

Subregional RTEP Committee - Western FirstEnergy Supplemental Projects

March 19, 2020

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



ATSI Transmission Zone M-3 Process Multiple Relay Misoperation- Solution

Need Number: ATSI-2019-Multiple (See next slide)
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption References:

Global Factors

- System reliability and performance
- Substation / line equipment limits

Upgrade Relay Schemes

- Relay schemes that have a history of misoperation
- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades
- Bus protection schemes

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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**Map Not Shown
Multiple Locations**

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| ATSI-2019 | Transmission Line / Substation Locations | Existing Line/Terminal Equipment MVA Rating (SN / SE) | Existing Conductor/Transformer MVA Rating (SN / SE) | Limiting Terminal Equipment |
|-----------|---|---|---|--|
| -072 | Eber-Swanton 138 kV Line 1. Eber – Johnson Controls 2. Johnson Controls – Swanton | 1. 327 (WN) / 396 (WE) 2. 327 (WN) / 396 (WE) | 1. 327 (WN) / 420 (WE) 2. 327 (WN) / 420 (WE) | Substation Conductor (Winter Ratings) @ Swanton |
| -073 | Eastlake-Lloyd 138 kV Q12 Line 1. Eastlake – Liberty 2. Lamont – Lloyd | 1. 273 / 287 2. 103 / 132 | 1. 273 / 332 2. 148 / 151 | Substation Conductor, Relay, CTs @ Lloyd |
| -074 | Chamberlin-Hudson East 138 kV Line | 226 (WN) / 249 (WE) | 226 (WN) / 286 (WE) | Relay (Winter Ratings) @ Chamberlin |
| -075 | Eastlake-Nottingham 138 kV Q11 Line Eastlake – Lamont | 324 / 382 | 324 / 395 | Meter, Relay @ Eastlake |
| -076 | Maclean-Lemoyne 138 kV Line | 329 / 413 | 376 / 465 | Disconnect Switch @ Maclean |
| -077 | Clinton-CPP 138 kV Line | 187 / 222 | 194 / 237 | Substation Conductor @ Clinton |
| -078 | Eastlake-Jordon 138 kV Q14 Line 1. Eastlake – Marble 2. Judi – Jordan | 1. 324 / 382 2. 265 / 316 | 1. 324 / 395 2. 273 / 332 | Substation Conductor, Meter, Relay @ Eastlake & Jordon |
| -079 | Beaver-West Lorain 345 kV Line | 1370 / 1646 | 1560 / 1900 | Substation Conductor, Disconnect Switch @ Beaver |

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| ATSI-2019 | Transmission Line / Substation Locations | New MVA Line Rating (SN / SE) | Proposed Solution | Estimated Costs (\$ M) | Target ISD |
|-----------|---|--|--|------------------------|------------|
| -072 | Eber-Swanton 138 kV Line 1. Eber – Johnson Controls 2. Johnson Controls – Swanton | 1. 327 (WN) / 420 (WE) 2. 327 (WN) / 420 (WE) | Replace the line relaying for the Eber-Swanton 138 kV line, the substation conductor (Winter Ratings), wave trap, line tuner and line disconnect at Swanton and Eber and line CCVT at Eber. | 1.1 | 06/24/2020 |
| -073 | Eastlake-Lloyd 138 kV Q12 Line 1. Eastlake – Liberty 2. Lamont – Lloyd | 1. 273 / 332 2. 148 / 151 | At Eastlake replace the Q-12 circuit breaker, line disconnect switch, relaying, line terminal arresters, and line CVTs. At Lloyd replace the substation conductor, and Eastlake-Lloyd Q-12 line relaying. | 0.9 | 12/01/2021 |
| -074 | Chamberlin-Hudson East 138 kV Line | 226 (WN) / 286 (WE) | Replace the line and breaker failure relays, disconnect switches, line metering, CCVTs (due to condition) at Chamberlin and Hudson. Replace rod gaps with arresters at Hudson. Replace breaker B-59, and substation jumper conductors at Chamberlin. | 1.5 | 11/19/2020 |
| -075 | Eastlake-Nottingham 138 kV Q11 Line Eastlake – Lamont | 324/395 | At Eastlake, replace the Q-11 circuit breaker, line disconnect switch, line and breaker failure relaying, line terminal arresters, and line CCVT's. At Nottingham, replace substation conductor, line and breaker failure relaying and line CCVTs. | 1.1 | 4/06/2022 |

Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Projected In-Service: See table

Project Status: Engineering (All Projects)

Model: N/A

No changes in topology; No bubble diagram required.

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| ATSI-2019 | Transmission Line / Substation Locations | New MVA Line Rating (SN / SE) | Proposed Solution | Estimated Costs (\$ M) | Target ISD |
|-----------|---|-------------------------------|---|------------------------|------------|
| -076 | Maclean-Lemoyne 138 kV Line | 376/465 | At Maclean, replace terminal end breaker B13202, disconnect switches, line and breaker failure relaying, carrier transceiver and monitor, metering, substation conductors, CCVT and add surge arresters. At Lemoyne, replace terminal end breaker B13219, disconnect switches, line and breaker failure relaying, substation conductors and add carrier monitor, and surge arresters. | 0.9 | 12/15/2020 |
| -077 | Clinton-CPP 138 kV Line | 194/237 | At Clinton, replace the circuit breaker, line disconnect switch, relaying for interconnection to CPP (Ridge Rd.) and breaker failure, substation conductor, and install new meter, surge arresters and line side CCVTs. | 0.9 | 11/13/2020 |
| -078 | Eastlake-Jordon 138 kV Q14 Line 1. Eastlake – Marble 2. Judi – Jordan | 1. 324 / 395 2. 273 / 332 | At Eastlake replace line disconnect switch and relaying. At Jordan replace the substation conductor. | 0.2 | 06/01/2021 |
| -079 | Beaver-West Lorain 345 kV Line | 1560/1900 | At Beaver replace bus differential relaying for Interconnection to Generating Company, metering, substation conductor, and disconnect switch. | 0.4 | 12/01/2023 |

Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Projected In-Service: See table

Project Status: Engineering (All Projects)

Model: N/A

No changes in topology; No bubble diagram required.



ATSI Transmission Zone M-3 Process

Fowles and Pleasant Valley 138 kV Substation - Solution

Need Number: ATSI-2019-086
ATSI-2019-091
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Supplemental Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global

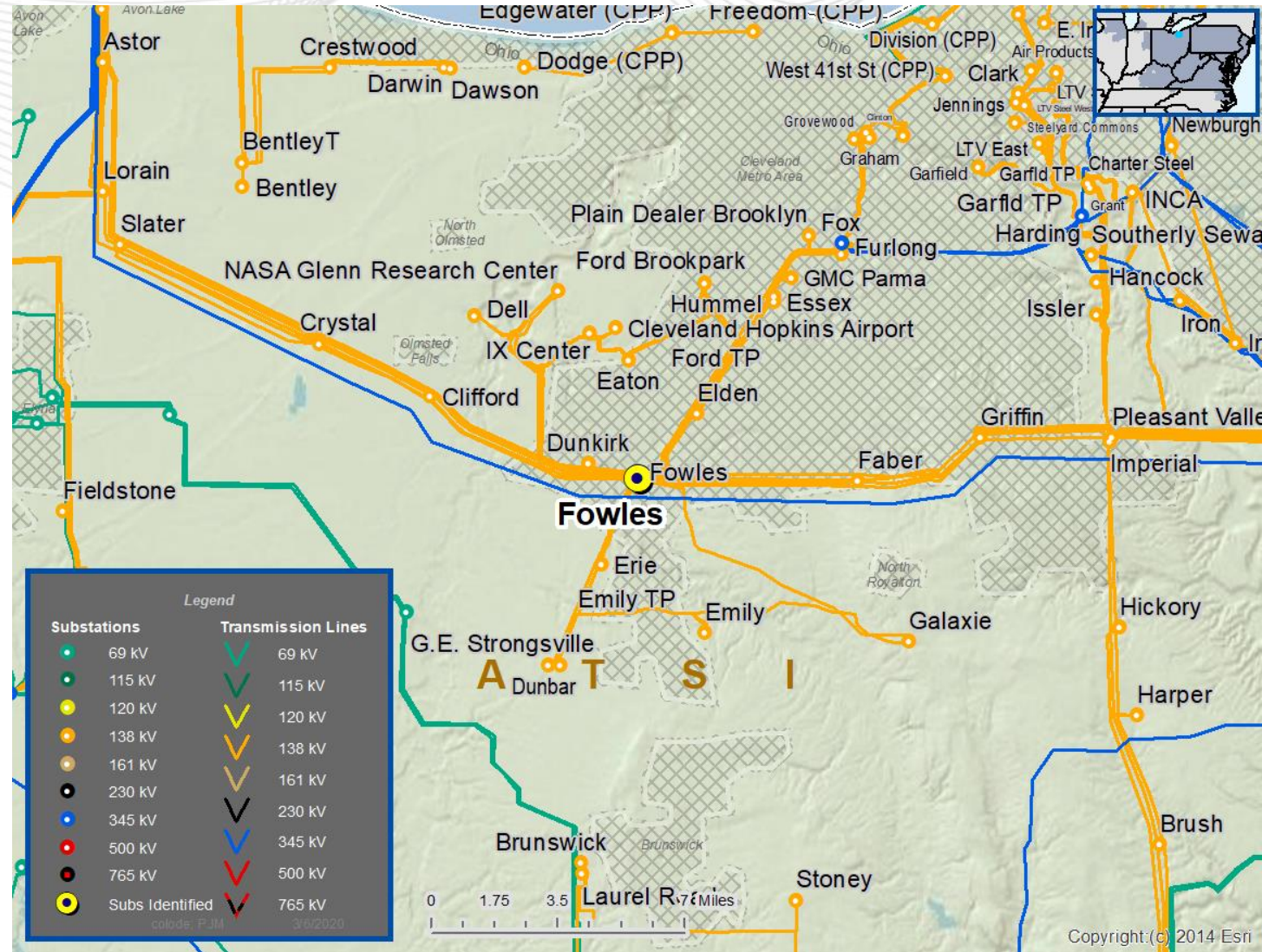
- System reliability and performance
- Substation/line equipment limits
- Failure risk, to the extent caused by asset design characteristics, or history industry/company performance data, or application design error
- Expected service life (at or beyond) or obsolescence

Circuit Breaker and other fault interrupting devices

- Condition of interrupting media (oil, gas, etc.)

Station Protection and Control

- Electromechanical relays





ATSI Transmission Zone M-3 Process

Fowles and Pleasant Valley 138 kV Substation - Solution

Need Number: ATSI-2019-086
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Problem Statement

ATSI-2019-086

Fowles Breaker Replacement

- Breaker B-8 Oil Circuit Breaker (OCB) is at/beyond expected service life (greater than 30 years) with increasing Maintenance concerns; Deteriorated bushing potential device and mechanism, Obsolete replacement parts, hot spots, and deteriorated oil within the tank.

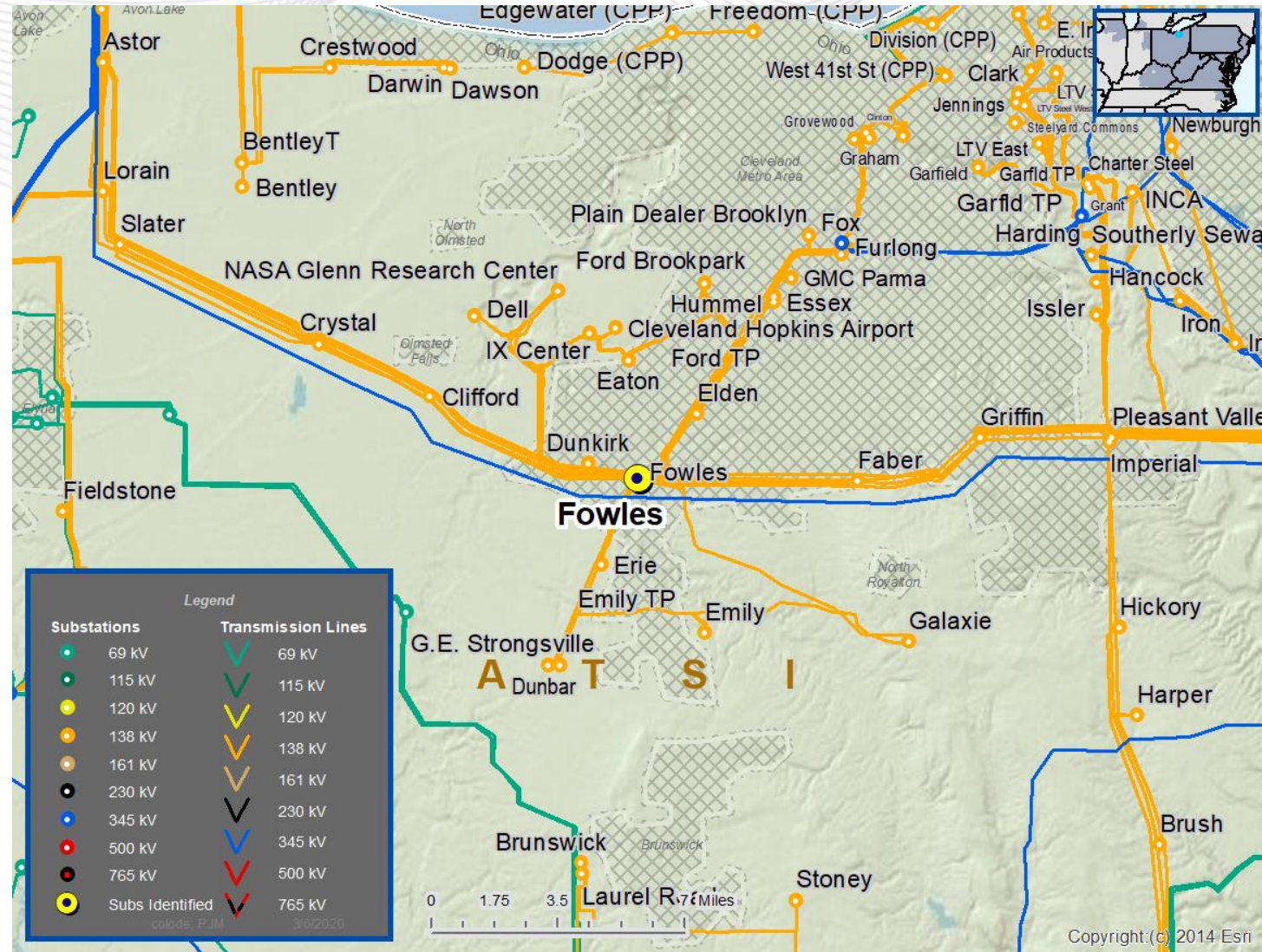
ATSI-2019-091

Fowles 138 kV Substation – Breaker and substation equipment

- Breaker B-2 Oil Circuit Breaker (OCB) is at/beyond expected service life (greater than 30 years) with increasing maintenance concerns; hot spots, oil leaks, and increasing maintenance trends.
- CTs and disconnect switches are at/beyond expected service life.
- Relays are electromechanical and prone to misoperation.

Pleasant Valley 138 kV Substation – Breakers and Substation Equipment

- Breaker B-1 Oil Circuit Breaker (OCB) is at/beyond expected service life (greater than 30 years) with increasing maintenance concerns; hot spots and deteriorated oil within the tank, deterioration of terminal block wiring in the cabinet.
- CTs and disconnect switches are at/beyond expected service life.





ATSI Transmission Zone M-3 Process

Fowles and Pleasant Valley 138 kV Substation - Solutions

Need Number: ATSI-2019-086
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

Fowles 138 kV Substation Breaker Replacement

- Fowles: Replace breaker B-8, CTs, disconnect switches, relays, and substation conductor and install surge arrestors and CVTs.

Estimated Project Cost: \$0.5 M

Transmission Line Ratings:

- Fowles – Fox Q13 138 kV Line
 - Before Proposed Solution: 267 MVA SN/ 332 MVA SE
 - After Proposed Solution: 273 MVA SN / 332 MVA SE

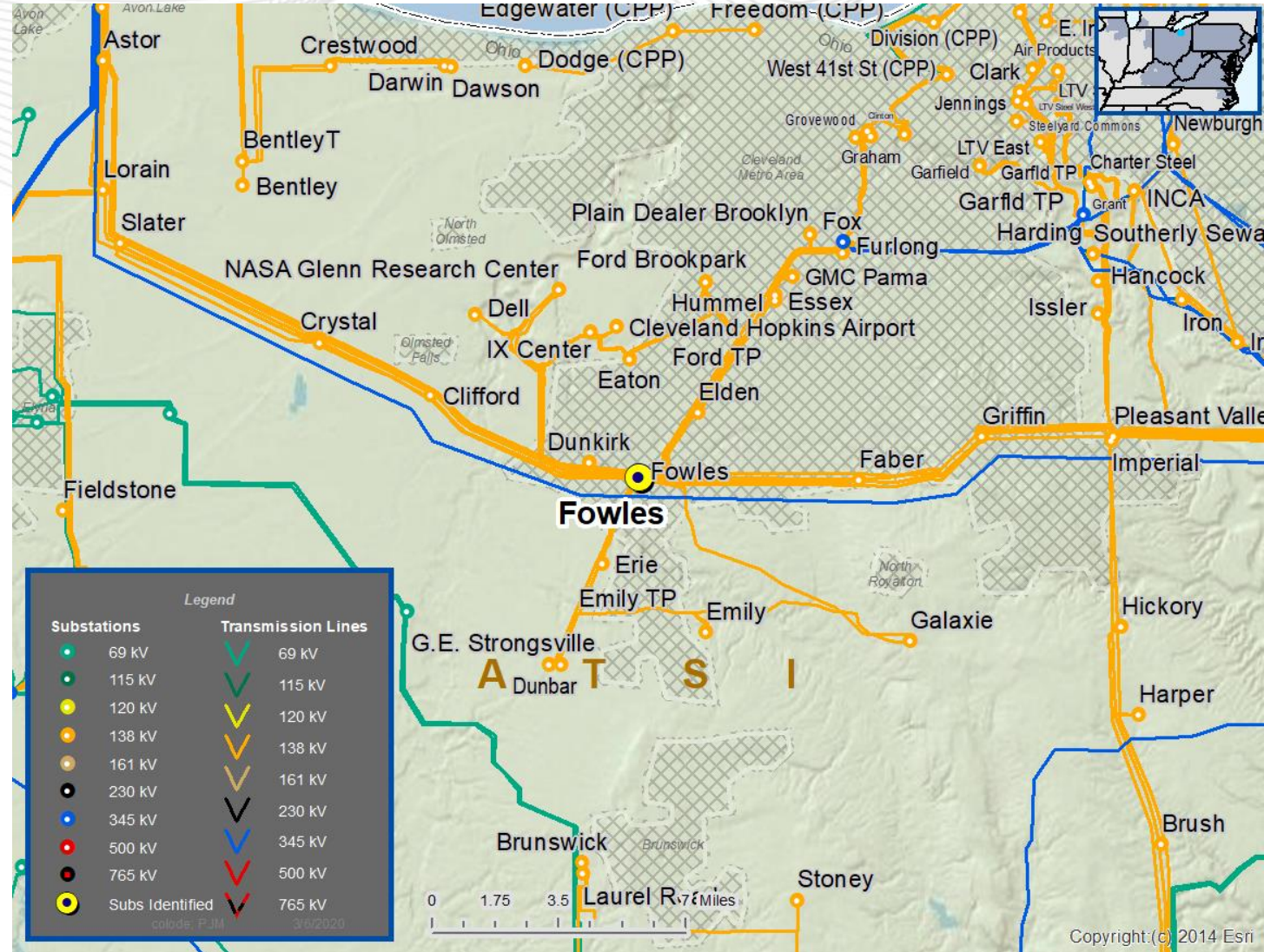
Alternatives Considered:

- Maintain existing equipment and risk of failure.

Projected In-Service: 06/01/2020

Project Status: Engineering

Model: 2018 Series 2023 Summer RTEP 50/50





ATSI Transmission Zone M-3 Process

Fowles and Pleasant Valley 138 kV Substation - Solutions

Need Number: ATSI-2019-091
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

Fowles and Pleasant Valley 138 kV Terminal Upgrades

- Fowles: replace breaker B-2, disconnect switches, relays, and substation conductor and install surge arrestors and CVTs.
- Pleasant Valley: replace breaker B-1, disconnect switches, relays, and substation conductor and install surge arrestors and CVTs.

Estimated Project Cost: \$0.9 M

Transmission Line Ratings:

- Fowles - Pleasant Valley Q1 138 kV Line
 - Before Proposed Solution: 267 MVA SN / 332 MVA SE
 - After Proposed Solution: 273 MVA SN / 332 MVA SE

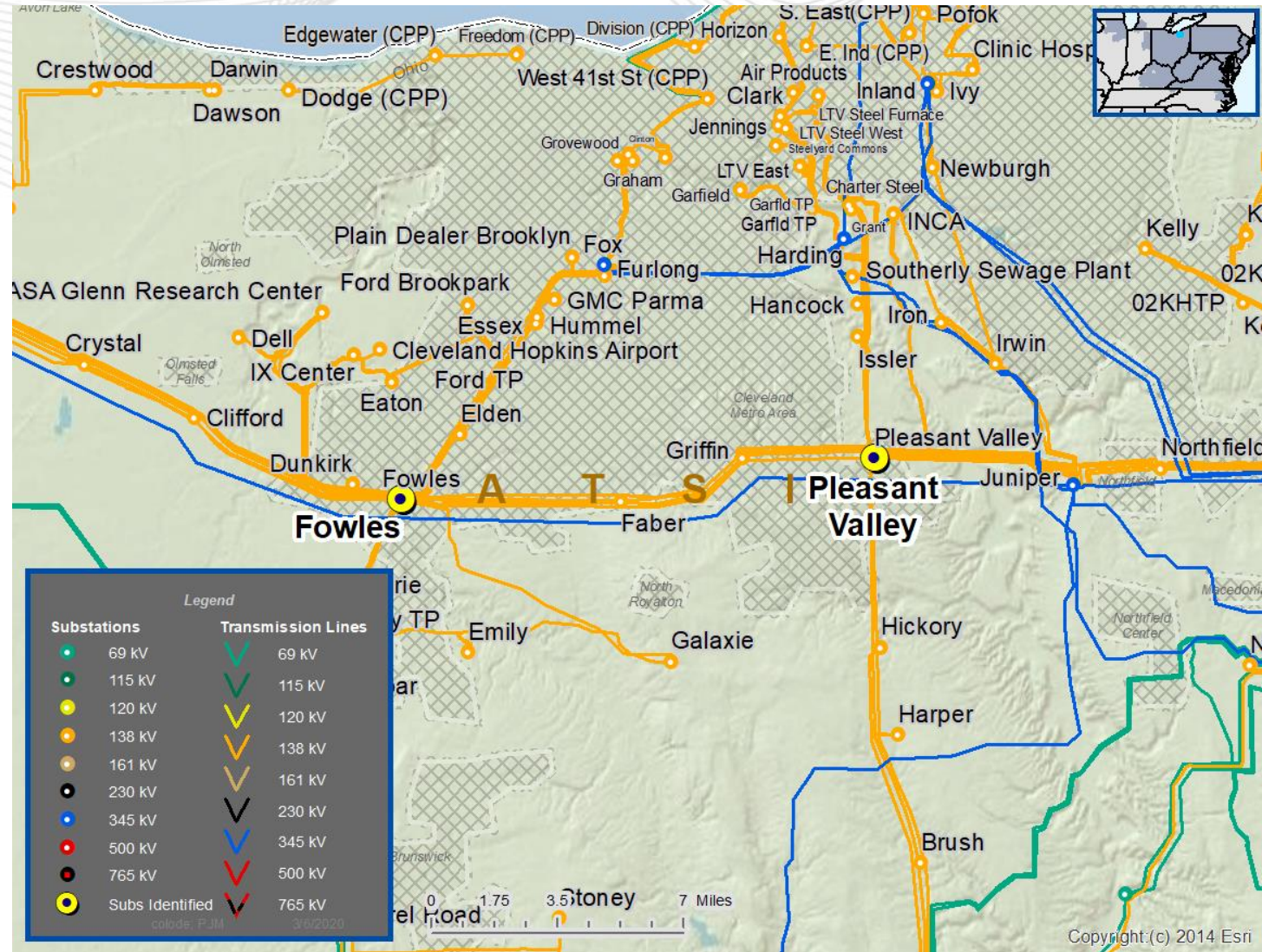
Alternatives Considered:

- Maintain existing equipment and risk of failure.

Projected In-Service: 12/31/2020

Project Status: Engineering

Model: 2018 Series 2023 Summer RTP 50/50



Need Number: ATSI-2019-Multiple (See next slide)

Process Stage: Solution Meeting – 03/19/2020

Previously Presented: Need Meeting – 11/22/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption References:

Global Factors

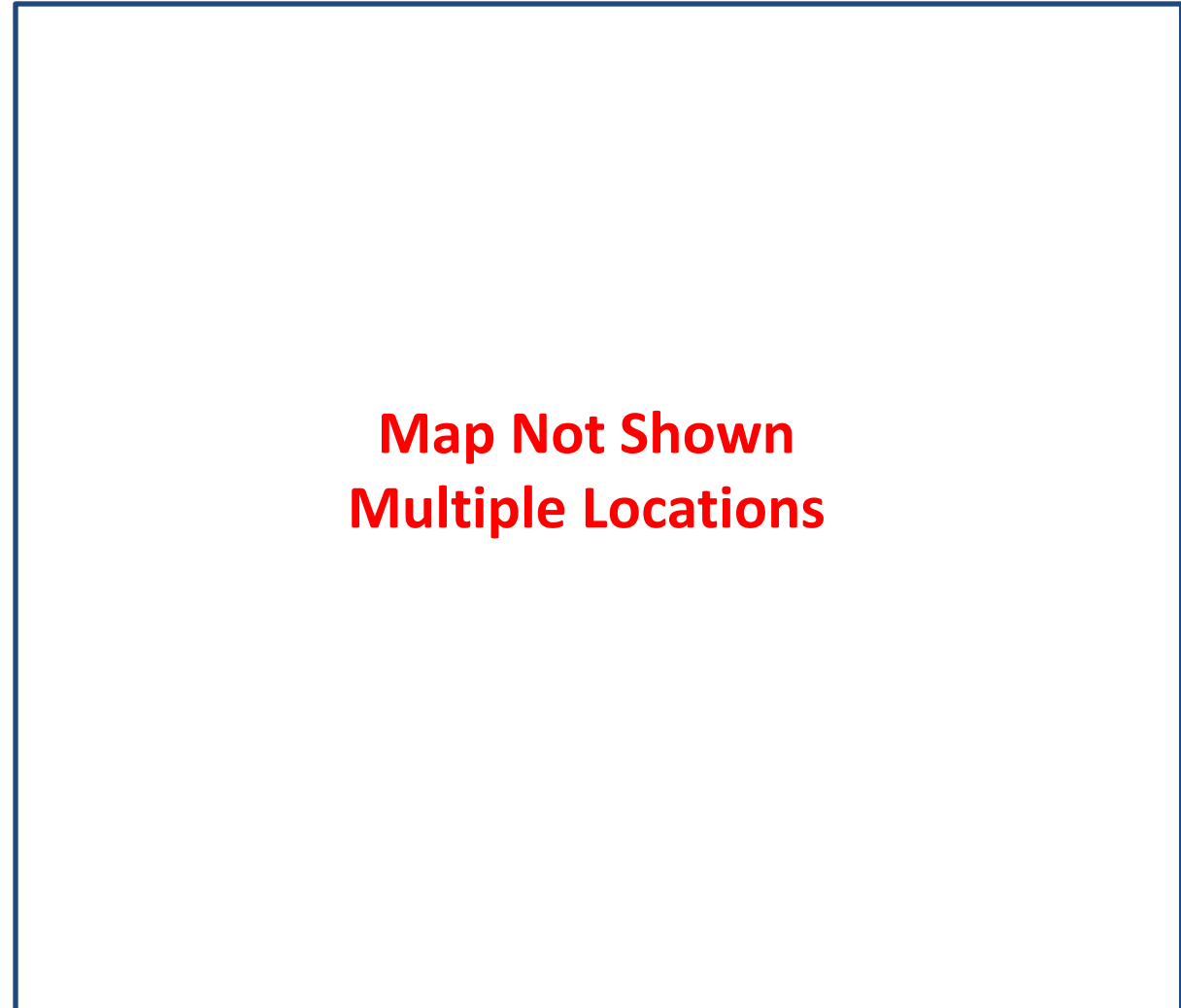
- System reliability and performance
- Substation / line equipment limits

Upgrade Relay Schemes

- Bus protection schemes which rely on remote clearing.
- Protection system with single point of failure.
- Relay schemes that have a history of misoperation.
- Obsolete firmware or software.

Problem Statement:

- FirstEnergy has identified protection schemes on networked lines and buses using a certain vintage of relays that have a history of misoperation.
 - Schemes protecting these facilities have no local backup so failures impact a larger portion of the system.
 - In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
 - Transmission line ratings are limited by terminal equipment.
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ATSI Transmission Zone M-3 Process Relay Single Point of Failure - Solution

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| ATSI-2019 | Transmission Line / Substation Locations | Existing Line/Terminal Equipment MVA Rating (SN / SE) | Existing Conductor/Transformer MVA Rating (SN / SE) | Limiting Terminal Equipment |
|------------------|---|--|--|------------------------------------|
| - 080 | Bluebell 138 kV Bus Protection | 100 / 100 | 164 / 206 | Relays @ Bluebell |
| - 081 | Maysville 69 kV Bus Protection | 143 / 143 | 153 / 184 | Relays @ Maysville |



ATSI Transmission Zone M-3 Process Bluebell Replace 138 kV Bus Protection-Solution

Need Number: ATSI-2019-080
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

- Replace 138 kV bus protection at Bluebell with dual SEL 487B scheme
- Upgrade substation conductor at Bluebell for the Bluebell-Knox 138 kV Line
- Upgrade substation conductor on the Bluebell #4 138/69 kV Transformer circuit

Estimated Project Cost: \$0.96 M

Transmission Line Ratings:

- Bluebell 138 kV Bus
 - Before Proposed Solution: 100 MVA SN / 100 MVA SE
 - After Proposed Solution: 164 MVA SN / 206 MVA SE
- Bluebell-Knox 138 kV Line
 - Before Proposed Solution: 153 MVA SN / 199 MVA SE
 - After Proposed Solution: 200 MVA SN / 242 MVA SE
- Bluebell #4 138/69 kV Transformer
 - Before Proposed Solution: 103 MVA SN / 133 MVA SE
 - After Proposed Solution: 188 MVA SN / 221 MVA SE

**No changes in topology;
No bubble diagram
required.**

Alternatives Considered:

- None

Projected In-Service: 12/31/2020
Status: Engineering
Model: 2019 Series 2024 Summer RTEP 50/50

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



ATSI Transmission Zone M-3 Process Maysville Replace 69 kV Bus Protection-Solution

Need Number: ATSI-2019-081
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

- Replace 69 kV bus protection with primary and backup differential
- Add CT to 69 kV breaker B46 for use with new bus protection relaying
- Upgrade substation conductor at Maysville for the Canal (Maysville) 69 kV Line

Estimated Project Cost: \$0.22 M

Transmission Line Ratings:

- Maysville 69 kV Bus
 - Before Proposed Solution: 143 MVA SN / 143 MVA SE
 - After Proposed Solution: 153 MVA SN / 184 MVA SE
- Maysville-Greenville 69 kV Line segment
 - Before Proposed Solution: 64 MVA SN / 83 MVA SE
 - After Proposed Solution: 80 MVA SN / 96 MVA SE

Alternatives Considered:

- None

Projected In-Service: 12/31/2020
Status: Engineering
Model: 2019 Series 2024 Summer RTEP 50/50

**No changes in topology;
No bubble diagram
required.**

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



ATSI Transmission Zone M-3 Process Cedar Street 138 / 69 kV Substation - Solution

Need Number: ATSI-2019-085
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Supplemental Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global

- System reliability and performance
- Substation/line equipment limits
- Failure risk, to the extent caused by asset design characteristics, or history industry/company performance data, or application design error

Expected service life (at or beyond) or obsolescence

Circuit Breaker and other fault interrupting devices

- Operating Mechanism

Switches

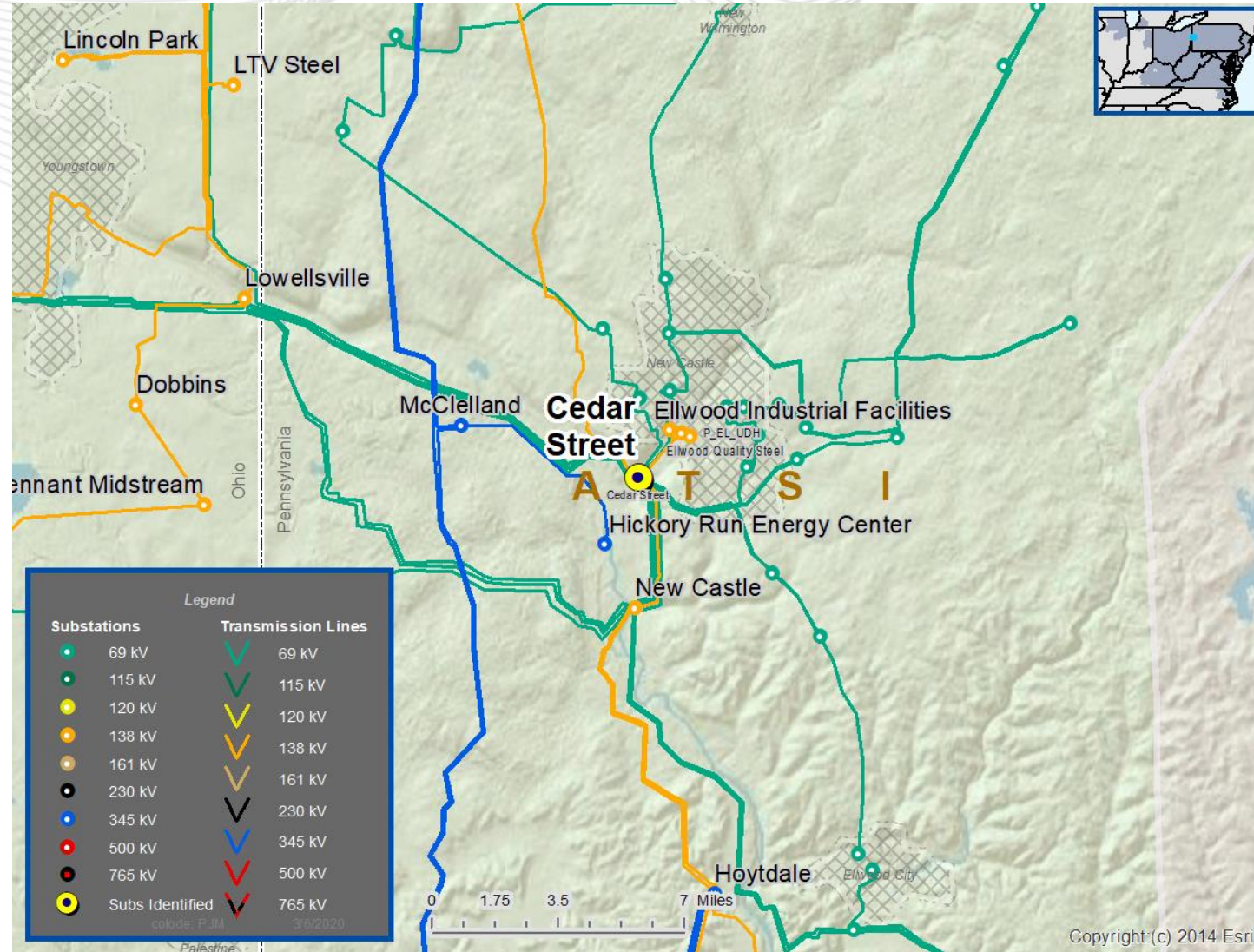
- Blade and jaw assembly
- Operating mechanism

Station Protection and Control

- Electromechanical relays

Devices used for panel, telemetry, and revenue metering

- Potential Transformers (PTs)



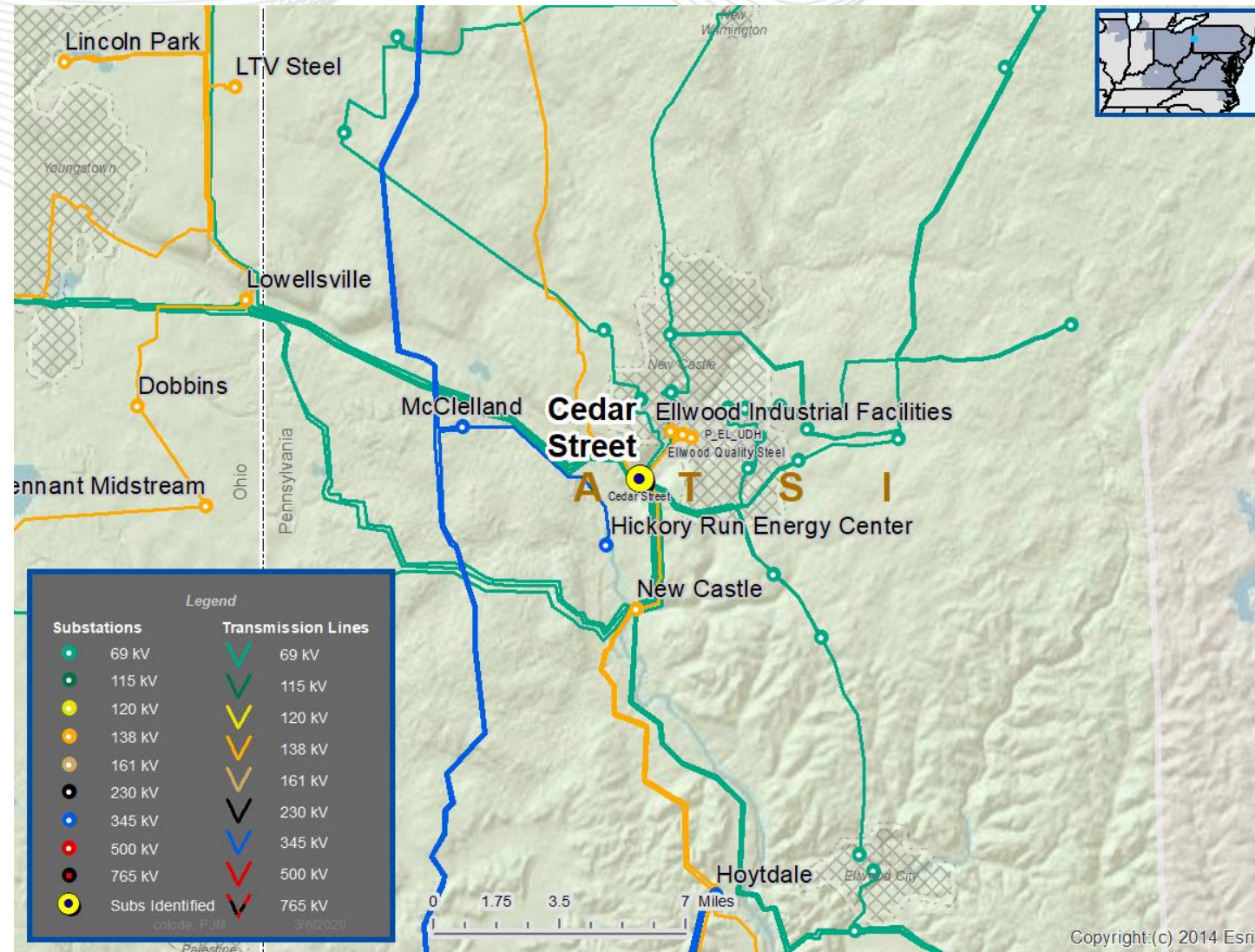
ATSI Transmission Zone M-3 Process Cedar Street 138 / 69 kV Substation - Solution

Need Number: ATSI-2019-085
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Problem Statement

Cedar 138/69 kV Street Substation – Breakers, Relays, and Control Building

- Breaker B-26 69 kV Bus Tie Breaker and disconnect switches are at/beyond expected service life (greater than 52 years) with increasing maintenance concerns; deteriorated operating mechanism, spare part availability, and increasing maintenance trends.
- North and South bus PTs are deteriorating and at/beyond expected service life (greater than 40 years).
- Transformer 138/69 kV #1, bus protection, and line exit relays are electromechanical and prone to misoperation.
 - Cedar Street – Shenango 138 kV Line
 - Cedar Street – New Castle 138 kV Line
 - Cedar Street – New Castle #1, #2 and #3 69 kV Lines
 - Cedar Street – Frisco #1 and #2 69 kV Lines
 - Cedar Street – McDowell 69 kV Line
 - Cedar Street – Grant Street 69 kV Line
 - Cedar Street – New Wilmington 69 kV Line
 - Cedar Street – Lowellville North 69 kV Line
 - Cedar Street – Lowellville South 69 kV Line
 - Cedar Street – Columbiana 69 kV Line





ATSI Transmission Zone M-3 Process Cedar Street Relocate Controls-Solution

Need Number: ATSI-2019-085
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

- Replace 69 kV transfer breaker B26
- Install new North and South bus PTs and disconnect switches
- Replace Cedar Street #1 138-69 kV transformer and breaker B62 with standard transformer relaying panel
- Replace relaying for the following line terminals with standard line relaying panels:
 - New Castle (Y-100) 138 kV Line
 - New Castle No. 1 (Y-83) 69 kV Line
 - New Castle No. 2 (Y-84) 69 kV Line
 - New Castle No. 3 (Y-185) 69 kV Line
 - Cascade (Y-189) 69 kV Line
- Replace relaying for the following line terminals with standard line relaying panels:
 - Columbiana (Y-52) 69 kV Line
 - Masury (Y-188) 69 kV Line
 - Campbell (Y-10) 69 kV Line
 - Lowellville North (Y-13) 69 kV Line
- Replace the following line breakers:
 - B252 (138 kV)
 - B32 (69 kV)
 - B14 (69 kV)
 - B93 (69 kV)
 - B40 (69 kV)
 - B274 (69 kV)
 - B86 (69 kV)
 - B78 (69 kV)
- Replace disconnect switches for the following 69 kV line/transformer breakers:
 - B8
 - B14
 - B26
 - B32
 - B40
 - B48
 - B60
 - B62
 - B70
 - B78
 - B86
 - B274
 - B96
 - B106
 - B114

**No changes in topology;
No bubble diagram
required.**

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



ATSI Transmission Zone M-3 Process Cedar Street Relocate Controls-Solution

Need Number: ATSI-2019-085
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Transmission Line Ratings:

- Cedar Street-Ellwood Tap 138 kV Line Segment
 - Before Proposed Solution: 299 MVA SN / 360 MVA SE
 - After Proposed Solution: 370 MVA SN / 452 MVA SE
- Cedar Street-New Castle #2 Y-84 69 kV Line
 - Before Proposed Solution: 82 MVA SN / 94 MVA SE
 - After Proposed Solution: 92 MVA SN / 94 MVA SE
- Cedar Street-Columbiana Y-52 69 kV Line
 - Before Proposed Solution: 72 MVA SN / 72 MVA SE
 - After Proposed Solution: 78 MVA SN / 81 MVA SE
- Cedar Street-Union Y-188 69 kV Line Segment
 - Before Proposed Solution: 76 MVA SN / 90 MVA SE
 - After Proposed Solution: 95 MVA SN / 97 MVA SE
- Cedar Street-Willowbrook Y-10 69 kV Line Segment
 - Before Proposed Solution: 79 MVA SN / 96 MVA SE
 - After Proposed Solution: 80 MVA SN / 96 MVA SE
- Cedar Street-Lowellville North Y-13 69 kV Line
 - Before Proposed Solution: 76 MVA SN / 76 MVA SE
 - After Proposed Solution: 92 MVA SN / 94 MVA SE

**No changes in topology;
No bubble diagram
required.**

Estimated Project Cost: \$8.0 M

Alternatives Considered:

- None

Projected In-Service: 12/31/2020

Status: Engineering

Model: 2019 Series 2024 Summer RTEP 50/50

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

Need Number: ATSI-2019-087
Process Stage: Solutions Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Supplemental Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global

- System reliability and performance
- Substation/line equipment limits
- Expected service life (at or beyond) or obsolescence

Switches

- Stick-operated line and/or bus switch – Blade and jaw assembly.

Station System Protection and Control

- Electro-mechanical relays – Capability

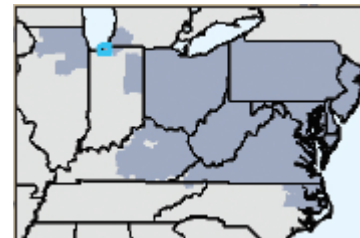
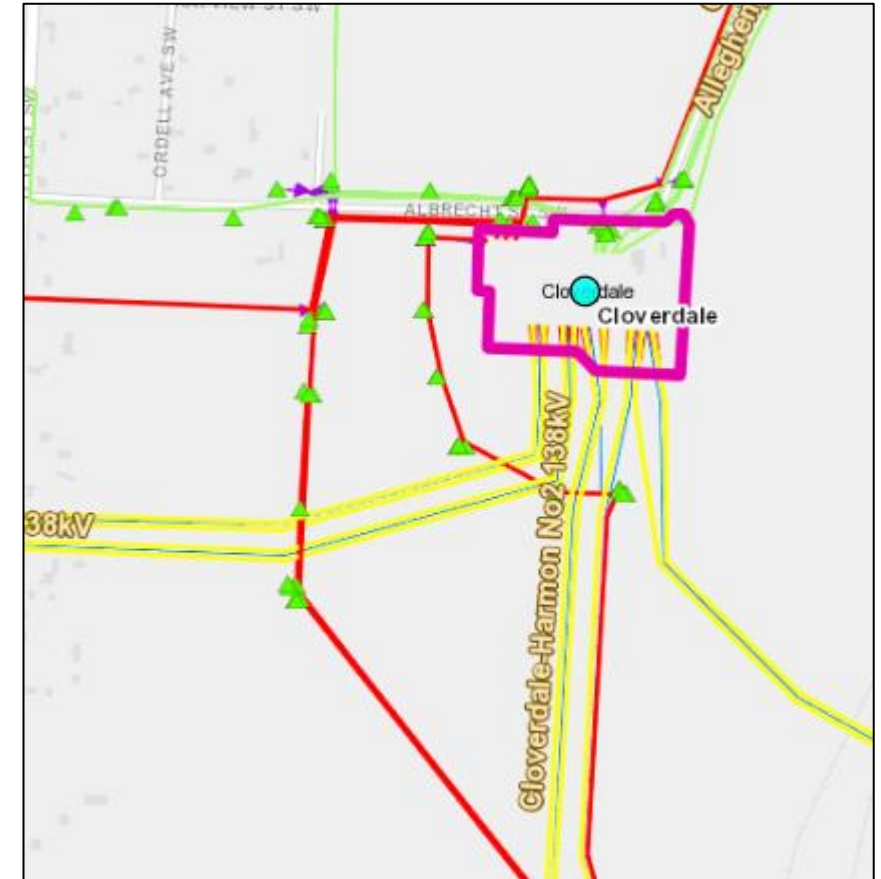
Upgrade Relay Schemes

- Relay schemes that have a history of misoperation

Problem Statement

Cloverdale Substation – Breakers and Relays

- The transformer 138/69 kV relaying is electro-mechanical and is prone to misoperation. The substation disconnects **D264**, **D262**, **D265**, **D195**, **D194**, **D193** and **D192** have deteriorating blades and jaws.
- Transformer Breaker B-191 Oil Circuit Breaker (OCB) is aging greater than 30 years with increasing replacement concerns.



| Legend | |
|--------|--|
| 345 kV | |
| 138 kV | |
| 69 kV | |



ATSI Transmission Zone M-3 Process Cloverdale 138-69 kV Transformer No.4 -Solution

Need Number: ATSI-2019-087

Process Stage: Solutions Meeting – 03/19/2020

Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

- Upgrade (5) 138kV disconnect switches (D192, D193, D194, D195, D265) with 138kV, 1200A DSWs
- Replace existing transformer No. 4 relaying with two (2) standard transformer relaying panels.
- Modify existing SCADA RTU for new relaying
- Replace breaker B-191

Estimated Project Cost: \$2.2 M

Transmission Line Ratings:

- Cloverdale TR4 rating:
 - Before Proposed Solution: 143/143 MVA
 - After Proposed Solution: 159/159 MVA

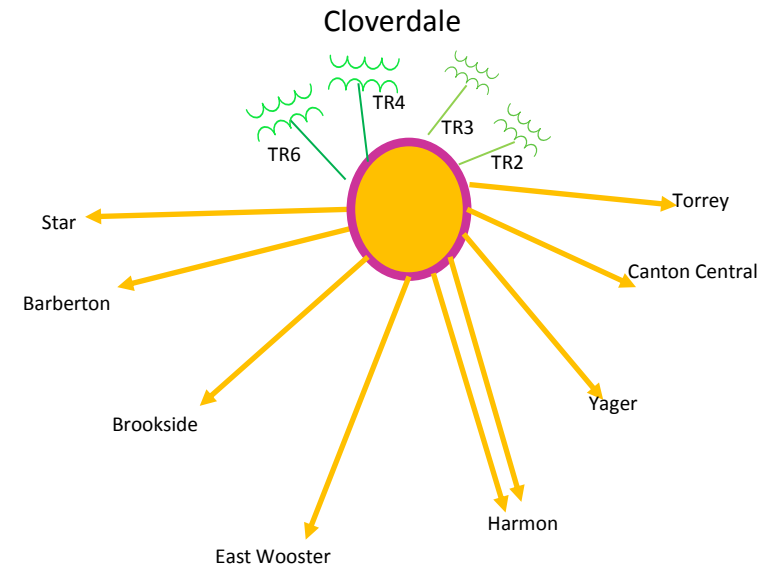
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Projected In-Service: 10/15/2020

Project Status: Conceptual

Model: N/A



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

Need Number: ATSI-2019-088
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Supplemental Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global

- System reliability and performance
- Load and/or Customer at risk on single transmission line.
- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or history industry/company performance data, or application design error
- Expected service life (at or beyond) or obsolescence

Automatic Sectionalizing Schemes

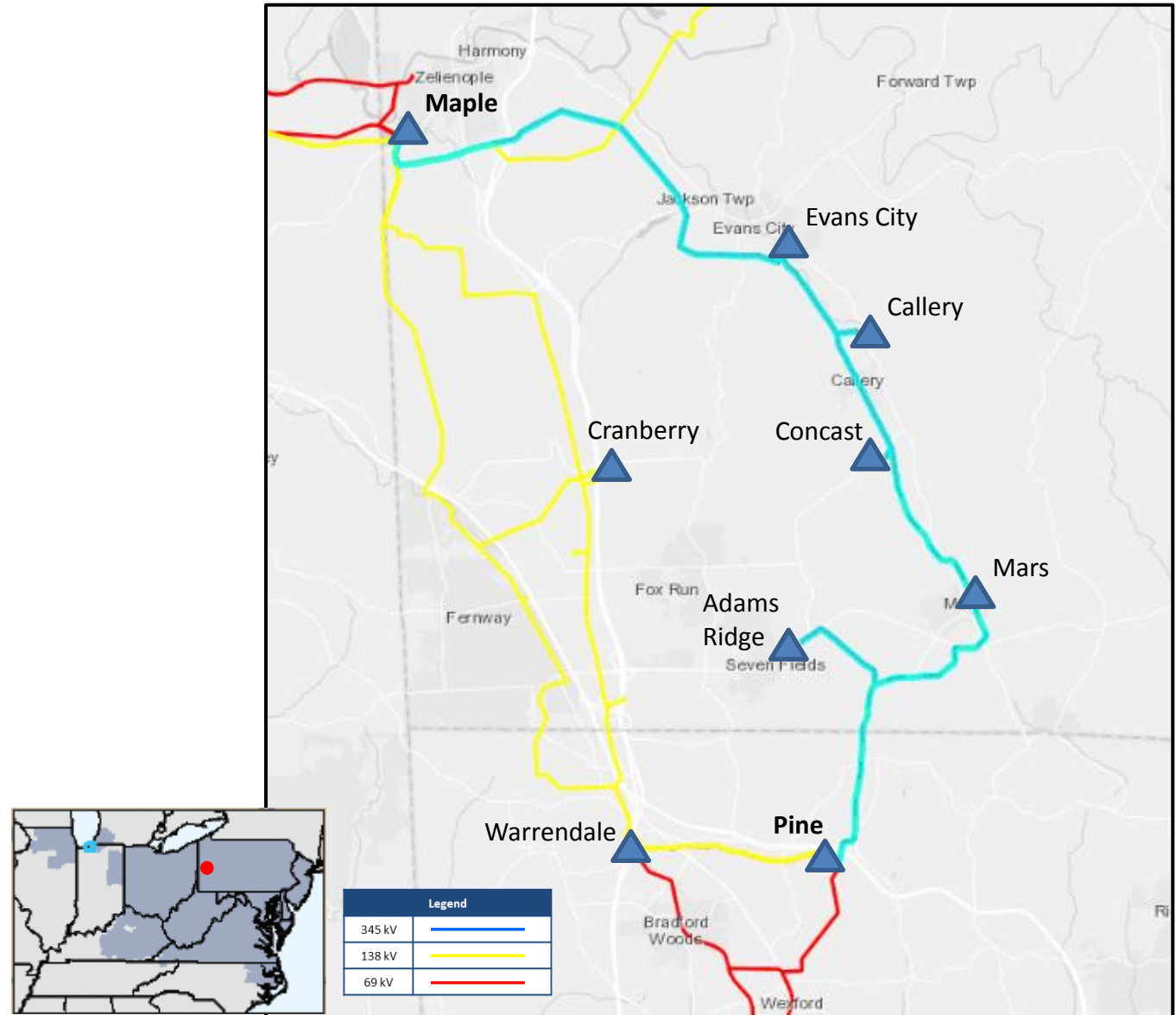
- Evaluate load at risk and/or customers impacted

Circuit Breaker and other fault interrupting devices

- Condition of interrupting media (oil, gas, etc.)
- Operating mechanism

Upgrade Relay Schemes

- Bus protection schemes which rely on remote clearing
- Protection system with single point of failure
- Relay schemes that have a history of misoperation



Need Number: ATSI-2019-088
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

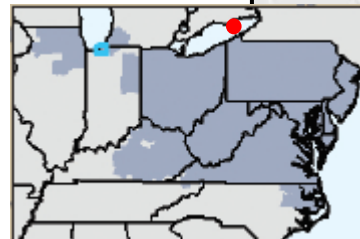
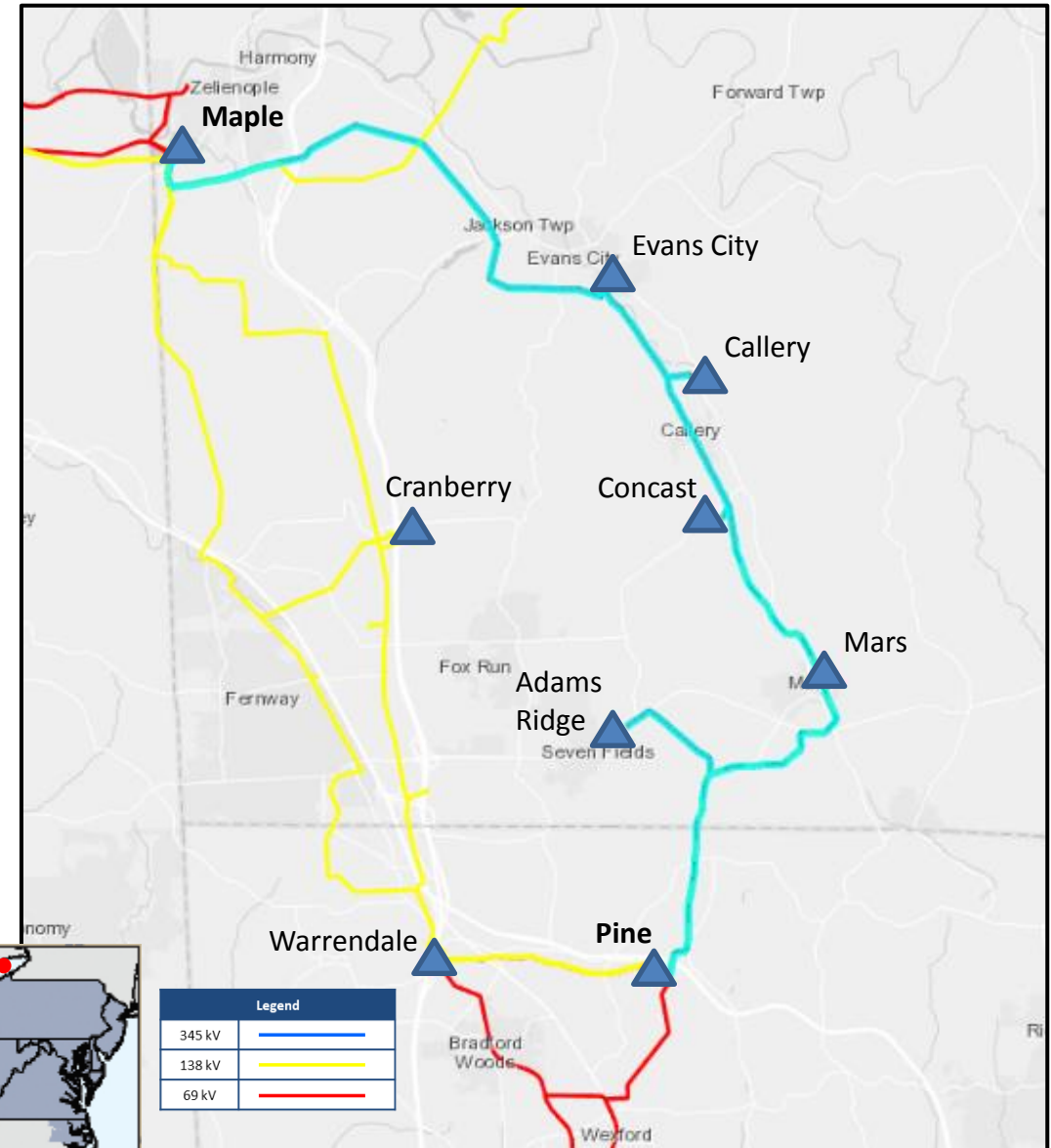
Problem Statement

Maple-Pine 69 kV Line

- The existing 69 kV transmission line is approximately 18 miles long with approximately 45 MWs of load and 11,500 customers at risk. The largest customer and load base at risk is located at Mars substation (22 MWs / 5,300 Customers).
- Overall line condition is adequate based on recent line inspection results.
- System performance over the past five years: 5 momentary / 6 sustained

Pine 69 kV Substation – Breakers and Protection Schemes

- Several SF6 breakers at Pine substation at/beyond expected service life with increasing maintenance concerns;
 - Breaker B-18 has history of SF6 leaks
 - Breaker B-14 has history of SF6 leaks and has had air tank issues
 - Breaker B-22 has experienced a bushing failure and repairs
 - Breaker B-26 has had a bushing, air receiver, pilot valve and a lower pressure cut-off valve issues
- The transfer line and bus protection electro-mechanical relays are prone to mis-operate due to components failing without warning.



ATSI Transmission Zone M-3 Process

Install Auto-Sectionalizing Scheme by Expanding Mars Substation-Solution

Need Number: ATSI-2019-088
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

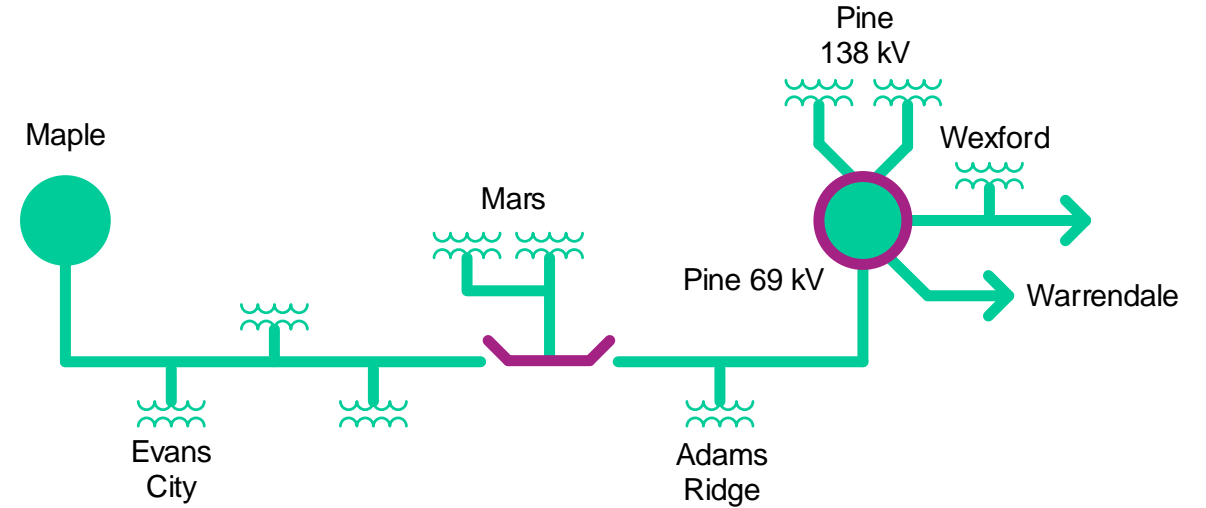
Proposed Solution:

- Expand Mars substation
- Install two 69 kV MOAB switches
- Replace the 69 kV Y-192 (B130) reclosing relay and adjust settings at Maple
- Replace the 69 kV Y-192 (B14) reclosing relay and adjust settings at Pine
- Replace 69 kV breakers B14, B18, B22, & B26 at Pine
- Replace 69 kV breaker B130 at Maple
- Upgrade substation conductor at Pine

Estimated Project Cost: \$3.5 M

Transmission Line Ratings:

- Pine-Adams Ridge 69 kV Line Segment
 - Before Proposed Solution: 133 MVA SN / 150 MVA SE
 - After Proposed Solution: 141 MVA SN / 171 MVA SE
- Pine-Wexford Tap 69 kV Line Segment
 - Before Proposed Solution: 133 MVA SN / 169 MVA SE
 - After Proposed Solution: 139 MVA SN / 169 MVA SE



Alternatives Considered:

- Maintain existing configuration (SCADA)
- Mars 69 kV ring bus (space constraint)

Projected In-Service: 12/31/2020
Status: Engineering
Model: 2019 Series 2024 Summer RTEP 50/50

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

Need Number: ATSI-2019-082
Process Stage: Solutions Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Supplemental Project Driver(s):
Customer Service

Specific Assumption Reference(s)

Customer connection request will be evaluated per FirstEnergy’s “Requirements for Transmission Connected Facilities” document and “Transmission Planning Criteria” document.

Problem Statement

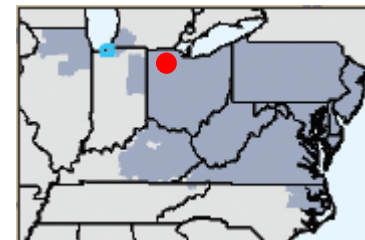
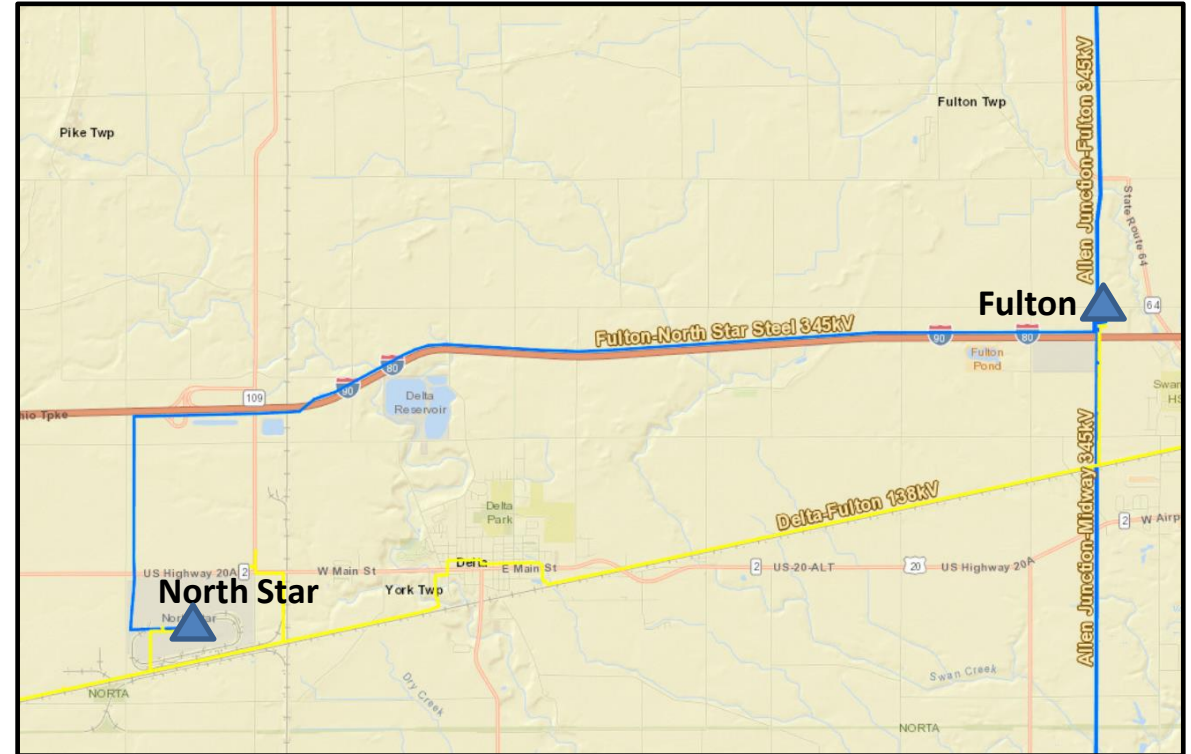
Existing Customer Connection – Load Increase

An existing transmission customer (North Star BlueScope Steel) is requesting load demand increase for the existing 345/34.5 kV substation to a new peak of 300 MVA on the Fulton-North Star Steel 345 kV line.

Requested In-Service Date: 03/01/2021

The customer is also requesting load demand increase for its existing 138/34.5 kV substation to a new peak load of 40 MVA on the Delta-Wauseon 138 kV line.

Requested In-Service Date: 11/01/2020



| Legend | |
|--------|--|
| 345 kV | |
| 138 kV | |
| 69 kV | |



ATSI Transmission Zone M-3 Process North Star BlueScope Steel Customer- Solution

Need Number: ATSI-2019-082
Process Stage: Solutions Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

When the additional 40 MVA from the customer is energized on the Delta-Wauseon 138 kV line, the N-1-1 contingency of losing the Midway-Wauseon 138 kV line and the Delta-Fulton 138 kV line results in voltage of 0.90 PU.

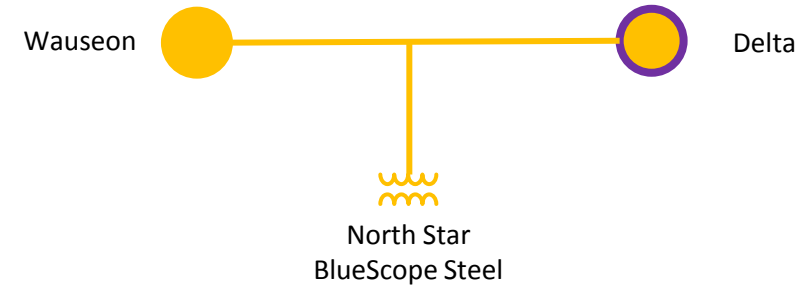
- Install two (2) 26 MVAR Capacitor Bank at Delta 138 kV substation.

Estimated Project Cost: \$2.3 M

Alternatives Considered:

- None (obligation to serve)

Projected In-Service: 11/2/2020
Status: Engineering
Model: 2019 Series 2024 Winter RTEP 50/50



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

Need Number: ATSI-2019-084
Process Stage: Solution Meeting – 03/19/2020
Process Stage: Need Meeting – 11/22/2019

Supplemental Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global

- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or history industry/company performance data, or application design error
- Expected service life (at or beyond) or obsolescence

Circuit Breaker and other fault interrupting devices

- Condition of interrupting media (oil, gas, etc.)

Switches

- Blade and jaw assembly
- Switch degradation

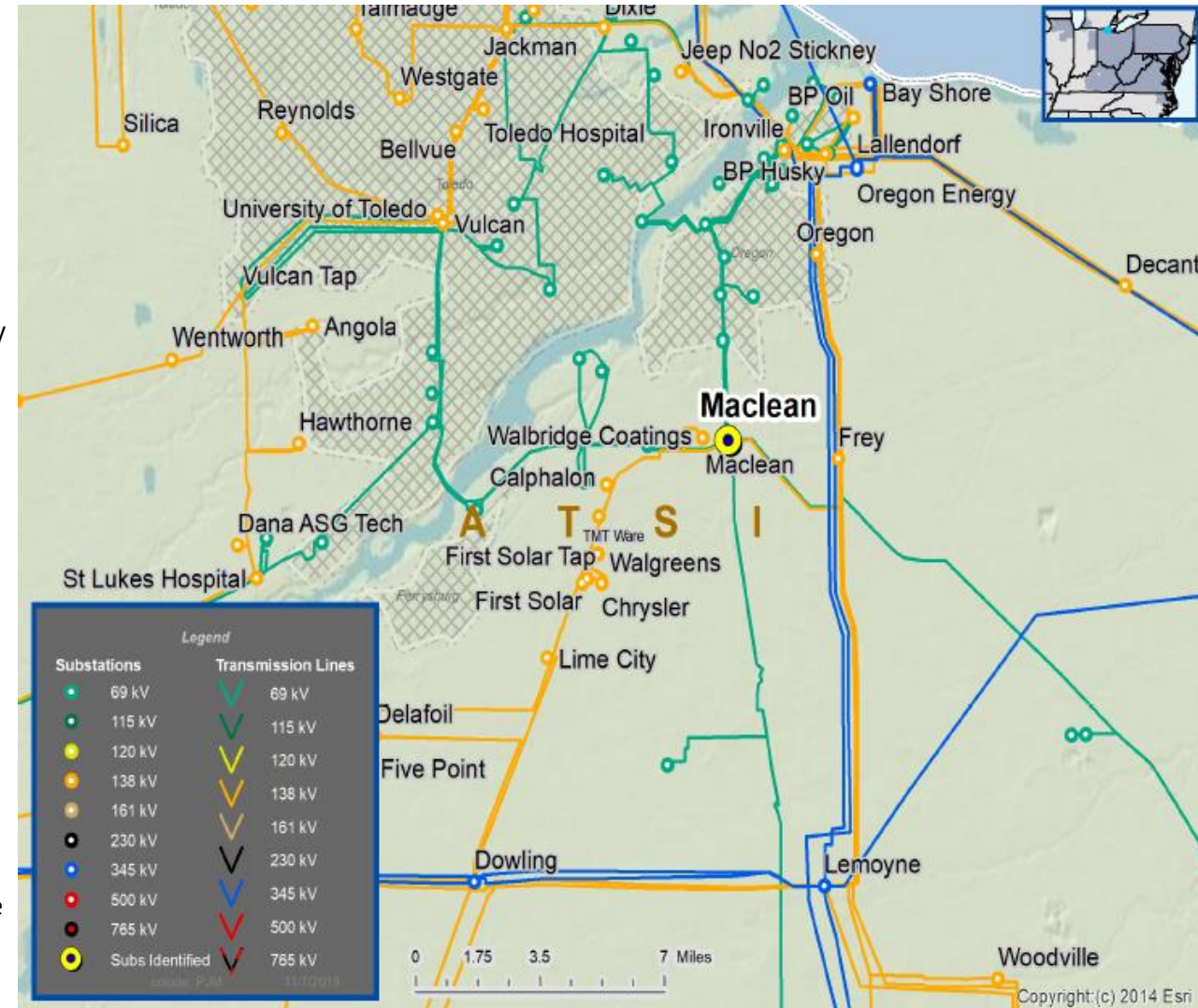
Upgrade Relay Schemes

- Bus protection schemes which rely on remote clearing
- Protection system with single point of failure
- Relay schemes that have a history of misoperation

Problem Statement

Maclean 138 kV Substation – Breakers and Protection Schemes

- Breakers B132203 and B13204 Oil Circuit Breakers (OCB) are at/beyond expected service life (greater than 30 years) with increasing maintenance concerns; severe hydraulic leaks, oil quality issues, and increasing maintenance trends.
- The electromechanical relays provide limited bus protection with single point of failure.
- The bus PTs are at/beyond expected service life (greater than 40 years).





ATSI Transmission Zone M-3 Process Maclean 138 kV Substation - Solution

Need Number: ATSI-2019-084
Process Stage: Solution Meeting – 03/19/2020
Previously Presented: Need Meeting – 11/22/2019

Proposed Solution:

- Replace 138kV breaker B13204
- Replace 138kV breaker B13203
- Replace disconnect switches for Breaker B13204
- Replace disconnect switches for Breaker B13203
- Replace one (1) disconnect switch for 138-69 kV Transformer No1
- Upgrade substation conductor at Maclean for the Maclean-Chrysler 138 kV Line

Estimated Project Cost: \$1.2 M

Transmission Line Ratings:

- Maclean-Chrysler 138 kV Line
 - Before Proposed Solution: 327 MVA WN / 394 MVA WE
 - After Proposed Solution: 327 MVA WN / 394 MVA WE
- Maclean-Walbridge Coatings 138 kV Line section of the (Maclean-Chrysler 138 kV Line)
 - Before Proposed Solution: 327 MVA WN / 394 MVA WE
 - After Proposed Solution: 327 MVA WN / 420 MVA WE

Alternatives Considered:

- Maintain existing equipment and risk of failure.

Projected In-Service: 11/11/2021
Status: Conceptual
Model: N/A

**No changes in topology;
No bubble diagram
required.**

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

Changes to Existing Supplemental Projects

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

ATSI Transmission Zone

Previously Presented: 8/31/2018 SRRTPEP

Supplemental Project

Problem Statement (Scope and Need/Drivers):

Operational Flexibility and Efficiency

- Improve operational flexibility during maintenance and restoration efforts.
- Improve system protection, coordination, and fault location under existing three-terminal line configuration.
- Reduce the amount of local load loss (Approaching 87MWs) under contingency conditions.
- Mitigate non-planning criteria voltage concerns on the < 100 kV system under contingency (P6) condition.
 - *Loss of Midway-Lemoyne 138 kV and Midway-Bowling Green 2 69 kV line*
 - *Results in potential low voltage or local voltage collapse in Bowling Green and other local distribution substations with load at risk approaching 87 MWs.*

Potential Solution:

Brim 138/69 kV Substation Expansion (s1703)

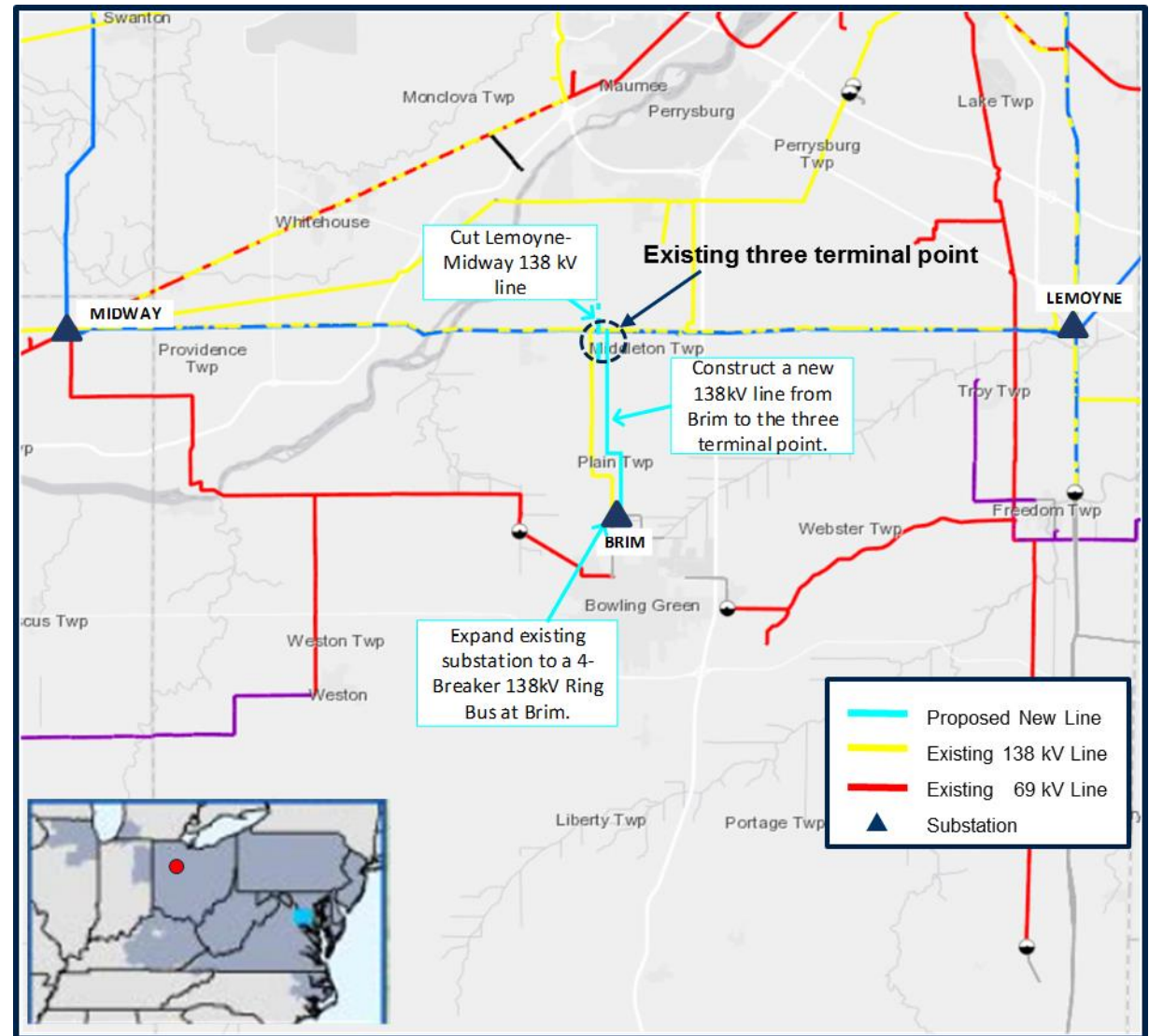
- Eliminate the three terminal point on the Lemoyne-Midway 138 kV line.
- Construct a new diverse route 138 kV line (Approximately 5 miles) from Brim substation to a location near the three terminal point with 336 ACSS conductor.
- Add four (4) breaker 138 kV ring bus at Brim substation
- ~~Add a 2nd 138/69 kV transformer.~~ Create a new 138 kV line exit at Brim substation for interconnection with AMPT.

Alternatives Considered: Bring a fourth 69 kV source from Pemberville.

Estimated Project Cost: ~~\$19.9M~~ \$16.0M

Projected IS Date: 6/1/2020

Status: Engineering Construction



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

3/6/2020 – V1 – Original version posted to pjm.com