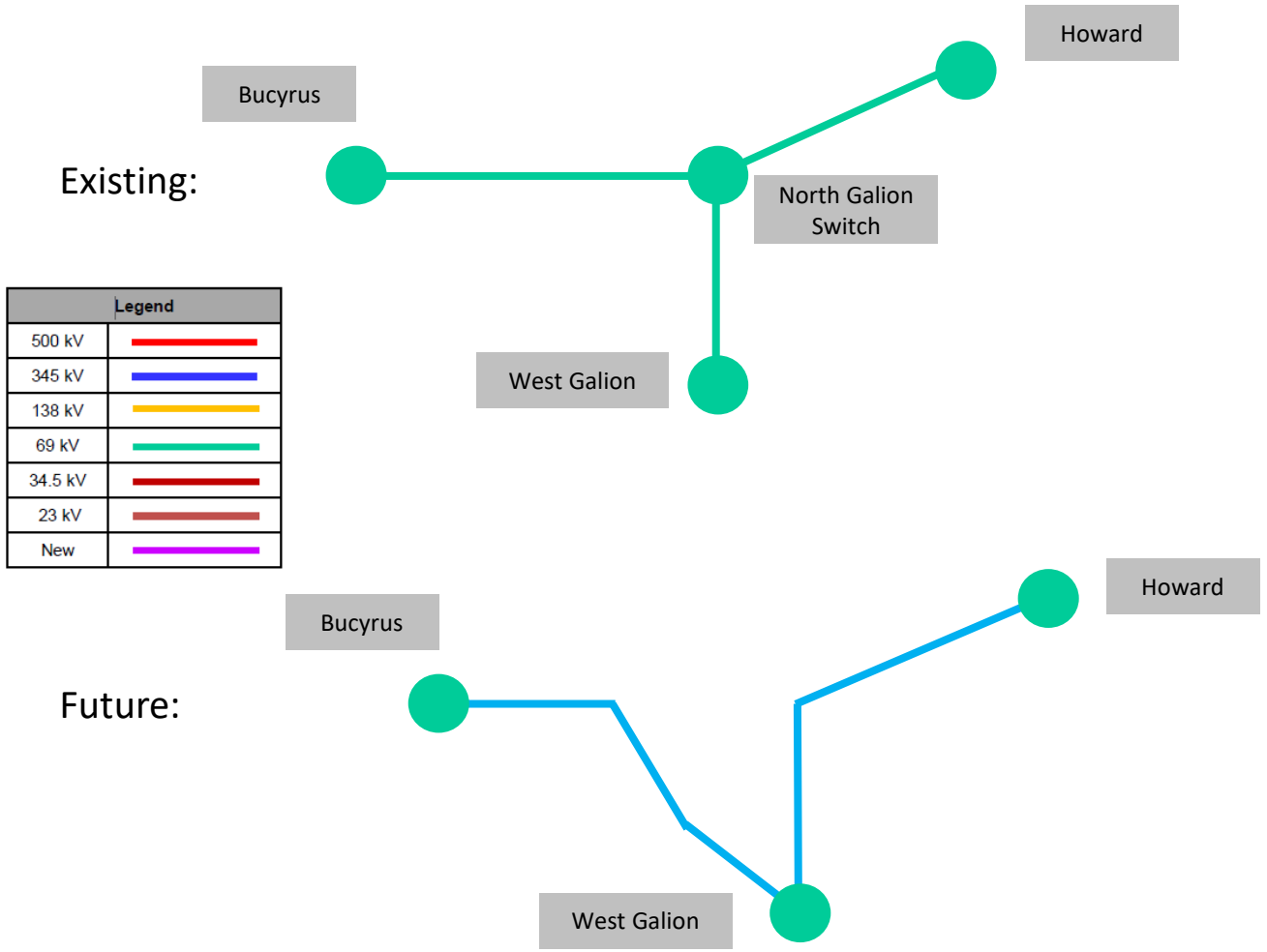
Total Cost: $52.7M

Alternatives Considered:

Rebuilding the circuit within the existing ROW was evaluated. Because of the line reroute of the proposed project, this alternative would have only resulted in a slightly less amount of line mileage being required. This alternative would leave a 3 mile radial feed into West Galion. Rebuilding the radial tap to West Galion would likely require new ROW due to constructability/outage constraints associated with it's radial nature. This alternative would have also required the replacement of the existing North Galion wood switching structure. Cost: $52 M

Projected In-Service: 3/31/2022

Project Status: Scoping



Need Number: AEP-2019-OH017

Process Stage: Solutions Meeting 12/18/2019

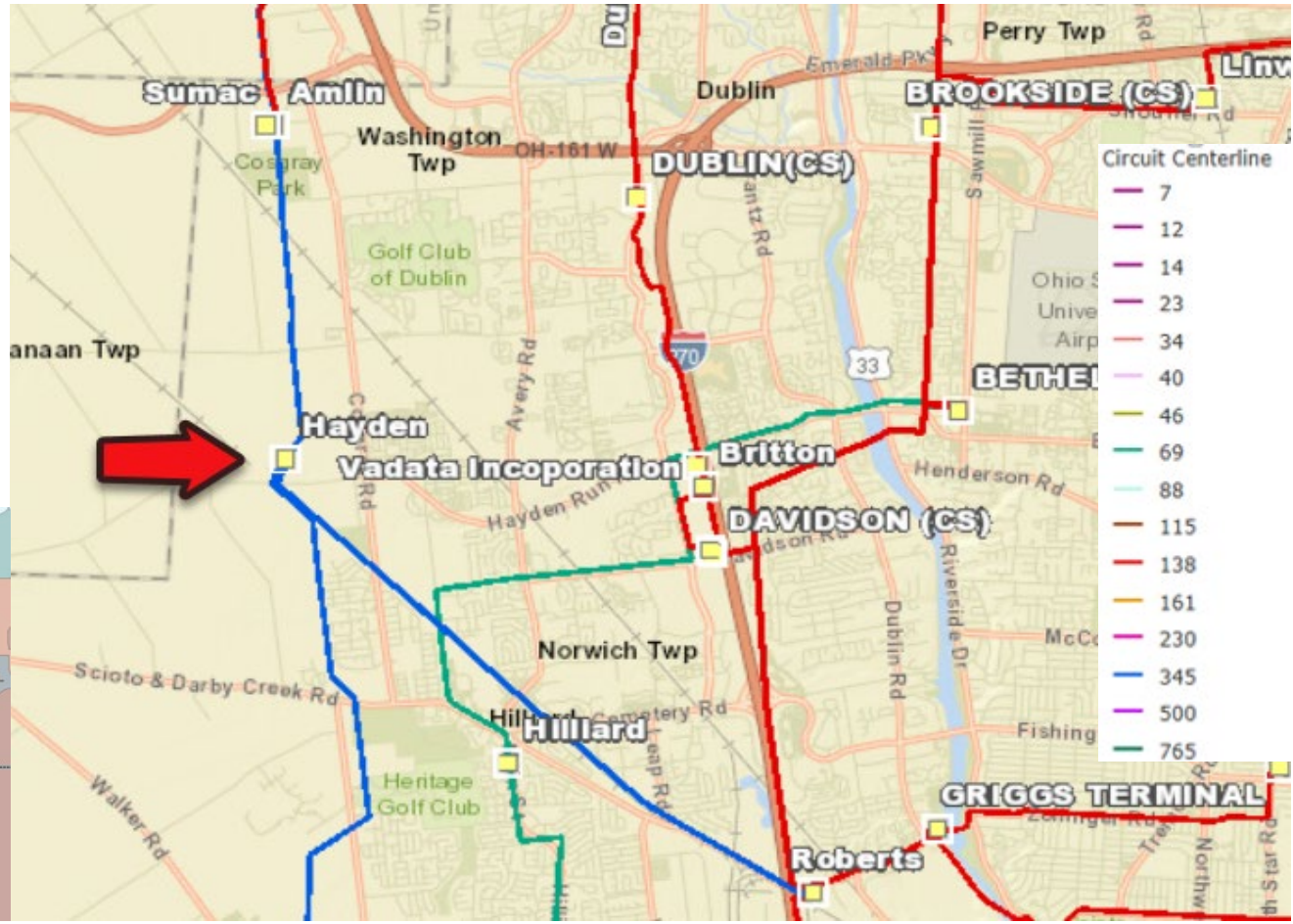
Previously Presented: Needs Meeting 04/23/2019

Supplemental Project Driver: Customer Service

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

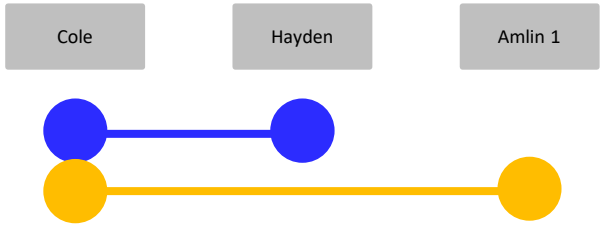
- AEP-Ohio is requesting a new 138kV delivery point at Hayden Station by 6/1/2020.
- There are several highly loaded distribution circuits at Dublin, Davidson, & Hilliard Stations that require a new delivery point.

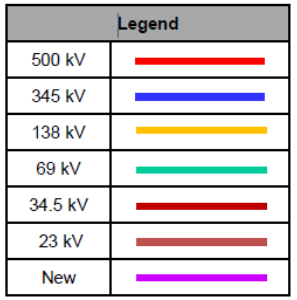


Need Number: AEP-2019-OH017
Process Stage: Solutions Meeting 12/18/2019
Selected Solution:
Cut the existing Amlin – Cole 138kV circuit into new Hayden 138kV yard using 2-954 ACSR. **Estimated Cost: $1.2M**
Install a new 138kV yard at Hayden station, including 3 circuit breakers (3000A, 138kV, 63KA CB's) and bus work to be operated in a ring bus configuration to serve a 50 MVA transformer for AEP Ohio.
Install a new DICM (16'X27') with associated components. Expand the station grading, fencing, and ground grid to accommodate this new 138 kV yard. **Estimated Cost: $9.2M**

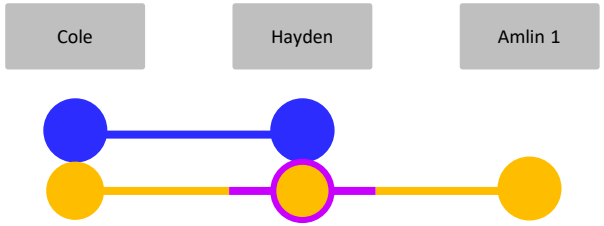
Total Estimated Cost: $10.4M
Alternatives Considered:
No viable cost-effective transmission alternative was identified. Location was at request of AEP Ohio.
Projected In-Service: 06/01/2020

Existing:





Proposed:



AEP Transmission Zone M-3 Process
Beaver, OH

Need Number: AEP-2019-OH023

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Needs Meeting 5/20/2019

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)

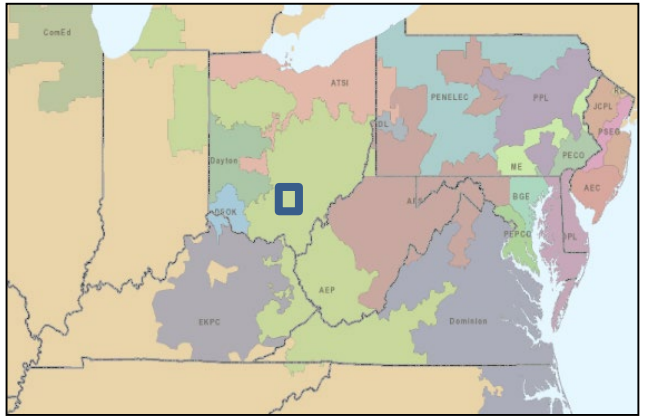
Problem Statement:

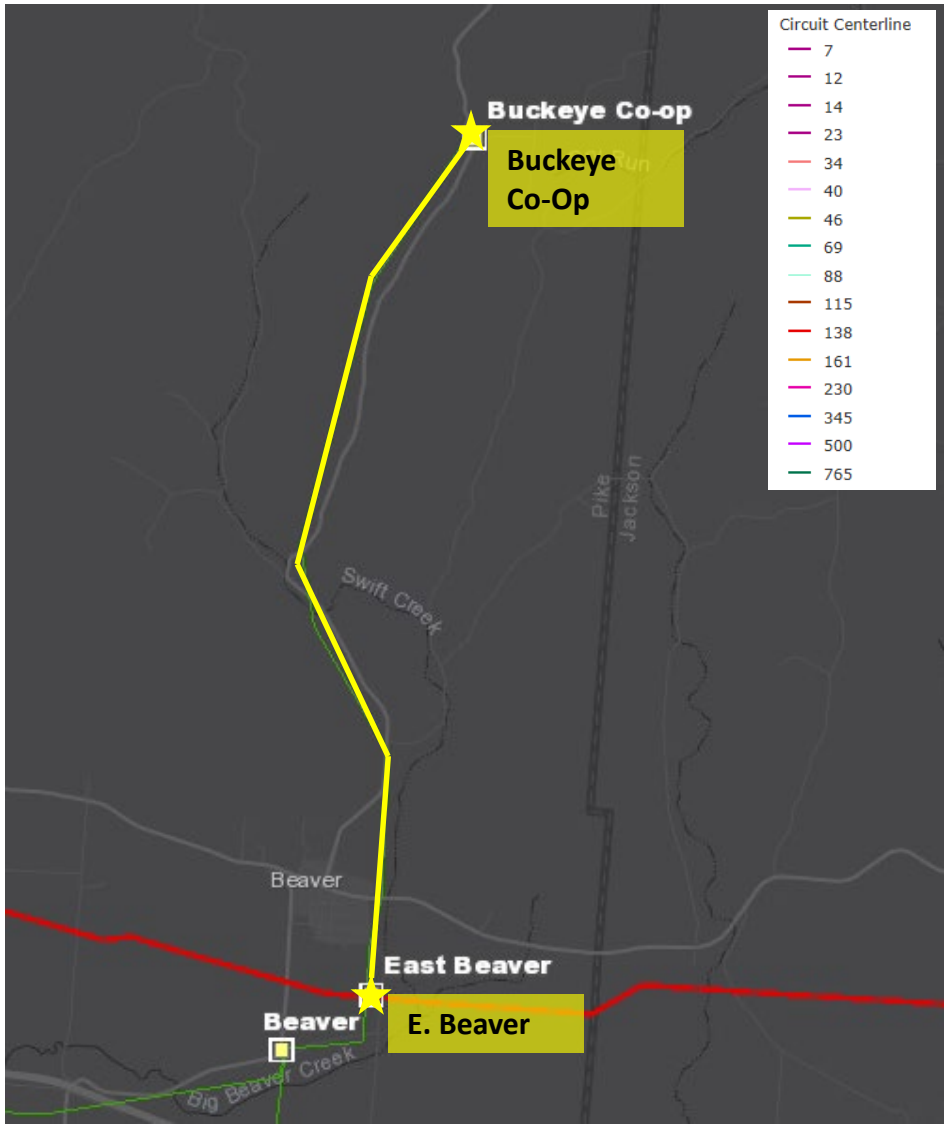
Equipment Material/Condition/Performance/Risk:

The East Beaver – Buckeye Co-Op 69 kV line was built in 1952. 60 out of the 71 wood structures of this 4.5 mile line are of early 1950s vintage and are affected by heavy rot and woodpecker & insect damage. There are 26 open A conditions on this line. The conductor on the entire line has never been replaced since originally installed.

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 M-3 Process
Beaver, OH

Need Number: AEP-2019-OH023

Process Stage: Solutions Meeting 11/23/2019

Proposed Solution:

Rebuild the ~4.5 miles Beaver-Buckeye Co-op 69 kV radial line. **Estimated Cost: $13.5M**

At East Beaver station, install three 138 kV breaker ring bus using 3000A, 40 kA breakers in a ring configuration. Install new DICM Control House. Install 3 new 3000A, 40 kA 69 kV breakers in a ring configuration. **Estimated Cost: $5.8M**

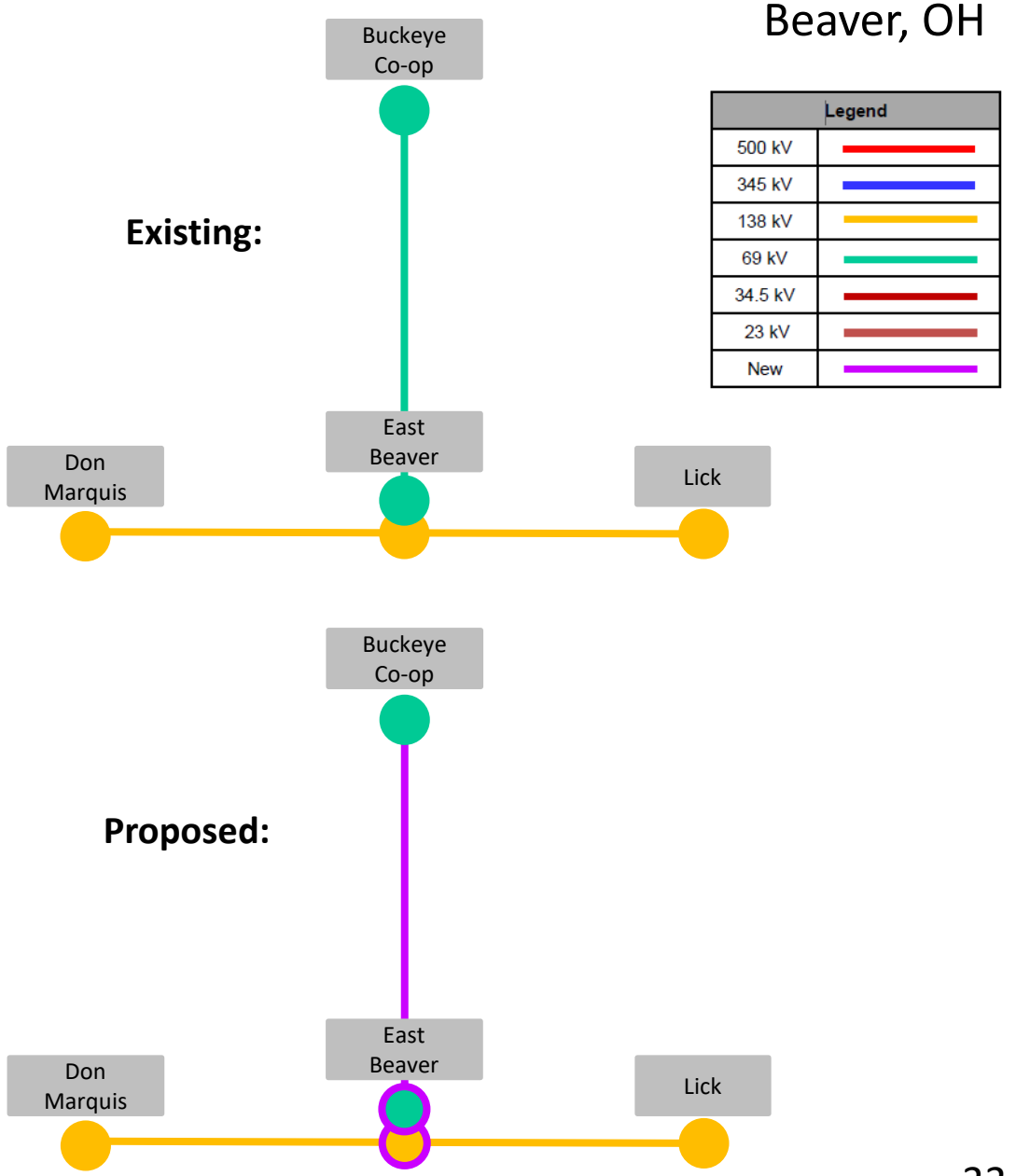
Alternatives Considered:

1. Build a second source into Buckeye Co-op's Beaver Station from Buckeye Co-op's Pine Ridge Station 6.8 miles away on the Berlin-Lick 69kV circuit. This option was not chosen because the line route crosses rough terrain and would require extensive permitting and right of way.
2. Rebuild while the circuit is energized (hot work). This option was not chosen due to the excessive expense and safety hazards.

Projected In-Service: 11/15/2021

Project Status: Scoping

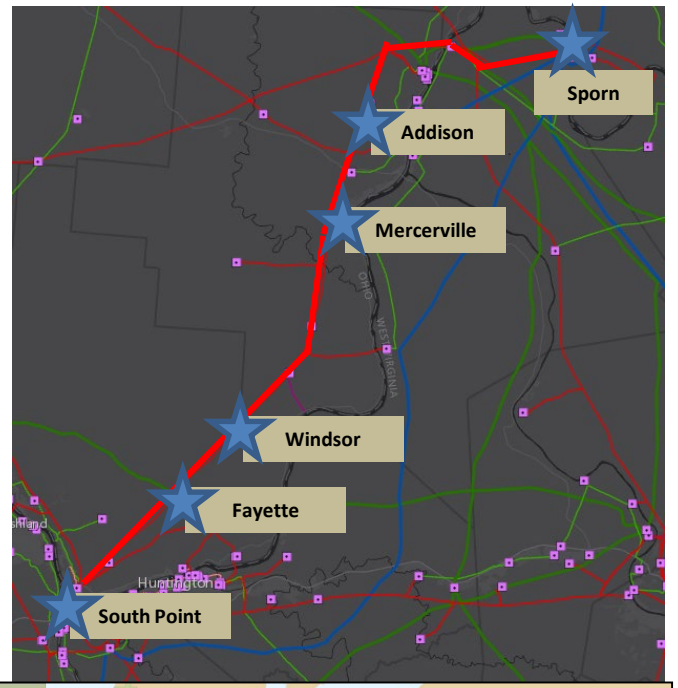
Cost: $19.3M

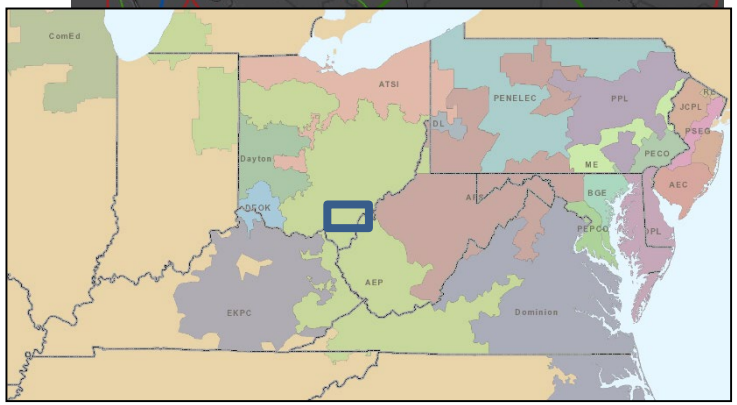


AEP Transmission Zone: Supplemental Gallia County

Need Number: AEP-2019-OH026
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: 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: Supplemental Gallia,County

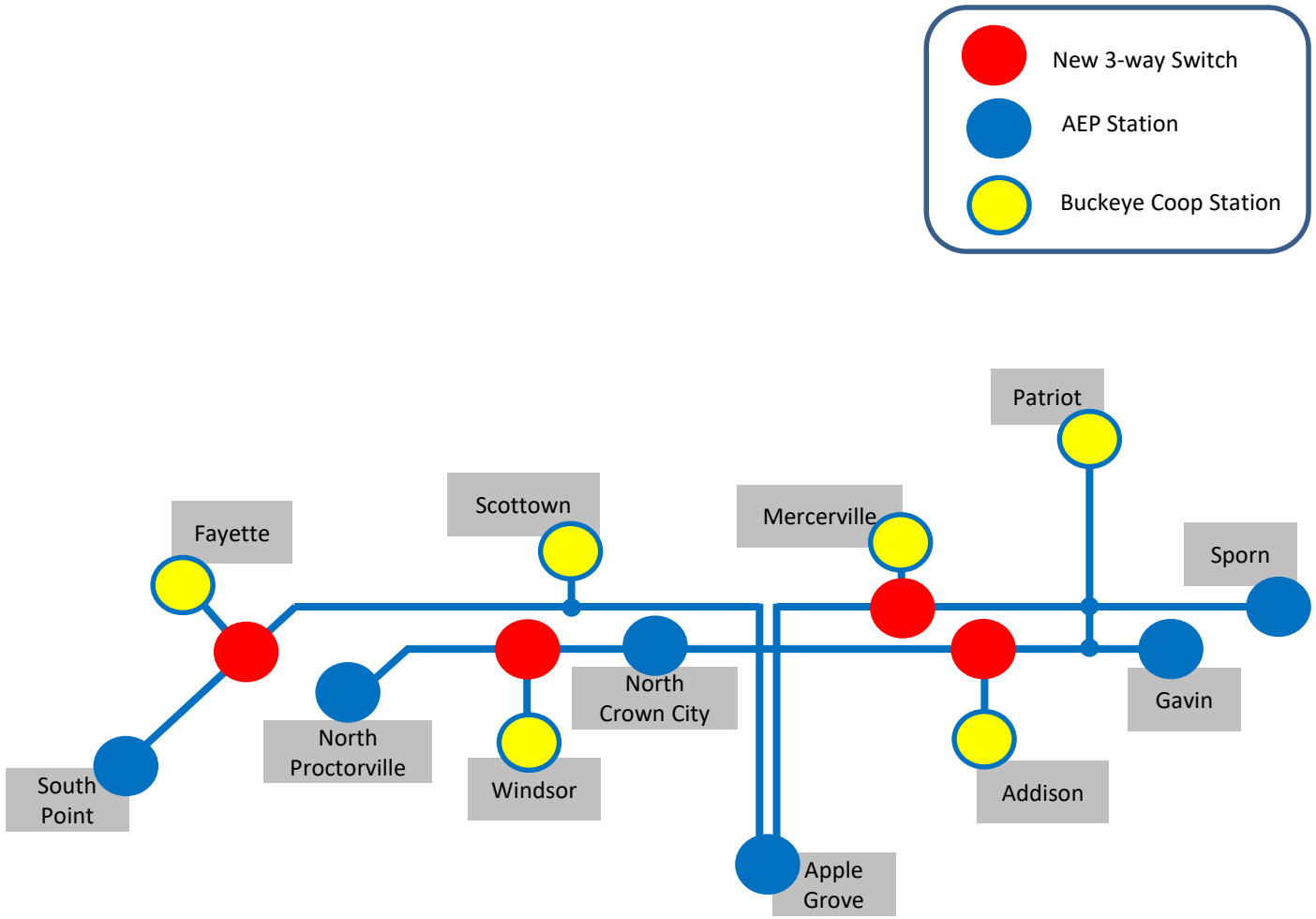
Need Number: AEP-2019-OH026
Process Stage: Solution Meeting 12/18/2019

Proposed Solution:
Install 3-way 138 kV (2000 A) MOAB's at Mercerville hard tap, including dead end structures to connect to new switch pole location. **Estimated Cost: $2.2M**
Install 3-way 138 kV (2000 A) MOAB's at Windsor hard tap.
Estimated Cost: $1.3M
Install 3-way 138 kV (2000 A) MOAB's at Fayette hard tap. Extend the existing line 0.25 miles to the new switch location.
Estimated Cost: $3.5M
Install 3-way 138 kV (2000 A) MOAB's at Addison hard tap, including dead end structures to connect to new switch pole location. **Estimated Cost: $2.5M**

Total Estimated Transmission Cost: $9.5M

Alternatives:
No viable alternatives.

Projected In-Service: 4/30/2021
Project Status: Scoping



AEP Transmission Zone M-3 Process
Crooksville – North Newark Rebuild

Need Number: AEP-2019-OH030

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Need Meeting 06/17/2019

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

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs

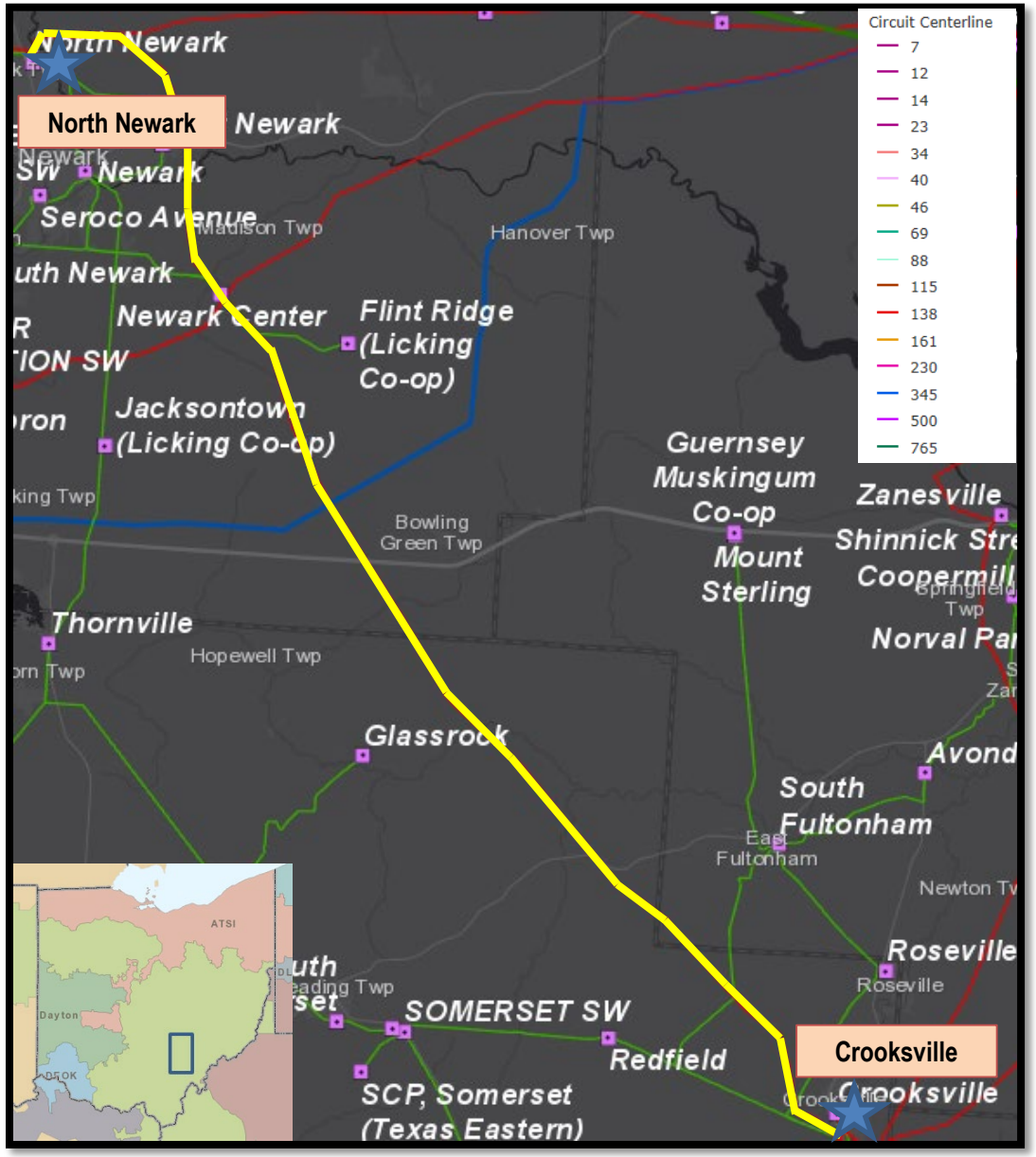
Problem Statement:

Line:

Crooksville – North Newark (Vintage - 1952)

- Length: 30.63 Miles
- Original Construction Type: Wood
- Original Conductor Type: 266,800 CM ACSR 26/7 (Partridge)
- Momentary/Permanent Outages: 5 outages last 5 years
- Number of open conditions: 338
  - Open conditions include: Pole Rot, Insect/Bird Damage, Damaged Conductors, Ground Wires, & Guy Wires.

Model: N/A



AEP Transmission Zone M-3 Process
Crooksville – North Newark Rebuild

Need Number: AEP-2019-OH030

Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

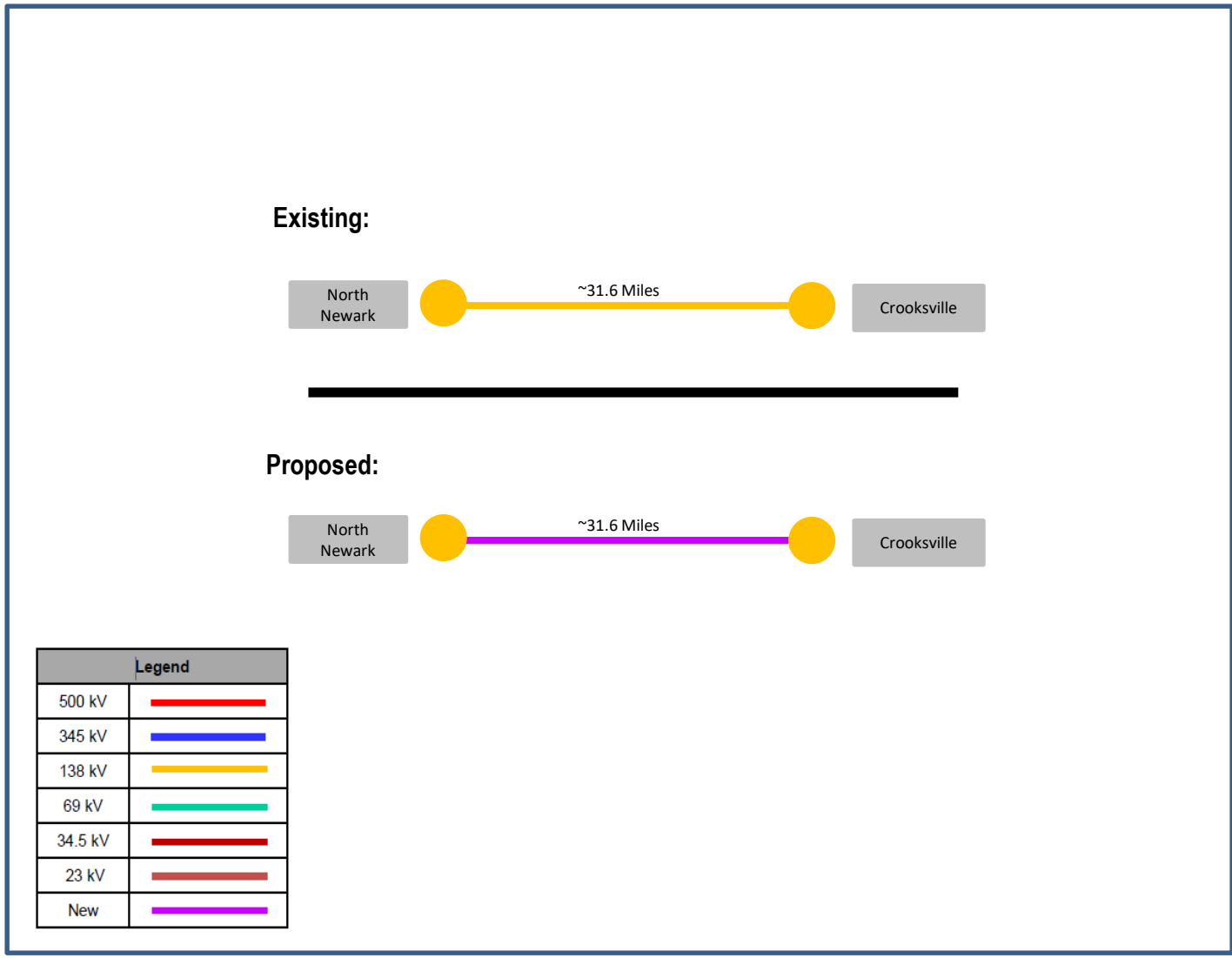
- Rebuild the existing 31.6-mile Crooksville - North Newark line using 795 ACSR. **Estimated Cost: $55.6M**

Alternatives Considered:

No viable cost-effective alternatives were identified.

Projected In-Service: 12/1/2023

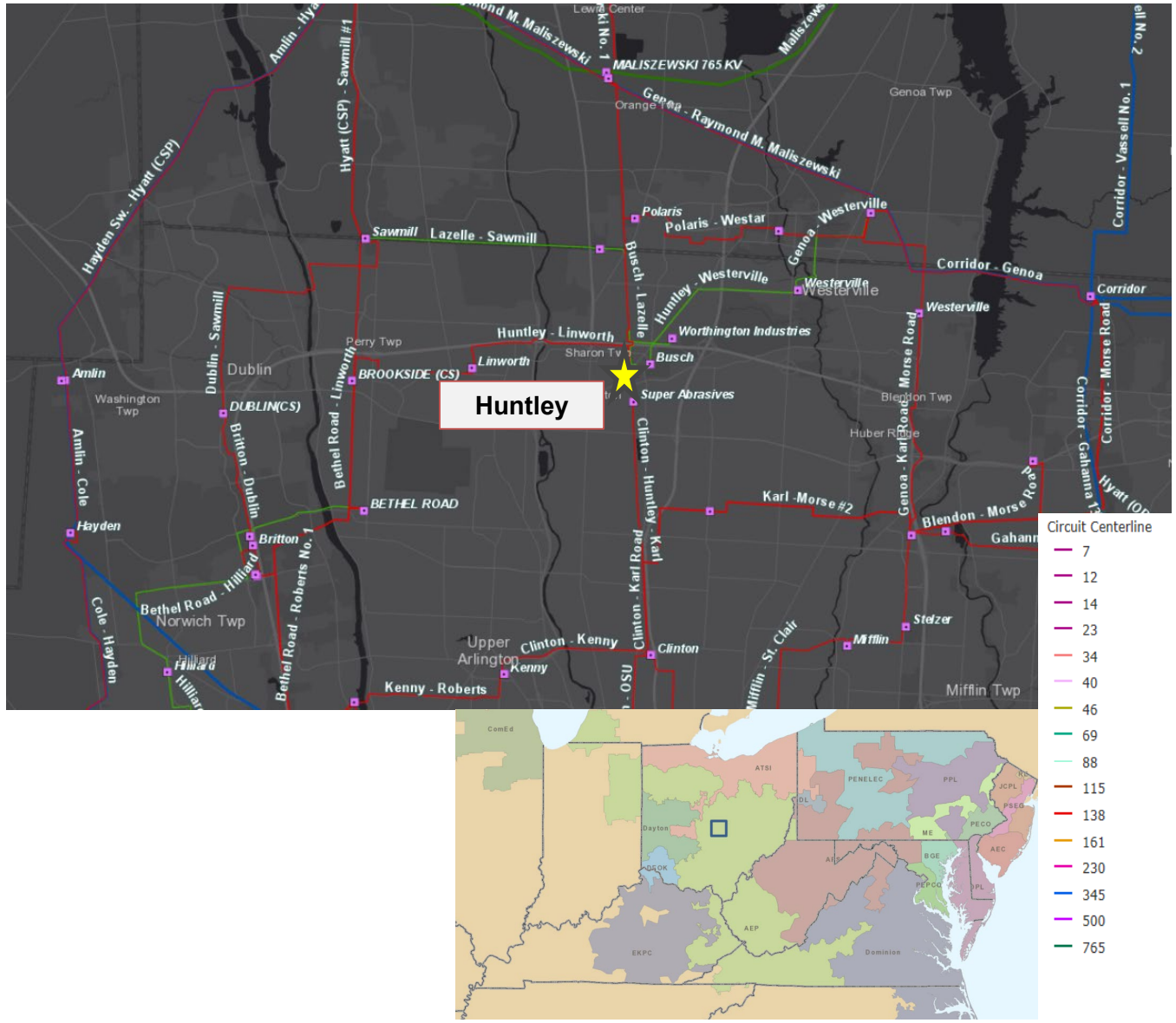
Project Status: Engineering



Need Number: AEP-2019-OH056
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: Needs Meeting 10/25/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Huntley Station
69/12kV Transformer #6

- The 1976 vintage 69/12kV transformer (33 MVA) has failed beyond repair in the field.



AEP Transmission Zone: Supplemental
Huntley Failed Bank Replacement

Need Number: AEP-2019-OH056
Process Stage: Solutions Meeting 12/18/2019
Proposed Solution:

Huntley Station:
Replace the failed 69/12 kV transformer #6 with a new 138/12 kV transformer.

Estimated Cost: $0.4M

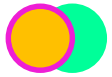
Alternatives Considered:

Replacing the failed transformer with a 69/12 kV bank was considered as an option.

AEP Ohio requested that the bank be replaced at 138 kV to better align with future plans for the area.

Projected In-Service: 11/10/2020
Project Status: Engineering

Huntley



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

AEP Transmission Zone M-3 Process
Hancock Co, OH

Need Number: AEP-2019-OH057

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Needs Meeting 10/21/2019

Supplemental Project Driver:

Customer Service

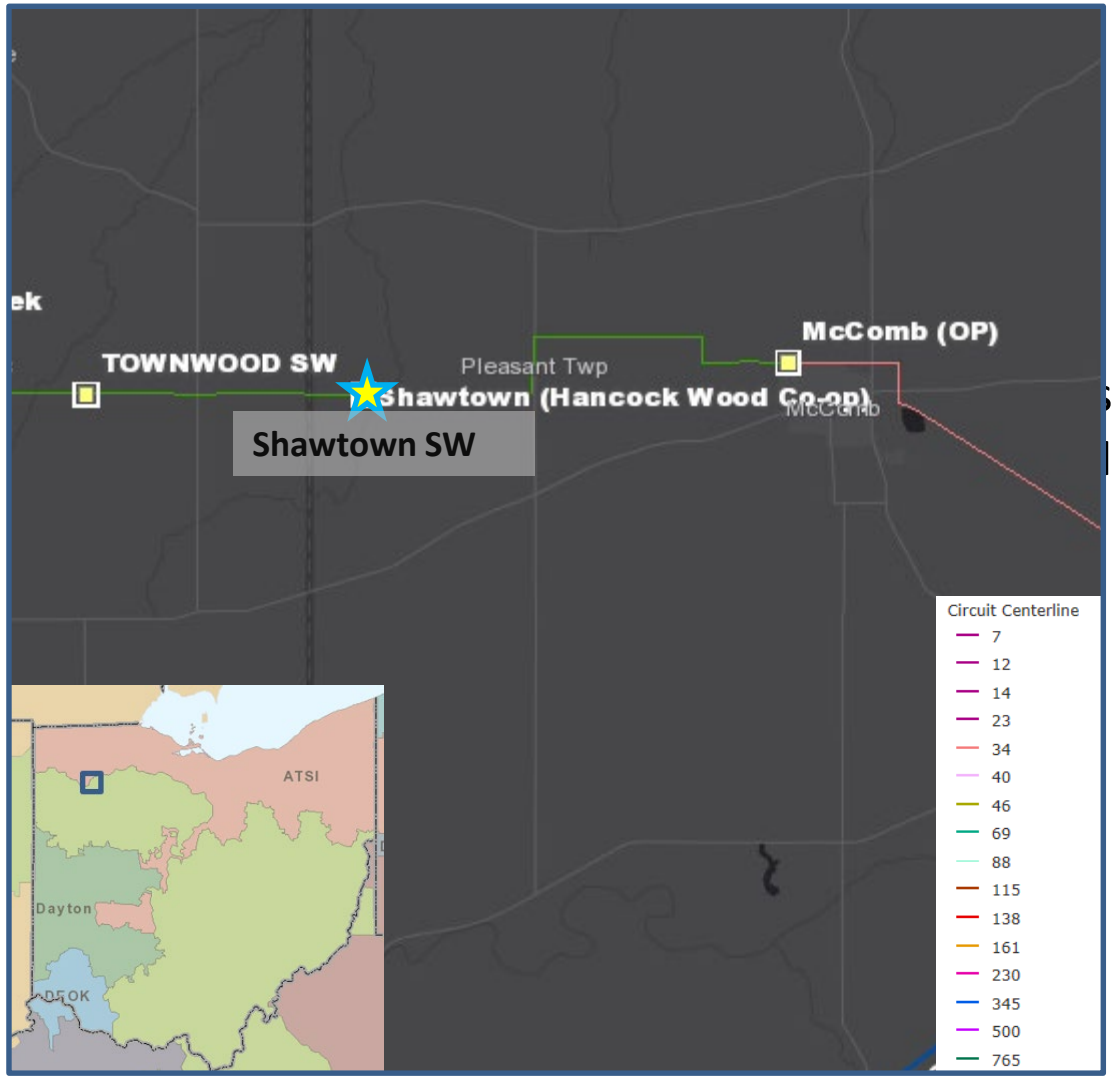
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Buckeye Power, Inc. on behalf of Hancock Wood Electric, Inc. has requested a new delivery point adjacent to their existing site. AEP plans to relocate the existing switch to be able to serve the new delivery point.

Model: N/A



AEP Transmission Zone M-3 Process
Hancock Co, OH

Need Number: AEP-2019-OH057

Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Upgrade the customer radial to 138kV standards (operated at 34.5kV) in anticipation of customer and full line conversion to 138kV. **Estimated Cost: $0.4M**

Replace the existing Shawtown Switch with a 138kV standard switch (operated at 34.5kV) with SCADA controls. Additional structures are required on either side of the switch. **Cost: $1.3M**

Total Cost: $1.7M

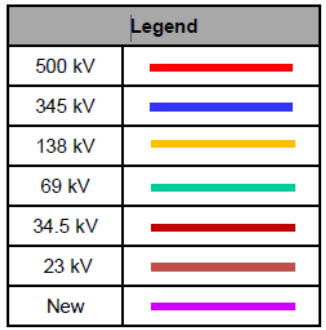
Alternatives Considered:

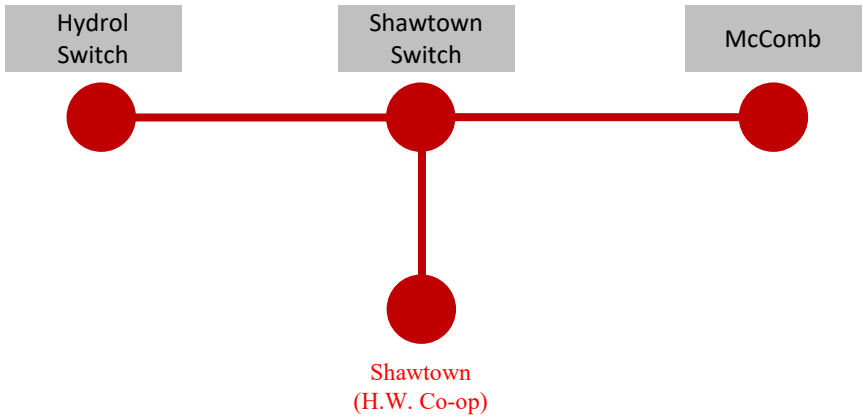
No viable cost-effective transmission alternative was identified.

Projected In-Service: 5/31/2020

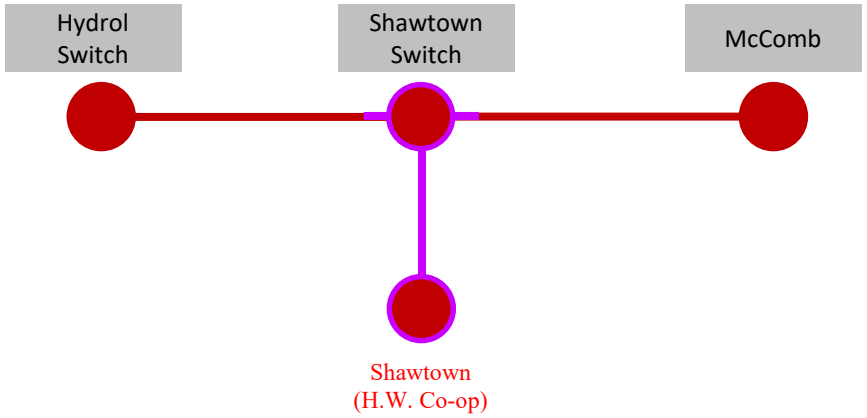
Project Status: Engineering

Existing:





Proposed:



AEP Transmission Zone M-3 Process
Dover 69kV Service

Need Number: AEP-2019-OH061

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Needs Meeting 11/22/2019

Supplemental Project Driver:

Customer Service

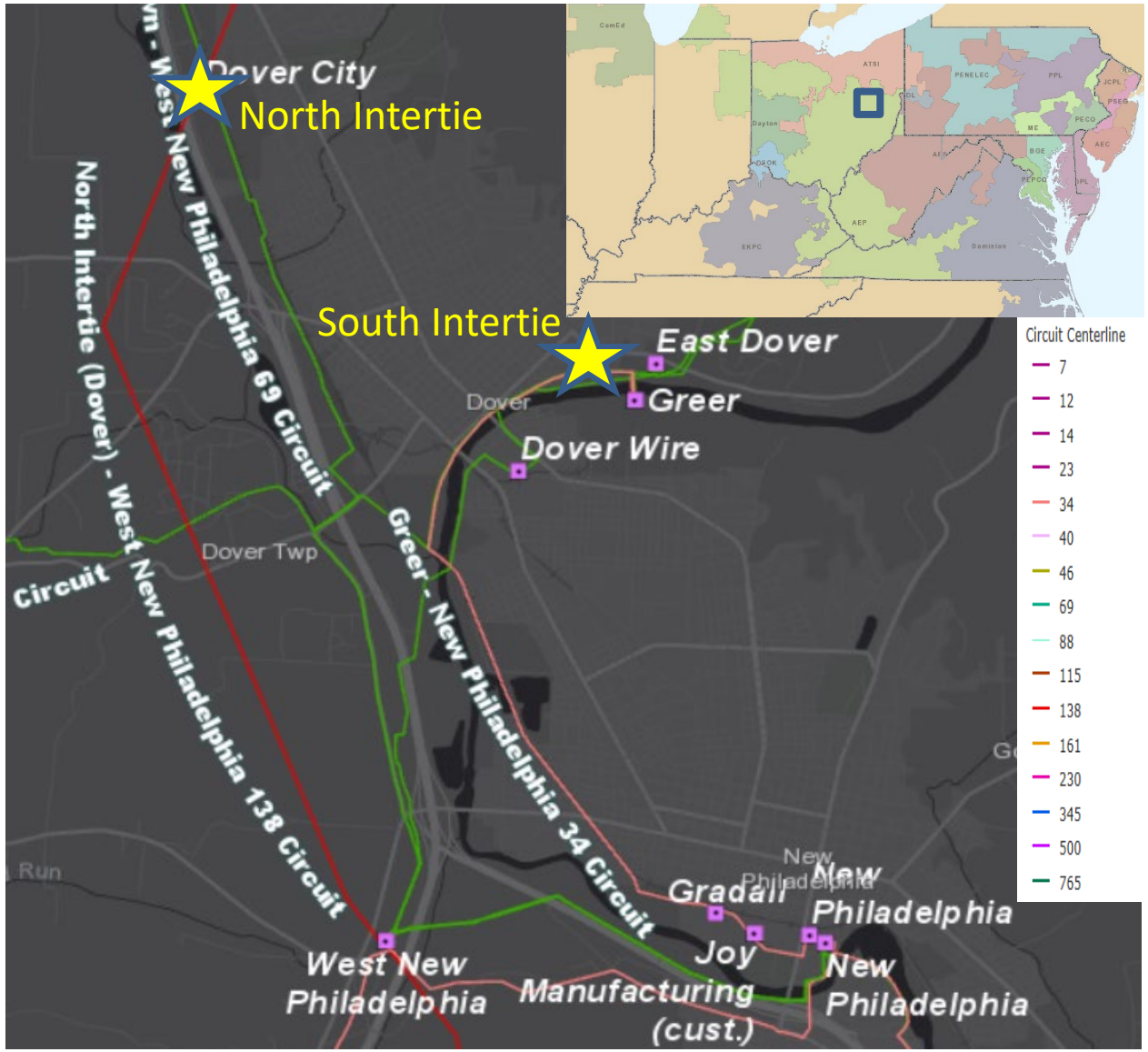
Specific Assumption Reference:

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

Problem Statement:

- The City of Dover (municipal customer) has a normally-open 69kV backup delivery point from AEP at South Intertie Switch. Dover is normally served by AEP from the North Intertie 138kV station. Dover has requested that AEP close the normally-open 69kV switch, to provide two parallel points of service. Dover's peak summer load is 45 MW.

Model: PJM 2019 RTEP Series



AEP Transmission Zone M-3 Process
Dover 69kV Service

Need Number: AEP-2019-OH061

Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Close the normally-open South Intertie 69kV Switch 'U' toward the City of Dover, to provide two points of service. Adjust area protective relaying settings, to account for the normal 69kV service to Dover (AEP's East Dover-West Dover 69kV circuit).

Estimated Cost: $0.02M

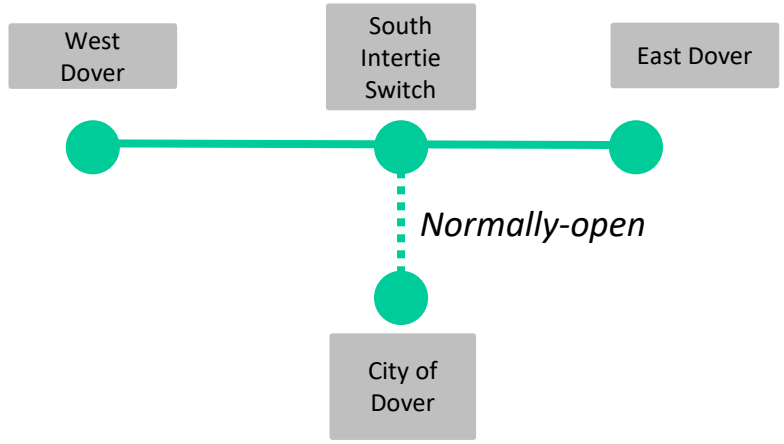
Alternatives Considered:

1. No viable cost-effective alternative was identified. A System Study was performed by AEP, which determined this system change would not adversely impact the AEP transmission system.

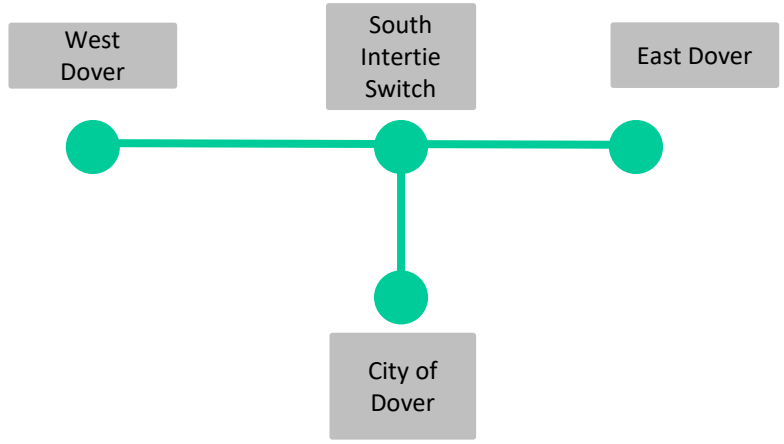
Projected In-Service: 12/19/2019

Project Status: Engineering

Existing:



Proposed:

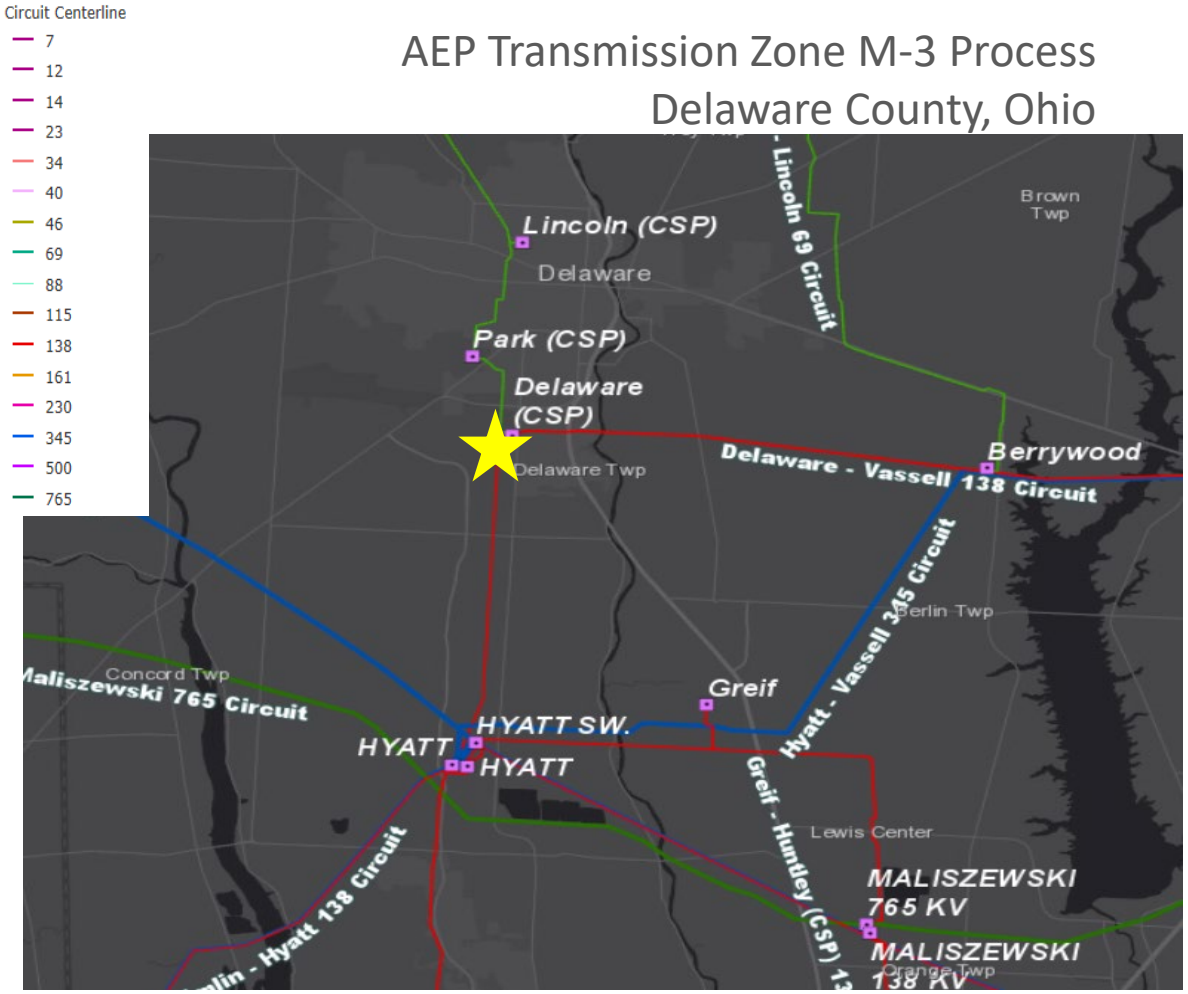


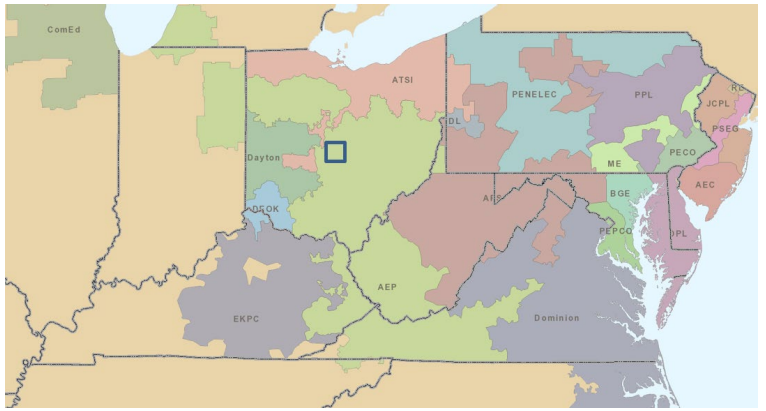
AEP Transmission Zone M-3 Process
Delaware County, Ohio

Need Number: AEP-2019-OH062
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: Needs Meeting 11/22/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk, Operational Flexibility
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Delaware 138kV Station:
Over the last five years Delaware station has accumulated approximately 2 million minutes of customer interruption associated with 19 outages at the station.

138 kV Circuit Breaker 114
- CB 114 is an FK type oil breaker (1964 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, spare part availability, historical reliability, and lack of vendor support of the breakers.





AEP Transmission Zone: Supplemental
Delaware CB 114 Replacement

Need Number: AEP-2019-OH062
Process Stage: Solutions Meeting 12/18/2019

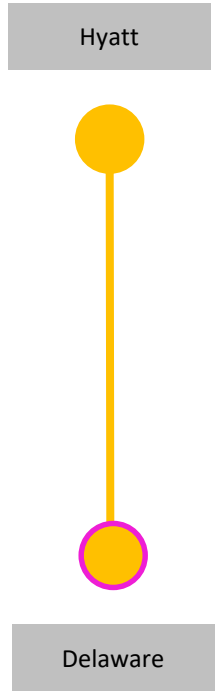
Proposed Solution:

Delaware 138kV station:
Replace the line breaker towards Hyatt, CB '114', with a 3000A 40 kA 138 kV circuit breaker, to be done in coordination with the previously approved Delaware – Hyatt 138 kV transmission line rebuild (b3105),
Estimated Cost: $0.5M

Alternatives Considered:

No alternates identified.

Projected In-Service: 6/1/2021
Project Status: Scoping



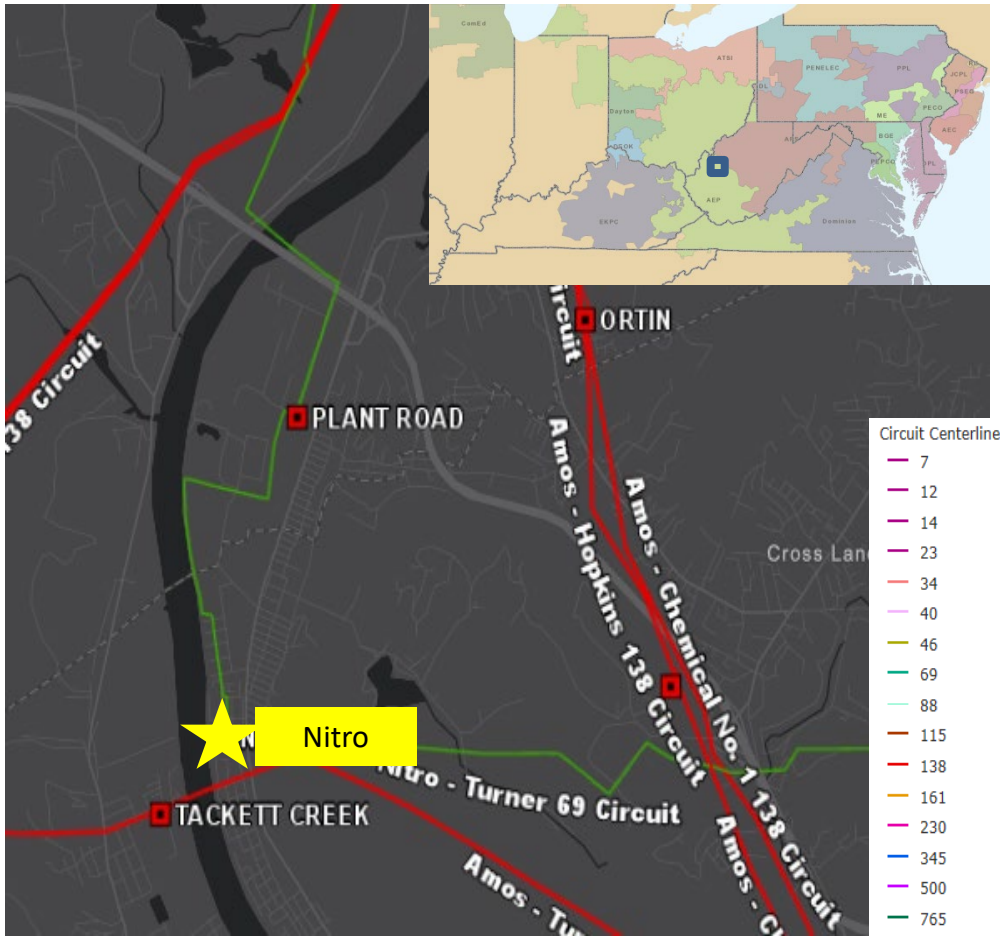
AEP Transmission Zone: Supplemental
Nitro, West Virginia

Need Number: AEP-2018-AP019
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: Needs Meeting 1/11/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Nitro 69 kV circuit breakers G and H are CF-48 oil type breakers that were manufactured in the 1960s. In general, oil breakers are more difficult to maintain as oil spills have the potential to occur during maintenance, which could cause environmental and safety hazards. In addition, breakers G and H have experienced 42 and 39 faults of operation, respectively. These both exceed the manufacturer's designed number of fault operations of 10.

Model: 2024 RTEP

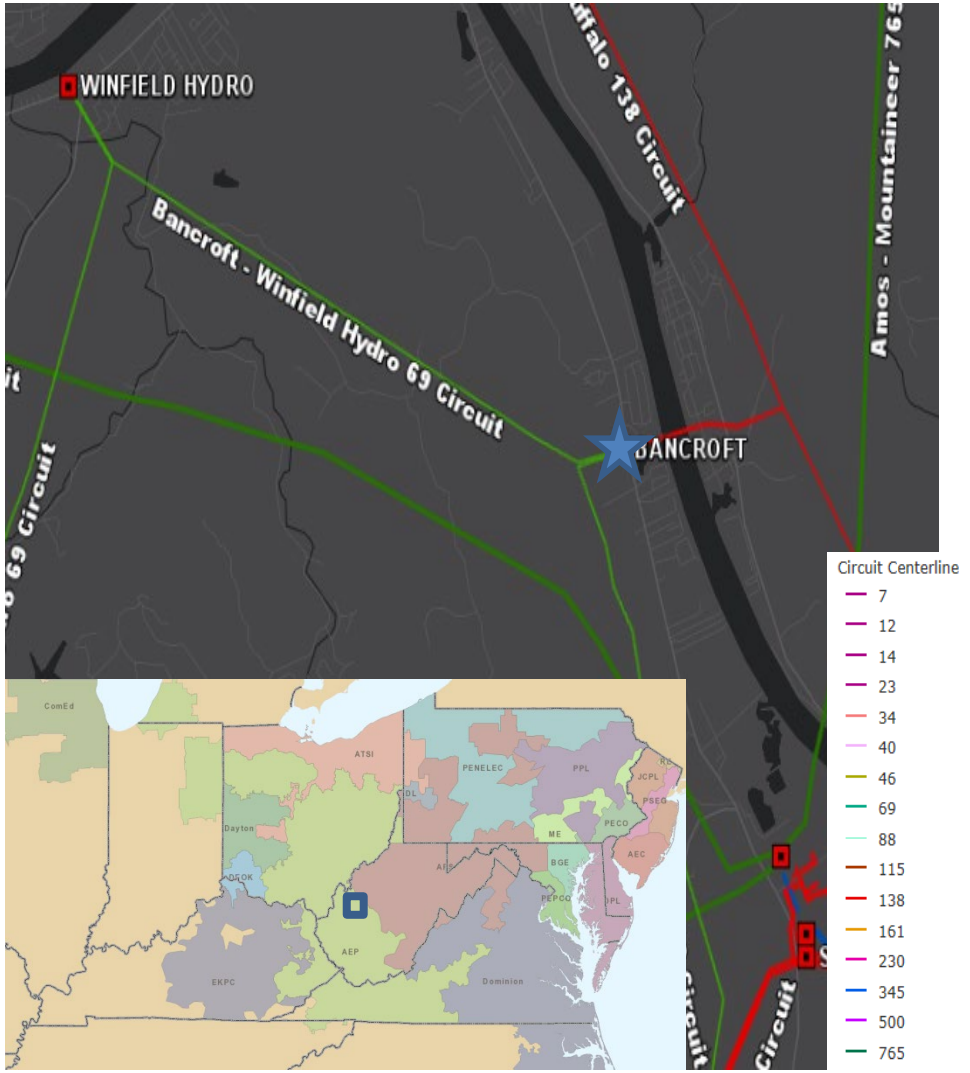


AEP Transmission Zone: Supplemental
Winfield, West Virginia

Need Number: AEP-2019-AP011
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: Needs Meeting 4/23/2019
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- 69 kV circuit breakers F and G at Bancroft station are CF-48 oil type breakers that were manufactured in 1965.
    - Oil breakers are more difficult to maintain as oil spills have the potential to occur during maintenance which can be an environmental and safety hazard.
    - Breakers F and G have experienced 55 and 70 fault operations, exceeding the manufacturer's designed number of fault operations of 10.

Model: 2024 RTEP



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

Need Number: AEP-2019-AP014
Process Stage: Solutions Meeting 12/18/2019
Previously Presented: 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.

Model: 2024 RTEP

AEP Transmission Zone M-3 Process
Putnam/Kanawha Counties, WV

Need Number: AEP-2019-AP013

Process Stage: Solutions Meeting 12/18/2019

Previously Presented: Need Meeting 6/17/2019

Supplemental Project Driver:

Equipment Condition/Performance/Risk

Specific Assumption References:

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

Model: N/A

Problem Statement:

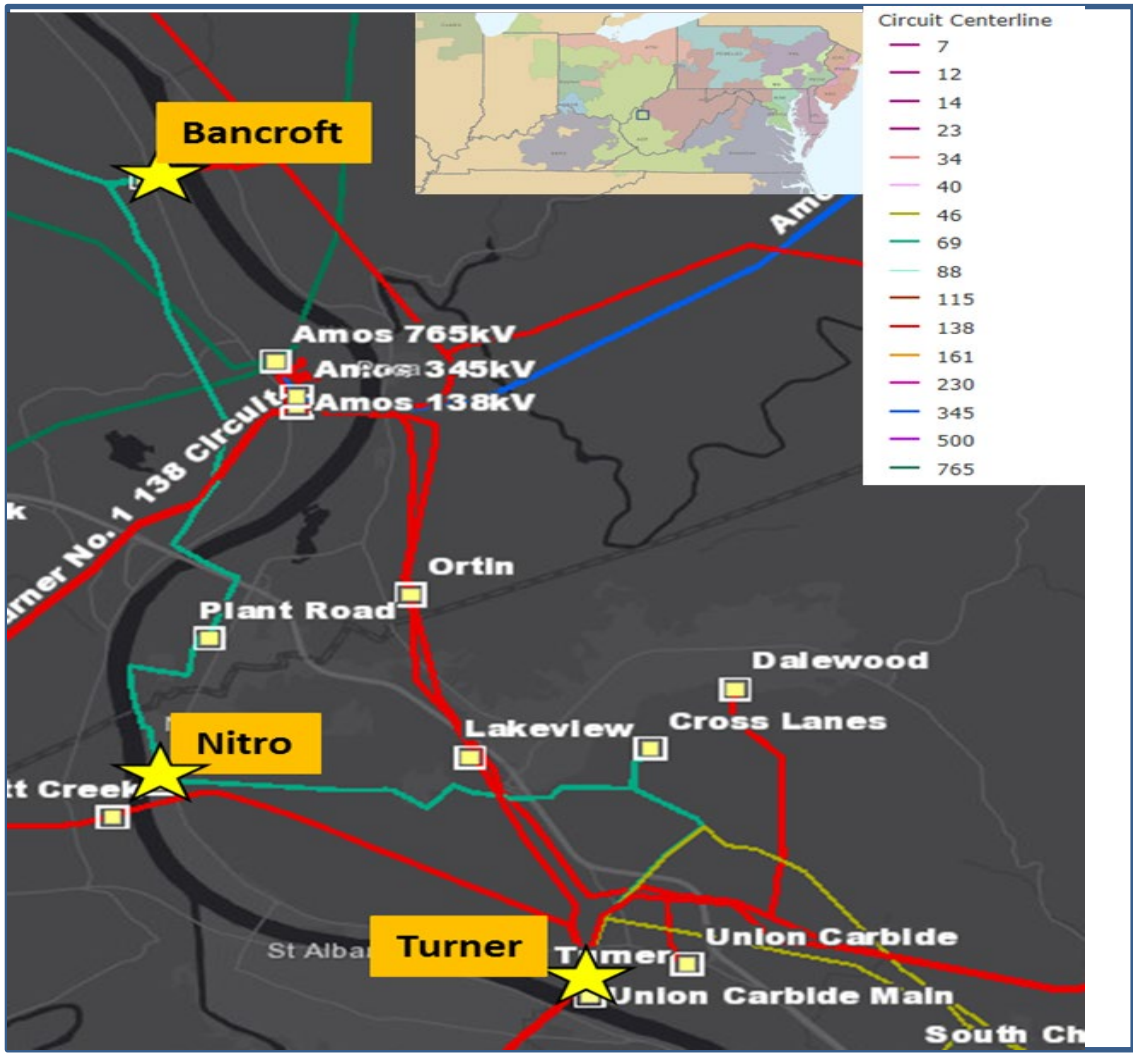
Bancroft – Nitro 69 kV (~7.6 miles)

- Majority of the circuit is constructed with 1930s (46/97, 47%) and 1960s (20/97, 21%) wood structures
- The circuit currently has 27 open conditions
- Structure loading does not meet current NESC standards.
  - The conductor is greater than 65 years old, and exceeds the recommended lifespan. Grounding on this line does not meet current standards.
- Between 2015-2018 the circuit experienced 2 momentary and 1 permanent outage resulting in approximately 800k customer minutes of interruption

Nitro – Turner 69 kV (~7.3 miles)

- Over half of the circuit is constructed with 1920s wood structures (51/75 structures, 68%)
- The circuit currently has 60 open conditions
- Approximately half of the line is not shielded.
- From 2015-2018 the circuit has experienced 8 momentary and 6 permanent outages resulting in approximately 130k customer minutes of interruption

Model: 2024 RTEP



AEP Transmission Zone M-3 Process
Bancroft – Turner

Need Number: AEP-2019-AP011, AEP-2019-AP013, AEP-2019-AP014, AEP-2018-AP019

Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Rebuild the existing Bancroft – Nitro 69kV line (~8.1 miles) to 69kV standards. **Estimated Cost: $27.3M**

Rebuild the existing Nitro – Turner 69 kV line, including Cross Lanes Double Ckt. Extension to 69 kV standards (total length ~6.2 miles). **Estimated Cost: $24.7M**

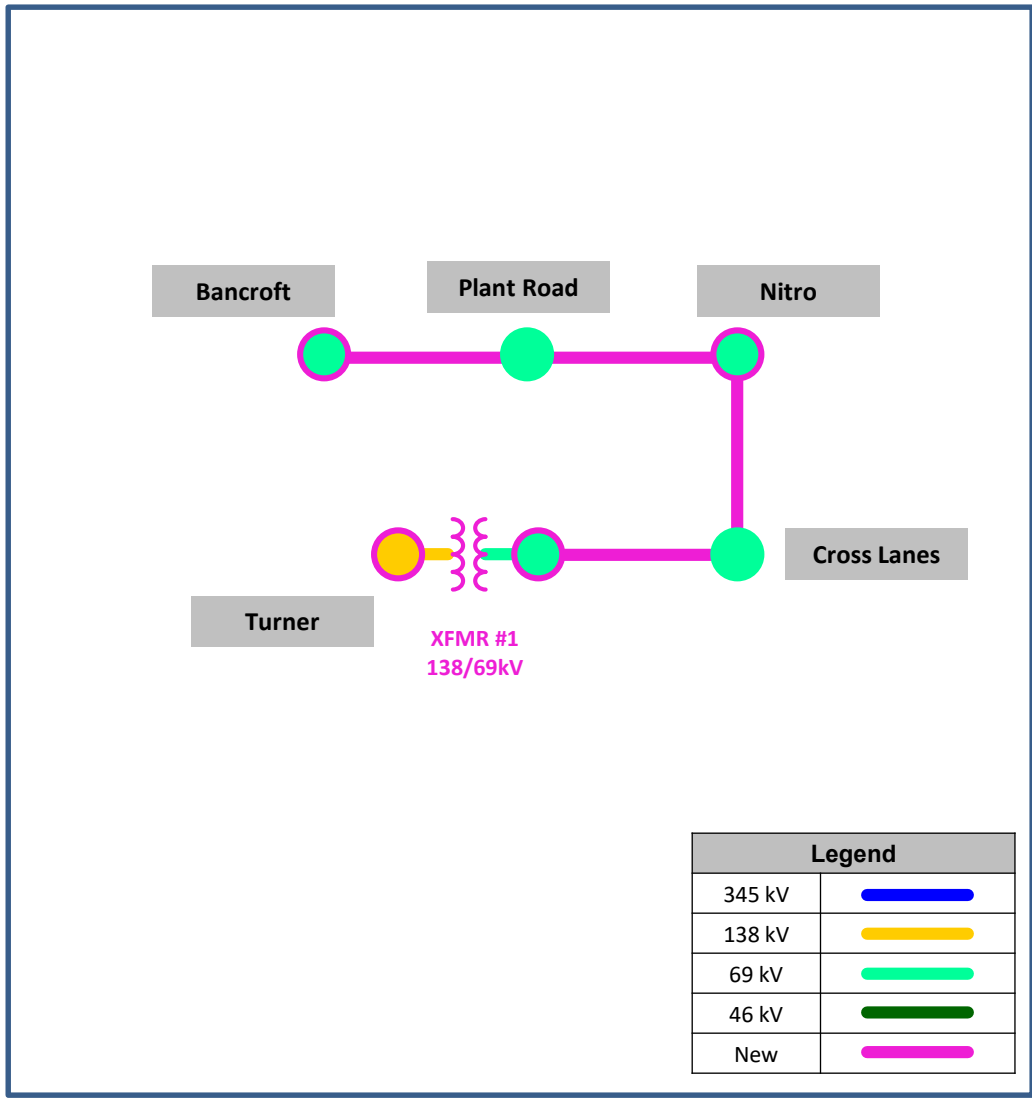
Associated line work outside of Turner Station needed to accommodate the Nitro – Turner Rebuild. **Estimated Cost: $1.3M**

Bancroft Station: Replace the existing 69 kV circuit breakers G and F with two new 69 kV 3000 A 40 kA circuit breakers, and perform associated remote end relaying work at Winfield Station. DICM is needed at the station to accommodate the new equipment. **Estimated Cost: $3.3M**

Nitro Station: Replace existing 69 kV circuit breakers G and H with two new 69 kV 3000 A 40 kA circuit breakers, and perform associated remote end relaying work Turner. **Estimated Cost: $2.3M**

Turner Station: Replace 138/69 kV 50 MVA XFR #5 with a new 138/69 kV 90 MVA XFR. Install a new 138 kV 3000 A 40 kA circuit breaker in the F string. Terminate the new 138/69 kV XFR in the F string. Install a new 138 kV 3000 A 40 kA circuit breaker in the E string and terminate XFR #6 in the E string. Replace grounding bank #7. Replace existing 46 kV 1200 A 20 kA CB-O with a new 69 kV 3000 A 40 kA CB (operated at 46 kV). 138/46 kV XFR #6 will be relocated to accommodate the work at the station. Install DICM and upgrade relaying at the station. **Estimated Cost: $6.9M**

Total Estimated Transmission Cost: $65.8M



AEP Transmission Zone M-3 Process
Bancroft – Turner

Alternatives Considered:

Alternate 1:

Install new double circuit 138 kV line in/out from Ortin to Plant Road Station (~2 miles) $7.5M

Install new double circuit 138 kV line in/out from the Amos – Turner #1 138 kV line to Nitro Station (~0.5 mile) $2.0M

Install new double circuit 138 kV line in/out from Dalewood to Cross Lanes Station (~1 mile) 4.0M

Retire Bancroft – Nitro 69 kV 2.9M

Retire Nitro – Turner 69 kV 2.0M

Bancroft Station 11.3M

- Install two 138 kV CBs on each 138 kV line into the station
- Install a new/redundant 138/69 kV 90 MVA XFR with high side circuit switcher
- Install a new 69 kV CB and reconfigure the 69 kV bus into a ring

Ortin Station 10.1M

- Install five 138 kV CBs in a ring configuration

Plant Road 4.4M

- Establish 138 kV bus
- Install three 138 kV CBs
- Install 138/12 kV 20 MVA XFR

Nitro Station 4.4M

- Establish 138 kV bus
- Install three 138 kV CBs
- Install 138/12 kV 20 MVA XFR

Cross Lanes 4.4M

- Establish 138 kV bus
- Install three 138 kV CBs
- Install 138/12 kV 20 MVA XFR

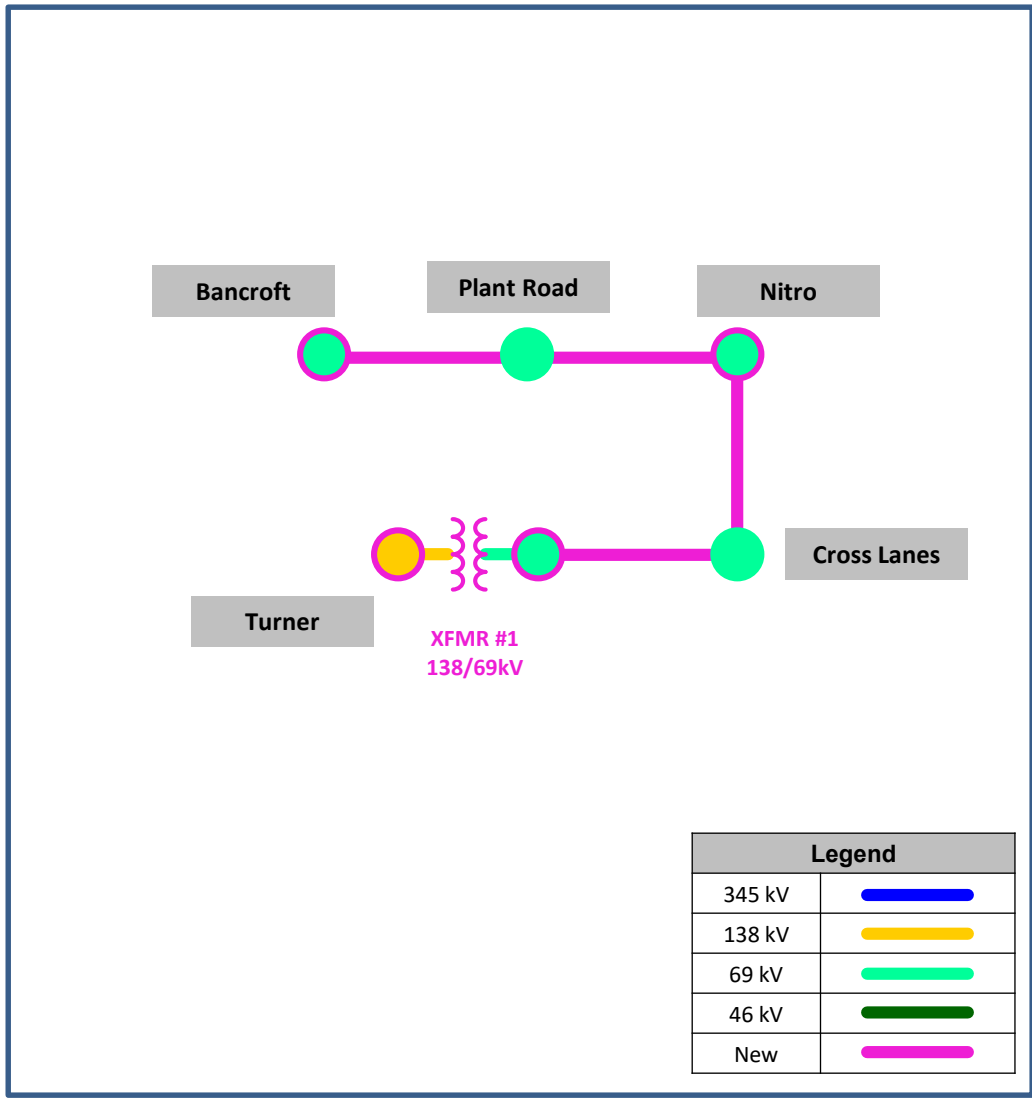
Dalewood Station 11.9M

- Install five 138 kV CBs in a ring configuration

Turner Station 3.8M

- Retire 138/69 kV XFR #5 and 69 kV bus/equipment (0.5M)
- Install a new 138 kV 3000 A 40 kA circuit breaker in the E string and terminate XFR #6 in the E string. Replace grounding bank #7. Replace existing 46 kV 1200 A 20 kA CB-O with a new 69 kV 3000 A 40 kA CB (operated at 46 kV). 138/46 kV XFR #6 will be relocated to accommodate the work at the station. (5.8M)

Total Cost: $70M



AEP Transmission Zone M-3 Process
Bancroft – Turner

Alternatives Considered:

Alternate 2:

Install new double circuit 138 kV line in/out from Lakeview to a New Station located somewhere between Plant Road and Nitro (~2.5 miles) 9.4M

Install new double circuit 138 kV line in/out from Dalewood to Cross Lanes Station (~1 mile) 4.0M

Retire Bancroft – Nitro 69 kV 2.9M

Retire Nitro – Turner 69 kV 2.0M

Bancroft Station 11.3M

- Install two 138 kV CBs on each 138 kV line into the station
- Install a new/redundant 138/69 kV 90 MVA XFR with high side circuit switcher
- Install a new 69 kV CB and reconfigure the 69 kV bus into a ring

Lakeview Station 13.5M

- Install five 138 kV CBs in a ring configuration

Plant Road 0.8M

- Retire/remove Station

Nitro Station 0.8M

- Retire/remove Station

New Station (Replace Nitro and Plant Road Stations) 12.7M

- Install four 138 kV CBs in a ring configuration
- Install two 138/12 20 MVA XFRs

Cross Lanes 4.4M

- Establish 138 kV bus
- Install three 138 kV CBs
- Install 138/12 kV 20 MVA XFR

Dalewood Station 11.9M

- Install five 138 kV CBs in a ring configuration

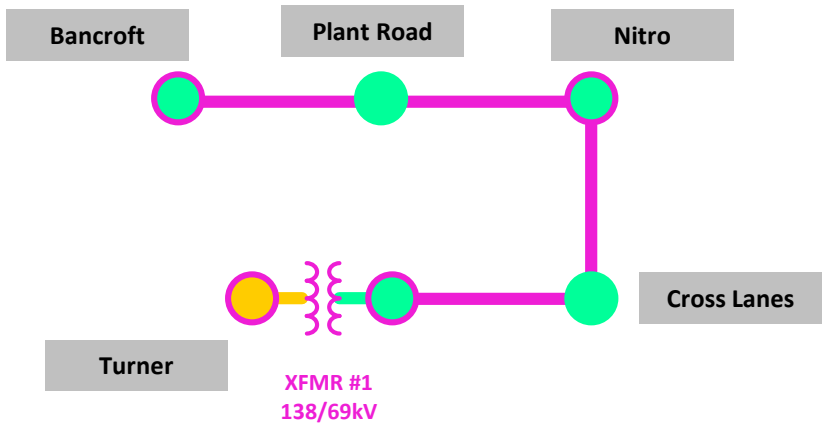
Turner Station 3.8M

- Retire 138/69 kV XFR #5 and 69 kV bus/equipment
- Install a new 138 kV 3000 A 40 kA circuit breaker in the E string and terminate XFR #6 in the E string. Replace grounding bank #7. Replace existing 46 kV 1200 A 20 kA CB-O with a new 69 kV 3000 A 40 kA CB (operated at 46 kV). 138/46 kV XFR #6 will be relocated to accommodate the work at the station.

Total Cost: $80M

Projected In-Service: 11/1/2023

Project Status: Scoping

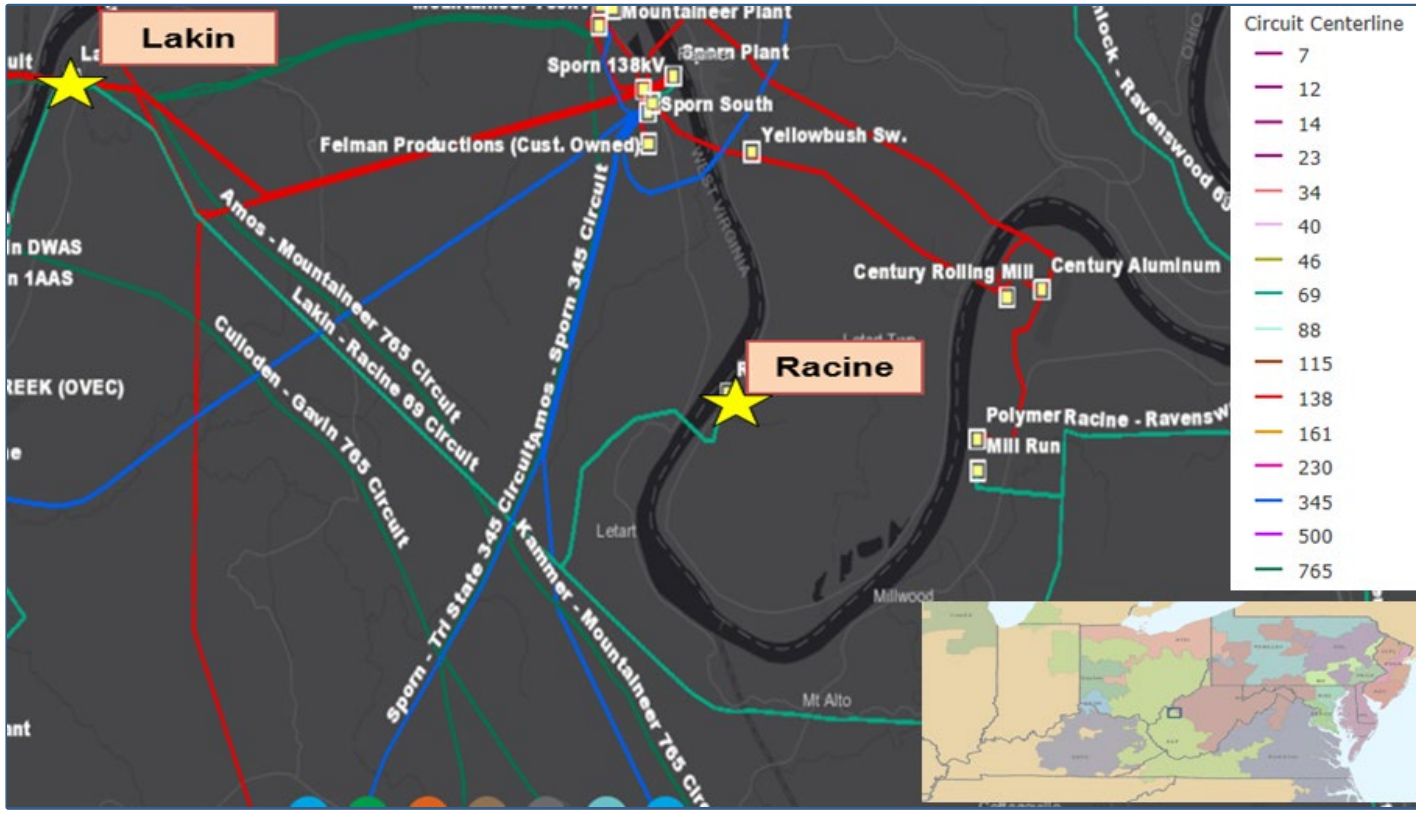


AEP Transmission Zone M-3 Process
Lakin – Racine Rebuild

Need Number: AEP-2018-AP013
Process Stage: Solutions Meeting 12/18/19
Previously Presented: Needs Meeting 1/11/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- The Lakin – Racine 69 kV circuit (~13.2 mi) currently has 125 open conditions on 70% of the structures.
  - These conditions include rot top, woodpecker damage, burnt insulator, broken knee/V braces.
  - The majority of the circuit is constructed with 1960s wood structures. From 2015-2018, the line has experienced 8 momentary and 3 permanent outages which have resulted in 27k customer minutes of interruption.
- The 69kV CB F at Lakin is a CF type oil filled breaker.
  - Oil filled breakers have significant maintenance requirements due to oil handling.
  - This CB model family has experienced numerous documented mechanism bearing issues and failures within the AEP population.
- Lakin Substation deploys 42 relays implemented to ensure the adequate protection and operation of the substation. Currently 35 of the 42 relays (83% of all station relays) are in need of replacement.
  - There are 32 electromechanical, 2 legacy ABB DPU microprocessor, and 1 static type relays with significant limitations in regards to spare part availability in addition to a lack of vendor support.
  - The electromechanical and static relays have no capability for fault data collection and retention. The 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.
  - If there is any arcing or something goes wrong as the breaker operates, the operator is now in the line of fire. Modern relays can program a delay (10 seconds) after an open or close button is pressed so the operator can have time to walk out of the line of fire.
- The 138kV line switches are mounted on cap and pin insulators at Lakin.
- The current MOAB/Ground SW configurations at Lakin create faults in the station to signal the remote end breakers to open; this results in Transmission lines breakers getting burdened to clear Transformer faults thus reducing their life span.

- Lakin 138/69 kV transformer bank #1 CO and CO2 levels have been on the rise since 2004 when all transformer bushings were replaced during minor transformer maintenance activities; the oil was processed at that time, accounting for the rapid decrease in gas concentrations in 2004. The latest CO reading of 493ppm is significantly high.
  - Moisture content had been trending up from 2008 to 2016 and has been in excess of 25ppm since 2016. Dielectric strength is currently trending up, but this rapid and significant 15.1kV increase was unexpected given the minor drop in moisture content levels from 2016 to 2017.
  - Together, these are potential indicators of insulating paper breakdown.
  - In addition, H2 concentrations have been rising since 2004. The presence of H2 indicates the potential for stray gassing in the oil and carbonization of the insulating paper.
  - The above conditions indicate a strong probability of degradation of the integrity of the paper insulation surrounding the transformer windings from carbonization, breakdown in cellulose, or both.



Model: 2022 Winter RTEP

AEP Transmission Zone M-3 Process
Lakin – Racine Rebuild

Need Number: AEP-2019-AP008
Process Stage: Solutions Meeting 12/18/19
Previously Presented: Needs Meeting 3/25/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Racine 69 kV circuit breaker B

- CG-48 oil type breakers that was manufactured in 1980.
- Oil breakers are more difficult to maintain as oil spills have the potential to occur during maintenance which can be an environmental and safety hazard.
- Experienced 43 fault operations, exceeding the manufacturer's designed number of fault operations of 10.

AEP Transmission Zone M-3 Process
Lakin – Racine Rebuild

Need Number: AEP-2018-AP013, AEP-2019-AP008

Process Stage: Solutions Meeting 12/18/19

Proposed Solution:

Rebuild Racine Hydro double circuit 69 kV line (~4 miles) to 69 kV standards utilizing 795 26/7 ACSR conductor (W.N. 162 MVA, W.E. 202 MVA)
Estimated Cost: $15.9M

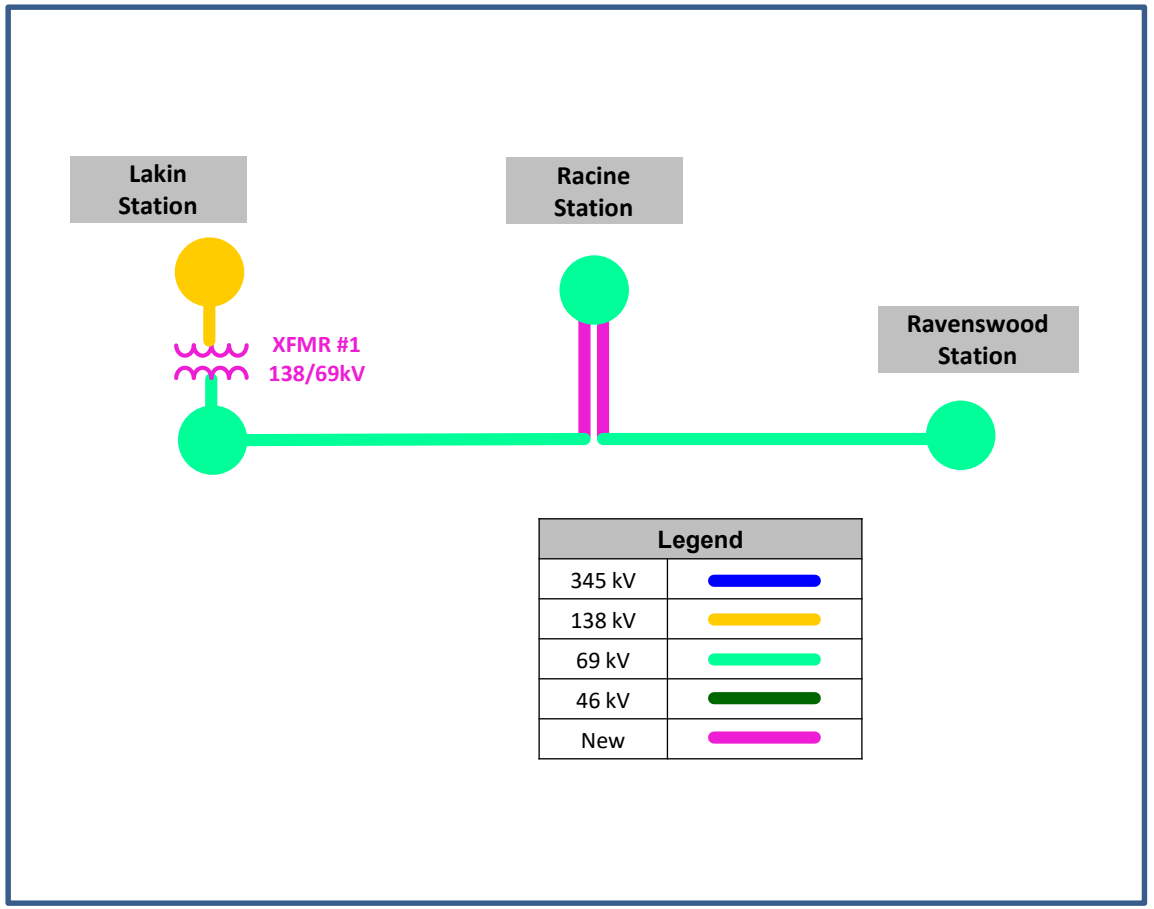
Lakin Station: Remove existing 138 kV line switches and MOAB/Gr. Sw. Install 4 new 138 kV 40 kA 3000 A circuit breakers in a ring configuration. Replace existing 138/69 kV 90 MVA XFR #1 with a new 138/69 kV 90 MVA XFR. Replace existing 69 kV CB-F with a new 69 kV 40 kA 3000 A circuit breaker. Associated remote end work at Sporn, Gavin and Point Pleasant Stations. **Estimated Cost: $14.5M**

Reconfigure the Sporn – Lakin – Gavin 138 kV line entrance and the Lakin – Point Pleasant 69 kV line entrance into the new station layout. **Estimated Cost: $1.6M**

Racine Station: Replace existing 69 kV circuit breaker with a new 69 kV 40 kA 3000 A circuit breaker. Associated remote end work at Ravenswood station. **Estimated Cost: $1.4M**

Total Estimated Cost: $35.0M

Ancillary Benefits: Supplemental solution combined with Baseline Projects b3040 and b3095 for holistic area solution.



AEP Transmission Zone M-3 Process
Lakin – Racine Rebuild

Need Number: AEP-2018-AP013, AEP-2019-AP008

Process Stage: Solutions Meeting 12/18/19

Alternatives Considered:

Racine Hydro 69 kV Loop: See alternative to baseline solution b3095. **Updated Estimated Cost $41.6M**

Lakin Station: Remove existing 138 kV line switches and MOAB/Gr. Sw. Install 4 new 138 kV 40 kA 3000 A circuit breakers in a ring configuration. Replace existing 138/69 kV 90 MVA XFR #1 with a new 138/69 kV 90 MVA XFR. Replace existing 69 kV CB-F with a new 69 kV 40 kA 3000 A circuit breaker. Associated remote end work at Sporn, Gavin and Point Pleasant Stations. **Estimated Cost: $14.5M**

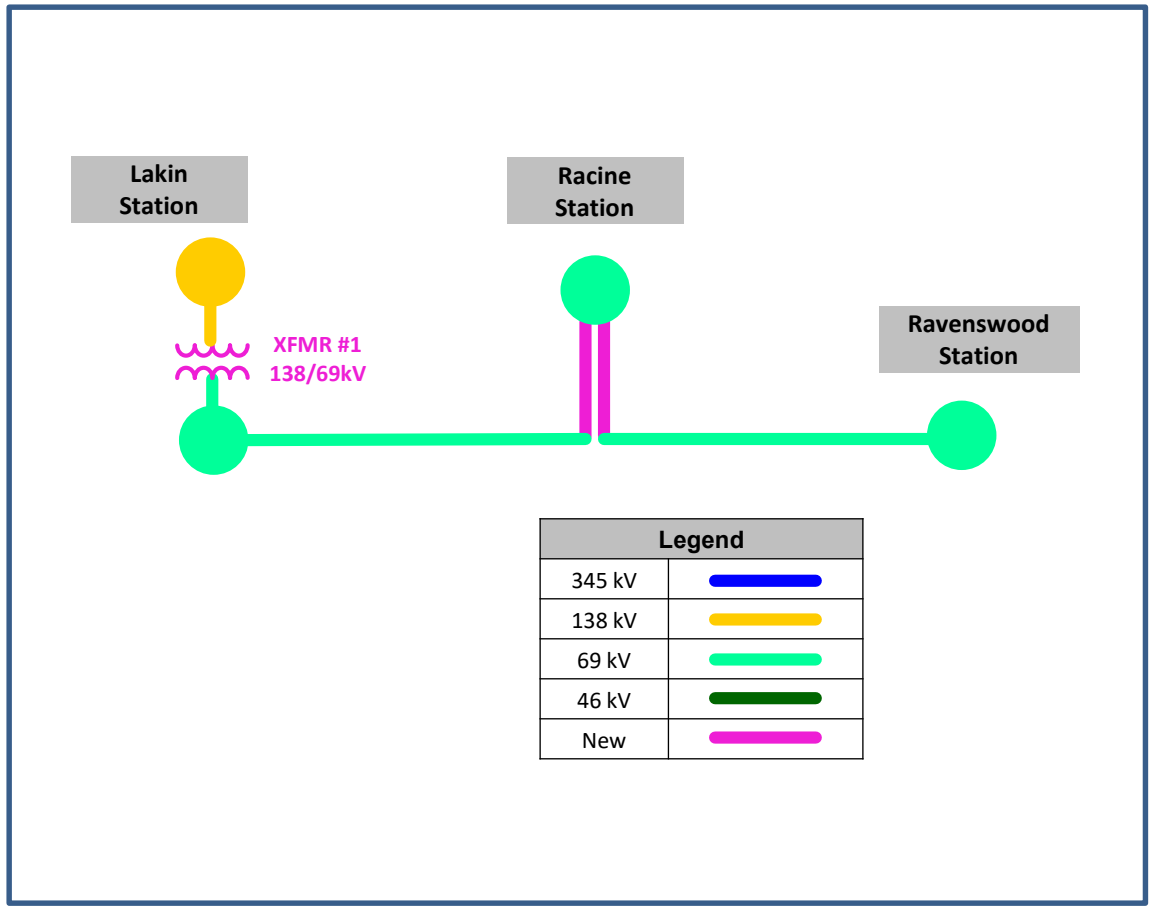
Reconfigure the Sporn – Lakin – Gavin 138 kV line entrance and the Lakin – Point Pleasant 69 kV line entrance into the new station layout. **Estimated Cost: $1.6M**

Racine Station: Replace existing 69 kV circuit breaker with a new 69 kV 40 kA 3000 A circuit breaker. Associated remote end work at Ravenswood station. **Estimated Cost: $1.4M**

Total Estimated Alternate Cost: $59.1M

Projected In-Service: 6/1/2022

Project Status: Scoping



AEP Transmission Zone: Supplemental Niles Area Improvements

Need Number: AEP-2018-IM002
Previously Submitted: Needs Meeting 10/26/18
Process Stage: Solution Meeting 12/18/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
The Pokagon Station

- CBs J, E, and H are oil filled breakers without oil containment
- Fault operations: CB E(28), CB H(61) - Recommended (10)

Lake Street Station

- CBs A and H are oil filled breakers without oil containment
- CB H is a GE FK type which are known to fail violently
- Fault operations: CB A(24), CB H(13) – Recommended (10)
- Transformer 1 – 1969 vintage
    - CO2 IEEE level 3
    - Moisture level high and rising
    - Wood tie supports

Niles Station

- CBs A, B, M, and N are oil filled breakers without oil containment
- CB M and CB N are GE FK type which are known to fail violently
- Fault operations: CB A(30), CB B(42), CB N(21) – Recommended (10)
- Transformer 2 – 1969 vintage
    - CO2 IEEE level 3
    - Moisture level high and rising
    - Wood tie supports

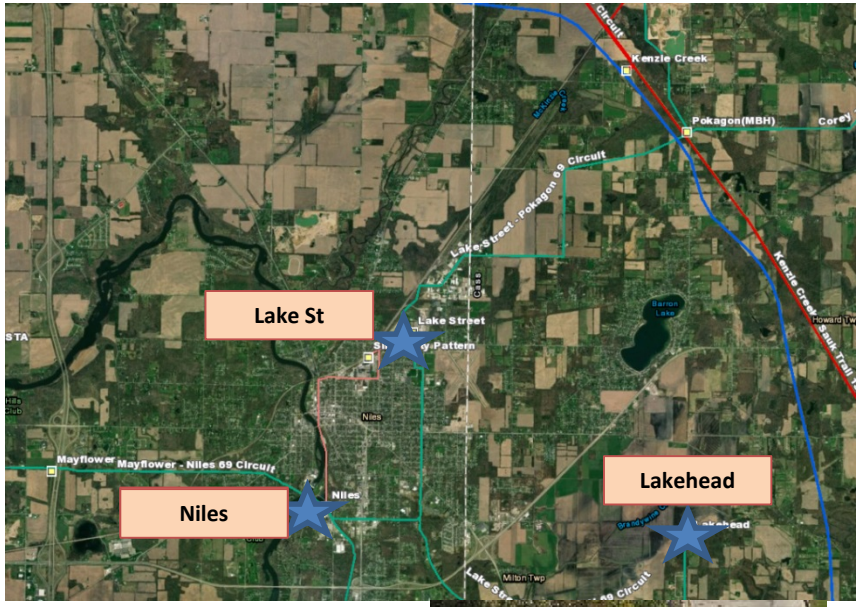
AEP Transmission Zone: Supplemental Niles Area Improvements

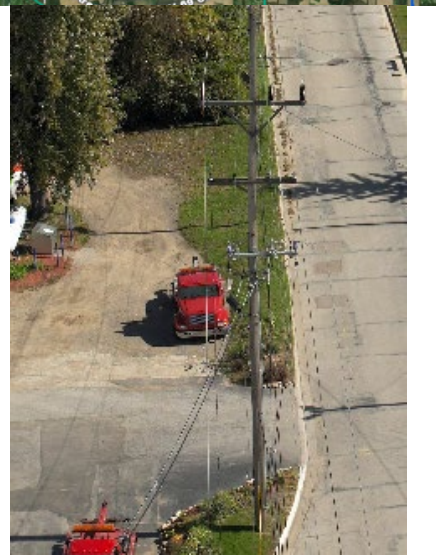
Need Number: AEP-2018-IM002
Previously Submitted: Needs Meeting 10/26/18
Process Stage: Solution Meeting 12/18/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Lake Street – Niles 69kV circuit

- 1960's wood cross arm construction
- Poor shielding condition
- Lakehead Pumping Tap has open conditions on 30% of structures
- Total open conditions – 54

Lake Street – Niles 34.5kV circuit

- 1965 wood pole construction
- Total open conditions – 51
- 40% of structures with open conditions
- 97% of line original wood poles
- Wooden cross arm with cap and pin insulator construction
- No shield wire



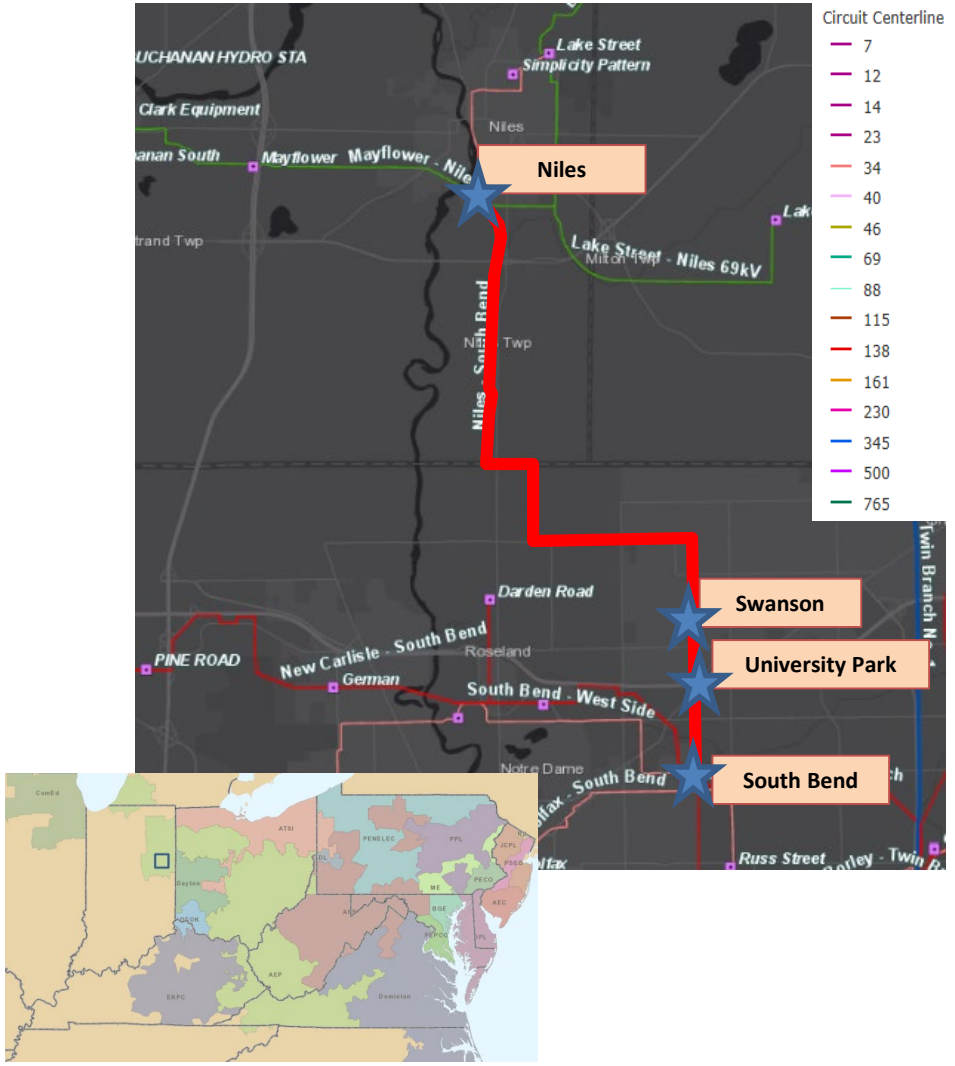


AEP Transmission Zone: Supplemental
Niles Area Improvements

Need Number: AEP-2019-IM035
Previously Submitted: Needs Meeting 08/29/19
Process Stage: Solution Meeting 12/18/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

South Bend – Niles 69kV Line (~11.47 Miles)

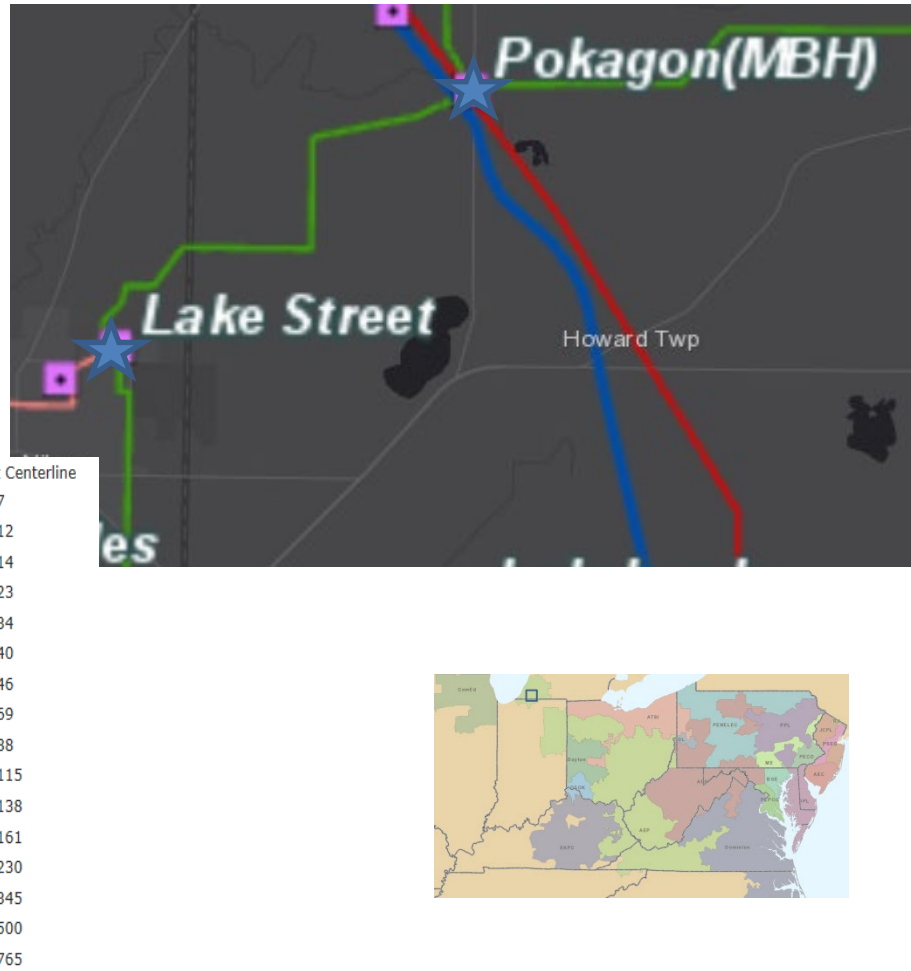
- 1968 vintage wood pole construction
- Forced Momentary outages: 5
- Forced Permanent outages: 3
- Total structure related open conditions – 47
- Unique structure count with open conditions – 44
- Insect Damage, Rotten Poles, Broken/Burnt cross-arm, Woodpecker holes, broken/burnt insulators, stolen/broken ground wires, broken guy strain insulators and cracked stub pole.
- More than three in-line sectionalizing MOABS



AEP Transmission Zone M-3 Process
Niles Area Improvements

Need Number: AEP-2019-IM025
Previously Submitted: Needs Meeting 10/25/19
Process Stage: Solution Meeting 12/18/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Pokagon – Lake Street 69kV line (4.9 miles)

- 28 open conditions
- 1952 wood cross-arm construction
- Many weather related failures/outages
- 12 momentary outages over the last 10 years

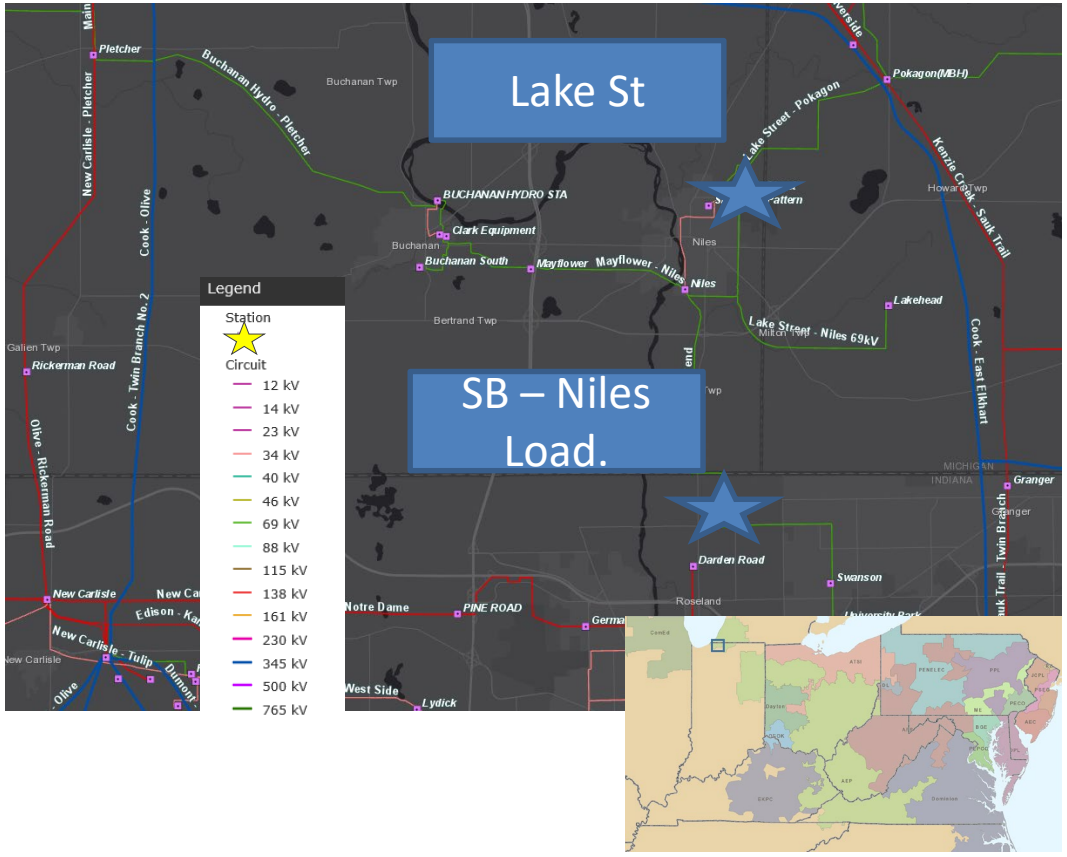


Need Number: AEP-2019-IM046
Previously Submitted: Needs Meeting 11/22/19
Process Stage: Solution Meeting 12/18/19
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:
Lake Street 69/34.5kV station
- New load delivery point which will serve ~8MW.

South Bend – Niles 69kV line
- New load delivery point which will serve ~15MW.

Model: 2024 RTEP



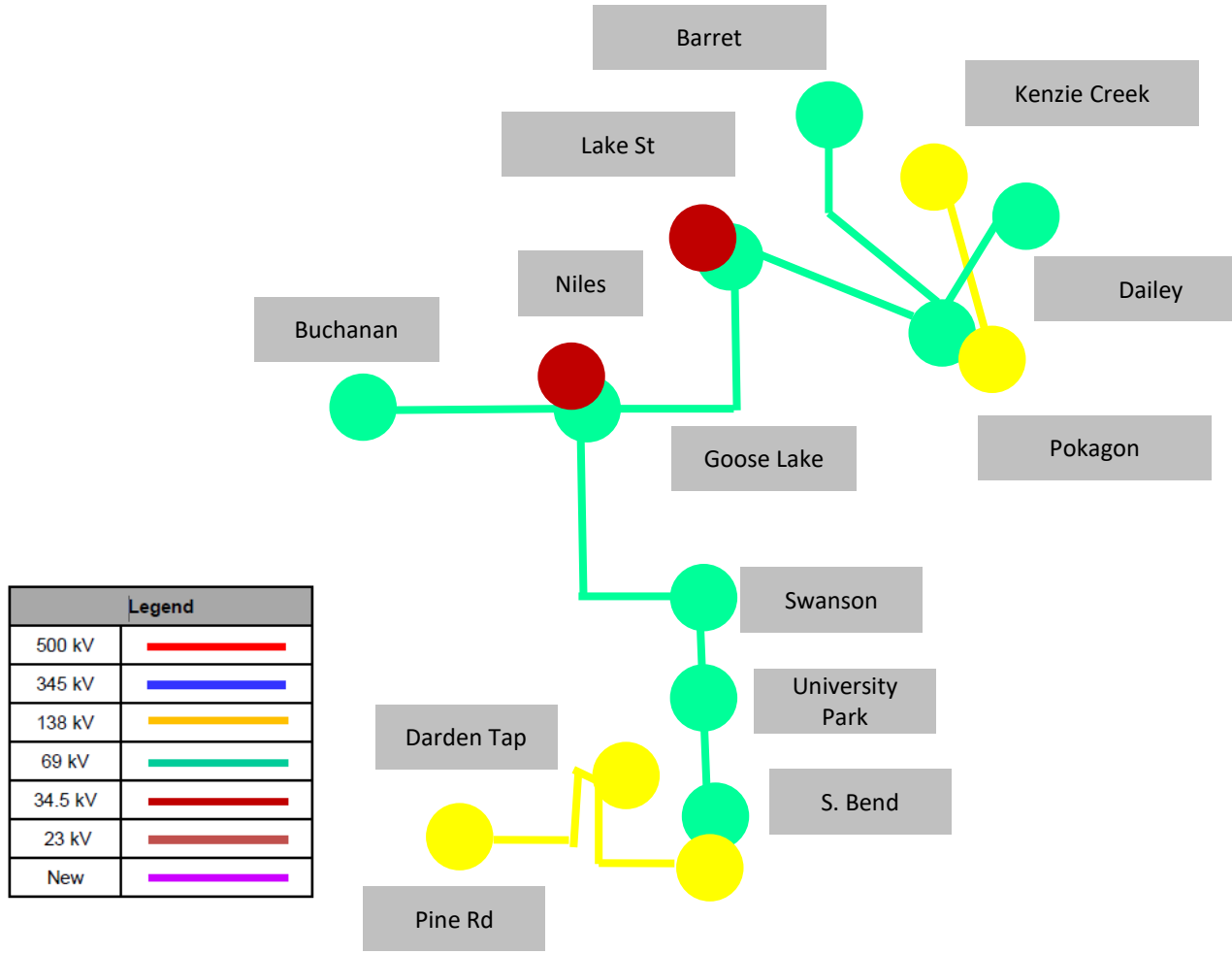
AEP Transmission Zone: Supplemental Niles Area Improvements

Need Number: AEP-2018-IM002, AEP-2019-IM035, AEP-0219-IM025, AEP-2019-IM046
Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

At Kenzie Creek station, install a 138/69kV XFR, 3 138kV breakers, 5 69kV breakers and a 14.4Mvar cap bank to allow for the retirement of Pokagon's 69 kV transmission yard.
Estimated Cost: $12M
At Pokagon station, retire the 69kV voltage class and re-organize this station as a 138/12kV station only.
Estimated Cost: $2M
At Lake Street station, install a new 69/12kV load delivery point, replace XFR 1 with a 50MVA bank, and replace 34.5kV CB "H" and 69kV Breaker "A"
Estimated Cost: $7.8M
At Niles station, replace 69kV breakers "B" and "A". Replace XFR 2 and the breaker toward the City of Niles
Estimated Cost: $6.2M
Route the Dailey, Barret and Lake St 69kV lines into Kenzie Creek station.
Estimated Cost: $2.8
Build the new 138/69/34kV Boundary station to serve the new 34.5kV distribution load and to separate the Swanson and University Park load form the network.
Estimated Cost: $13.6M

Total Estimated Transmission Cost: $101.3M



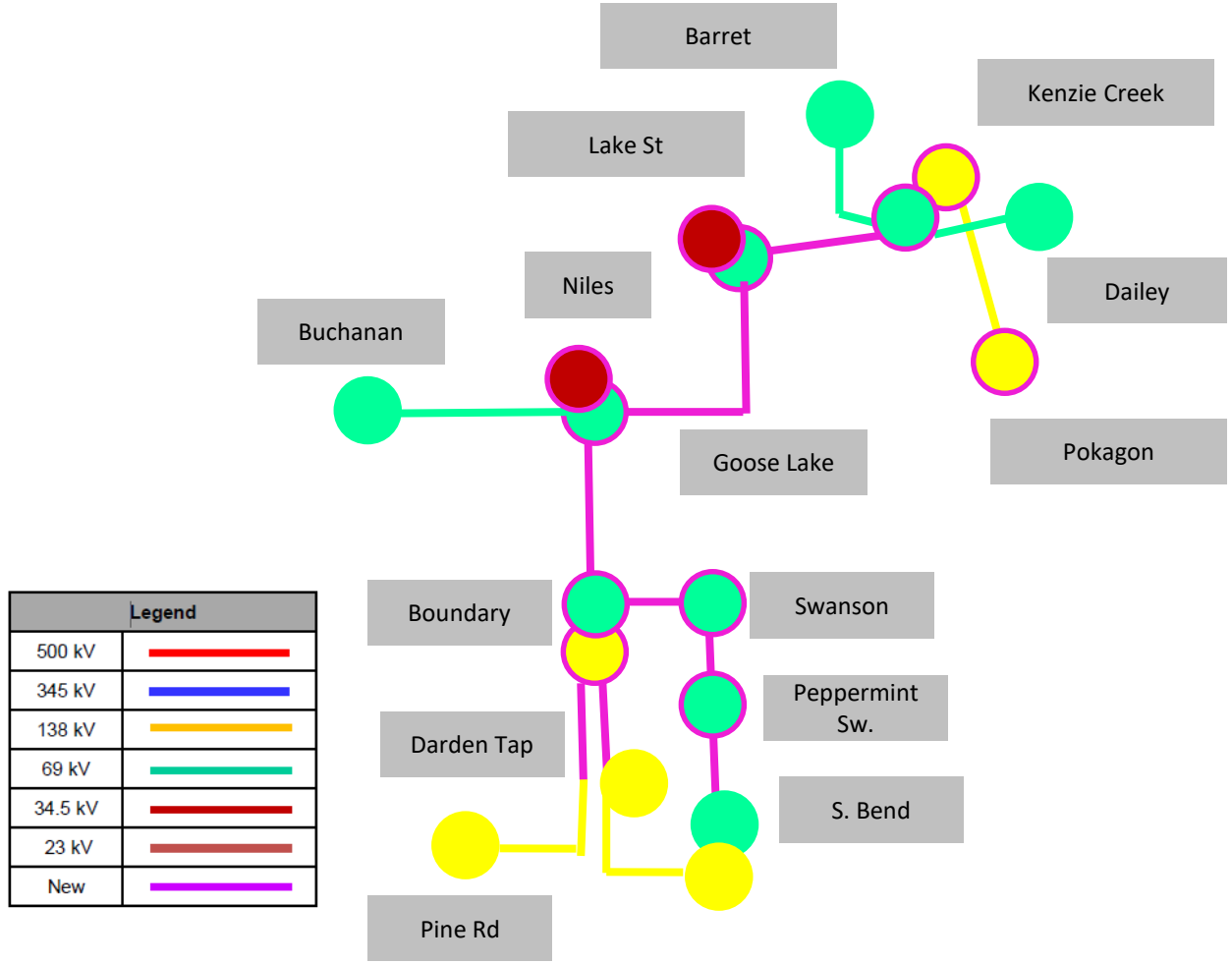
AEP Transmission Zone: Supplemental
Niles Area Improvements

Need Number: AEP-2018-IM002, AEP-2019-IM035, AEP-0219-IM025, AEP-2019-IM046
Process Stage: Solutions Meeting 12/18/2019

Proposed Solution:

Build the ~2 mile 138kV double ckt Boundary Extension
Cost: $4.4M
Rebuild the Pokagon – Niles 69kV line as the ~9.3 mile Kenzie – Niles 69kV line.
Cost: $22.8M
Rebuild the ~11.8 mile South Bend – Niles 69kV line as the South Bend – Boundary – Niles 69kV line
Cost: $26.6M
Install a 69kV bus tie CB at Swanson station to separate the 4 Moabs in series.
Cost: $2.1M
Replace the switch pole for University Park. The new PoP Switch pole will be called "Peppermint Switch".
Cost: $1M

Total Estimated Transmission Cost: $101.3M



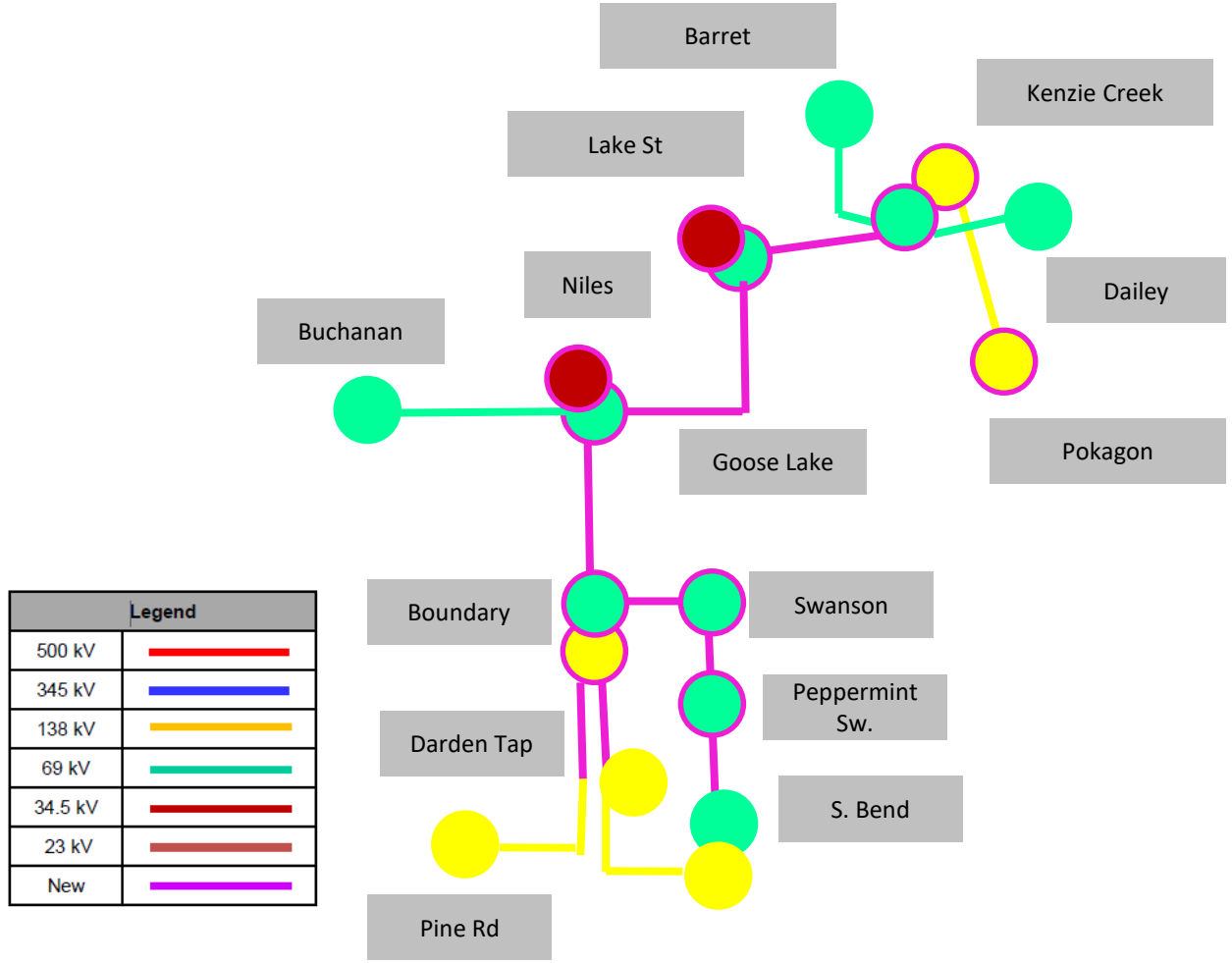
AEP Transmission Zone: Supplemental Niles Area Improvements

Need Number: AEP-2018-IM002, AEP-2019-IM035, AEP-0219-IM025, AEP-2019-IM046
Process Stage: Solutions Meeting 12/18/2019

Alternates Considered:
Rebuild the Pokagon 69kV yard. Pokagon Station is surrounded on the East by a road, on the South and West by rivers and wetlands, and on the North by a residential area. Due to the high amount of baseline and supplemental work needed at this station, this station will be subject to a lengthy outage unless a greenfield option is chosen. Due to the baseline issues in this area, there are issues with having this feed out for periods of time. Kenzie Creek is less than a mile away, we already own enough land there to do what is needed, and would be a stronger area source. Because of these reasons, rebuilding at Kenzie Creek was the preferred option.

In lieu of building Boundary station, build the Kenzie Creek – Niles line as double circuit 69kV. Due to the line going through the downtown Niles area and within a half mile of a airport, going double circuit would reduce the ability to overhang road ROW and would cause the line to go underground which is a significantly more costly alternative.

Projected IS Date: 06/01/2022
Project Status: Scoping



Appendix

High Level M-3 Meeting Schedule

Assumptions

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

Needs

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

Solutions

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

Submission of Supplemental Projects & Local Plan

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

Revision History

12/5/2019 – V1 – Original version posted to pjm.com

12/9/2019 – V2 – Slide #27, Changed 2nd West Union to Poplar Flats

12/10/2019 – V3 – Remove slides #26, and #27

12/17/2019 – V4 – Remove slides #6, and #7 (AEP-2018-AP010)

1/3/2020 – V5 – Correct the typo 11/22/18 to 11/22/19 for Needs meeting

1/6/2020 – V6 – Slide #24 and #28, Changes are reflected in the slides.