Sub Regional RTEP Committee
PJM West

June 26, 2018

First Review

Baseline Reliability and Supplemental Projects

EKPC Transmission Zone: Baseline B2332 Cancellation

Cancel B2332,
B2332 was presented in 8/21/2013 PJM West SRTEAC

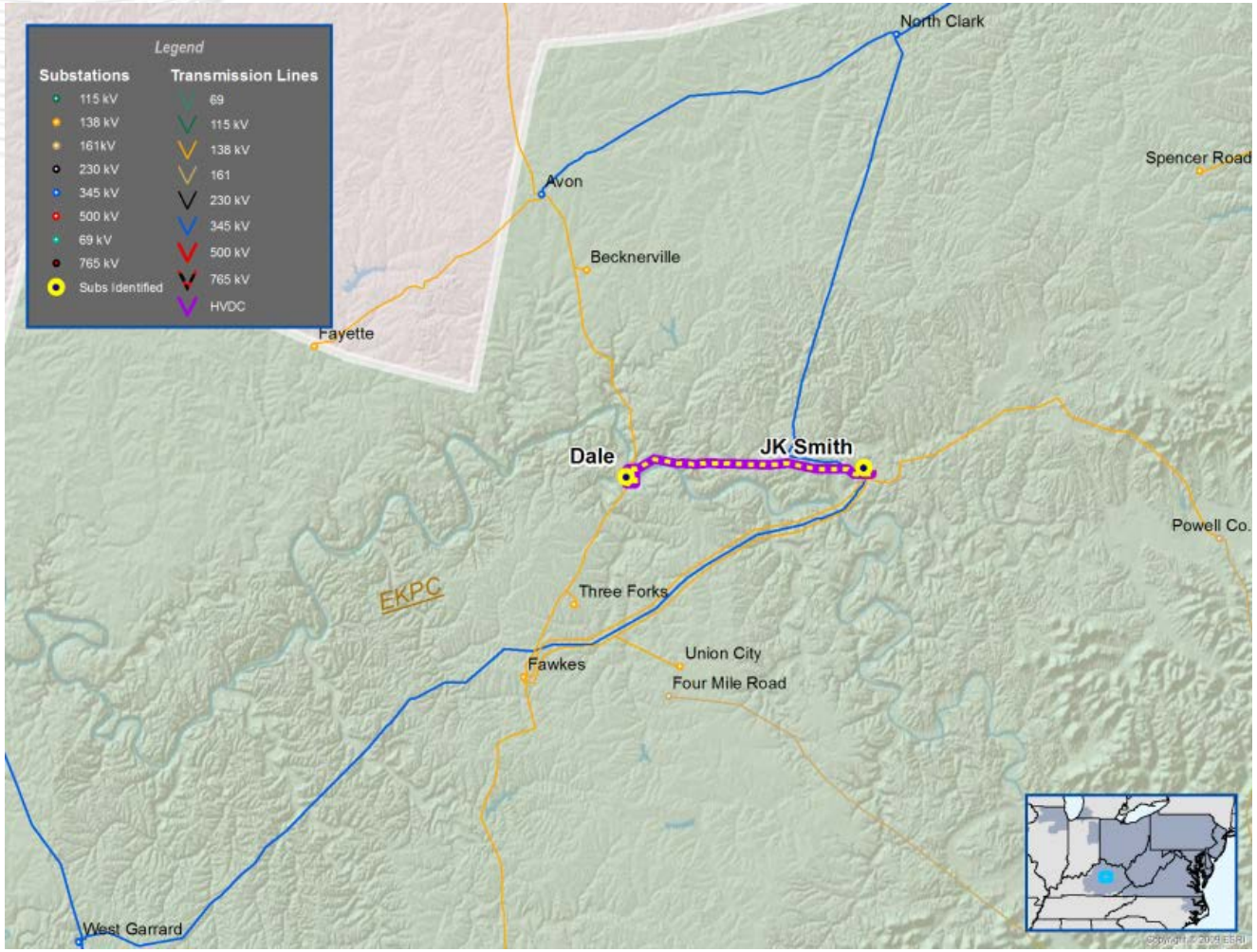
B2332:Increase the maximum operating temperature of the JK Smith - Dale 138 kV line to 275 degrees Fahrenheit

Original Driver: EKPC TO Criteria (Overload of JK Smith-Dale 138 kV line for the loss of North Clark - Avon 345 kV line and LGE/KU's Brown Unit #3)

TEAC Cost: $0.19M

Required IS date: 6/1/2019

Reason for Cancellation: EKPC screening study for the past couple years show that the violation doesn't exist anymore.



AEP Transmission Zone: Supplemental Tams Mountain Station Rebuild

Supplemental Project

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Tams Mountain 46 kV circuit breakers A, B, C, D and E are all oil-filled breakers installed in 1965. In general, oil breakers are difficult to maintain. Oil spills are frequent with failures and routine maintenance which is also an environmental risk. All five 46 kV breakers have exceeded the manufacturer's expected number of 10 fault operations; A: 237 fault ops, B: 248 fault ops, C: 113 fault ops, D: 84 fault ops, E: 63 fault ops.

Tams Mountain 138/69/46 kV XFR #1 (vintage 1965) is showing rising ethane, ethylene, and methane levels. All three gas concentrations are trending upwards. Despite decreasing moisture content, the dielectric strength has continued to decline. The short circuit strength has been deteriorated by the amount of thermal through faults.

Sophia 46 kV circuit breaker C is an oil-filled breaker manufactured in 1965. In general oil breakers are difficult to maintain. Oil spills are frequent with failures and routine maintenance which is also an environmental risk. Breaker C has experienced 41 fault operations which exceeds the manufacturer's expectation of 10 fault operations.

Operational Flexibility and Efficiency

The Tams Mountain – Mullens 138 kV and Tams Mountain – Pemberton 138 kV lines currently connect and create a three terminal line at Tams Mountain 138 kV bus #2. Two new 138 kV breakers will be installed and the station will be re-configured into a ring bus to eliminate the three terminal line at the station. The Ground-Switch MOAB on the high side of the 138/69/46 kV transformer at Tams Mountain is obsolete and creates an overlap in the zones of protection.

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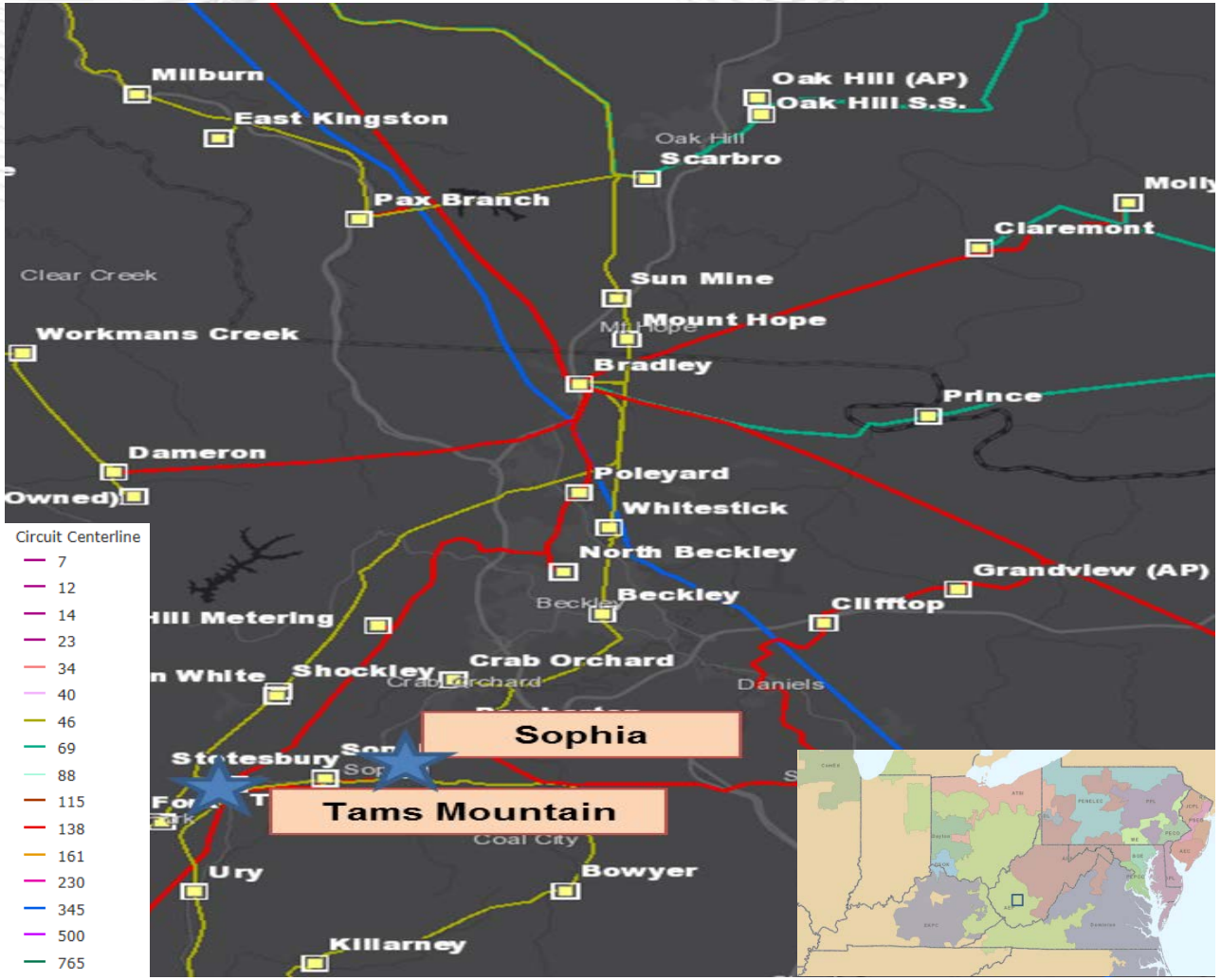

AEP Transmission Zone: Supplemental
Tams Mountain Station Rebuild

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Potential Solution

At Tams Mtn. Station, replace all 46 kV CB's (A, B, C, D, E) with 3000 A 40 kA CB's designed to 138 kV standards in ring bus operated at 46 kV. Replace the 138 kV GR. SW. MOAB with a new circuit switcher. Retire 138 kV bus tie breaker 'F' and establish one 138 kV bus. Install two new 3000 A 40 kA 138 kV CB's on Pierpont 138 kV line and Pemberton 138 kV lines. Replace existing 138/69/46 kV 40 MVA XFR with a new 138/69/46 130 MVA XFR. Reconfigure transmission lines entering the station to accommodate new ring configuration.
Estimated Trans. Cost: $19.7M

Sophia 46 kV Station remote end work to upgrade line relays, replace existing 1200 A 21 kA circuit breaker "C" with a new 3000 A 40 kA 69 kV CB. Estimated Trans. Cost: $0.9M

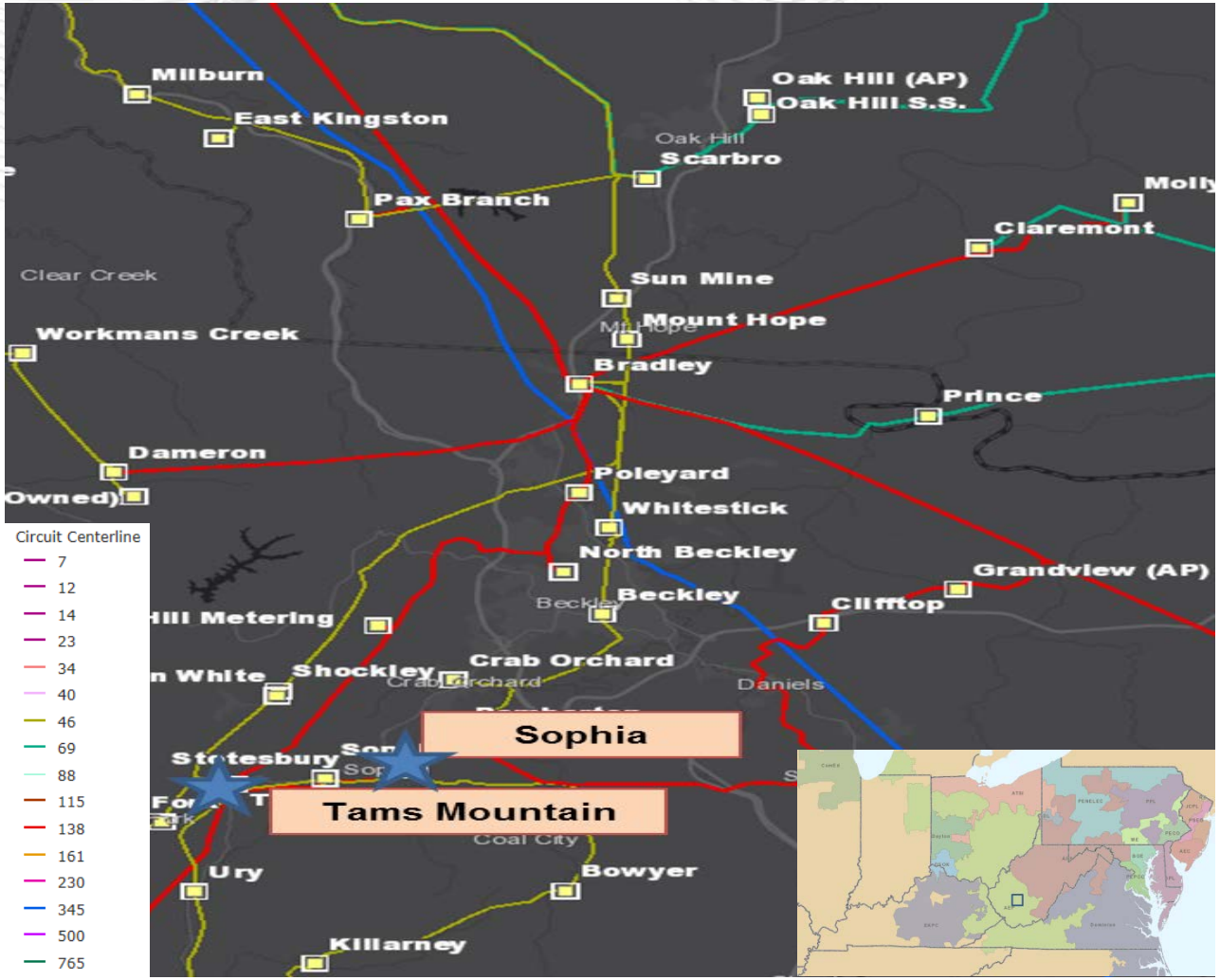
Pemberton 138 kV Station remote end relay work. Estimated Trans. Cost: $0.6M

Total Estimated Transmission Cost: $21.2M

Alternatives:
No cost effective alternatives were identified.

Projected In-service: 6/1/2021

Project Status: Scoping



AEP Transmission Zone: Supplemental Joshua Falls

Supplemental Project

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Joshua Falls: The Gas Insulated Station (GIS) at Joshua Falls, installed in 1979 , will only operate if the hydraulic pressure is at a minimum of 5000 psi. The hydraulic gears that are used to open and close the circuit breakers were leaking hydraulic oil at a high rate, and therefore we were not able to keep the pressure to 5000 psi. The hydraulic reservoirs needed to have hydraulic fluid added weekly to maintain adequate fluid levels in the system. Many of the hydraulic seals have deteriorated, causing additional oil leakage. Because the oil leakage was so severe, the circuit breakers often didn't have enough pressure to close when required. When this situation occurred, field personnel are dispatched to the station to re-pressurize the system. Because of the nature of the GIS issues, AEP installed a temporary station in 2014 until the new 138 kV yard could be rebuilt in the clear.

765/138 kV transformer #1 phase 1 (vintage 1980) is showing short circuit strength breakdown caused through fault events, gassing of the unit (high readings for ethane and methane), and a significant number of overheating events. There is an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress through aged gaskets, tank or pump leaks, or a breakdown of paper insulation of the transformer windings.

765/138 kV transformer #1 phase 3 (vintage 1992) is showing short circuit strength breakdown caused by thermal through fault events that this unit has experienced. These events have led to gassing of the unit and carbonization of the insulating paper, showing high readings of carbon dioxide and carbon monoxide. Phase 3 has shown signs of accelerated winding aging from the recent hot spot indicated on the low side winding well above the alert level. Similar transformer units have seen failures in the windings.

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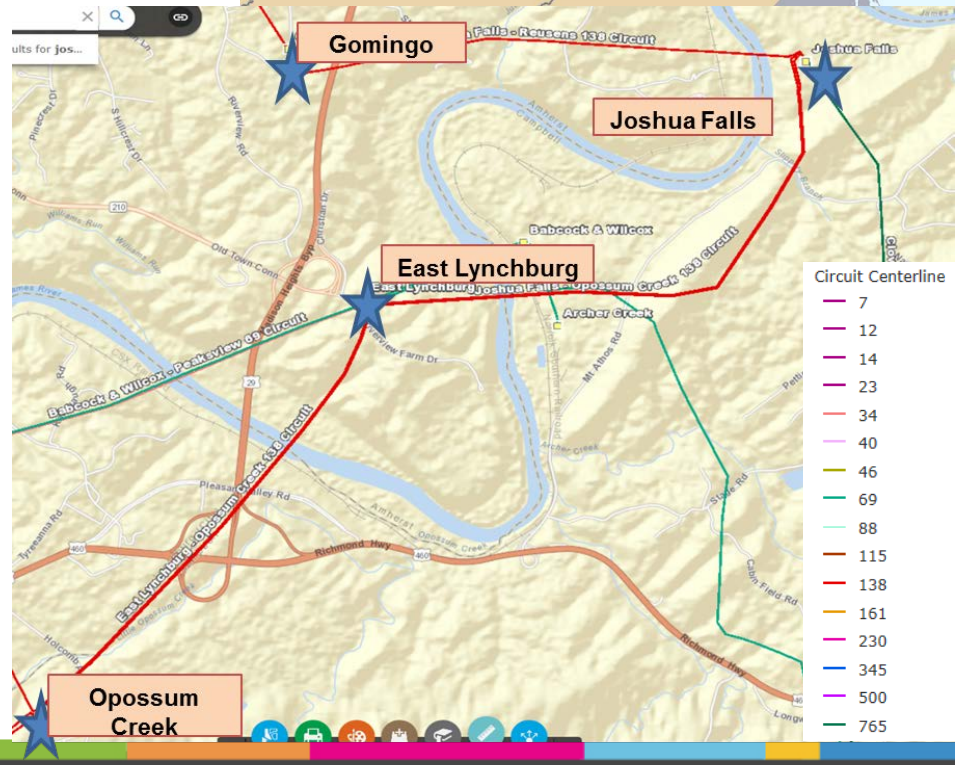

AEP Transmission Zone: Supplemental Joshua Falls

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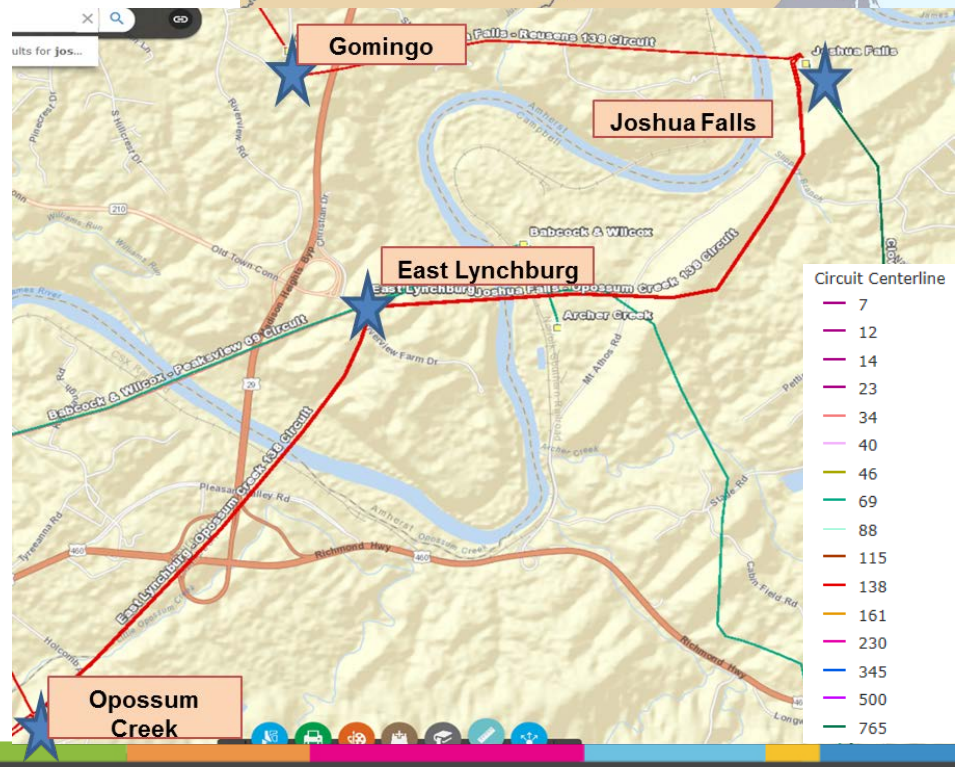
East Lynchburg: The 138 kV circuit breaker “K” (vintage 1974) at East Lynchburg is an air blast PK type breaker, which have become a safety concern due to their catastrophic and violent failures. During failures sharp pieces of porcelain are expelled, which can be a hazard to field personnel. In addition, CB “K” has experienced 70 fault operations exceeding manufacturers recommended fault operations of 10. The East Lynchburg 34.5 kV circuit breaker “A” (vintage 1956) is an oil type breaker without oil containment. These oil breakers have become more difficult to maintain due to the required oil handling. In general, oil spills occur more frequently during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings. CB “A” has experienced 33 operations, exceed the manufacturers recommended number of 10. Circuit Switcher “AA” is a MARK V unit, which have presented AEP with a large amount of failures and misoperations.



Operational Flexibility and Efficiency

There are currently three dissimilar zones of protection at East Lynchburg station: 138 kV Opossum Cr. line, 138/69/34.5 kV XF #1, and the 69 kV Babcock & Wilcox line. This configuration can lead to misoperations and over tripping.

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AEP Transmission Zone: Supplemental Joshua Falls

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Potential Solution

At Joshua Falls, retire the existing 138 kV yard at Joshua Falls Station and build a new one in the clear. The new 138 kV yard includes two 138 kV busses and 4-3000 A/63 kA circuit breakers in a breaker and a half layout. In addition, primary and backup single phase station service transformers will be added on bus 1 & 2 respectively. New CCVT's will be installed on the 138 kV lines and busses. A new 16'x 48' DICM will also be needed for this new station. In the Joshua Falls 765 kV yard a bus will be established to allow the spare 765/138 kV bank to be switchable. Electromechanical relaying packages on the transformers and line exit will be upgraded. A DICM will be required in this 765kV yard. Replace 765/138 kV 250 MVA phase 1 & 3 with new 250 MVA transformers. Estimated Cost: $34.6M

Construct 0.25 miles of 1590 ACSR (operated at 138kV) connecting the Joshua Falls 765 kV station to the new 138 kV yard.
Estimated Cost: $0.5M

Install 0.25 miles of 1590 ACSR connecting the Gomingo – Joshua Falls line to the new 138 kV yard.
Estimated Cost: $0.8M

Install 0.4 miles of double circuited 1590 ACSR connecting the Opossum Creek and Easy Lynchburg lines to the new 138 kV yard.
Estimated Cost: $1.1M

At East Lynchburg, install a new 3000 A/40 kA 138 kV circuit breaker "L" towards Opossum Creek. Replace the existing circuit breaker 3000 A/50 kA "K" with a 3000 A/40 kA 138 kV circuit breaker. Install a new 3000 A/40 kA circuit breaker "F" on the 69 kV station exit. Replace the existing 1200 A/17 kA 34.5 kV circuit breaker "A" with a 1200 A/25 kA breaker. Install a new station service transformer on the 138 kV bus and replace the existing 34.5 kV station service transformer (used for a backup). Retire capswitcher "AA" and 57.6 MVAR capacitor bank. Estimated Cost: $3.7M

Total Estimated Transmission Cost: $40.7M

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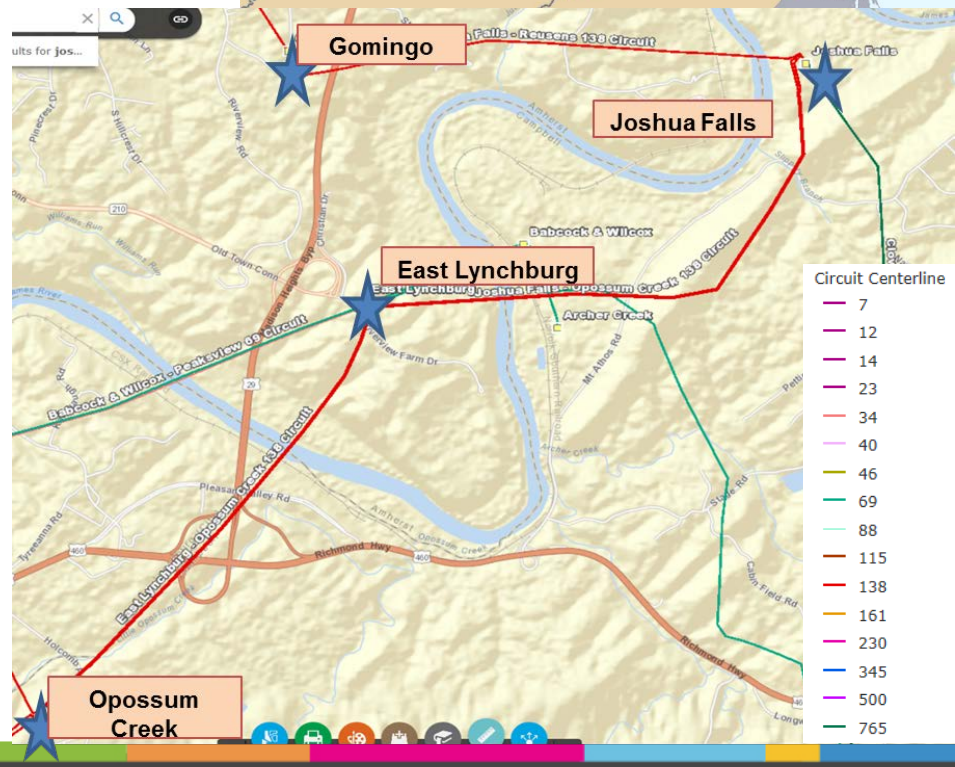

AEP Transmission Zone: Supplemental
Joshua Falls

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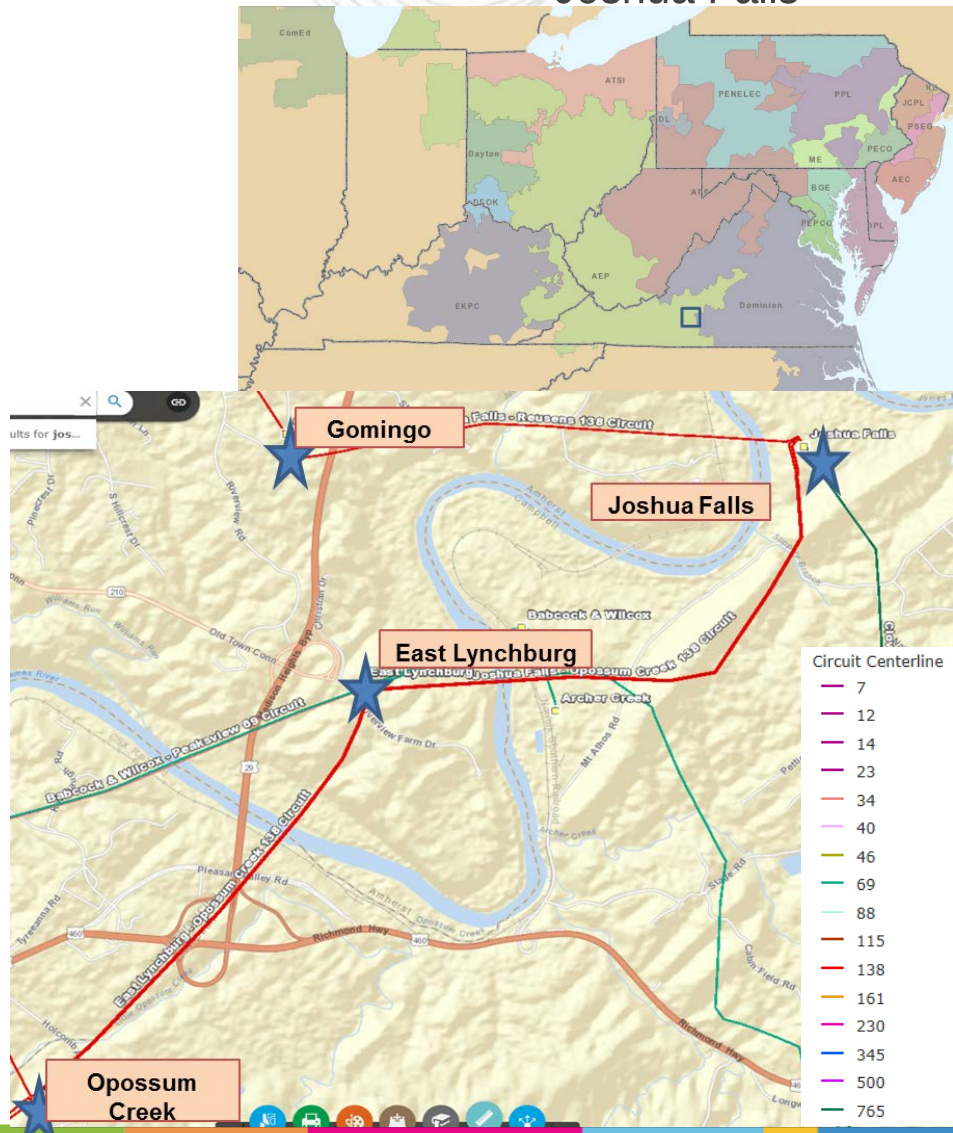
Alternative:
Leave the current temporary arrangement in place at Joshua Falls. This temporary arrangement was not designed as a long term solution. The four corner poles that make up the temporary ring bus are direct imbedded steel poles that require guy wires for structural support. These poles were not designed for this type of application. In addition, guy wires reduce the maneuverability of vehicles within the station fence. No expansion of the 138kV yard is possible with this current temporary configuration in place.

Projected In-service: 7/31/2020

Project Status: Engineering



DEOK Transmission Zone: Supplemental
South Bethel – Brown 69 kV Feeder Rebuild

Supplemental Project

Problem Statement:
The 69 kV feeder between South Bethel and Brown substations is aged and in deteriorating condition (1970's era).
Driver: Equipment Material Condition, Performance and Risk

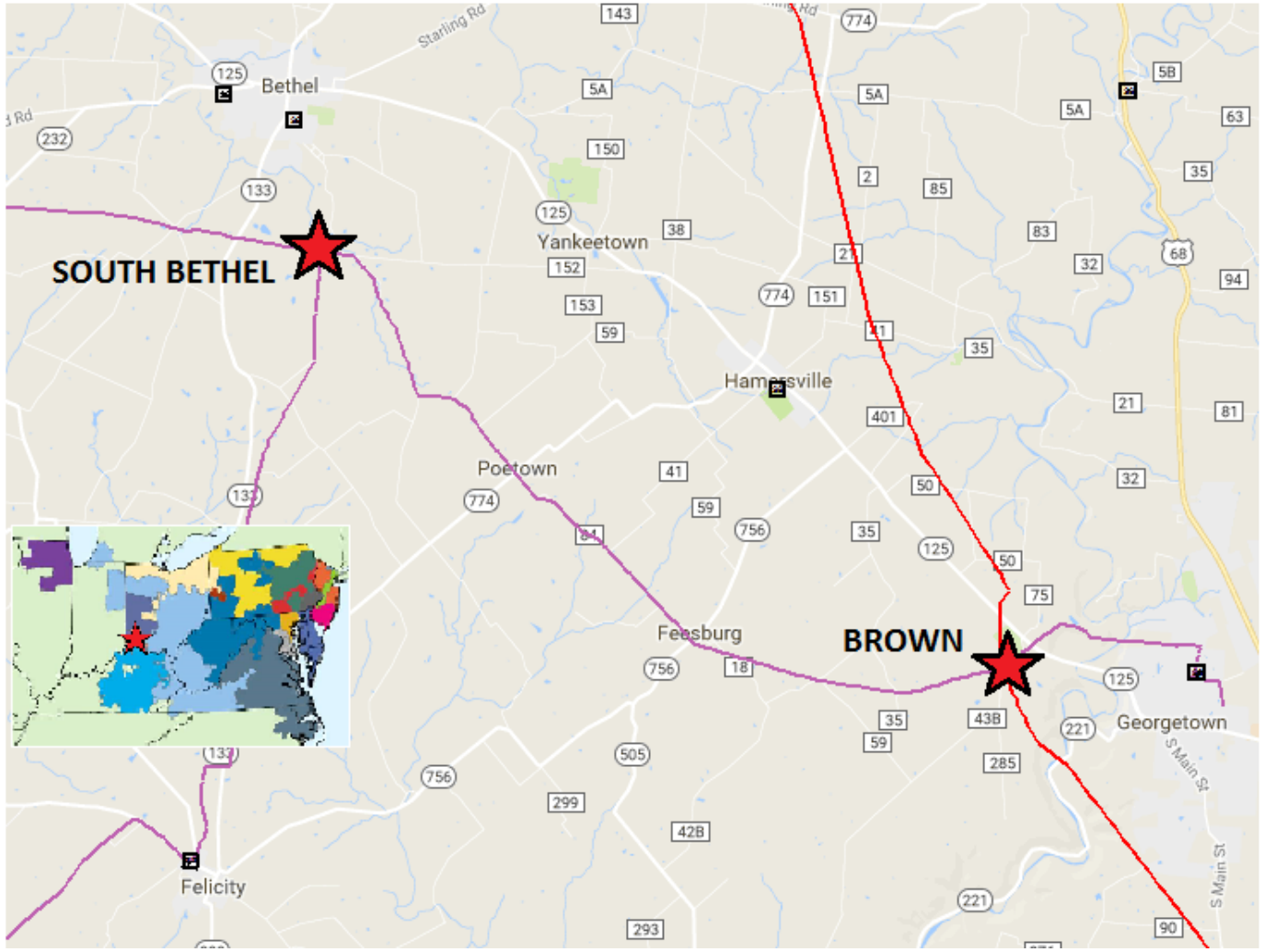
Potential Solution:
Rebuild 9.8 miles of feeder between South Bethel and Brown substations with new structures, hardware, and conductor. Replace one 69 kV switch. Capacity of the line will increase from 97 MVA to 150 MVA (conductor limited).

Estimated Cost: $10.0 M

Alternatives:
- none

Projected In-service: 6-1-2019

Project Status: Engineering



Short Circuit

AEP Transmission Zone: Baseline
Replace South Canton Breakers

Problem Statement:
South Canton 138kV breakers 'N', 'N1', and 'N2' are overdutied.

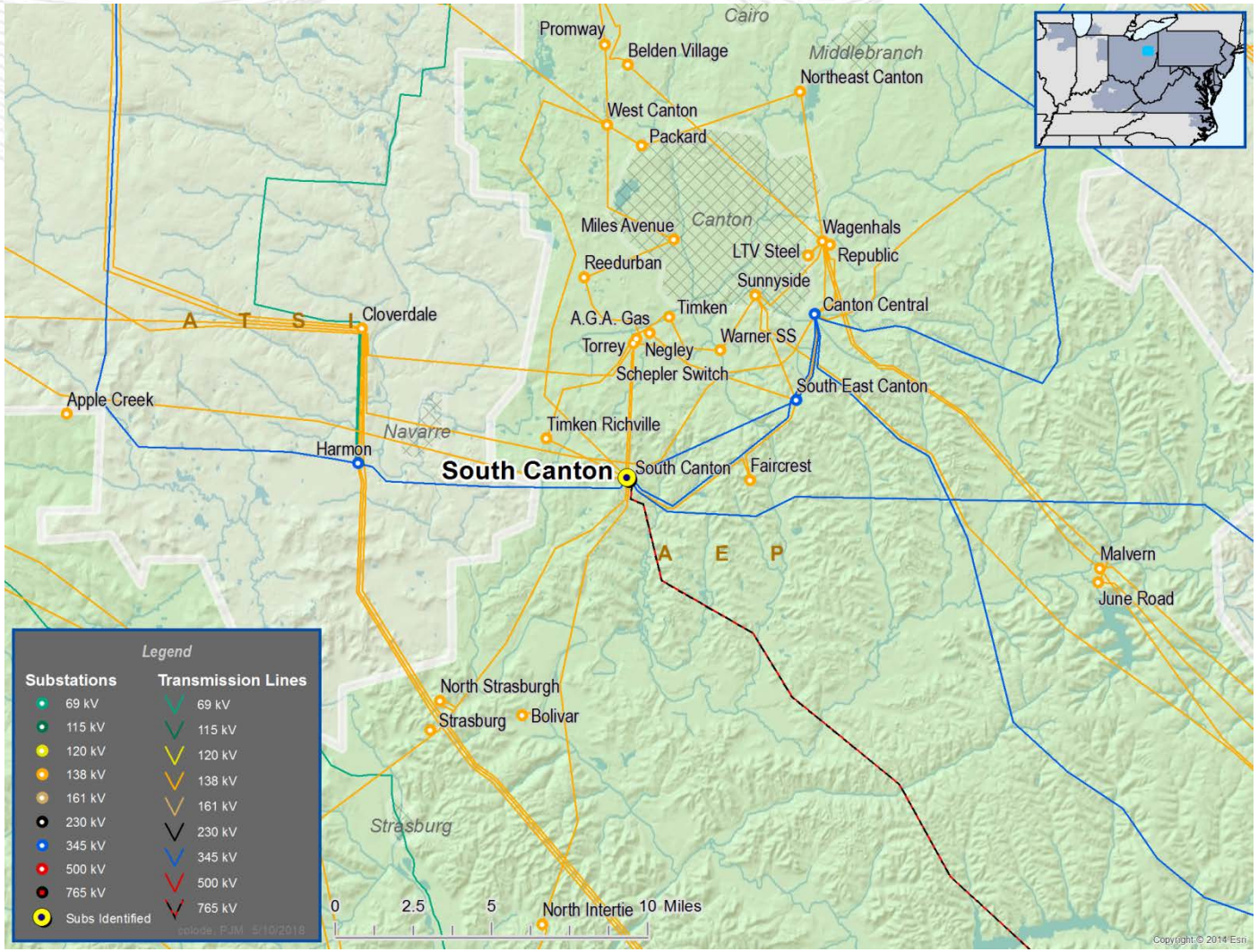
Immediate Need:
Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Selected Solution:
Replace South Canton 138kV breaker 'N' with 80kA breaker. (b3000)
Replace South Canton 138kV breaker 'N1' with 80kA breaker. (b3001)
Replace South Canton 138kV breaker 'N2' with 80kA breaker. (b3002)

Alternatives:
No feasible alternative is considered due to the immediate need.

Estimated Project Cost: $1M each

Required IS Date: 06/01/2020



Second Review

Baseline Reliability and Supplemental Projects

ATSI Transmission Zone: Supplemental
Cliffs Natural Resource Substation

Previously Presented: 5/21/2018 SRRTEP

Problem Statement:

Customer Service

- Provide 138 kV service to new customer
- Customer load 46 MWs

Selected Solution:

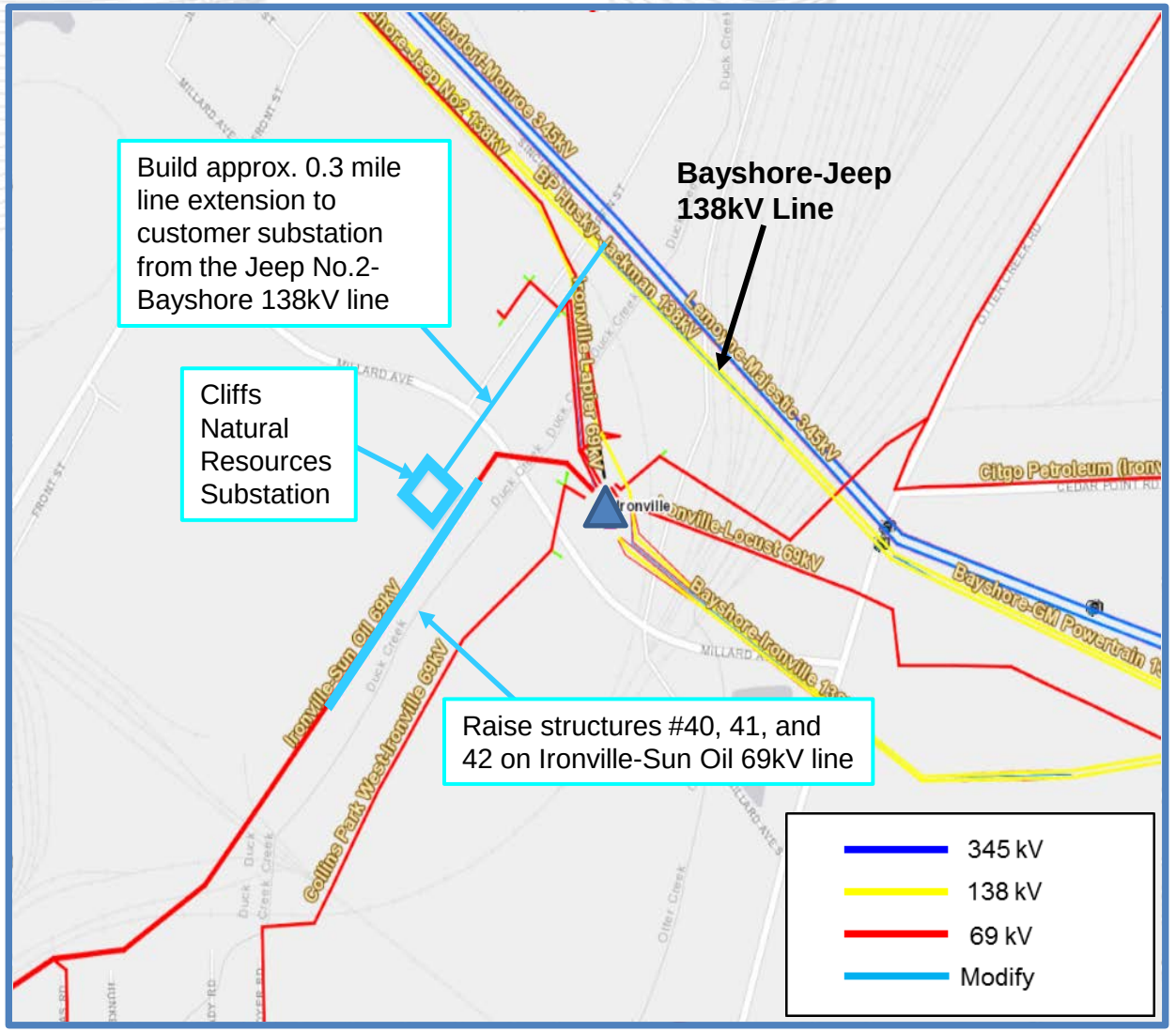
Cliffs Natural Resource Substation - Provide 138 kV Service (S1649)

- Tap the existing Bayshore-Jeep #2 138kV circuit to the new Cliffs Natural Resource Substation (approx. 0.3 miles).
- Raise the line from tower #40 to tower #43 on the Ironville-Sun Oil 69kV line to increase clearances. (Reimbursable)
- Install SCADA Control at the in line switches of the tap connection. (Reimbursable)

Estimated Project Cost: $0.9M

Projected IS Date: 9/01/2019

Status: Engineering



Previously Presented: 5/21/2018 SRRTEP

Problem Statement:

Customer Service

- Pennsylvania Corrective Action Plan (PA CAP) project for improved reliability
- Provides capacity relief for the area
- Customer load 3 MWs

Selected Solution:

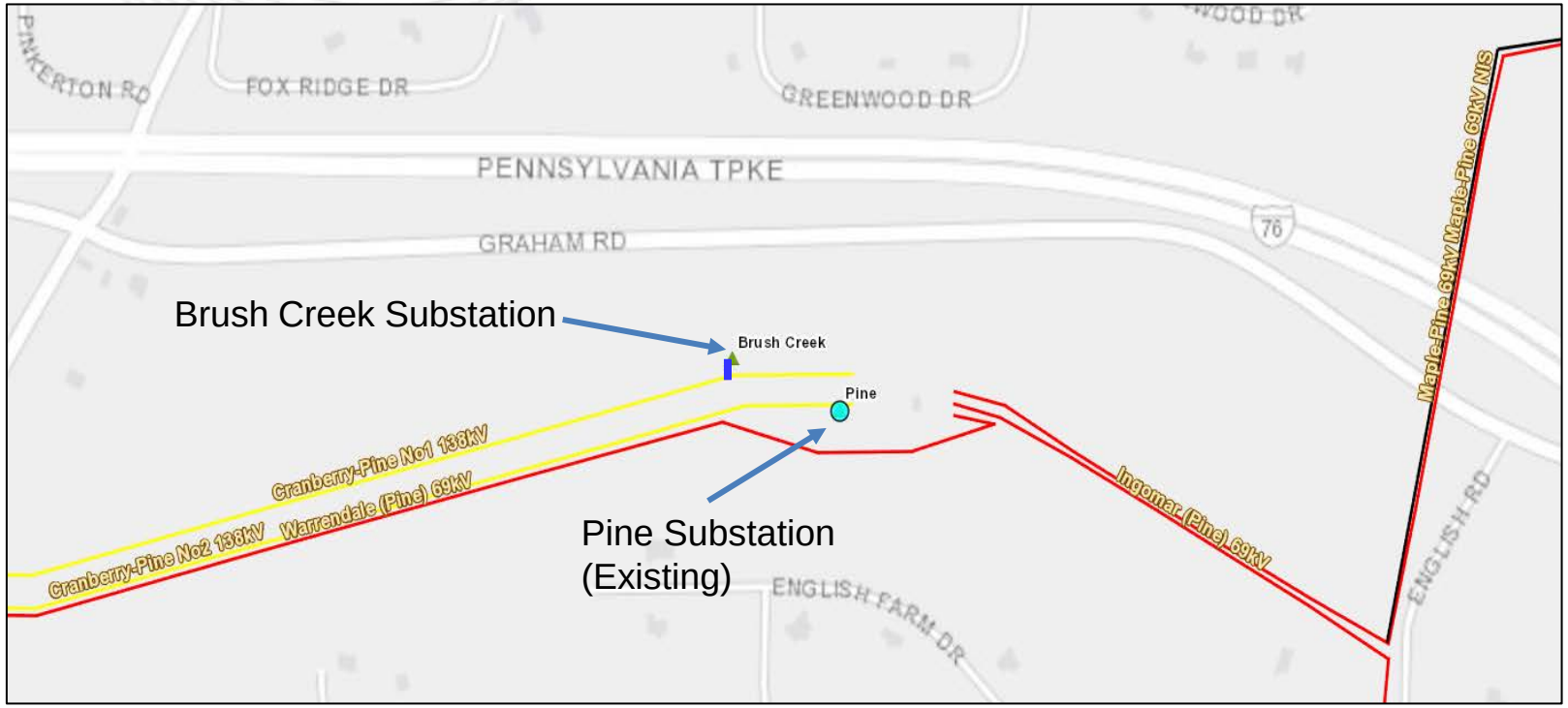
Brush Creek 138 kV Substation – Provide 138kV Service

- Tap the existing Cranberry-Pine #1 138 kV Line to connect a new 138-12.47 kV distribution Mod Sub next to the existing transmission line. (S1650)

Estimated Project Cost: $0.1M

Projected IS Date: 09/30/2018

Status: Construction



ATSI Transmission Zone: Supplemental
North Titus Substation

Previously Presented: 5/21/2018 SRRTEP

Problem Statement:

Customer Service

- Provide 138 kV service to new customer
- Customer requested redundant feeds and ring for reliability (Reimbursable)
- Customer load 19 MWs

Selected Solution:

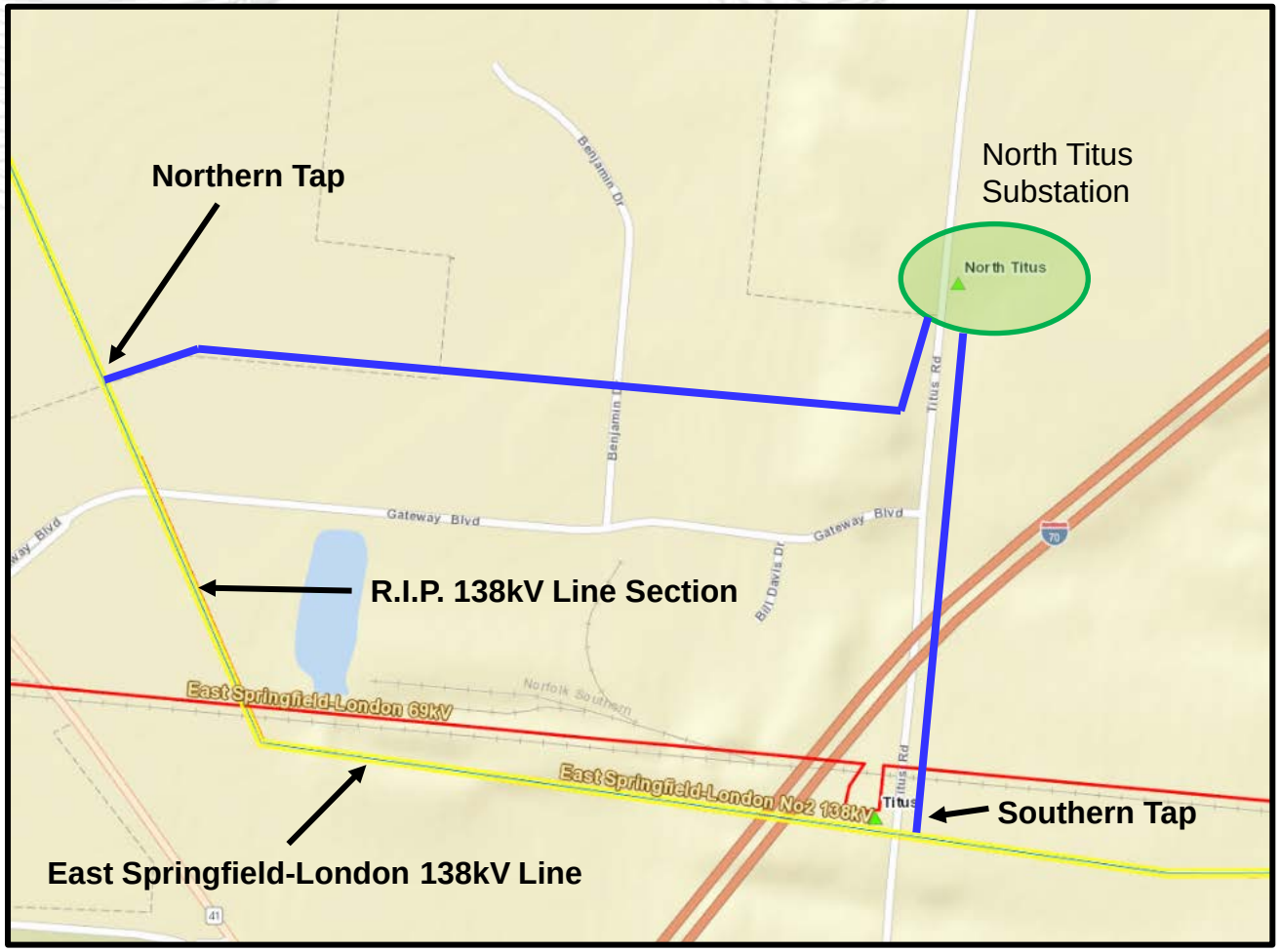
North Titus Substation - Provide 138 kV Service (S1651)

- Build new 3-breaker 138kV ring bus (Reimbursable)
- Build new ~1 mile of 795 ACSR from northern tap location (Reimbursable)
- Build new ~0.5 miles of 795 ACSR from southern tap location
- Retire-In-Place 138kV line section between Northern and Southern tap locations.

Estimated Project Cost: $2.0 M

Projected IS Date: 10/01/2018

Status: Construction



Conceptual 138kV Route
Existing 138 kV Line
Existing 69 kV Line

ATSI Transmission Zone: Supplemental
Ellwood Quality Steel #2 Substation

Previously Presented: 5/21/2018 SRRTEP

Problem Statement:

Customer Service

- Provide 138 kV service to new customer
- Customer load 15 MWs

Selected Solution:

Ellwood Quality Steel #2 Substation - Provide 138 kV Service (S1652)

- Tap the existing New Castle-Cedar Street 138 kV radial line extension.
- 8 new spans of 336.4 ACSR

Estimated Project Cost: $1.0 M

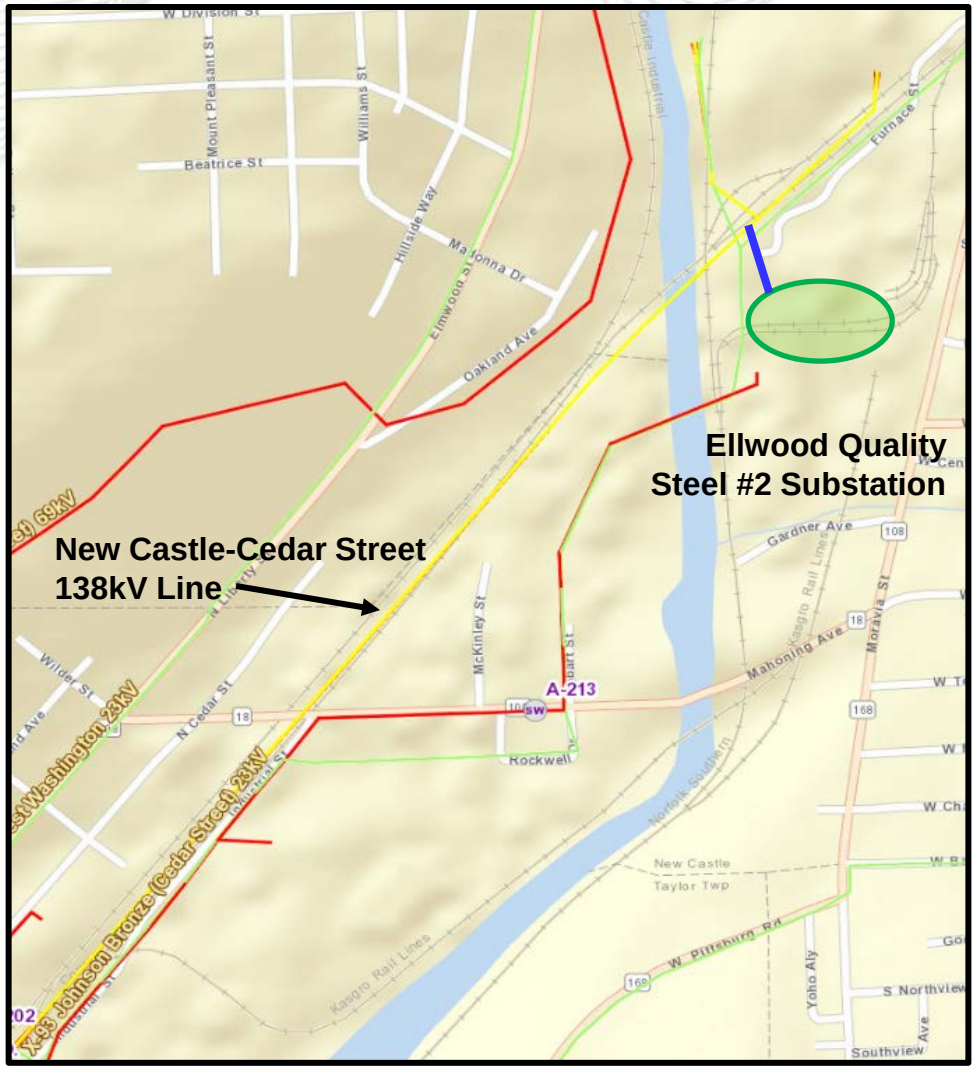
Projected IS Date: 9/1/2018

Status: Engineering

Conceptual 138kV Route

Existing 138 kV Line

Existing 69 kV Line



ATSI Transmission Zone: Supplemental Envelope 1 Substation

Previously Presented: 5/21/2018 SRRTEP

Problem Statement:

Customer Service

- Provide 69 kV service to new customer
- Customer load 4 MWs

Selected Solution:

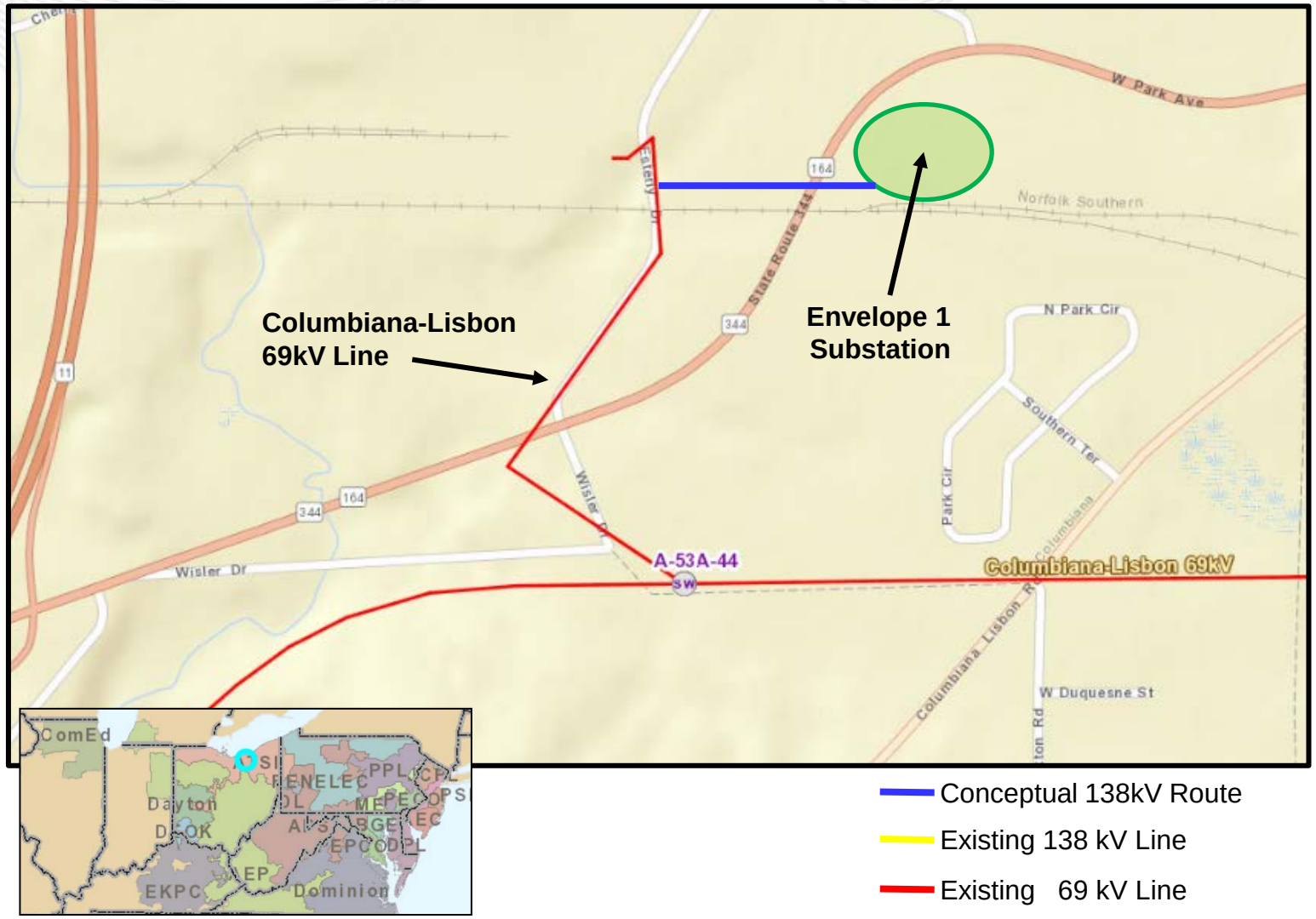
Envelope 1 Substation - Provide 69 kV Service (S1653)

- Tap the existing Columbiana-Lisbon 69 kV radial line extension.
- Build 5 spans of 477 ACSR 69 kV Line

Estimated Project Cost: $0.6 M

Projected IS Date: 12/31/2018

Status: Engineering



ATSI Transmission Zone: Supplemental
Ironville – Collins Park West 69kV Line Re-conductor

Previously Presented: 5/21/2018 SRRTEP

Problem Statement (Scope and Need/Drivers):

Equipment Material Condition, Performance and Risk

- Improve system reliability and performance.
- Remove obsolete and deteriorated equipment.
- Upgrade to current FE Standards

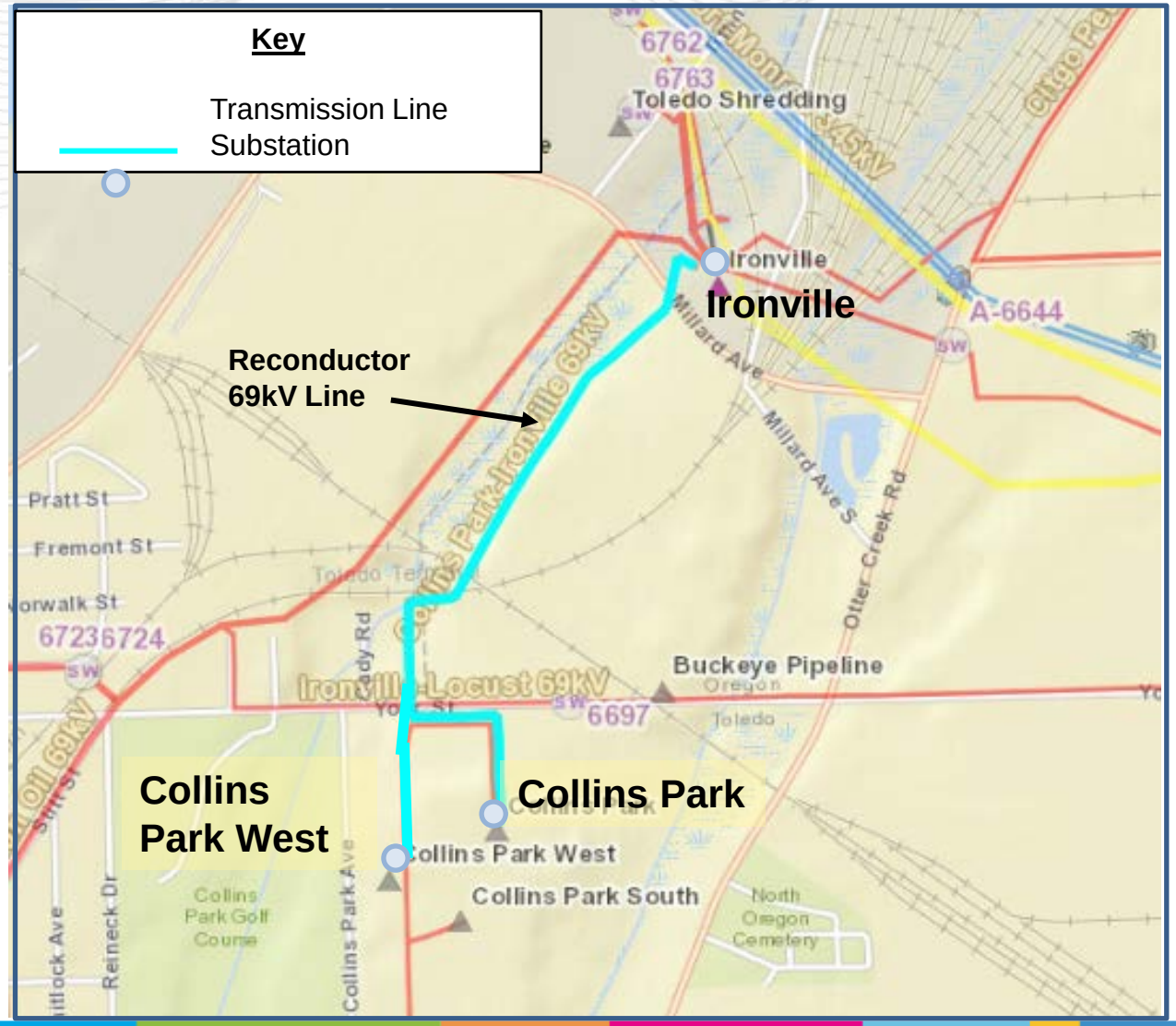
Selected Solution (S1654):

- Reconductor the existing 397.5 ACSR Ironville-Collins Park West 69 kV line, including the Collins Park 69kV Tap, with 477 ACSR (0.9 miles).
- Old Line Ratings MVA: 82 SN / 104 SE
- New Line Ratings MVA: 99 SN / 119 SE
- Rehab / Replace poles as required.

Estimated Project Cost: $1.6M

Projected IS Date: 9/19/2018

Status: Construction



DEOK Transmission Zone: Supplemental
Symmes – Northgreen 69 kV Feeder Rebuild

Previously Presented: 5/21/2018 SRRTEP

Problem Statement:
The 69 kV feeder between Symmes and Northgreen substations is aged and in deteriorating condition (1950's era).

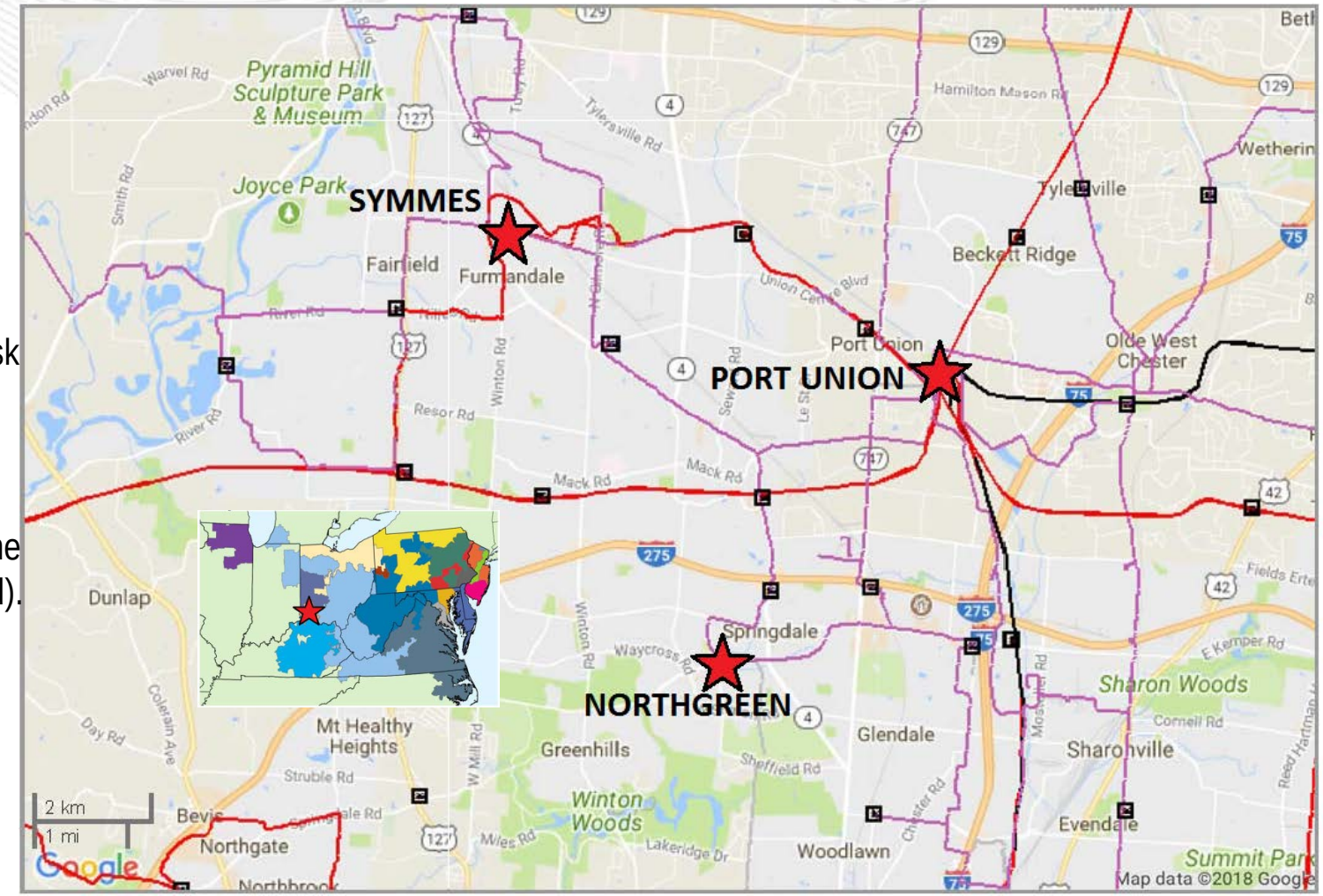
Driver: Equipment Material Condition, Performance and Risk

Selected Solution:
Rebuild 10.5 miles of 69kV feeder between Symmes and Northgreen substations including the tap to Port Union with 298 new structures, hardware, and conductor. Capacity of the line will increase from 97 MVA to 150MVA (conductor limited). (S1657)

Estimated Cost: $21.3 M

Projected In-service: 12/31/2018

Project Status: Engineering



DEOK Transmission Zone: Supplemental
Princeton – Trenton 69 kV Feeder Rebuild

Previously Presented: 5/21/2018 SRRTEP

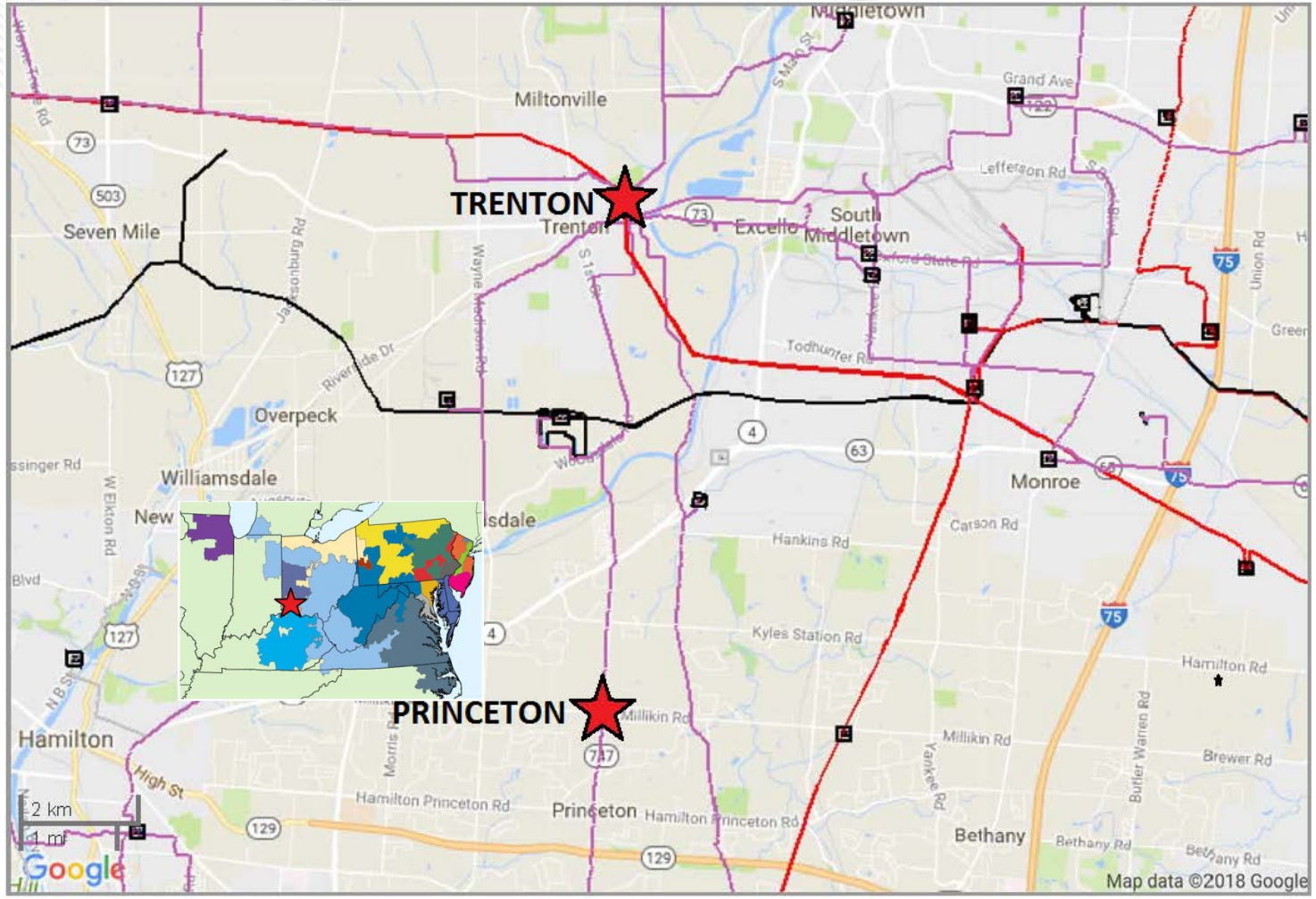
Problem Statement:
The 69 kV feeder between Princeton and Trenton substations is aged and in deteriorating condition (1950's era).
Driver: Equipment Material Condition, Performance and Risk

Selected Solution:
Rebuild 6.1 miles of feeder between Princeton and Trenton substations with 137 new structures, hardware, and conductor. Replace two 69 kV switches. Capacity of the line will increase from 97 MVA to 107 MVA (bus limited). (S1658)

Estimated Cost: $7.8 M

Projected In-service: 12/31/2018

Project Status: Engineering



DEOK Transmission Zone: Supplemental Oakley - Fairfax 69 kV Feeder Rebuild

Previously Presented: 5/21/2018 SRRTEP

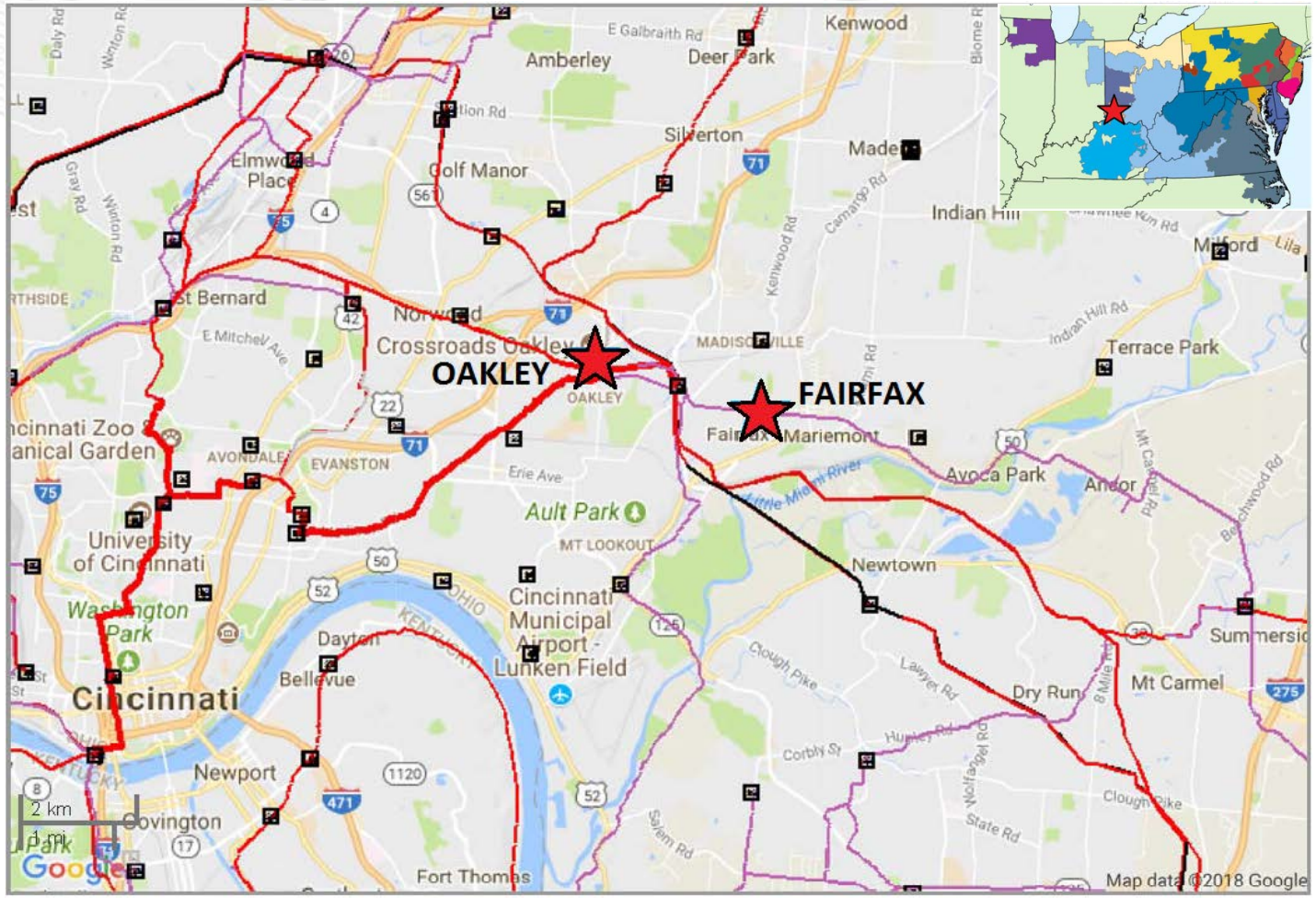
Problem Statement:
The 69 kV feeder between Oakley and Fairfax substations is aged and in deteriorating condition (1970's era).
Driver: Equipment Material Condition, Performance and Risk

Selected Solution:
Rebuild 2.3 miles of feeder between Oakley and Fairfax substations with 65 new structures, hardware, and conductor. Replace one switch. Access issues due to hills, creek and railroad. Capacity of the line will increase from 97 MVA to 150 MVA (conductor limited). (S1659)

Estimated Cost: $4.0 M

Projected In-service: 12-31-2018

Project Status: Engineering



AEP Transmission Zone: Supplemental South Point Bus Reconductor

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency

The South Point-Millbrook Park Line was loaded to 96% of the 107 MVA rating as recently as Sept 22, 2017. Low ratings on the 138kV South Point-Millbrook Park and South Point-Apple Grove lines will cause delays in outage scheduling for construction and maintenance to avoid overloads.

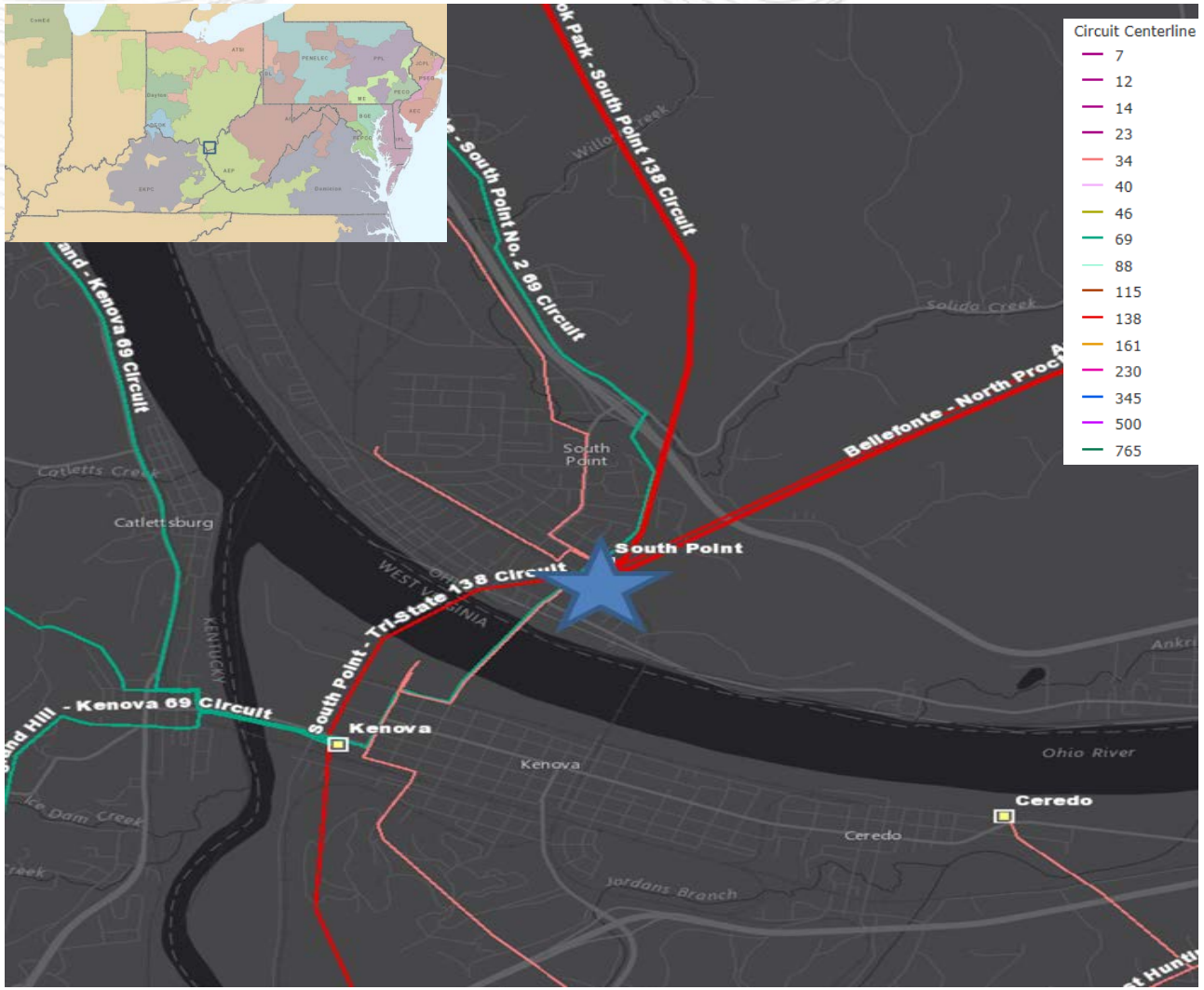
Selected Solution:

Replace 4/0 Copper risers that are the limiting elements on the South Point 138kV transmission lines to Millbrook Park and Apple Grove. Upgrade two section of 300 Cu on the bus ends to match the bus thermal rating. Upgrade the electromechanical relays for the bus diff and capacitor. (S1660)

Estimated Cost: $0.5M

In-service Date: 5/1/2018

Project Status: In Service



AEP Transmission Zone: Supplemental Stadium Park

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

The NFL Hall of Fame (HOF) in Canton, Ohio has a major expansion in the works for 2017 through 2020. The Pro Football Hall of Fame Village will be an $800 million mixed-use development, including the museum, expanded stadium, hotels, apartments, and other features. There will be a large amount of new load forecasted, which is above the capacity of the existing Stadium Park 69-12kV distribution transformer. In addition, the HOF needs additional land, which is occupied by AEP's distribution station. AEP will be relocating the station further to the west.

Equipment Material/Condition/Performance/Risk:

West Canton 69kV breaker 'S' is a CF oil breaker made in 1970 (47 years old). It is recommended for replacement, due to age, lack of spare parts, and breaker-failure system impact to other facilities. Since the year 2000, the breaker has experienced 25 fault operations (lifetime count of 45), above the recommended limit of 10. The breaker lacks modern gas & moisture-monitoring capabilities. In general, oil breakers have become increasingly difficult to maintain due to the oil handling and environmental hazards associated with them. The breaker itself is rusting, along with heavy rust on the supporting structure and foundations.

During the time that the 69kV circuit protection is being upgraded, it makes sense to also replace this breaker, so as to reduce engineering/construction costs and utilize outage-windows, by doing it all in one project.

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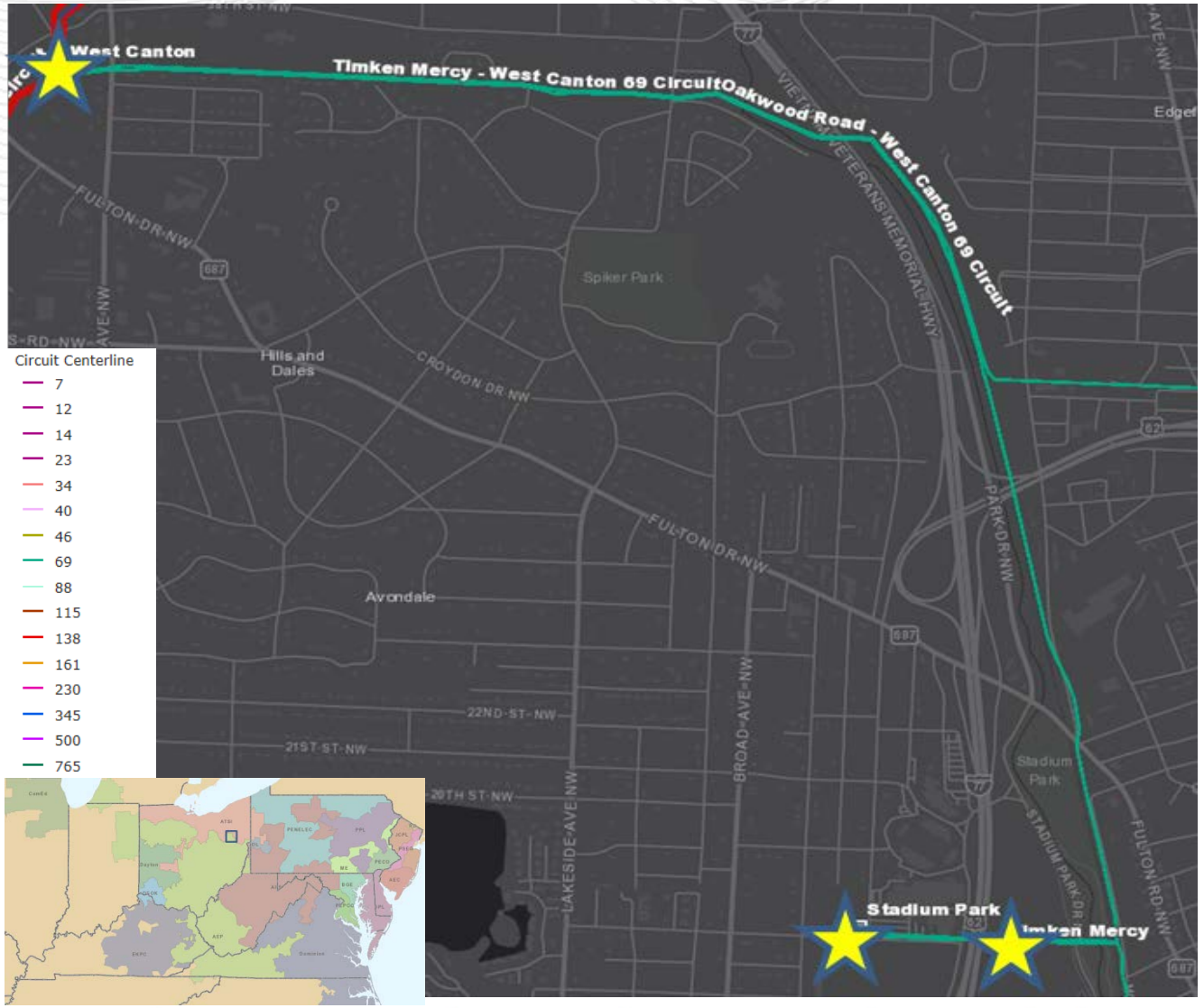

AEP Transmission Zone: Supplemental Stadium Park

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Operational Flexibility and Efficiency

Two new 20 MVA 69-12kV Distribution (AEP Ohio) transformers will be installed at the greenfield station. Due to the existing and future load growth, 2- 69KV circuit breakers will be installed. The addition of the Stadium Park 69kV circuit breakers will prevent a distribution fault at Stadium Park from causing an outage to the hospital served from Timken Mercy Hospital station.

The 69kV capacitor bank will be retired due to space constraints. This retirement was studied in conjunction with AEP Operations, and no concerns were found.

Selected Solution:

Relocate Distribution (AEP Ohio) station next to the HOF to the west, to facilitate the needed station upgrades to address capacity overloads. Install 2- 69kV circuit breakers and relaying. Retire the 69kV cap bank. (S1661.1) Estimated Cost: $2.1M

At the 69kV remote-end of West Canton, upgrade protection to coordinate with Stadium Park; replace 69kV oil breaker 'S'. (S1661.2) Estimated Cost: $0.8M

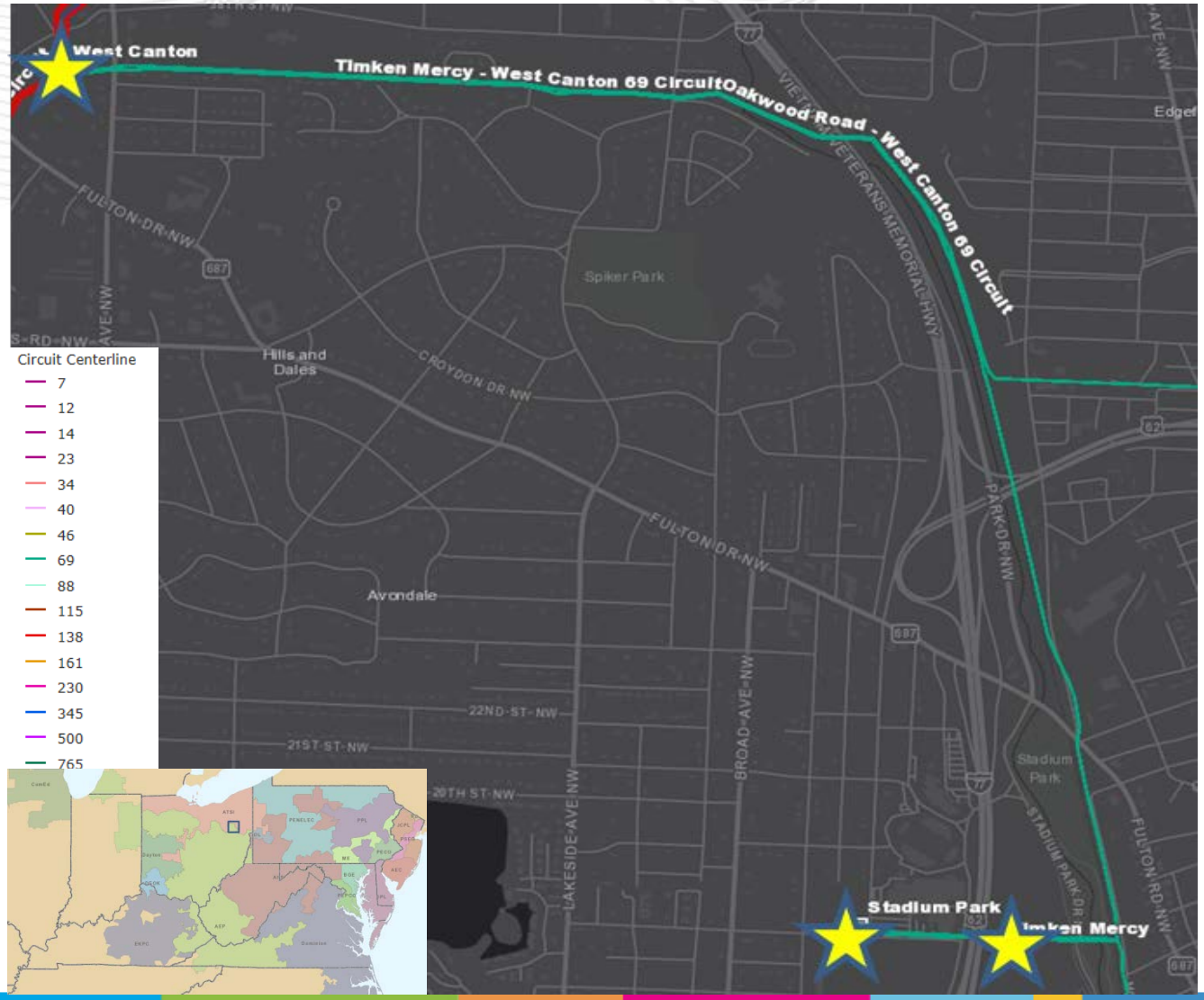
At the 69kV remote-end of Timken Mercy, upgrade protection to coordinate with Stadium Park; install CCVT's. (S1661.3) Estimated Cost: $0.8M

Extend West Canton-Stadium Park-Timken Mercy 69kV double-circuit loop to new Stadium Park station location, approximately 300 ft. to the west. (S1661.4) Estimated Cost: $0.3M

Total Estimated Transmission Cost: $4.0M

Projected In-service: 12/31/2018

Project Status: Engineering



AEP Transmission Zone: Supplemental Tidd Station

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 5- remaining 1600A 50 kA 138kV 'ATB' air-blast breakers at Tidd were manufactured in 1966. These units are overall in poor condition and a safety hazard to field personnel, due to the violent manner in which they tend to fail. Air-blast breakers are being replaced across the AEP system due to their catastrophic and violent failures. Sharp pieces of porcelain from their bushings are typically expelled from the breakers and can be a potential safety hazard to field personnel. Other factors driving the replacement are age (52 years), scarce availability of spare parts, and system impact upon failure. The breakers lack real-time condition monitoring, but instead require a de-energized test for evaluation

The existing control house is in poor condition and has experienced flooding in the basement, placing protection and telecom equipment at risk numerous times. There are various safety concerns in the deteriorating building, including lighting and heating/cooling issues. The DC system in the building has failed due to degraded cables.

The majority of the relays being replaced are electromechanical or solid-state units, which are aging and prone to failure; these also lack modern fault-location and event-recording functionality. The 138kV bus PT's are rusting and leaking oil, along with deteriorated foundations. The 138kV bus-work utilizes cap-and-pin insulators, which are prone to failure.

The 138kV switches are in a hard-to-access location, due to the station being retrofitted from double-bus double-breaker to breaker-and-a-half over the years. Any work on the 12- incoming T-Line entrances or Transformer leads requires a full bus outage due to necessary safety clearances over the bus extensions. The placement of the current switches is very complex (in a stacked arrangement on the bus), which can lead to switching errors by field personnel or safety issues.

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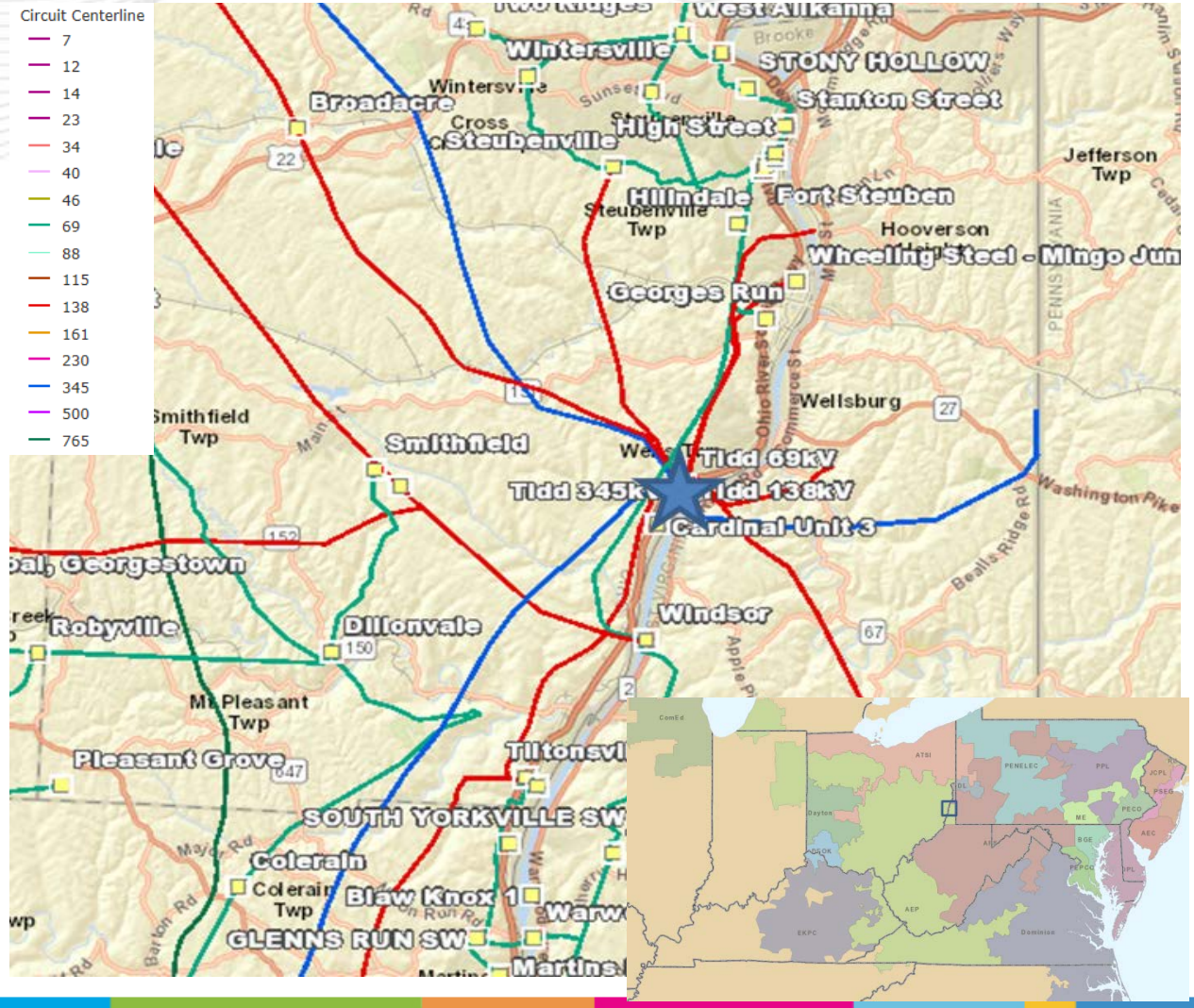

AEP Transmission Zone: Supplemental Tidd Station

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Operational Flexibility and Efficiency

Currently, the two 138kV straight buses at Tidd have significantly more than the recommended amount of connected breakers. A fault on Bus 1 requires the tripping of 9 breakers and the loss of a source of station service power. A fault on Bus 2 requires the tripping of 9 breakers, the loss of an 86 MVAR cap bank, and the loss of a source of station service power. Furthermore, when either bus must be taken out of service for maintenance or project commissioning, it takes significantly longer than necessary to isolate the bus. AEP's general recommendation is to limit the amount of breakers tripped for a bus fault to 6 or less. To remedy the situation, two 138kV bus-tie breakers will be installed, to split the two buses into four.

The area around Tidd has a significant amount of industrial load, such as power plant scrubbers, steel-making, and shale gas processing loads. The addition of a 2nd 138kV capacitor bank will provide operational flexibility, by providing needed voltage support capability, especially for times when any of the Cardinal power plant generators may be offline or if there are performance problems with the single existing 138kV cap bank.

In addition, SCADA indication/control & metering capability will be added to parts of the 138kV station where it is currently lacking (e.g., 6- circuit breakers).

Customer Service:

Tidd provides two direct 138kV feeds to a steel-making customer, which will benefit from the Tidd station reliability improvements. This customer has significant expansion plans in the future.

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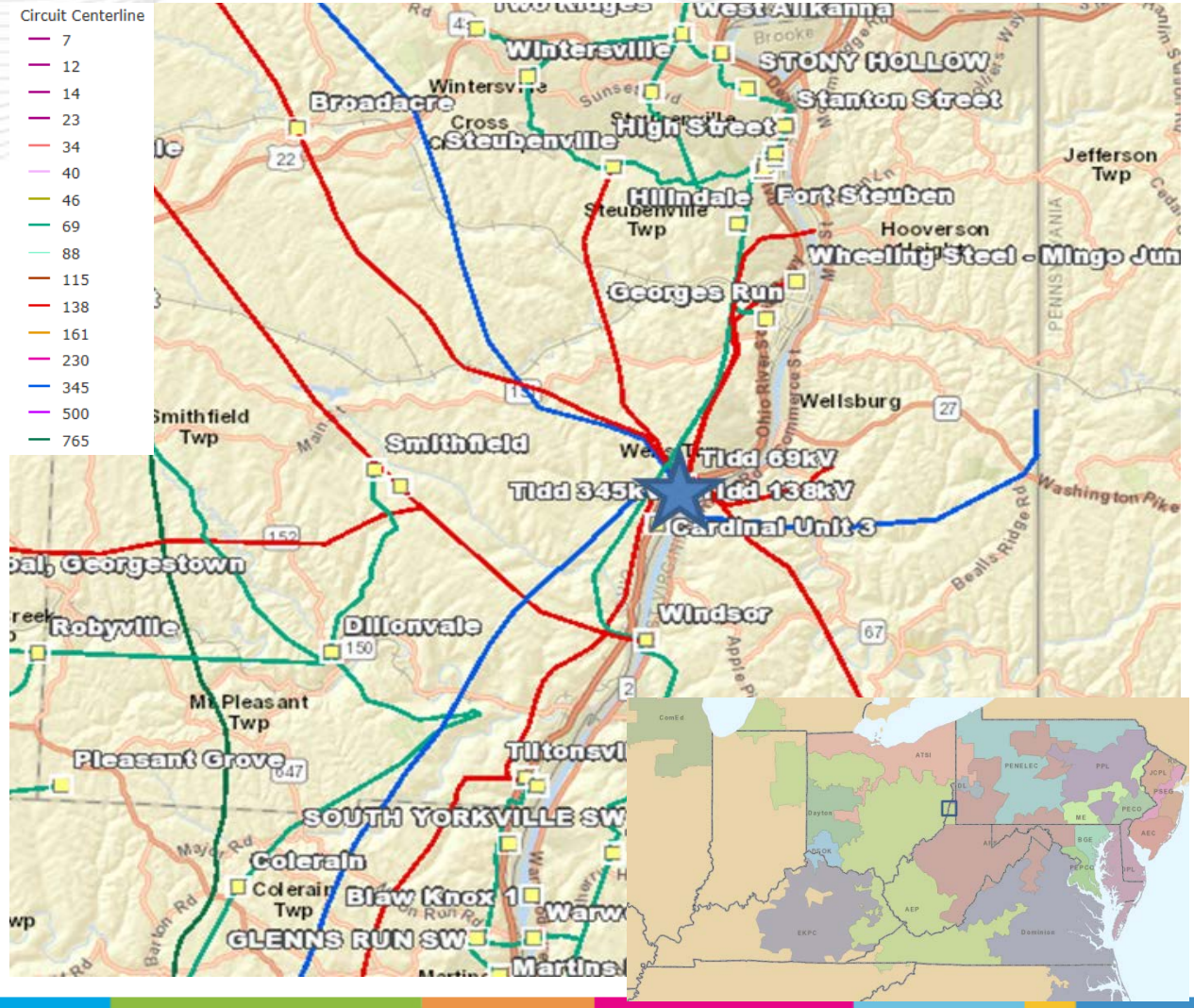

AEP Transmission Zone: Supplemental Tidd Station

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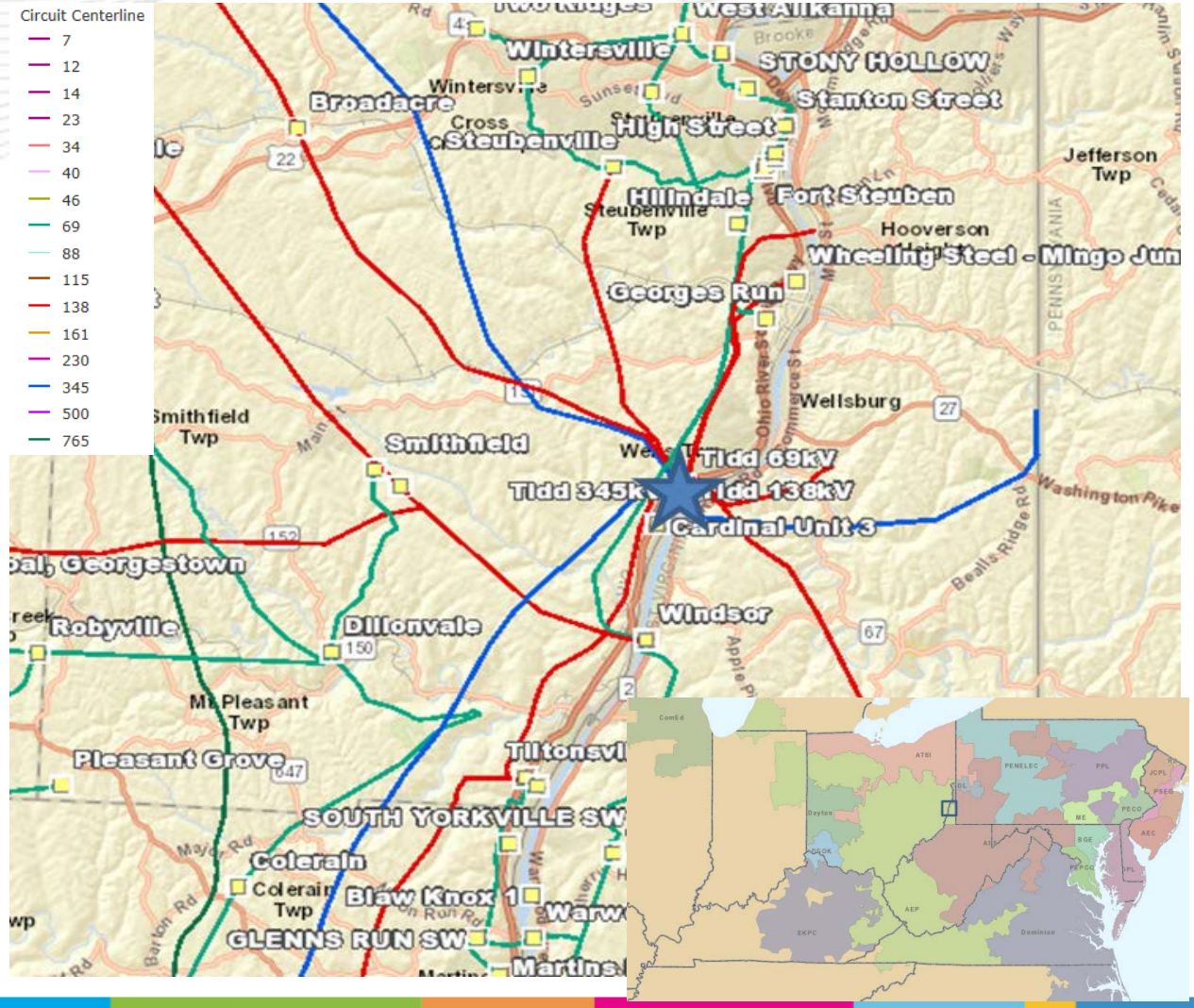
Selected Solution:

At the Tidd 138kV station, replace the 5 remaining 'ATB' air-blast circuit breakers with new 4000A 63kA units. Install 2- 138kV bus-tie breakers. Install new protection & communications equipment in a new DICM (drop-in control module) and demolish the old control house. Install a 58 MVAR cap bank. To address safety hazards, replace and relocate a number of manual disconnect switches throughout the station. (S1662)

Estimated Cost: $9.1M

Projected In-service: 12/01/2020

Project Status: Engineering



AEP Transmission Zone: Supplemental Newbery Station

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

PUCO obligation to serve a new 138kV service to a 56 MVA PRO-TEC facility, with a typical steady state load of 40MVA.

Operational Flexibility and Efficiency

FOI calculations (21.47) have determined that at a minimum MOABs should be installed. With Pro-Tec's existing service from Yellow Creek containing breakers, to maintain consistent practice and reliable service, due to the critical and sensitive nature of Pro-Tec's steel production processes, and requests from operations for breakers, breakers will be installed.

Selected Solution:

New ~0.75 mile double-circuit 138kV line extension to a new substation to serve a new PRO-TEC facility by cutting the existing East Leipsic-Yellow Creek 138kV circuit (Yellow Creek Extension). Match existing conductors on new line extension, which are 1033 ACSR Curlew. (S1663.1) Estimated Cost: $0.9M

New 2-breaker, 3000A, 40kA, 138kV in and out station (Newbery), with two line exits (East Leipsic & Yellow Creek) and one tap to a PRO-TEC transformer. (S1663.2)

Estimated Cost: $6.0M

Total Estimated Transmission Cost: $6.9M

Projected In-service: 12/31/2018

Project Status: Engineering

AEP Transmission Zone: Supplemental Buckeye Pipe Line

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

Buckeye Pipe Line, LP has requested a new 34.5kV service for a new customer owned station to be installed adjacent to the existing Cygnet Buckeye Pipe Line station. Their peak diversified demand will be 2.5MW with a requested in service date of 3/1/18, although we have worked with the customer on a more realistic ISD of Q2 2018.

The new load and station is needed to move new refined petroleum east to Pennsylvania. The existing Cygnet Buckeye Pipe Line station will become fully owned and operated by Sunoco Pipeline LP. No significant changes are expected with the existing Cygnet Buckeye Pipe Line station.

Operational Flexibility and Efficiency

FOI calculations (8.96) justify a MOAB on this circuit. With the circuit being radial, it is recommended to install a MOAB towards the remaining portion of the radial. This will enable AEP to remotely isolate any problems further down the radial, retaining service to Buckeye Pipe Line as well as all other customers served from the radial line.

Selected Solution:

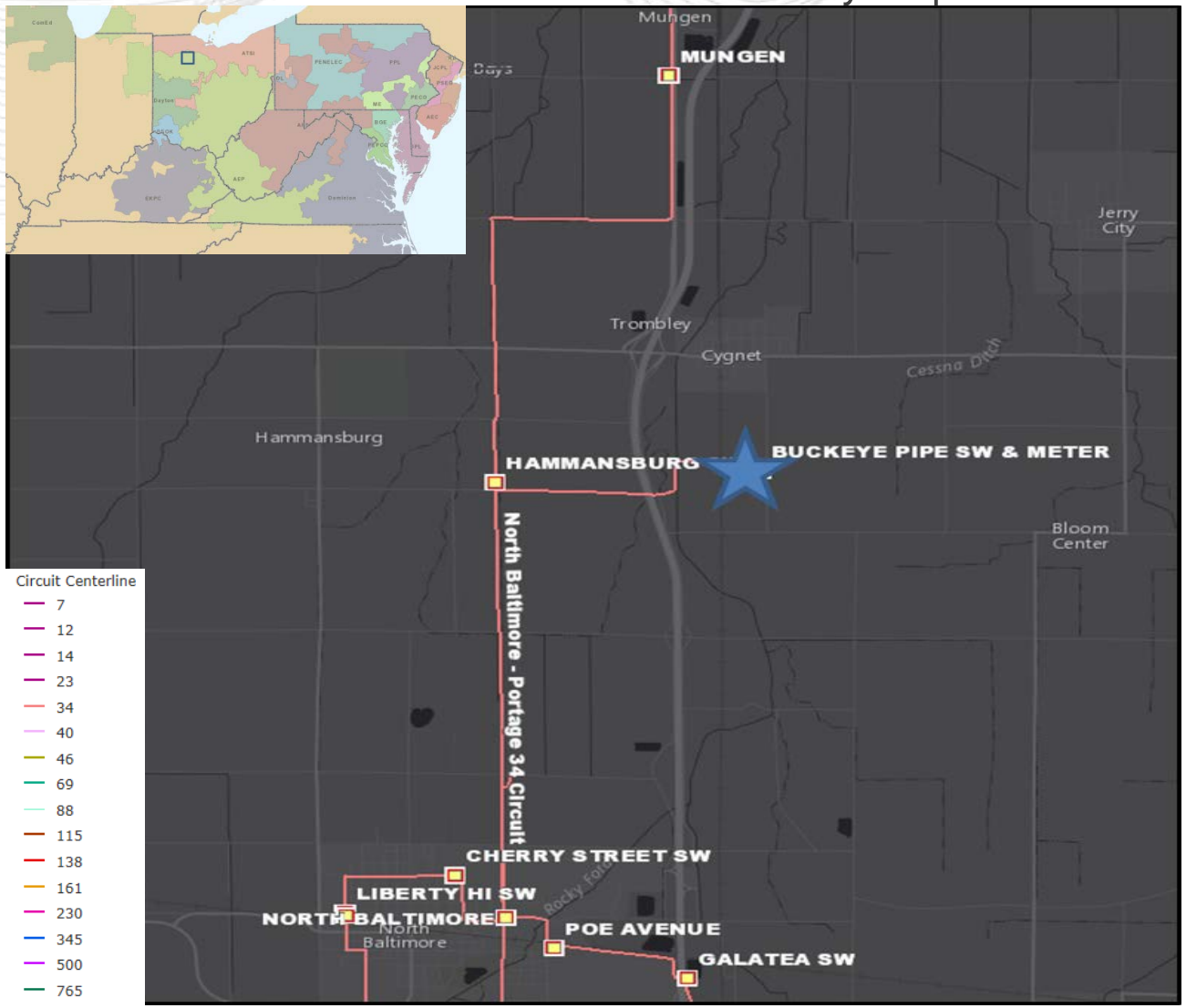
New 69kV (energized at 34.5kV) POD Box Bay (Hoiles Switch), with one MOAB towards the former customer station, Cygnet. Relaying upgrades at North Baltimore 34.5kV station. (S1664.1) **Estimated Cost:** $0.9M

Cut existing line into new 34.5kV station, matching existing conductors of 4/0 ACSR (25 MVA rating). (S1664.2) **Estimated Cost:** $1.5M

Total Estimated Transmission Cost: $2.4M

Projected In-service: 10/31/2018

Project Status: Engineering



AEP Transmission Zone: Supplemental Zuber

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

AEP-Ohio requested service for a 2nd 138/13kV 50 MVA transformer with 2 additional distribution circuits to address expected overloads on existing distribution as early as 2018. Ultimate station design will include up to 4-138/13kV 50 MVA transformers.

Operational Flexibility and Efficiency

The Zuber distribution station is designed to eventually serve 4-50 MVA transformers. AEP-Ohio now plans to install the 2nd of these transformers. Due to the load density of the Columbus area, Distribution utilizes 50MVA transformers. Transmission is recommending installation of 138kV circuit breakers due to the large size of these banks and the amount of load served.

AEP Transmission is anticipating serving a large customer in the area which would drive the need for a second circuit between Beatty and Harrison. It is desirable to both maximize reliability of the station in it's proposed configuration and to minimize future outages for the future circuit to be cut into Zuber.

Selected Solution:

Expand Zuber 138kV station bus to a ring design with 3,000A 40kA CB's. (S1665.1) Estimated Cost: $3.9M

Reterminate Harrison-Beatty 138kV line on new bus work. (S1665.2) Estimated Cost: $0.7M

Total Estimated Transmission Cost: $4.6M

Projected In-service: 12/1/2019

Project Status: Engineering

AEP Transmission Zone: Supplemental
Central South Bend Improvements

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

AEP has identified multiple rehab needs at Colfax, Drewry's and Saint Mary's stations. Colfax station is a cubicle switch gear type construction, is obsolete, and spare parts are unavailable. Mobile transformer can't be installed on site due to physical space limitations and complete station outage can only be taken during off-peak months (Sep-May). The 34.5 kV CB C and D at Colfax Station are GE FK oil-filled breakers manufactured in 1950s, have operated through 12 and 20 fault operations, exceeding the manufacturer recommendation of 10. These breakers are oil breakers. Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. The drivers for replacement of these breakers are age, number of fault operations, and a lack of repair parts. The 34.5/12 kV Transformer at Colfax was manufactured in 1974 and is also showing significant signs of deterioration. It has a load tap changer (LTC) and therefore distribution voltage regulation is difficult. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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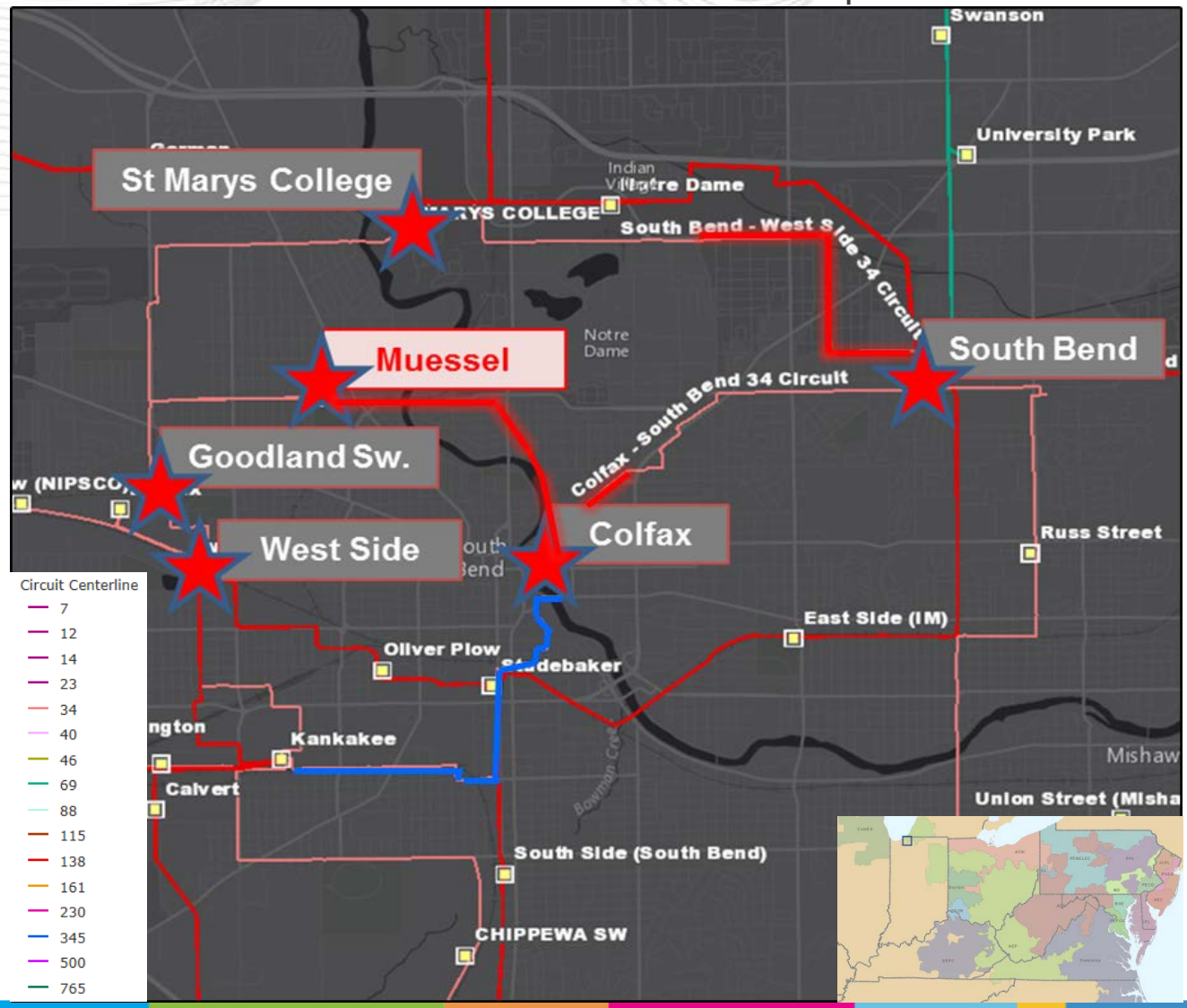

AEP Transmission Zone: Supplemental Central South Bend Improvements

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Drewry's Station is very congested and is located adjacent to Muessel Grove public park. On site mobile transformer can't be installed due to physical space limitations. Station transformers do not meet present day electrical clearance standards. Transformer high side ground switches can't be replaced with circuit switchers and low side breakers can't be installed due to physical space limitations. There is no control house present and 14 out of 20 relays are electromechanical and are obsolete. Station drive path is not available and poses additional maintenance and safety challenges. Station foundations and steel on 12 kV structures are beginning to show signs of deterioration. 12 kV circuit breaker A,B,C & D at Drewry's are 2000 vintage but have severely exceeded the life expectancy of full fault operations. The 34.5/12kV Transformer#2 was manufactured in 1963 and the steady increase in ethylene, methane, and carbon dioxide over the years show that there has been heating of the Transformer #2 at Drewry's which has deteriorated its insulation. Additionally, the LTC is not operating properly.

The 34.5/4kV Transformer at Saint Mary's Station was manufactured in 1952 and is also showing significant signs of deterioration. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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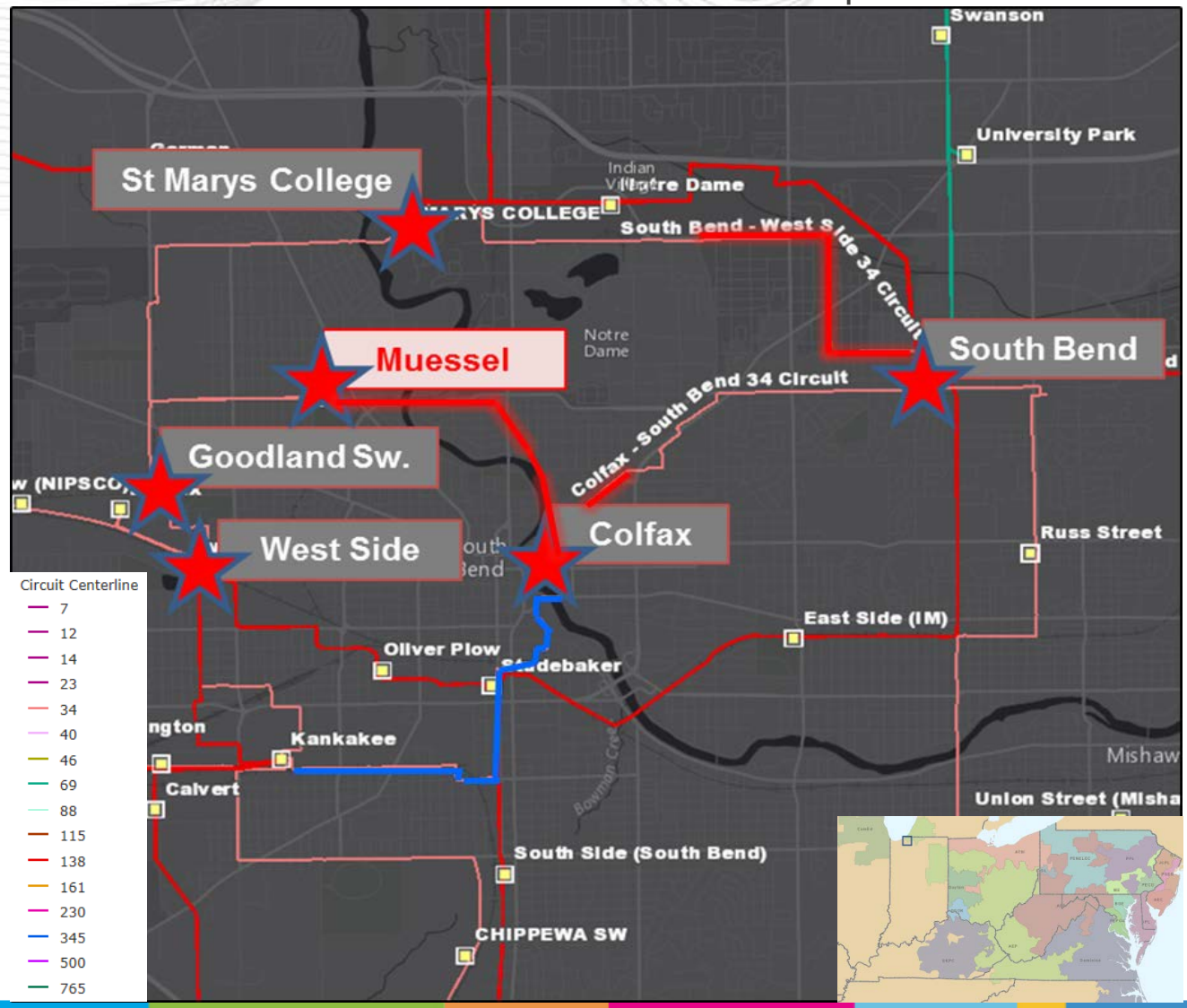

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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On the Colfax-Kankakee 34.5 kV circuit, the overhead portion is ~1.5 miles while the underground section is ~1.3 miles. The overhead portion utilizes wood poles cross arm construction which is not a current AEP transmission standard. The overhead portion of this circuit is suspension insulator type construction with smaller cross-section distribution-type cross arms and braces. Historical experience with these types of wood cross arms is a higher frequency of required proactive replacement and occasional failure resulting in forced outages. The underground portion of the line occupies a manhole and conduit system that was not designed for transmission use. The underground portion occupies 33 manholes. Over half of the manholes contain transmission cable splices. An underground transmission cable system of this length should require no more than 4-7 manholes in order to minimize the number of cable splices required. Due to the number of manholes, the required number of cable splices is very excessive. Industry experience is that cable system components such as splices are a far more common failure cause than the transmission cables themselves. Almost all of the manholes are physically undersized for transmission cable system occupation, making splicing very difficult to accomplish. Many conduits are clay tile ducts installed in the 1930s. Since 2009 there have been at least seven documented failures, primarily on cable system components (splices and terminations). Cable testing performed in September 2013 and the cables passed the testing however, nine days later a cable failure occurred, causing the circuit to trip from service.

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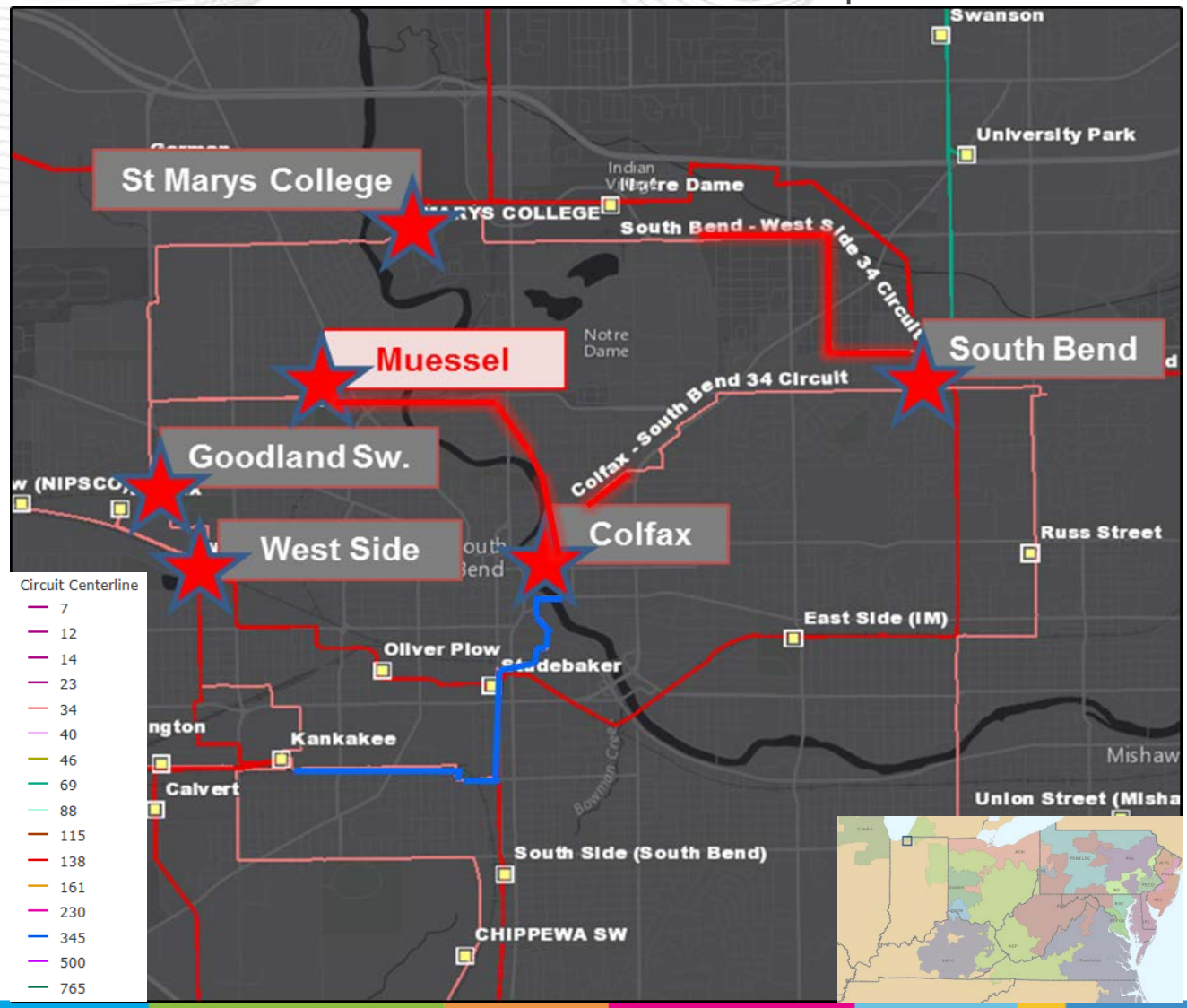

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Operational Flexibility and Efficiency:

Colfax station backs up a portion of distribution load from the South Bend station. South Bend is a 138 kV station while Colfax is 34.5 kV which results in a load drop and pick issue. On average there are between 3 to 5 drop and pick cycles per year that are experienced by Colfax and Drewry's customers. Drewry's station is served by a double circuit transmission line which traverses through residential areas and a gravel pit. An outage involving the double circuit lines results in a complete station outage and the station peak load is not recoverable from an alternate source. Colfax station serves central South Bend load and is presently served from two 34.5 kV sources, South Bend and Kankakee. Kankakee source has an underground line section which is near its useful life and has been forced out multiple times in the recent past. The new Colfax – Drewery 34.5kV Line will be an additional source to Drewry's and Colfax Station. The transformer high side protection at Drewry's and Saint Mary's station is via high side ground switch scheme which is not a standard practice in modern installations. South Bend-West Side 34.5 kV circuit is ~11 miles and serves three stations (Goodland, Drewry's, and St Mary's College). There are two series MOBs each at Drewry's and St Mary's College. Having 4 MOAB in series is an undesirable configuration as it introduces coordination challenges related to P&C.

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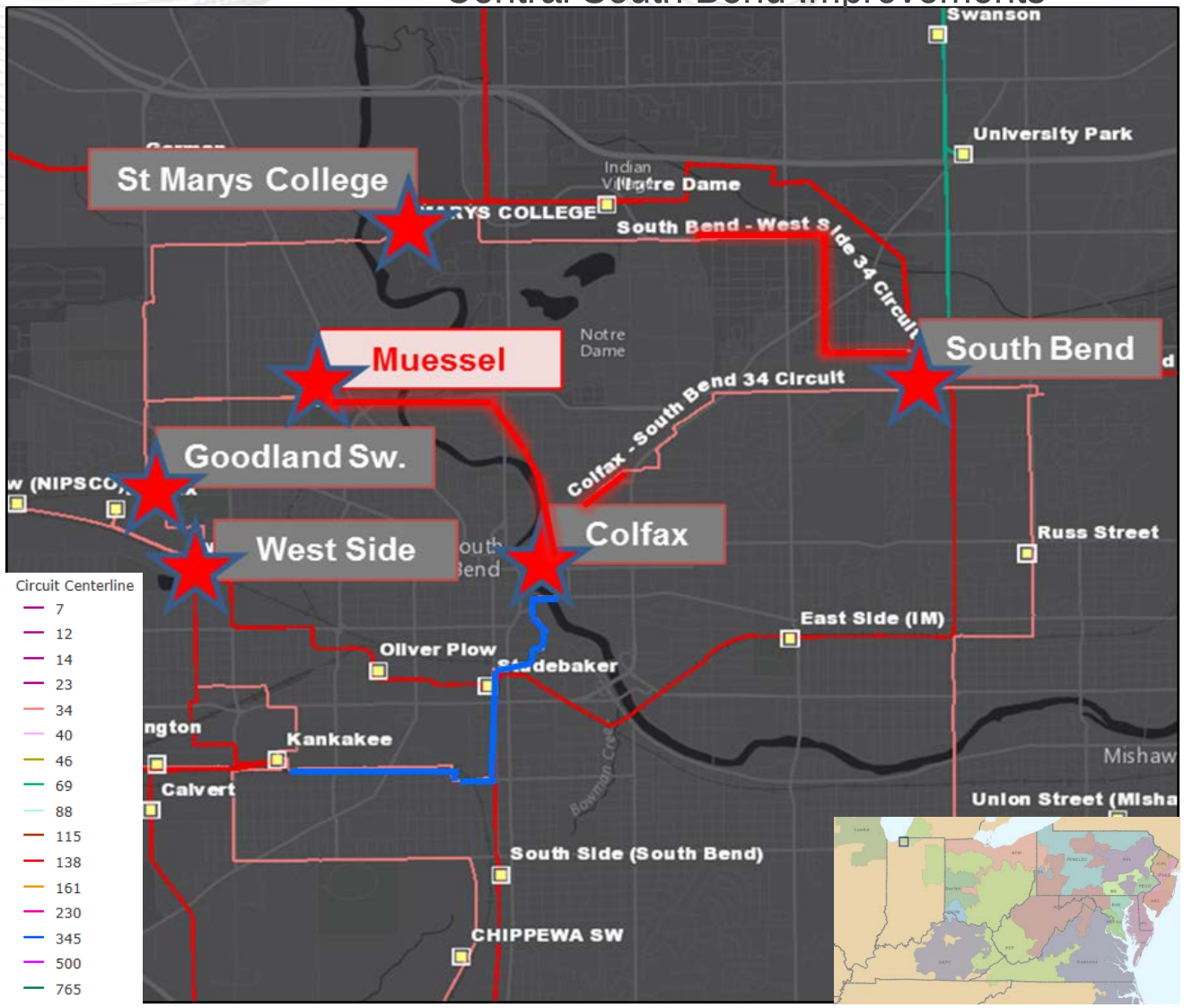

AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Selected Solution:

Construction of approximately 2.5 mile 69 kV underground line between Colfax and Muessel using 1750KCMIL Copper XLPE Conductor. (S1666.1) Estimated Cost: $20.1M

Install Drewry's Extension 34.5kV. (S1666.2) Estimated Cost: $0.7M

Retire Kankakee – Colfax (UG) 34kV Line. (S1666.3) Estimated Cost: $0.6M

Rebuild .33 miles of the South Bend - Colfax UG line using 1750KCMIL Copper XLPE Conductor. (S1666.4) Estimated Cost: $4.1M

Rebuild 1.9 miles of the South Bend – West Side Line using 795 ACSR (64 MVA rating). (S1666.5) Estimated Cost: $3.7M

Bendix – Kankakee 34.5kV Line Work. (S1666.6) Estimated Cost: $0.2M

South Bend station work to set up 69kV energization. (S1666.7) Estimated Cost: $0.6M

West Side station work to set up 69kV energization. (S1666.8) Estimated Cost: $0.5M

Completely rebuild Colfax station. Install a 69kV CB towards Muessel Station. Replace 34kV CB D with a 69kV CB towards South Bend Station. Install a 69kV SWR, 69/12kV TR#1 and (4) 12kV CB's. All 69kV CB's are 40kA breakers. (S1666.9) Estimated Cost: $1.8M

Completely rebuild Drewrys station as Muessel station in the clear. Install (3) 69kV line CB's, (1) Bus Tie CB, (2) 69kV SWR's, (2) 69/12kV TR's and (7) 12kV CB's.All 69kV CB's are 40kA breakers. (S1666.10) Estimated Cost: $5.0M

At St. Mary's College, install 69kV circuit switcher. Replace 69/12kV TR and (2) 69kV switches. (S1666.11) Estimated Cost: $0.4M

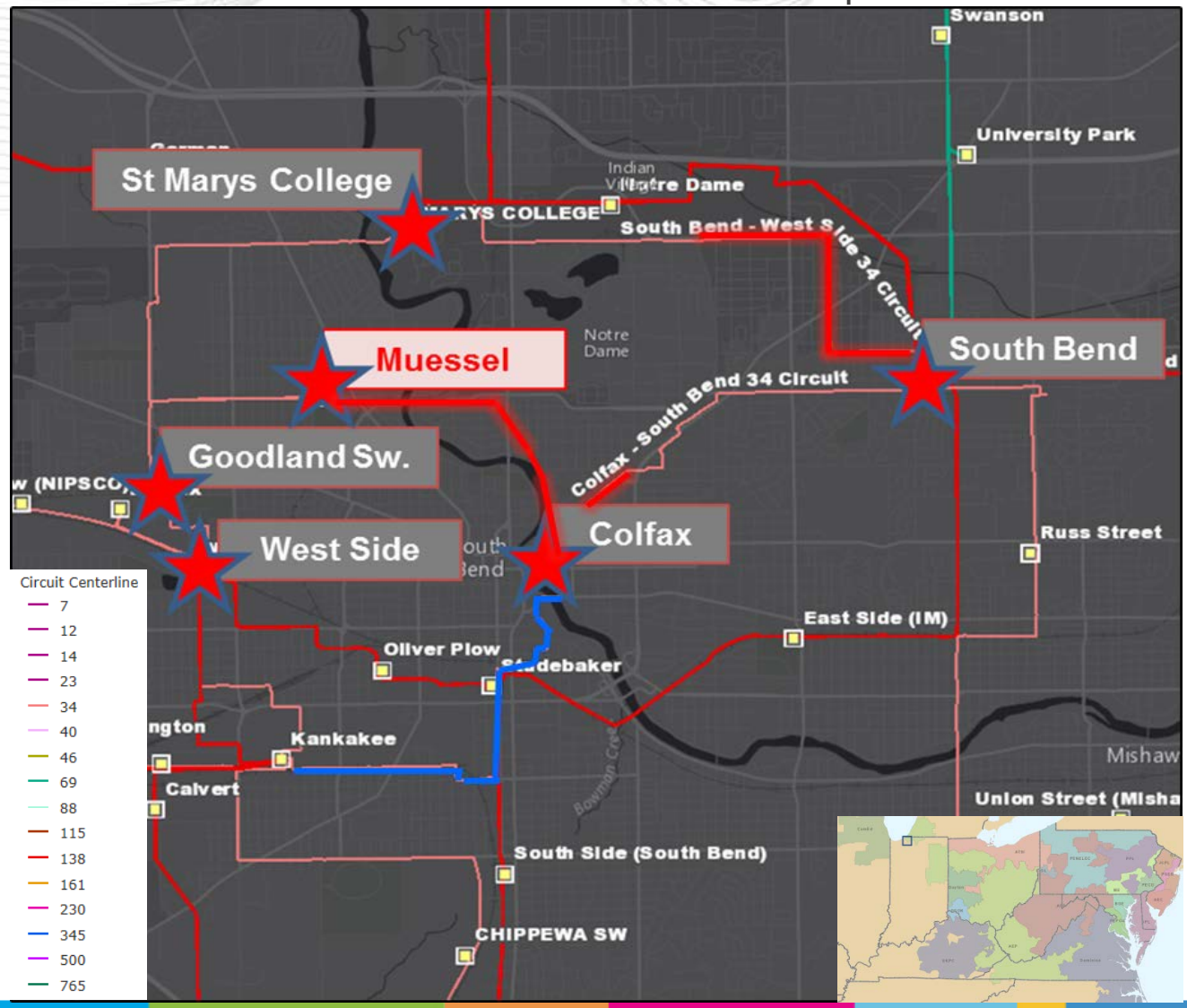
Relocate Goodland Sw to West Side – Bendix 34kV Line. (S1666.12) Estimated Cost: $1.0M

Kankakee: Remove 34.5kV breaker I. (S1666.13) Estimated Cost: $0.1M

Total Estimated Transmission Cost: $38.8M

Projected In-service: 5/10/2020

Project Status: Scoping



Next Steps

Upcoming Western SRRTEP Dates

West	Start	End
7/27/2018	12:00	4:00
8/31/2018	12:00	4:00
9/28/2018	12:00	4:00
10/26/2018	12:00	4:00
11/29/2018	12:00	4:00
12/5/2018	12:00	4:00

RTEP@pjm.com to Be Retired

- PJM will retire the RTEP@pjm.com email address as of September 1, 2018. Stakeholders with questions about planning updates or planning windows should use the Planning Community.
- PJM is enhancing the way we communicate to follow industry standards and maintain its standing as an industry leader.
- The Planning Community is a vital avenue for PJM members and staff to collaborate on planning updates, including RTEP windows, and get their questions answered.

Revision History

6/20/2018 – V1 – Original version posted to pjm.com

7/2/2018 – V2

- Slide #12: Revised upgrade IDs. Updated description and clarify cost estimate for each ID.
- Slide #10, #20-22: Updated project status. Listed limited equipment for upgraded circuits in project description.
- Slide #36: Updated cost estimate for S1666.11.
- Slide #30: Updated cost estimate for S1664.2. Changed the Projected IS Date.

711/2018 – V3

- Slide #36: Renumber S1666.12, S1666.13.