



# Sub Regional RTEP Committee Western Region ATSI - Solutions

October 26, 2018



# ATSI Transmission Zone

Need Number: ATSI-2018-001  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

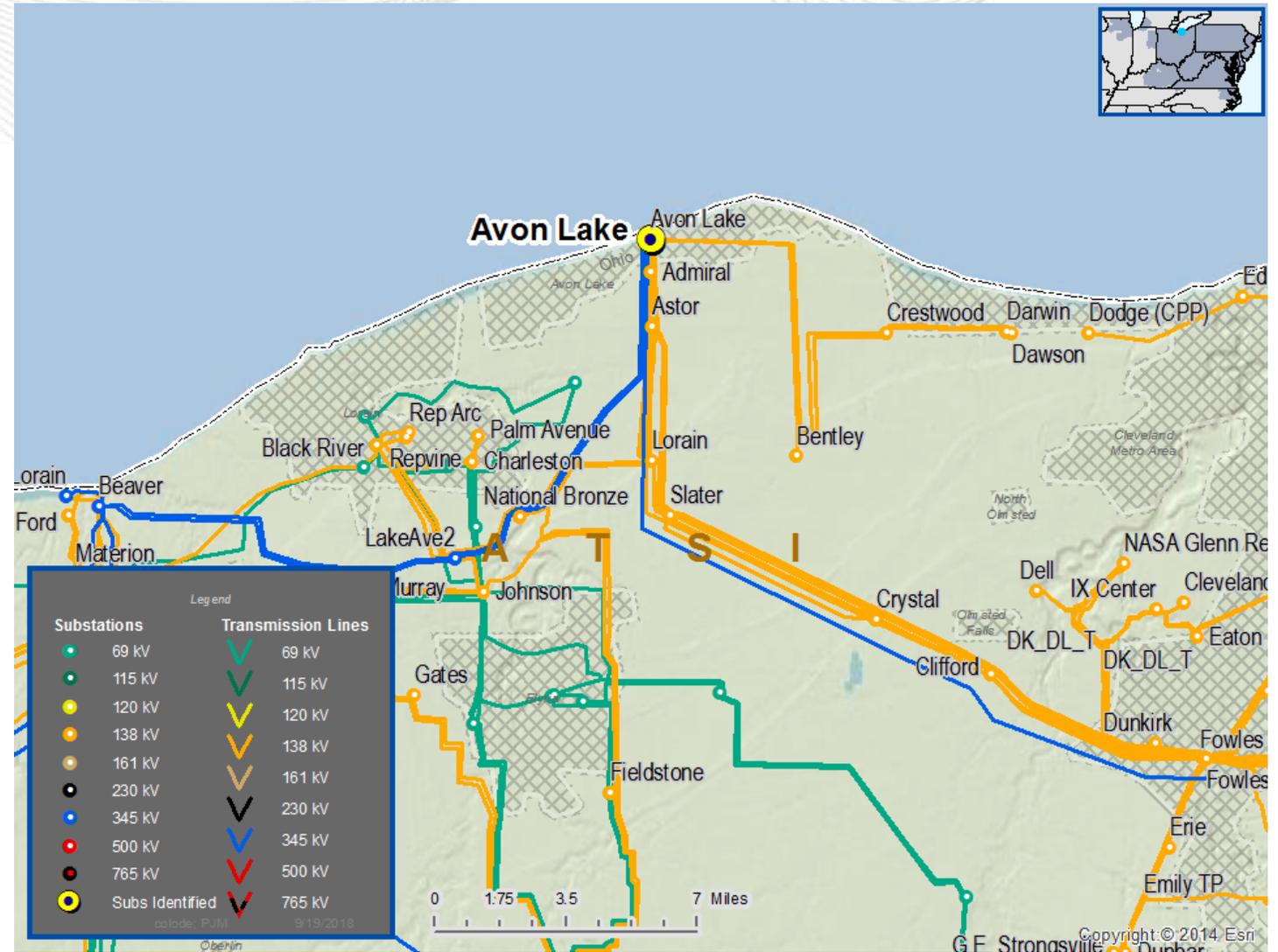
Project Driver(s):  
*Equipment Material Condition, Performance and Risk*

Specific Assumption Reference(s)  
 Substation Condition Rebuild / Replacement

- Power Transformers and Load Tap Changers (LTC)

Problem Statement  
 Avon 345 / 138 kV 448 MVA #91 Transformer

- Transformer is gassing at an increasing rate
- Oil condition is degraded
- Leaks – Not cost effective to repair
- Severe loading history
- Cooler condition is degraded





Need Number: ATSI-2018-001

**Proposed Solution:**

**Avon 345/138 kV #91 Transformer Replacement**

- Replace existing Avon #91 345/138 kV transformer (448 MVA) with a new 345/138 kV transformer (560 MVA)

*Avon Substation – Terminal equipment to be replaced include:*

- Substation conductor

**Alternatives Considered:**

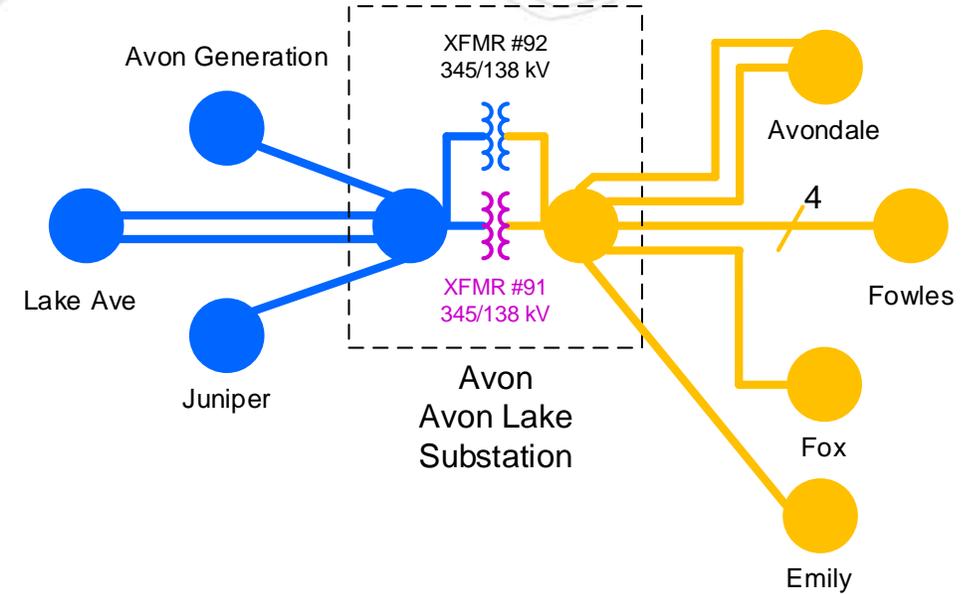
- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$5.8M

Projected IS Date: 12/31/2019

Status: Engineering

**ATSI Transmission Zone**



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



# ATSI Transmission Zone

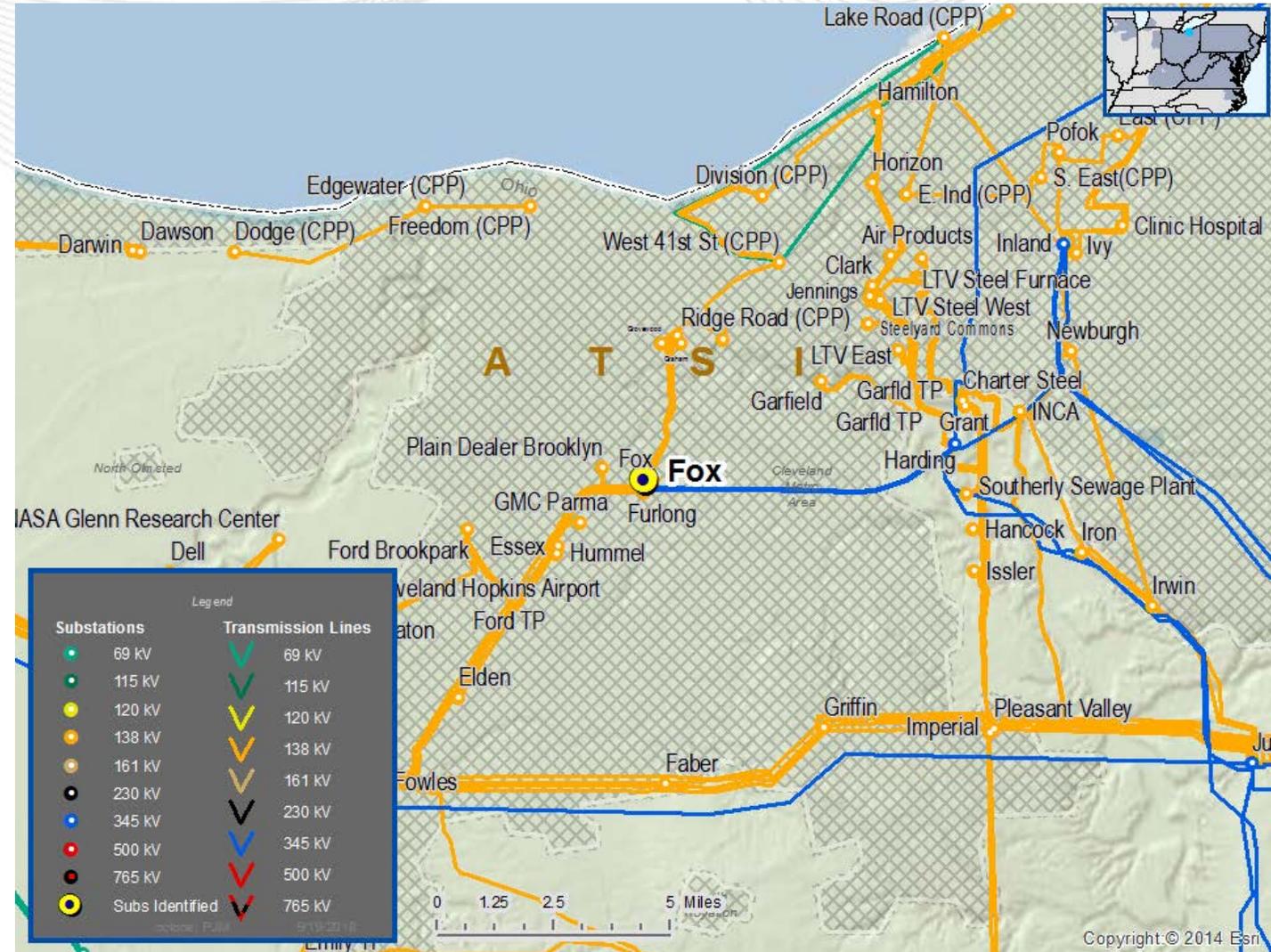
Need Number: ATSI-2018-002  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

- Specific Assumption Reference(s)  
 Substation Condition Rebuild / Replacement
- Power Transformers and Load Tap Changers (LTC)
  - Circuit Breaker and Other Fault Interrupting Devices

- Problem Statement  
 Fox 345 / 138 kV 224 MVA #5 Transformer
- Oil Pump/cooler maintenance
  - Aging/deteriorating bushings
  - Increased failure risk

- Fox 138 kV Circuit Breaker Q5
- Mechanism issues
  - Aging/deteriorating bushings
  - Spare part availability/vendor support limitations
  - Negative impact on equipment health (transformer)





Need Number: ATSI-2018-002

**Proposed Solution:**

**Fox 345/138 kV #5 Transformer Replacement**

- Replace existing Fox #5 345/138 kV transformer (224 MVA) with a new 345/138 kV transformer (280 MVA).

*Fox Substation – Terminal equipment to be replaced includes:*

- 138kV circuit breaker Q5, substation conductor, CCVT, and associated relaying.

**Alternatives Considered:**

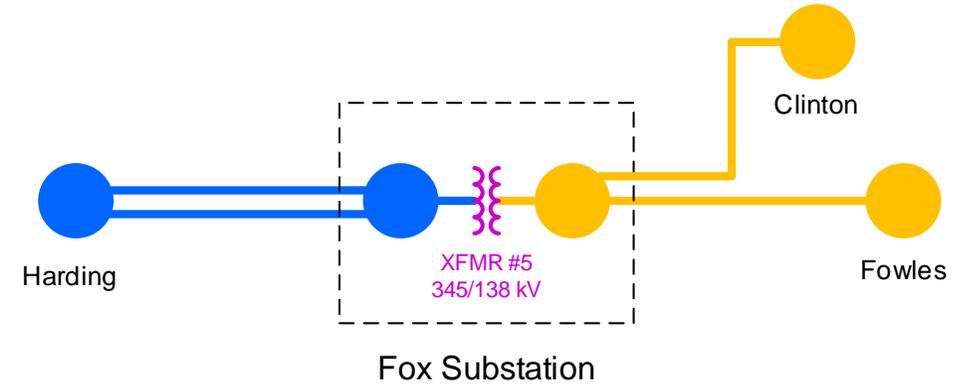
- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$6.3 M

Projected IS Date: 12/31/2019

Status: Engineering

ATSI Transmission Zone



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

Need Number: ATSI-2018-003  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)

- Substation Condition Rebuild / Replacement
- Power Transformers and Load Tap Changers (LTC)
  - Circuit Breaker and Other Fault Interrupting Devices

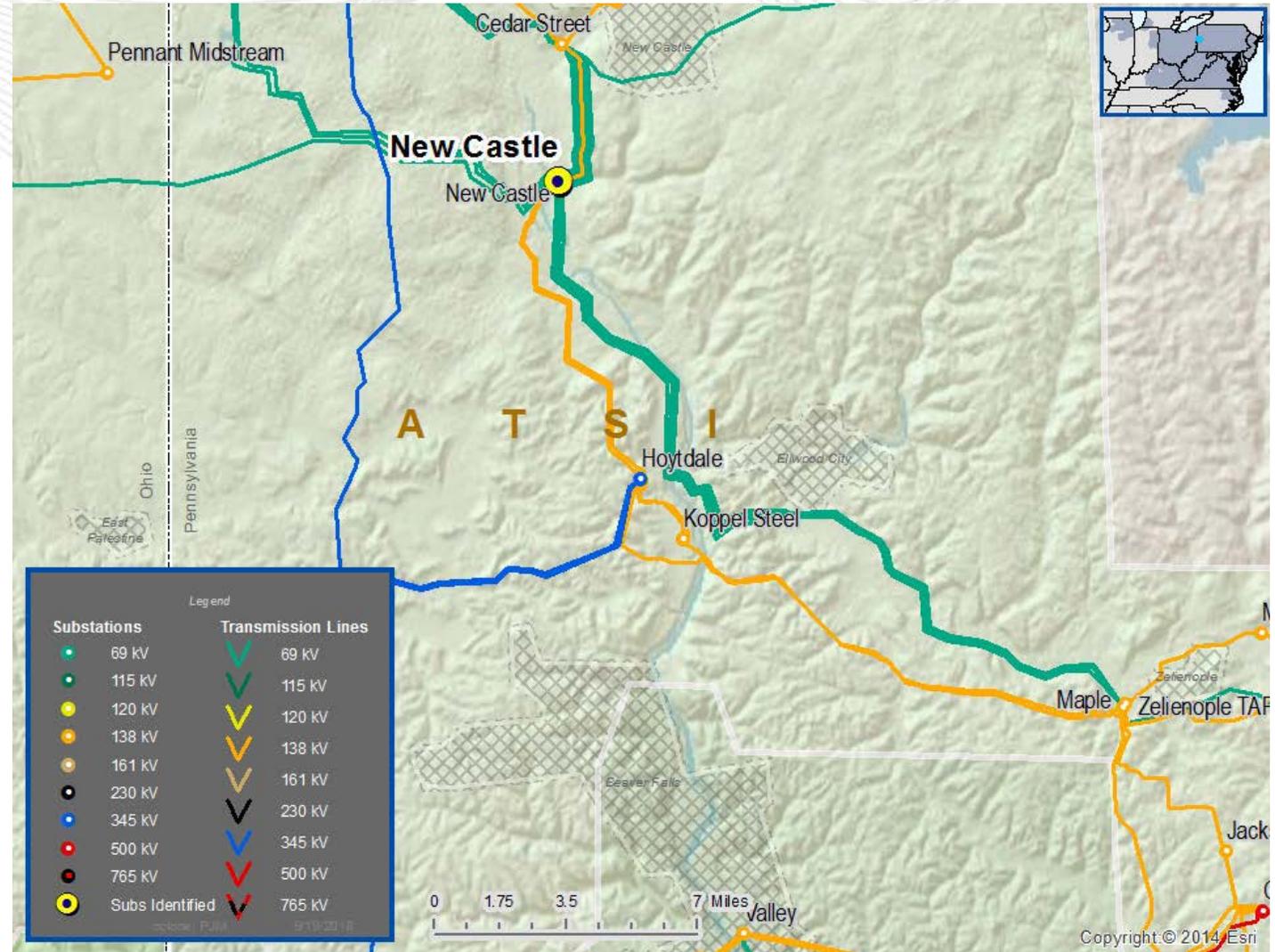
Problem Statement

**New Castle 138 / 69 kV 75 MVA #7 Transformer**

- Oil Leaks/moisture ingress
- Aging/deteriorating bushings
- Increased failure risk

**New Castle 69 kV Circuit Breaker B32**

- Mechanism issues
- Aging/deteriorating bushings
- Spare part availability/vendor support limitations
- New breaker will offer improved transformer protection



Need Number: ATSI-2018-003

**Proposed Solution:**

**New Castle #7 138/69 kV Transformer Replacement**

- Replace existing New Castle #7 138/69/4.2 kV transformer (125 MVA) with new 138/69 kV transformer (134 MVA).
- Replace existing 69 kV breaker (B32).
- Install new 69/4.2 kV transformer (15 MVA) and a 69 kV circuit breaker in existing 69 kV transformer position for generation station service.

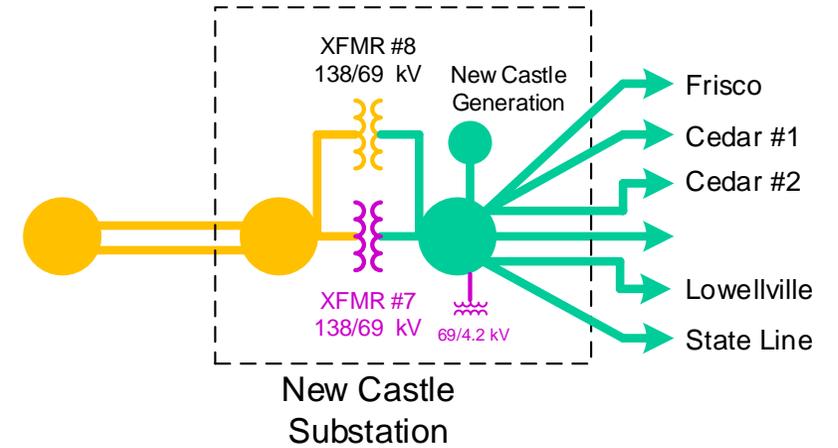
**Alternatives Considered:**

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$3.9M

Projected IS Date: 12/31/2020

Status: Conceptual



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



# ATSI Transmission Zone

Need Number: ATSI-2018-004  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Substation Condition Rebuild / Replacement

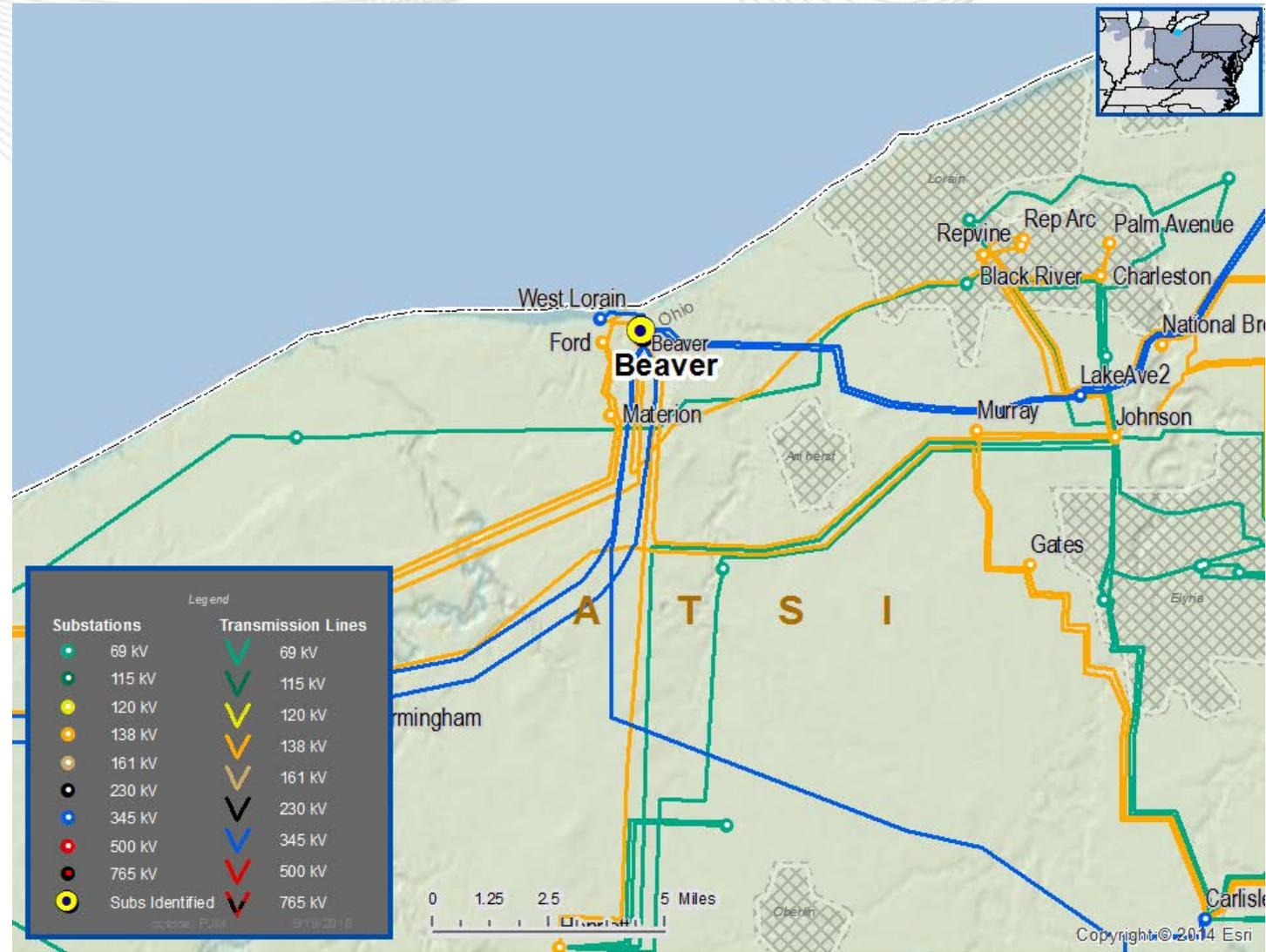
- Power Transformers and Load Tap Changers (LTC)

Problem Statement  
 Beaver 345 / 138 / 13.2 kV 392 MVA #1 Transformer

- Oil Pump issues and maintenance
- Increased failure probability
- Aging/deteriorating bushings

Beaver 345 / 138 / 13.2 kV 392 MVA #2 Transformer

- Oil Pump issues and maintenance
- Increased failure probability
- Aging/deteriorating bushings





Need Number: ATSI-2018-004

**Proposed Solution:**

**Beaver #1 and Beaver #2 345/138 kV Transformer Replacement**

- Replace existing Beaver #1 345/138/13.2 kV transformer (350 MVA) with new 345/138 kV transformer (448 MVA)
- Replace existing Beaver #2 345/138/13.2 kV transformer (350 MVA) with new 345/138 kV transformer (448 MVA)
- Install new 138/13.2 kV transformer (14MVA) and breaker for power to station service at Beaver
- Install new 138/13.2 kV transformer (14MVA) and breaker for power to station service at West Lorain Generation

*Beaver Substation – Terminal equipment to be replaced include:*

- Replace disconnect switches, VT's, CCVT's, and associated relaying.

**Alternatives Considered:**

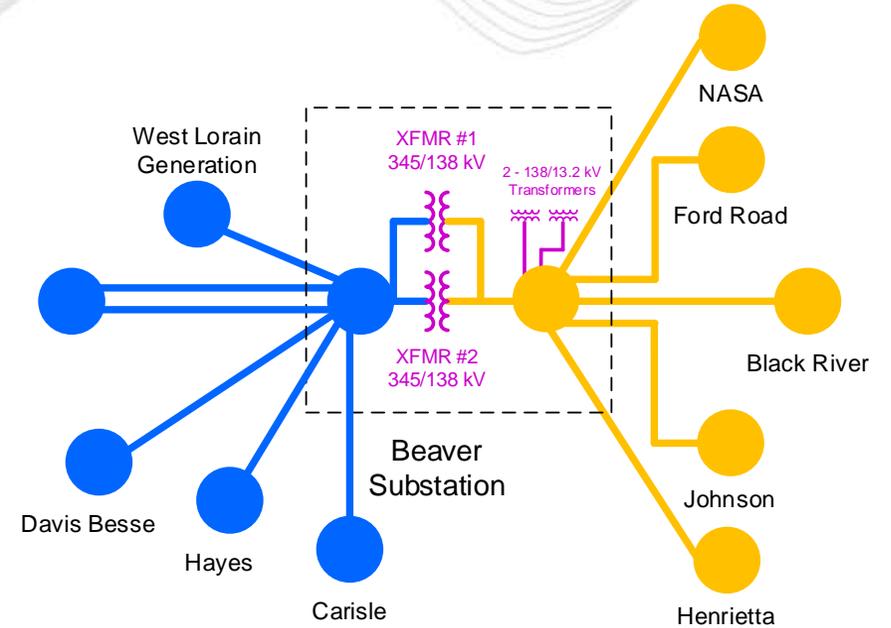
- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$12.7M

Projected IS Date: 12/31/2021

Status: Conceptual

**ATSI Transmission Zone**



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

Need Number: ATSI-2018-005  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Substation Condition Rebuild / Replacement

- Circuit Breaker and Other Fault Interrupting Devices
- Disconnect Switches
- Electromechanical and Solid-state Protective Relaying
- Potential Transformers (PTs), Coupling Capacitor Voltage Transformers (CCVTs)
- Line Arresters

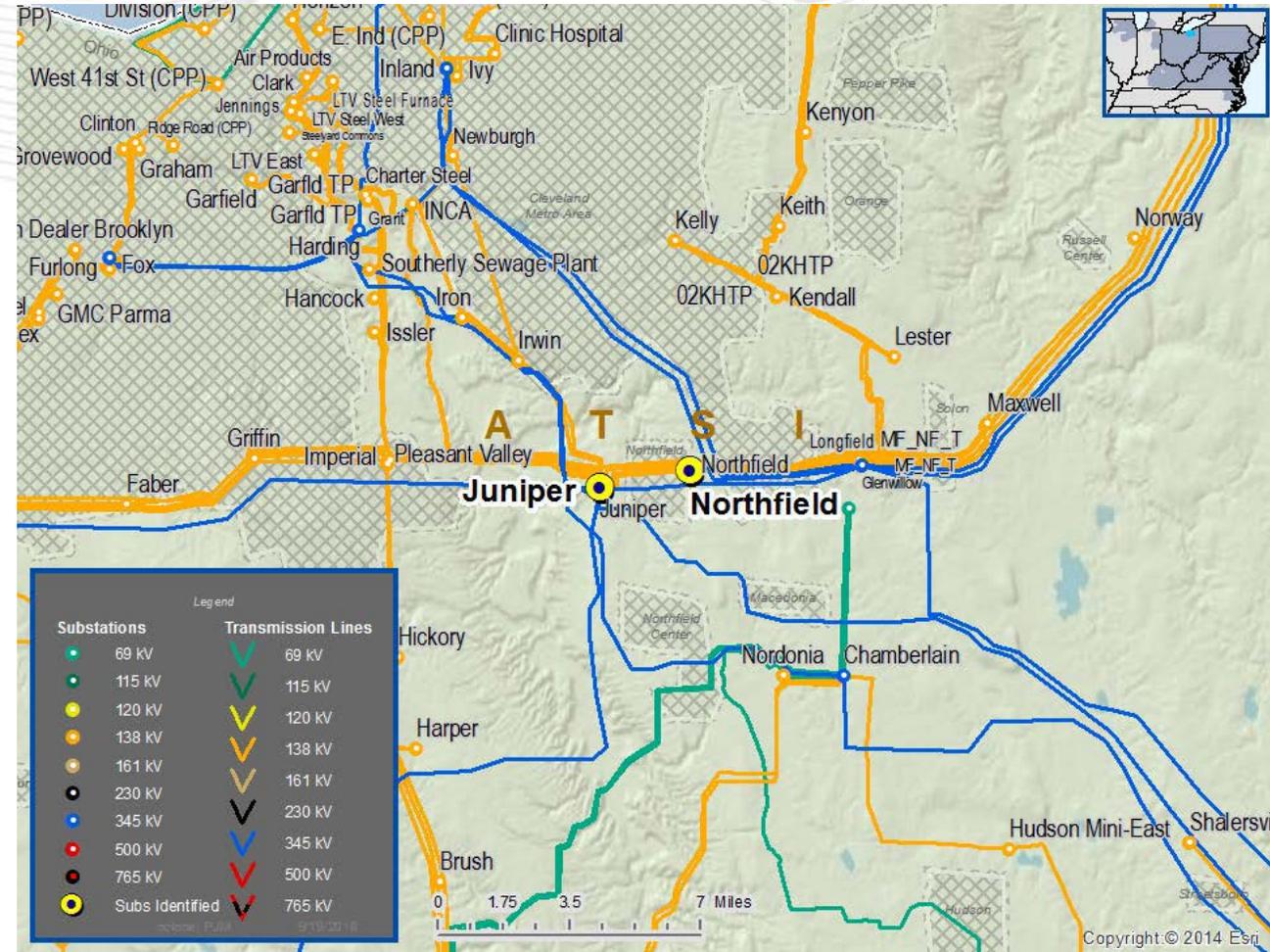
**Problem Statement**

**Northfield 138 kV Bus 2 and Bus 4**

- Deteriorated bushings and insulators, increased failure risks
- Reliability issues, EM relaying mis-operations

**Juniper 138 kV Bus 1**

- Deteriorated bushings and insulators, increased failure risks
- Reliability issues, EM relaying mis-operations





Need Number: ATSI-2018-005

Proposed Solution:

Northfield and Juniper 138 kV Bus Upgrades

*NORTHFIELD 138 kV Substation – Terminal equipment to be replaced include:*

- Replace bus relaying, disconnect switches, VT's, CCVT's, breakers (B18, B20, B21), and arresters, for Northfield 138 kV Bus 2 and Bus 4.

*JUNIPER 138 kV Substation – Terminal equipment to be replaced include:*

- Replace bus relaying, disconnect switches, CCVT's, breakers (B25 and B27), and arresters for Juniper Bus 1.

Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$2.1M

Projected IS Date: 3/15/2020

Status: Engineering

Bubble Chart  
Not Applicable

Substation upgrades only.

Need Number: ATSI-2018-006  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

Project Driver(s):  
*Operational Flexibility and Efficiency*

Specific Assumption Reference(s)  
 Add / Expand Bus Configuration

- Substation buses that adversely impact system performance
- Reduce amount of exposed potential local load loss during contingency conditions.

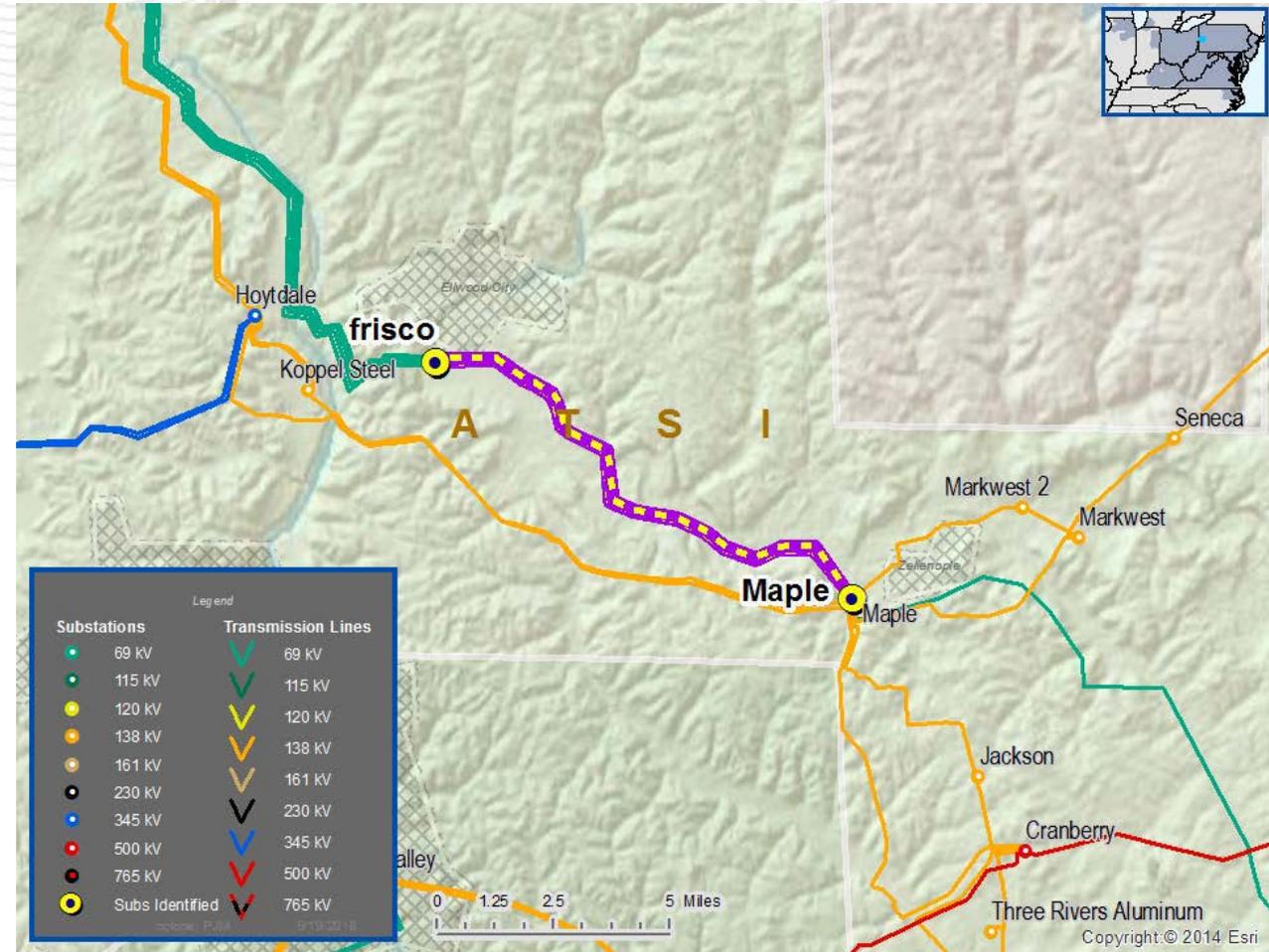
Reconductor / Rebuild Transmission Lines

- Mitigation of PJM issued PCLLRWs or post contingency switching limitations.

### Problem Statement

#### Frisco-Maple # 1 and #2 69 kV line Terminal Equipment

- Mitigate PJM issued PCLLRWs / Pre-contingency switching orders, eight times, for thermal concerns on the 69 kV system under contingency conditions.
  - Loss of the New Castle-Hoytdale #1 and New Castle-Hoytdale #2 138 kV lines.
  - Results in potential thermal loading greater than 100% on the Frisco-Maple #1 69 kV line or potential thermal loading on the Frisco-Maple #2 69 kV line depending on system conditions.





Need Number: ATSI-2018-006

**Proposed Solution:**

Frisco-Maple #1 and #2 69 kV Line Upgrades

**FRISCO Substation**

- Install new relay panels on B4 breaker and line exit.
- Upgrade 336.4 ACSR substation conductor
- Replace disconnect switches

**MAPLE Substation**

- Install new relay panels on B118 breaker and line exit.
- Upgrade 336.4 ACSR substation conductor at Maple
- Replace disconnect switches
- Replace Breaker B118 (due to age and condition)

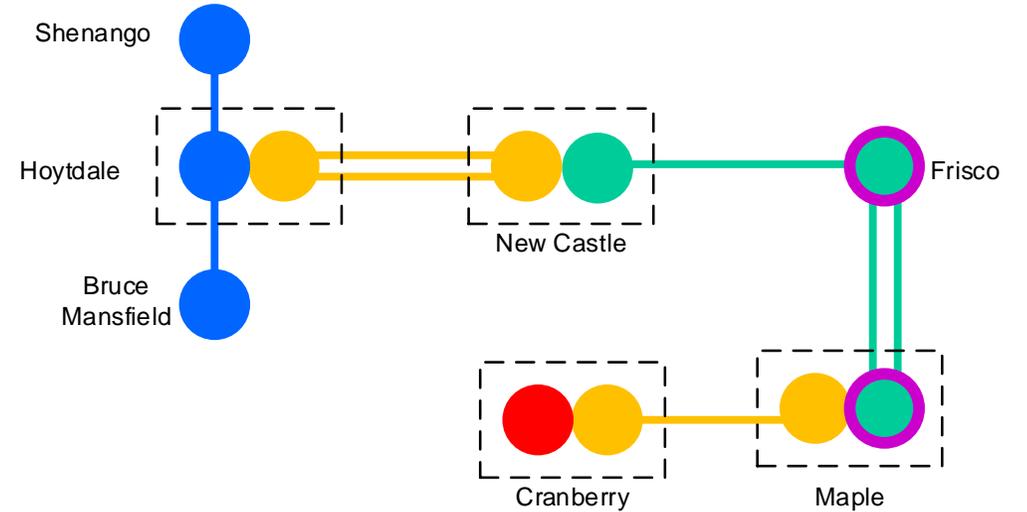
- Existing Frisco-Maple #1 69 kV Line rating: 72 MVA SN / 72 MVA SE
- New Frisco-Maple #1 69 kV Line rating: 80 MVA SN / 96 MVA SE
- Existing Frisco-Maple #2 69 kV Line rating: 62 MVA SN / 62 MVA SE
- New Frisco-Maple #1 69 kV Line rating: 80 MVA SN / 96 MVA SE

**Alternatives Considered:**

Reconductor Frisco-Maple #1 and #2 69 kV Lines

Estimated Project Cost: \$1.3M  
 Projected IS Date: 12/31/2019  
 Status: Engineering

# ATSI Transmission Zone



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

Need Number: ATSI-2018-007  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

Project Driver(s):  
*Operational Flexibility and Efficiency*

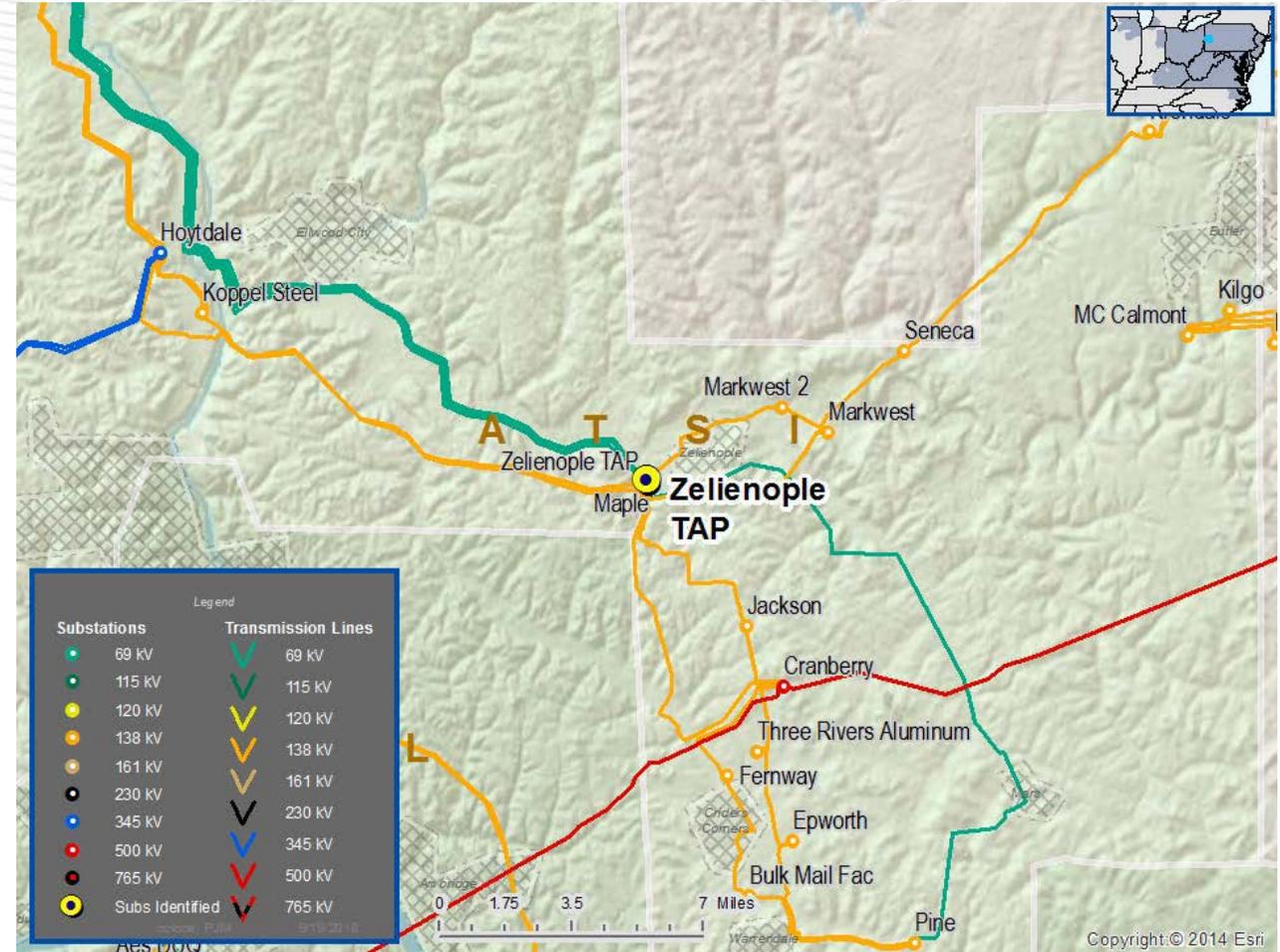
Specific Assumption Reference(s)  
 Add / Expand Bus Configuration

- Substation buses that adversely impact system performance
- Reduce amount of exposed potential local load loss during contingency conditions.

### Problem Statement

#### Zelienople 69 kV Area Load At Risk

- Outage of the Zelienople circuit results in loss of 16.6 MW and 3,762 customers
- Radial line exposure is 1.2 miles
- Line has experienced 2 sustained outages in the past 5 years





Need Number: ATSI-2018-007

**Proposed Solution:**

**Zelienople Normally Open Switch Addition**

- Install one normally closed SCADA controlled switch on the Maple-Zelienople 69 kV Line
- Install one normally open SCADA controlled switch to connect the Zelienople 69 kV load to the Maple-Frisco 69 kV Line under emergency or maintenance conditions.

**Alternatives Considered:**

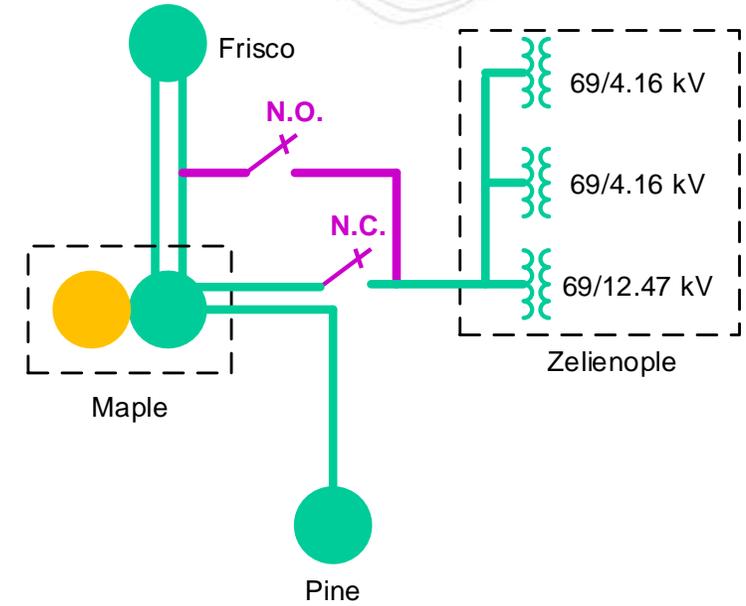
- Maintain existing configuration
- Build a second 69kV line (1.2 miles) from Maple substation to Zelienople substation

Estimated Project Cost: \$0.6M

Projected IS Date: 12/31/2019

Status: Engineering

**ATSI Transmission Zone**



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

Need Number: ATSI-2018-008  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

Project Driver(s):  
*Equipment Material Condition, Performance and Risk  
 Operational Flexibility and Efficiency*

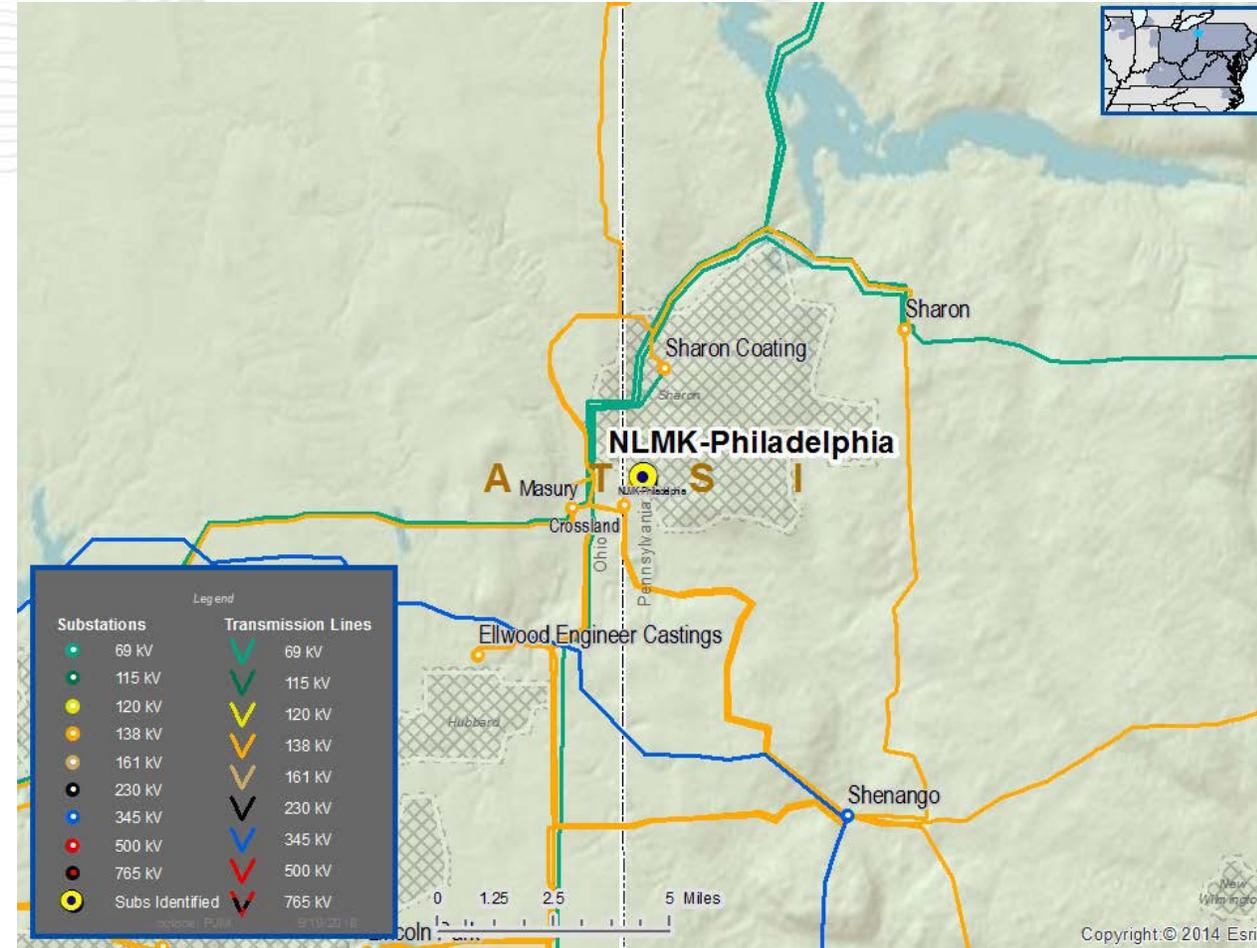
Specific Assumption Reference(s)  
 Add / Expand Bus Configuration

- Substation buses that adversely impact system performance
- Reduce amount of exposed potential local load loss during contingency conditions.

Substation Condition Rebuild / Replacement

- Power Transformers and Load Tap Changers (LTC)
- Circuit Breaker and Other Fault Interrupting Devices

Line Condition Rebuild / Replacement  
 Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.



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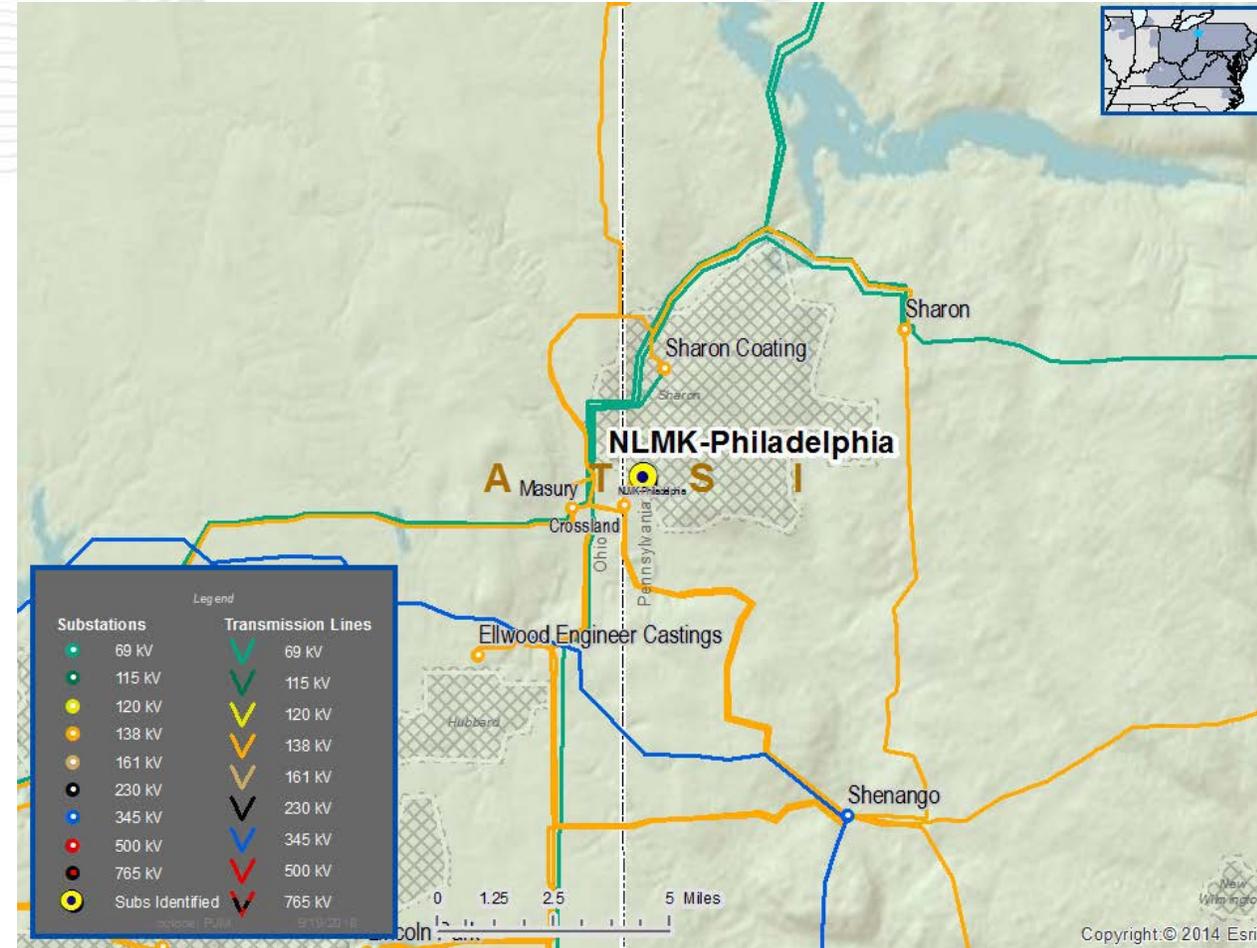
Need Number: ATSI-2018-008 (Continued)  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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### Problem Statement

#### NLMK 69 kV Load At Risk

- Reduce the amount of local load loss under contingency conditions.
  - Loss of Crossland-NLMK 138 kV line
  - Results in loss of approximately 58 MWs of load.
- Or
  - Masury 69 kV bus fault
  - Results in potential local voltage collapse of the Masury 69 kV area
- Equipment Material Condition, Performance and Risk
  - NLMK 69 kV system cable trenches are deteriorated and in need of replacement
  - 69 kV breakers in need of replacement (bus-tie breaker has already failed)
  - NLMK 138/69 kV transformer # 6 and # 12 are aged (> 50 years) and not standard design.
  - Transformer #6 has elevated gas levels.
  - Existing 69 kV transmission line conductor around NLMK is corroded and deteriorated with multiple splice locations.
  - Need to upgrade to current standards



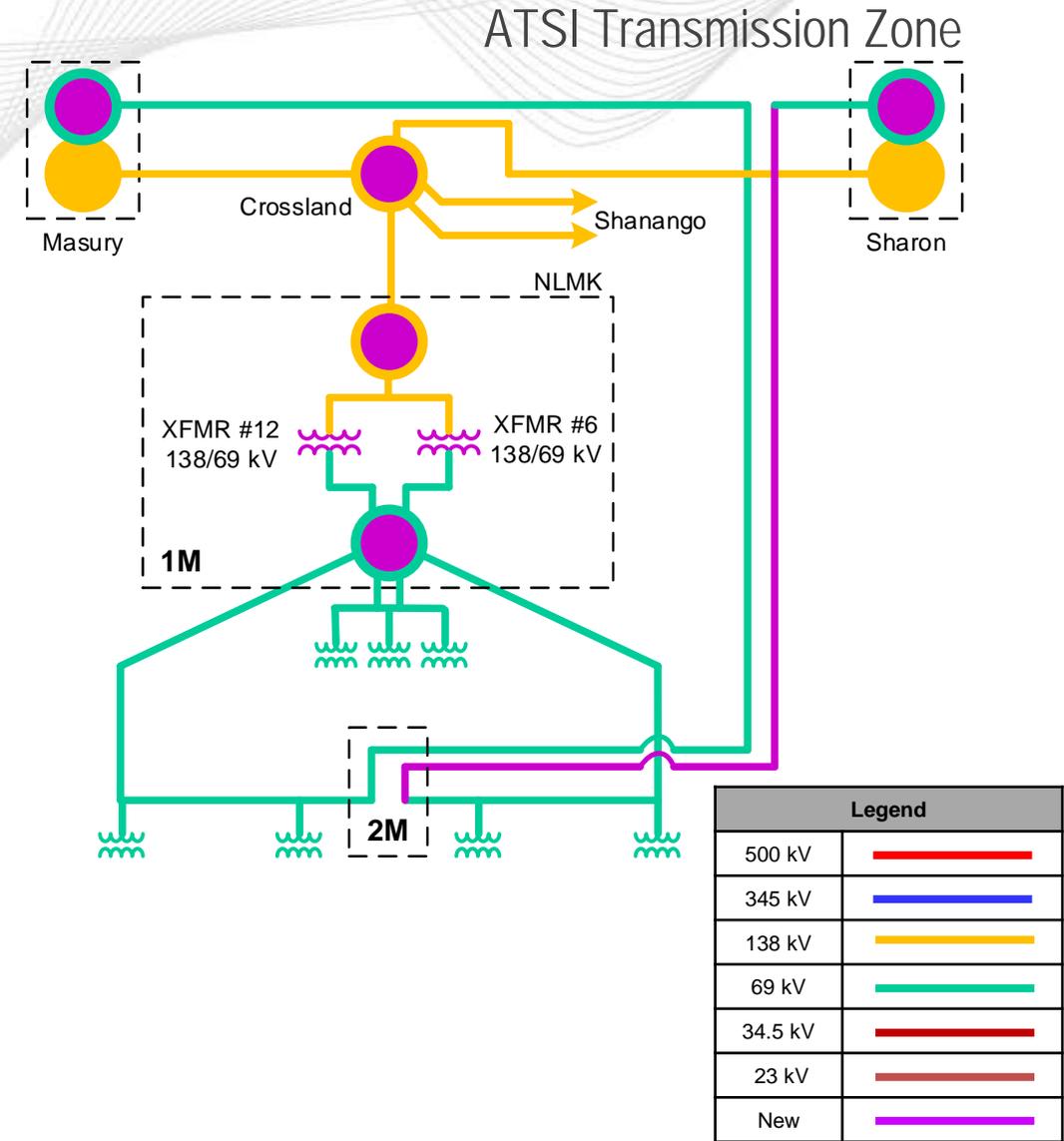


Need Number: ATSI-2018-008 (Continued)

**Proposed Solution:**

**NLMK 138/69 kV Substation Rebuild Project**

- Retire existing NLMK 1M and 2M substations and network the existing NLMK 69 kV system with the Masury-Sharon 69 kV line
- Install a loop structure at the Masury tap and rebuild the segment of line from the tap to the 2M substation as double circuit 336 ACSR (0.8 miles)
- Replace existing NLMK 138/69 kV 1M substation with new a 138/69 kV substation
  - 3-138 kV breakers in a straight bus configuration (1-Line and 2-transformer breakers)
  - 2-138/69 kV transformers (134 MVA)
  - Six (6) breaker 69 kV ring bus
  - New control building
- Re-configure existing 69 kV lines around NLMK
  - Masury-NLMK 69 kV Line: 57 MVA SN / 73 MVA SE
  - Sharon-NLMK 69 kV Line: 57 MVA SN / 73 MVA SE
- Install revenue metering
- Add a 138 kV breaker at Crossland for the Crossland-NLMK 138 kV Line
- Upgrade 69 kV relays at Masury and Sharon substations





Need Number: ATSI-2018-008 (Continued)

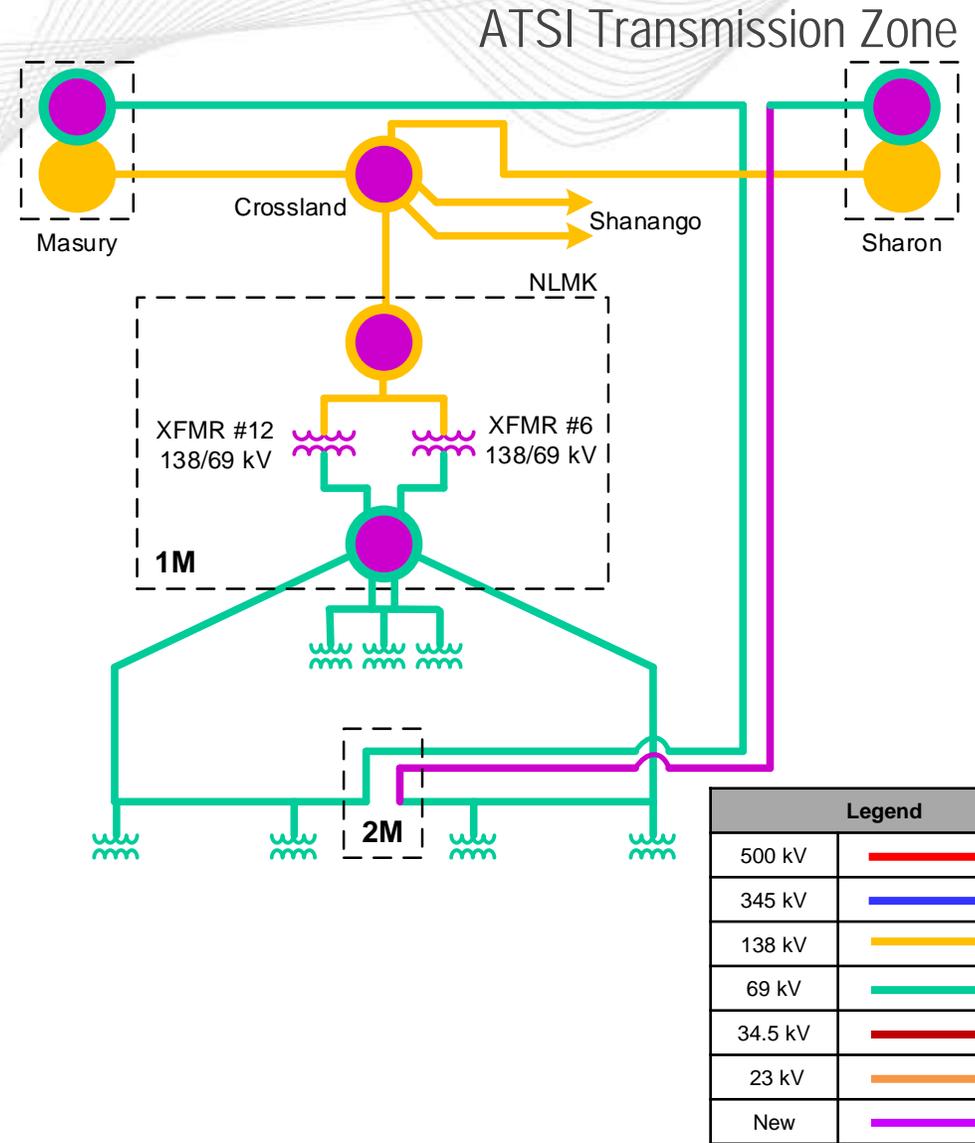
**Alternatives Considered:**

Convert Masury 69 kV into breaker-and-a-half configuration and replace two (2) 138/69 kV transformers, seven (7) 69 kV breakers at NLMK 1M substation, and all substation control cable at NLMK 1M substation

Estimated Project Cost: \$30.0M

Projected IS Date: 12/31/2021

Status: Conceptual



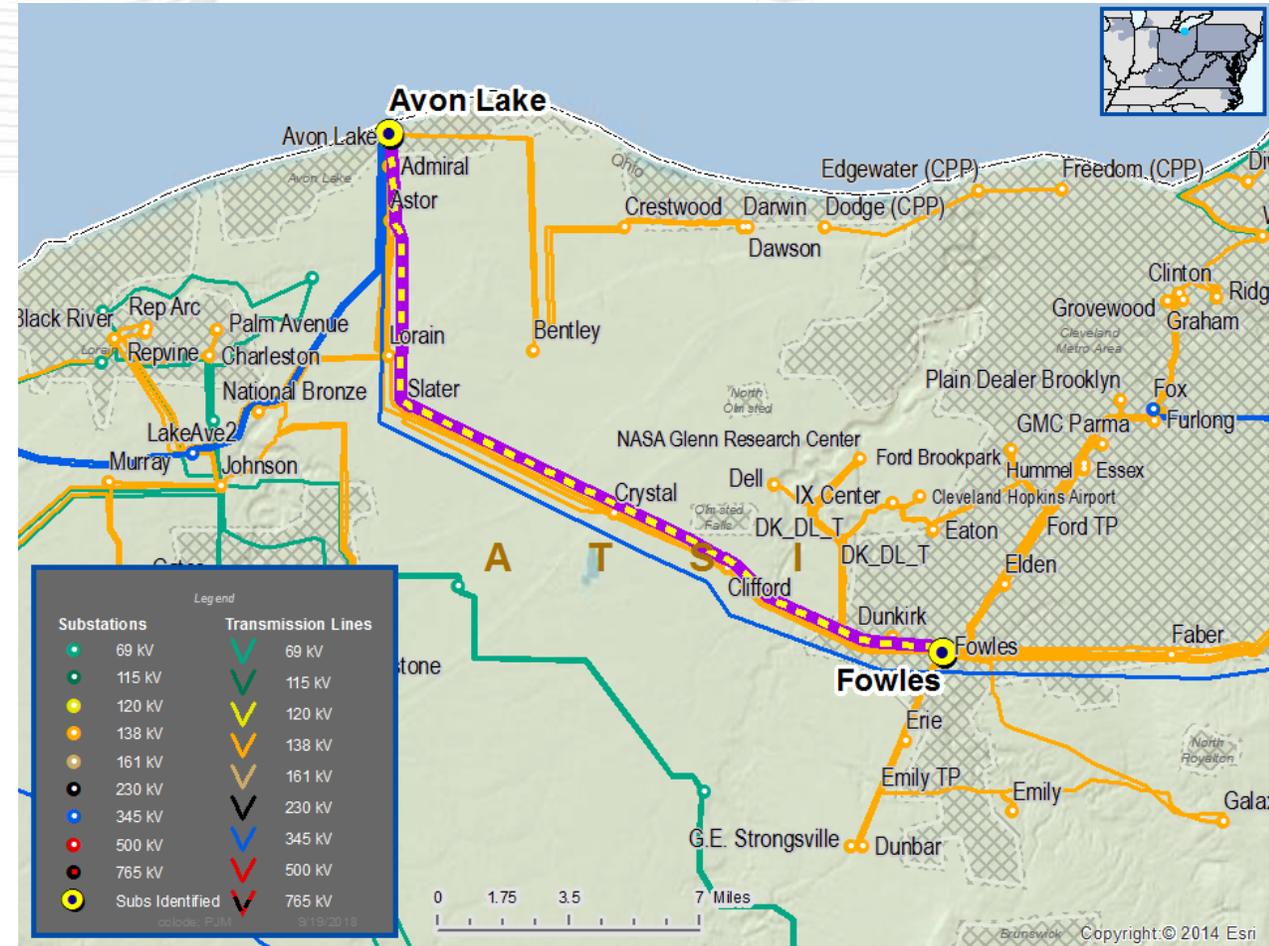
Need Number: ATSI-2018-009  
 Process Stage: Solution Meeting  
 Need Present: 9/28/2018

Project Driver(s):  
*Operational Flexibility and Efficiency*

Specific Assumption Reference(s)  
 Add / Expand Bus Configuration

- Reduce amount of exposed potential local load loss during contingency conditions.
- Build New Transmission Line**
- Improve system reliability under contingency conditions.
  - Reduce the amount of potential local load loss during contingency conditions.

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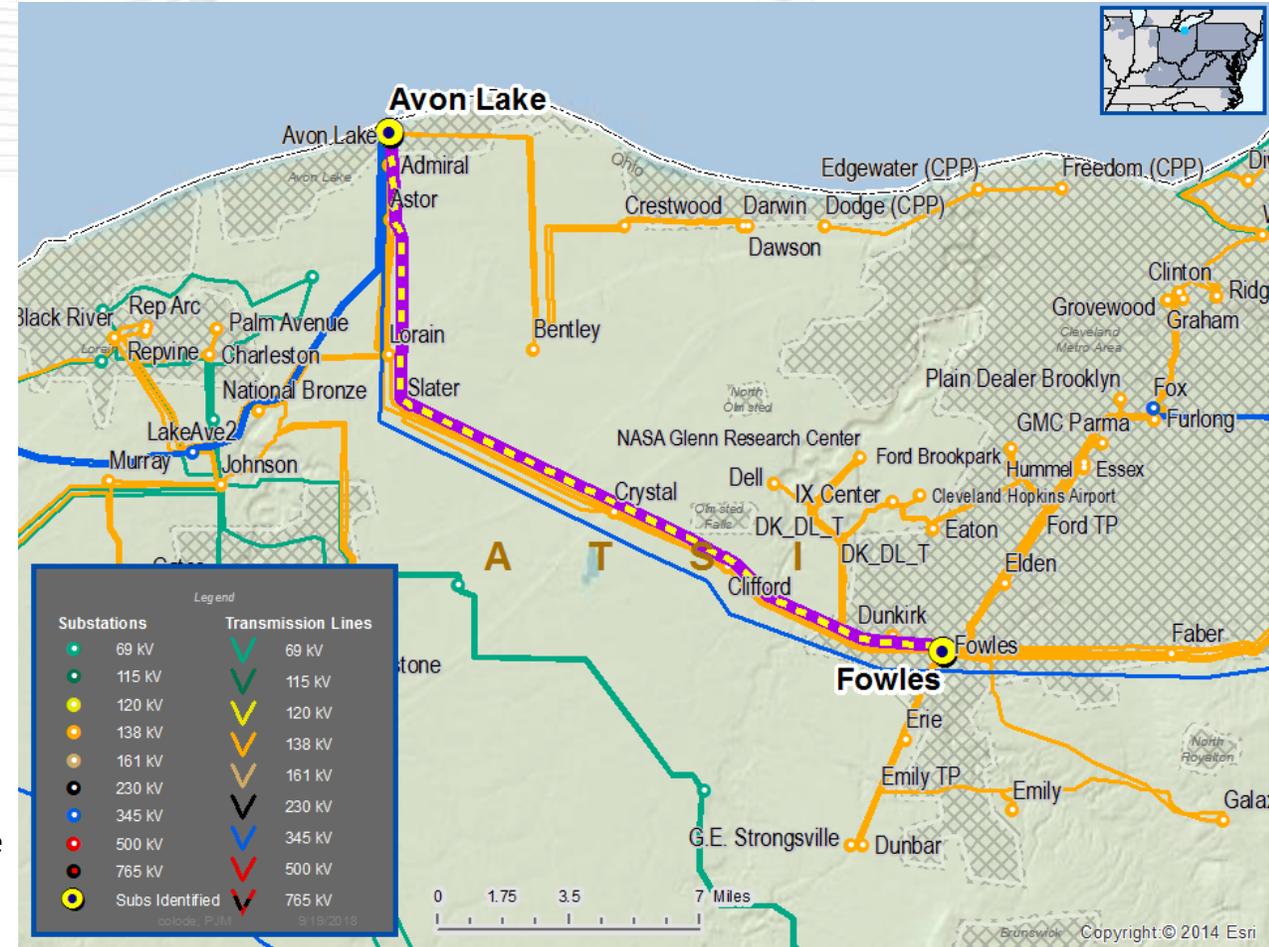
Need Number: ATSI-2018-009 (Continued)  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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### Problem Statement

#### Avon-Fowles 138 kV Q1 and Q3 Line Load at Risk

- Reduce the amount of local load loss at risk and mitigate non-planning criteria voltage concerns on the > 100 kV system under contingency conditions.
  - Loss of Avon-Fowles Q1 138kV line (“B\_LINE1\_NR\_006”) and path-end outage of the Avon-Fowles Q3 138 line.
  - Results in the potential loss of approximately 60 MWs and 14,000 customers.
  - Results in the potential low voltage (0.91 p.u.) at Dawson 138kV Substation
- Or
- Common tower outage Avon-Fowles Q1 138kV line and the Avon-Fowles Q3 138 line (“C5-TWL-NR005”).
- Results in the consequential load loss of approximately 237 MWs and 68,200 customers.



Proposed Solution:

Avon-Clinton Install 138kV Double Circuit Corridor

- Construct double circuit lines (~ 12 miles) from Dawson to Clinton with 795 ACSR conductor; utilize existing lines that are build for future 138kV expansion for part of the new double circuit. New conductor rating is 278 MVA SN / 339 MVA SE
- Expand Dawson substation to a 6-breaker ring bus.
  - Avon-Dawson #1 and Avon-Dawson #2 138 kV Lines
  - Dawson-New Clinton Substation # 1 and Dawson-New Clinton Substation #2 138kV lines.
  - Connect 2 – 138 / 36 kV load transformers
- Build a new substation near Clinton substation to convert Clinton to a breaker and half bus scheme, and incorporate the new Avon-Clinton 138 kV lines into the scheme. The breaker and half scheme will have 4 strings (12 breakers total).
- Create two new line exits at Avon to incorporate the new Clinton lines.
- Rearrange Grovewood taps to eliminate common tower contingency issues by tapping one transformer to the new Avon-Clinton 138 kV line.

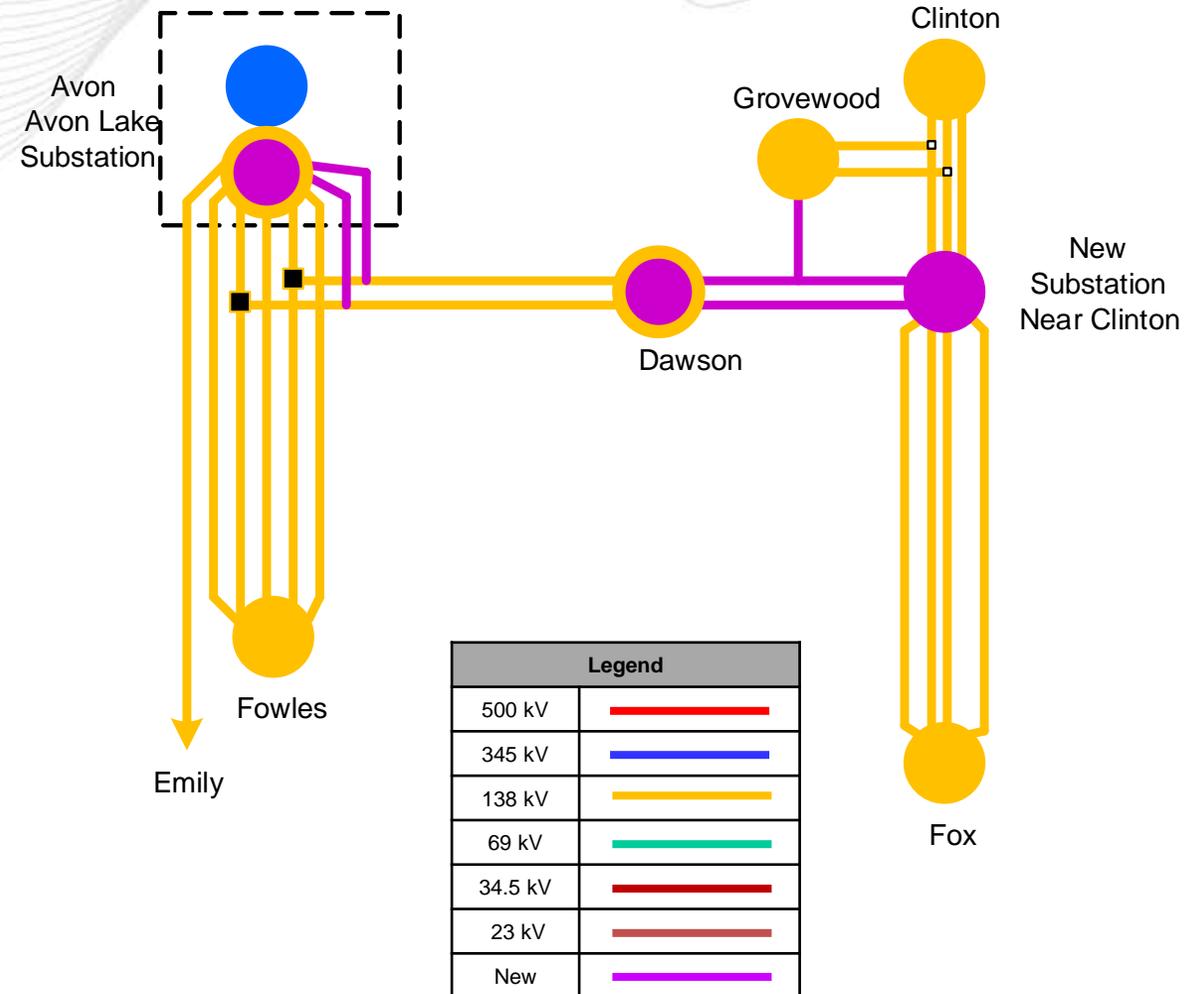
Alternatives Considered:

- Create two new line exits at Avon for dedicated 138kV radial lines to feed Dawson.

Estimated Project Cost: \$57.1M

Projected IS Date: 12/31/2022

Status: Conceptual



Need Number: ATSI-2018-010  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

Network Radial Transmission Line

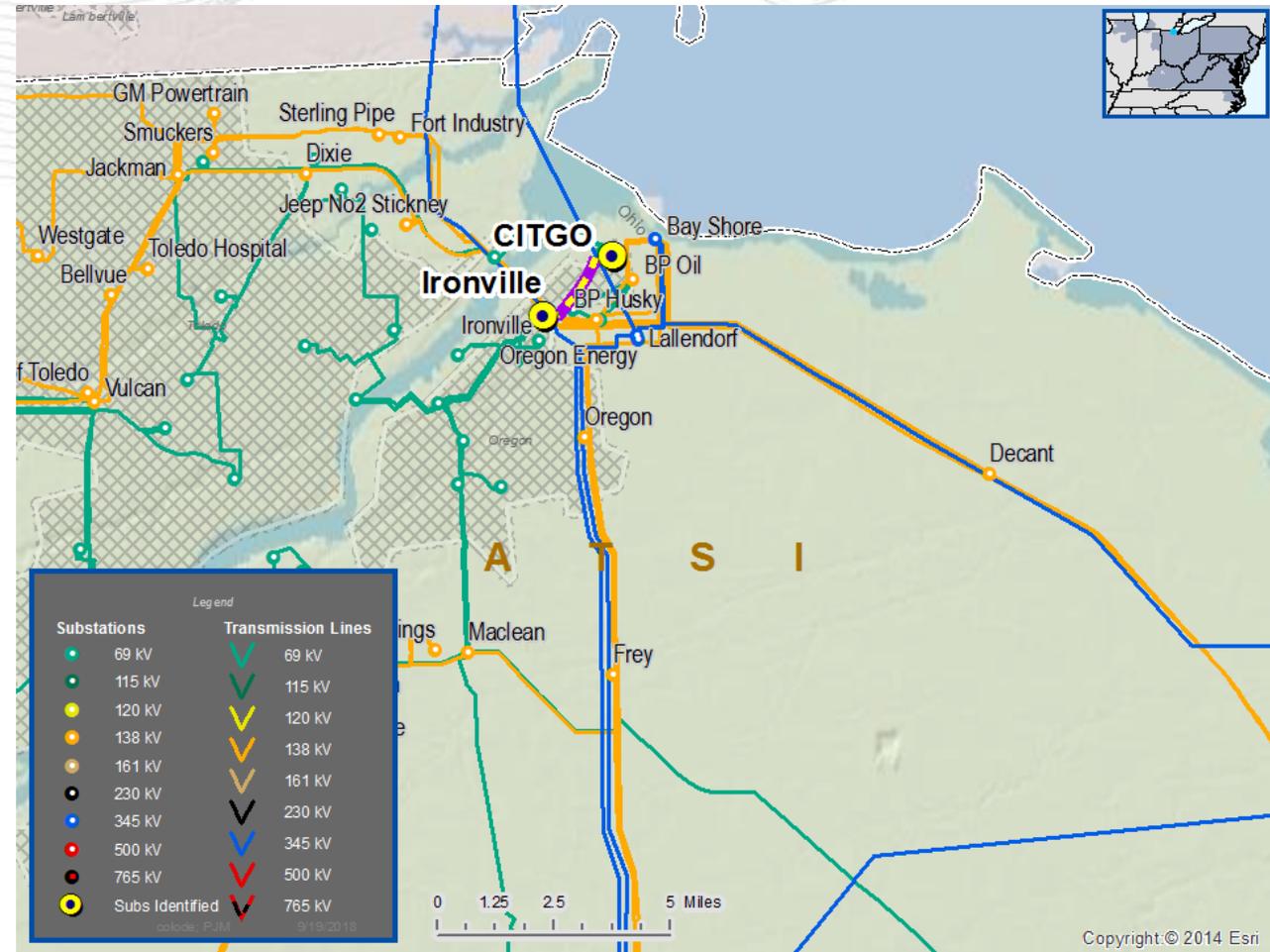
- Radial lines that serve multiple delivery points.

Problem Statement

Ironville-Citgo 69 kV Condition Assessment (Approximately 4 miles)

Line Condition Rebuild / Replacement

- Identified obsolete and deteriorated equipment.
  - 60-68 year old construction; poor inspection results, 89 % rejection rate.
  - Approximately 2 repair records over the past 5 years.
- Multiple transmission delivery points (3) impacted; back-up source to (4) transmission delivery points.





Need Number: ATSI-2018-010

Proposed Solution:

Ironville – Citgo 69 kV Line Rebuild

- Rebuild/reconductor existing radial Ironville – Citgo 69 kV Line with 477 ACSR and replace line switches A6648, A6791, A6792, A6793, and A6647.
- Existing conductor is 336 ACSR.
  
- Existing line rating: 79 MVA SN / 95 MVA SE
- New line rating: 100 MVA SN / 120 MVA SE

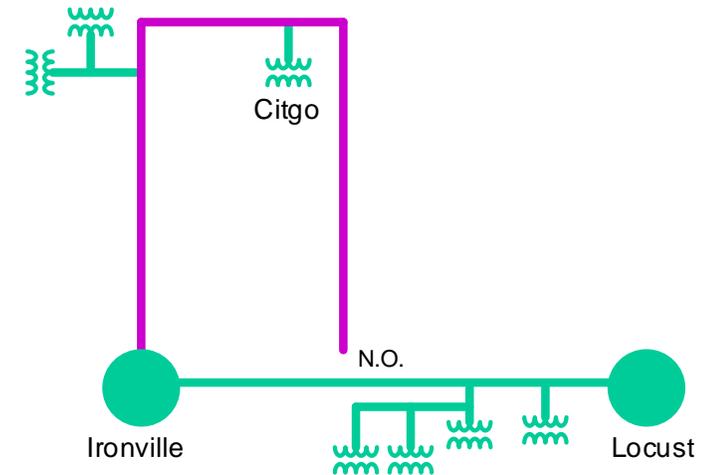
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$4.2M

Projected IS Date: 12/31/2020

Status: Engineering



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



# ATSI Transmission Zone

Need Number: ATSI-2018-011  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

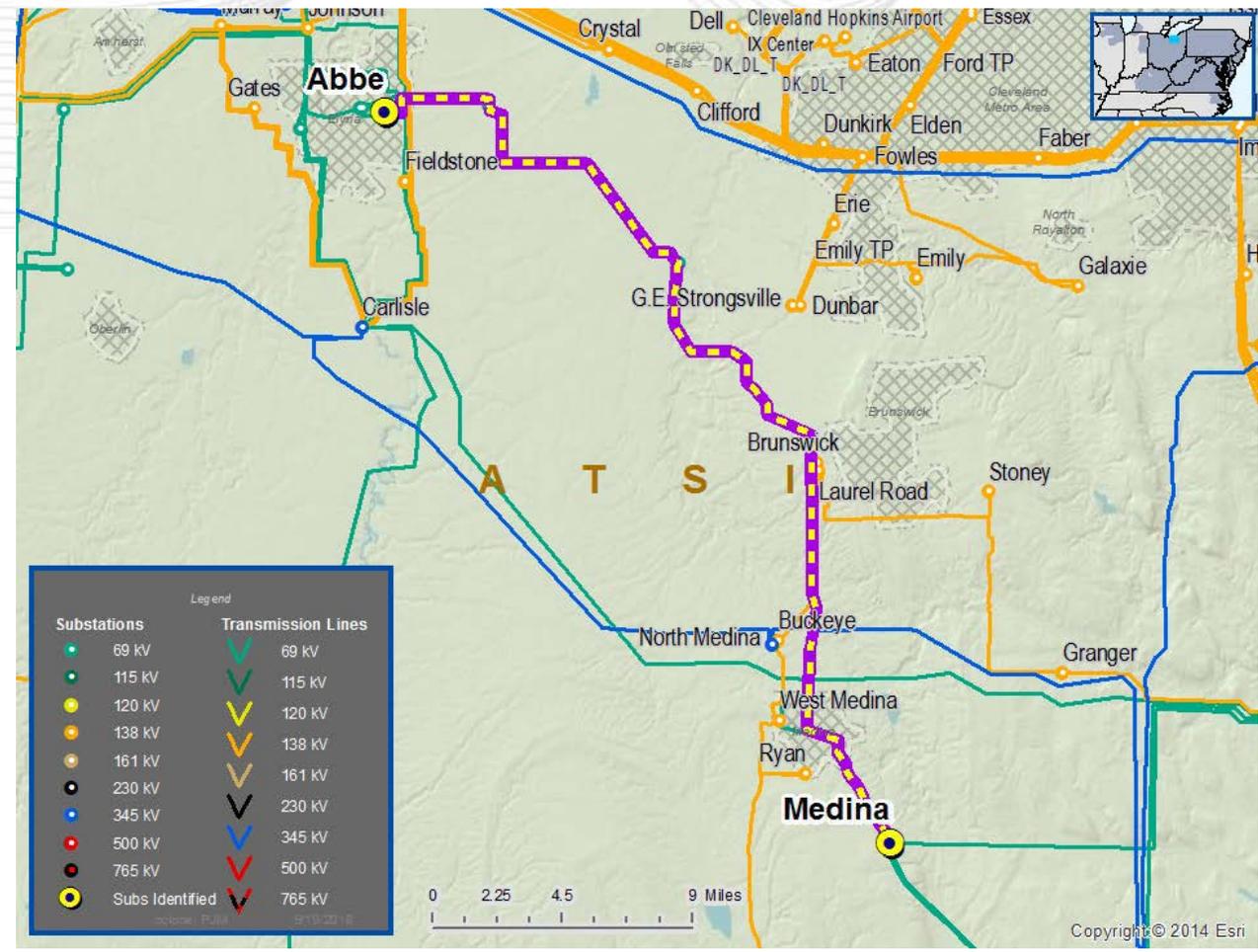
Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

- Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.
- Aged or deteriorated wood pole transmission line structures.
  - Negatively impact customer outage frequency and/or durations.
  - Demonstrate an increasing trend in maintenance findings and/or costs

### Problem Statement

#### Abbe-Medina 69 kV Condition Assessment (Approx. 30 miles)

- Identified obsolete and deteriorated equipment.
  - 62 year old construction; poor inspection results.
  - Negative outage history over past 5 years.
  - Approximately 17 repair records over the past 5 years; increasing trend .
- Multiple transmission delivery points (8) impacted.
- Need to upgrade to current standards





Need Number: ATSI-2018-011

**Proposed Solution:**

**Abbe-Medina 69 kV Line Rebuild**

- Rebuild/reconductor the existing Abbe-Medina 69 kV line with 477 ACSR; existing conductor is mixed with 477 ACSR, 336 ACSR, 1/0 CU, and 3/0 ACSR conductors.

*Abbe 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor and disconnect switch

*Columbia 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor and disconnect switches

*Medina 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor and breaker B1 bypass and disconnect switch

- Existing line rating: 45 MVA SN / 46 MVA SE
- New line rating: 100 MVA SN / 121 MVA SE

- Rebuild/reconductor approximately 1 mile existing Medina Industries 69 kV line using 477 ACSR; shared structure with Abbe-Medina 69 kV Line for ~1 mile; existing conductor is mixed 1/0 CU and 3/0 ACSR.
- Line portion from Shawville-Columbia (~ 7.5 miles) was rebuilt in 2014 and will not be included in this rebuild.

**Alternatives Considered:**

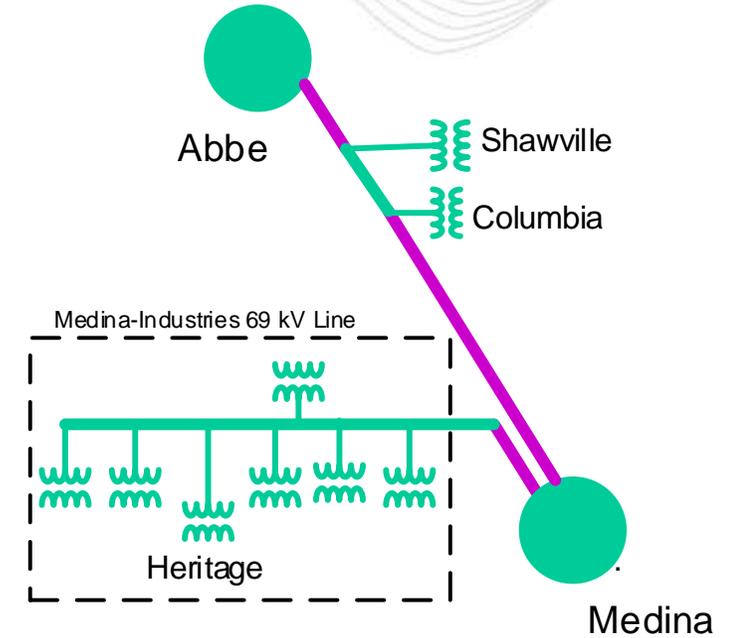
- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$20.9 M

Projected IS Date: 12/31/2019

Status: Engineering

ATSI Transmission Zone



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

Need Number: ATSI-2018-012  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

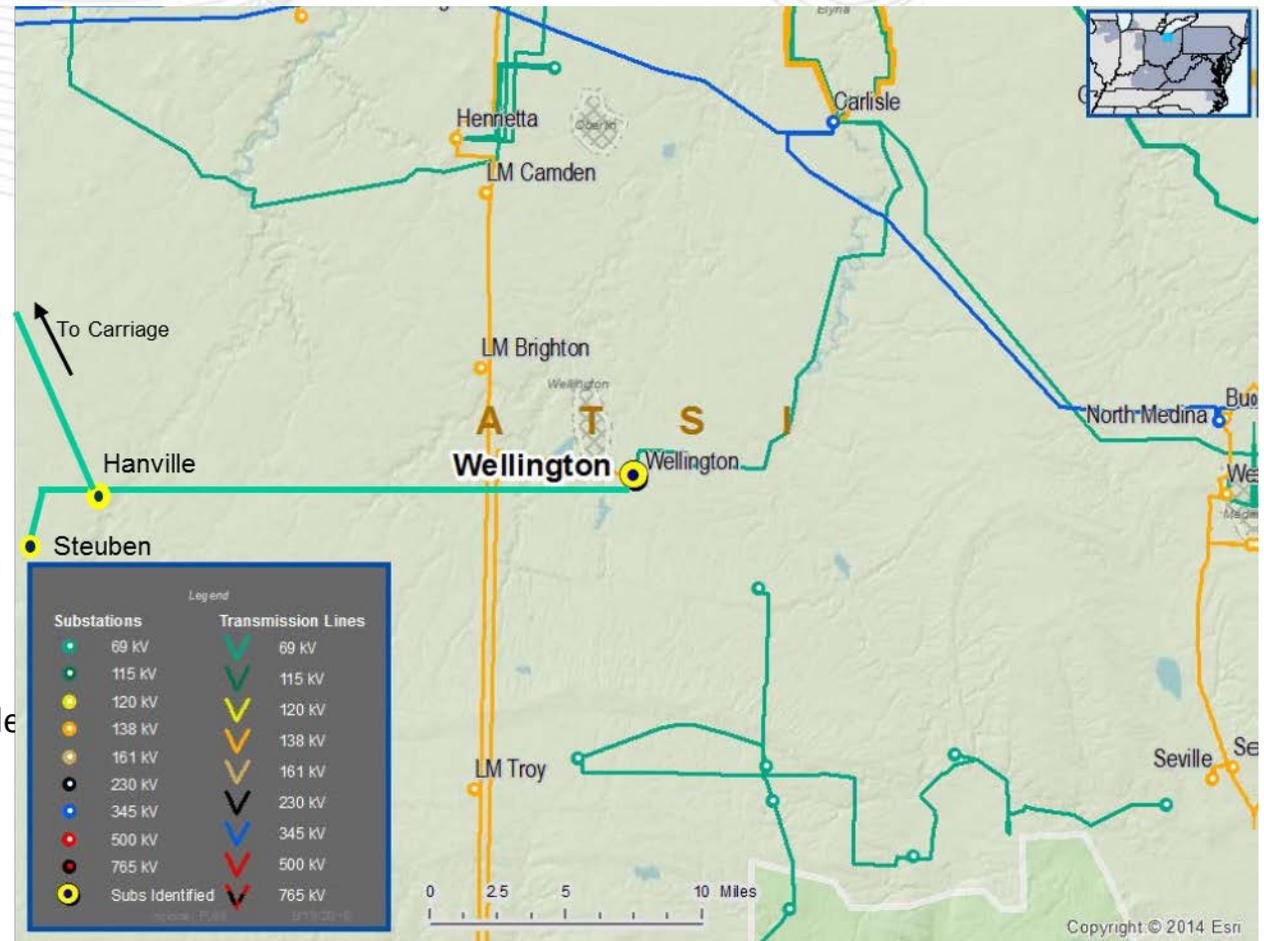
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

Problem Statement

Wellington-Hanville-Steuben 69 kV Condition Assessment (Approx. 33 miles)

- Identified obsolete and deteriorated equipment.
  - 50 to 56 year old construction; poor inspection results.
  - Negative outage history over past 5 years;
  - Previous radial line (now networked) with 5 distribution delivery points.
  - Approximately 13 repair records over the past 5 years; increasing trend.
- Multiple transmission delivery points (5) impacted.
- Need to upgrade to current standards



Note: Added general location of the Wellington-Hanville Line to PJM map



Need Number: ATSI-2018-012

**Proposed Solution:**

**Hanville-Wellington-Stueben 69 kV Line**

- Rebuild/reconductor ~26 miles of the existing Hanville-Wellington 69 kV Line with 477 ACSR (existing conductor 336 ACSR and 3/0 ACSR)

*Wellington 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor and disconnect switches
- Existing line rating: 33 MVA SN / 33 MVA SE
- New line rating: 100 MVA SN / 121 MVA SE

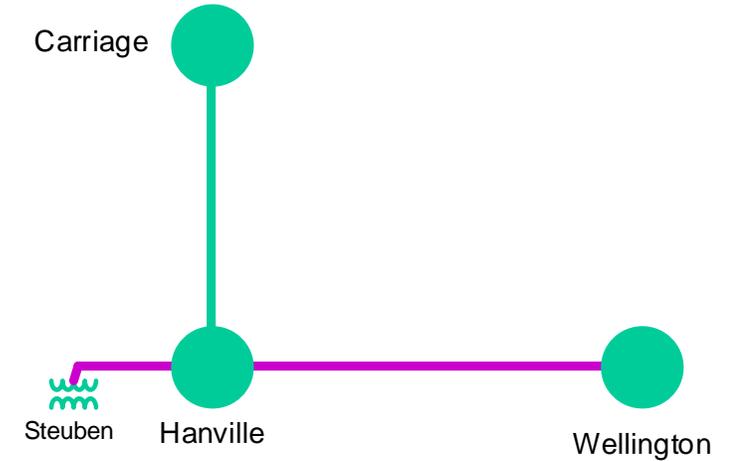
**Alternatives Considered:**

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$27.8 M

Projected IS Date: 12/31/2021

Status: Engineering



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

Need Number: ATSI-2018-013  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

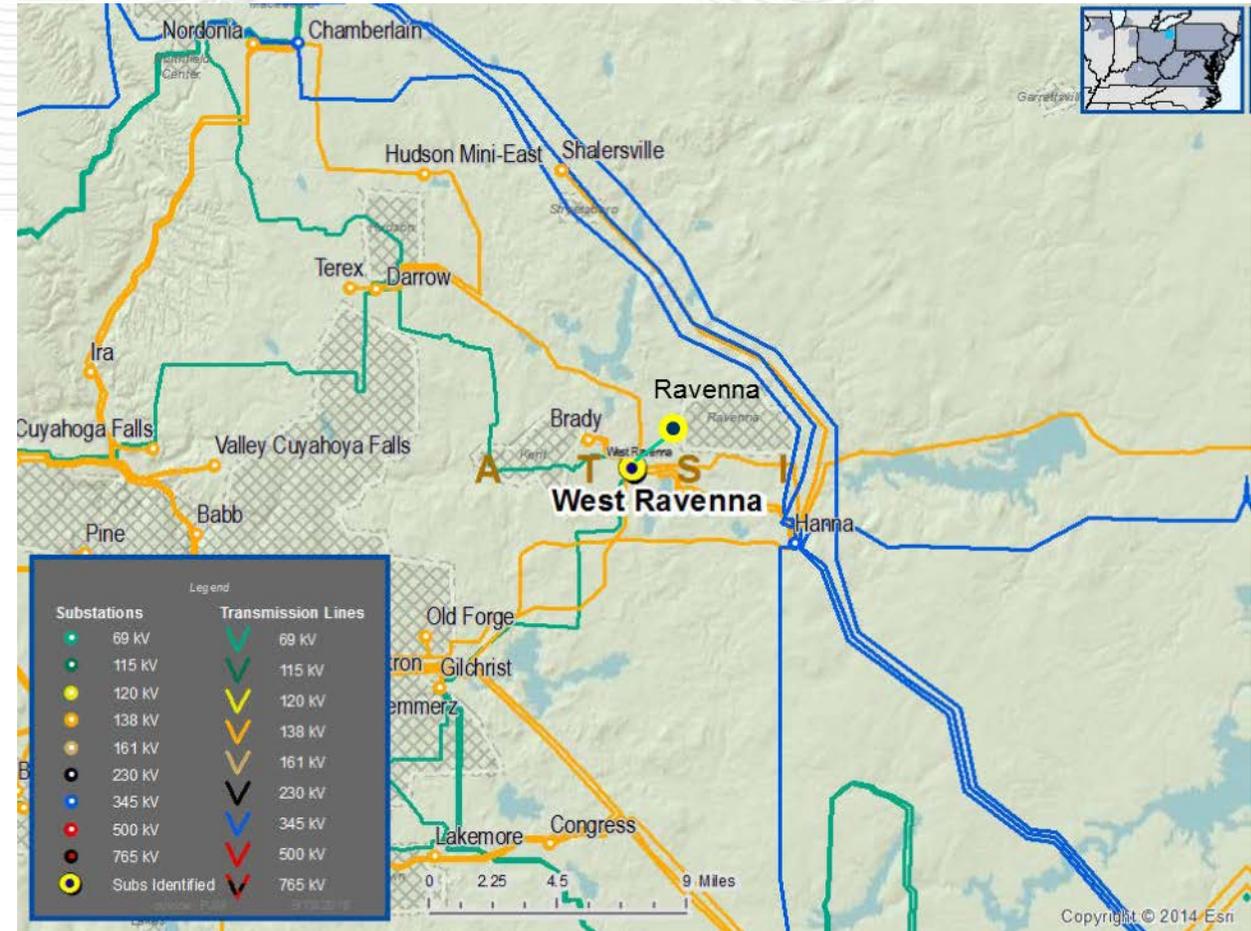
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

### Problem Statement

Ravenna-West Ravenna #1 69 kV Condition Assessment (Approx. 4 miles)

- Identified obsolete and deteriorated equipment.
  - 50 year old construction; poor inspection results, 94 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 21 repair records over the past 5 years; increasing trend.
- Need to upgrade to current standards



Note: Added general location of the Ravenna-West Ravenna line to PJM map



Need Number: ATSI-2018-013

Proposed Solution:

Ravenna-West Ravenna #1 69 kV Line

- Rehab existing ~4.1 miles of the Ravenna-West Ravenna #1 69 kV Line (Existing 605 ACSR conductor not changing)

*Ravenna 69 kV Substation – Terminal equipment to be replaced includes:*

- Disconnect switches and transfer switches (due to condition)
- Existing line rating: 82 MVA SN / 103 MVA SE
- New line rating: 100 MVA SN /121 MVA SE

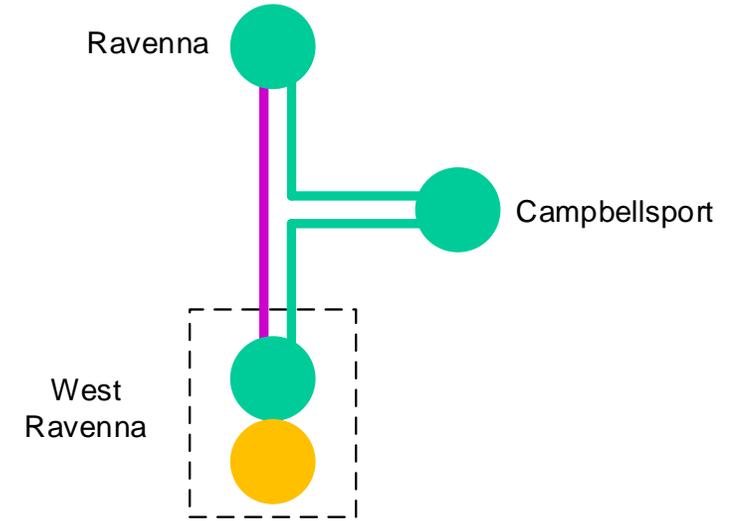
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$3.4 M

Projected IS Date: 12/31/2020

Status: Conceptual



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

Need Number: ATSI-2018-014  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

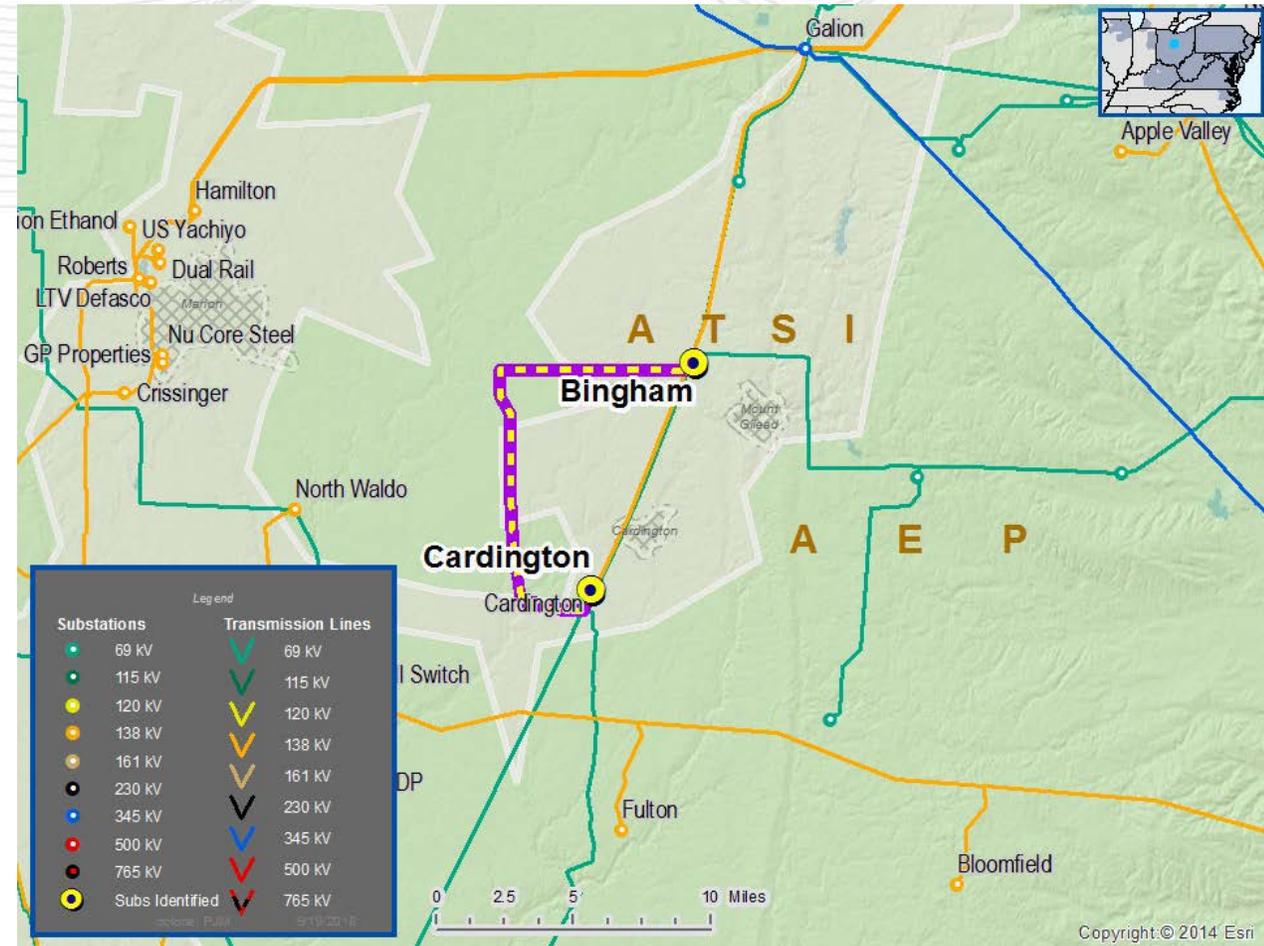
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

### Problem Statement

#### Bingham-Cardington (Schaff) 69 kV Condition Assessment (Approx. 15 miles)

- Identified obsolete and deteriorated equipment.
  - 45-62 year old construction; poor inspection results, 92 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 10 repair records over the past 5 years; increasing trend.
- Need to upgrade to current standards



Need Number: ATSI-2018-014

Proposed Solution:

**Bingham-Cardington (Schaff) 69 kV Line**

- Rebuild/reconductor ~15 miles of the existing Bingham-Cardington (Schaff) 69 kV Line with 477 ACSR (existing conductor 3/0 ACSR)

*Schaff 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor and disconnect switch
- Existing line rating: 45 MVA SN / 54 MVA SE
- New line rating: 100 MVA SN / 121 MVA SE

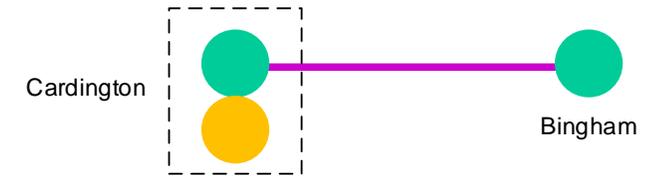
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$13.3 M

Projected IS Date: 6/1/2020

Status: Engineering



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

Need Number: ATSI-2018-015  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

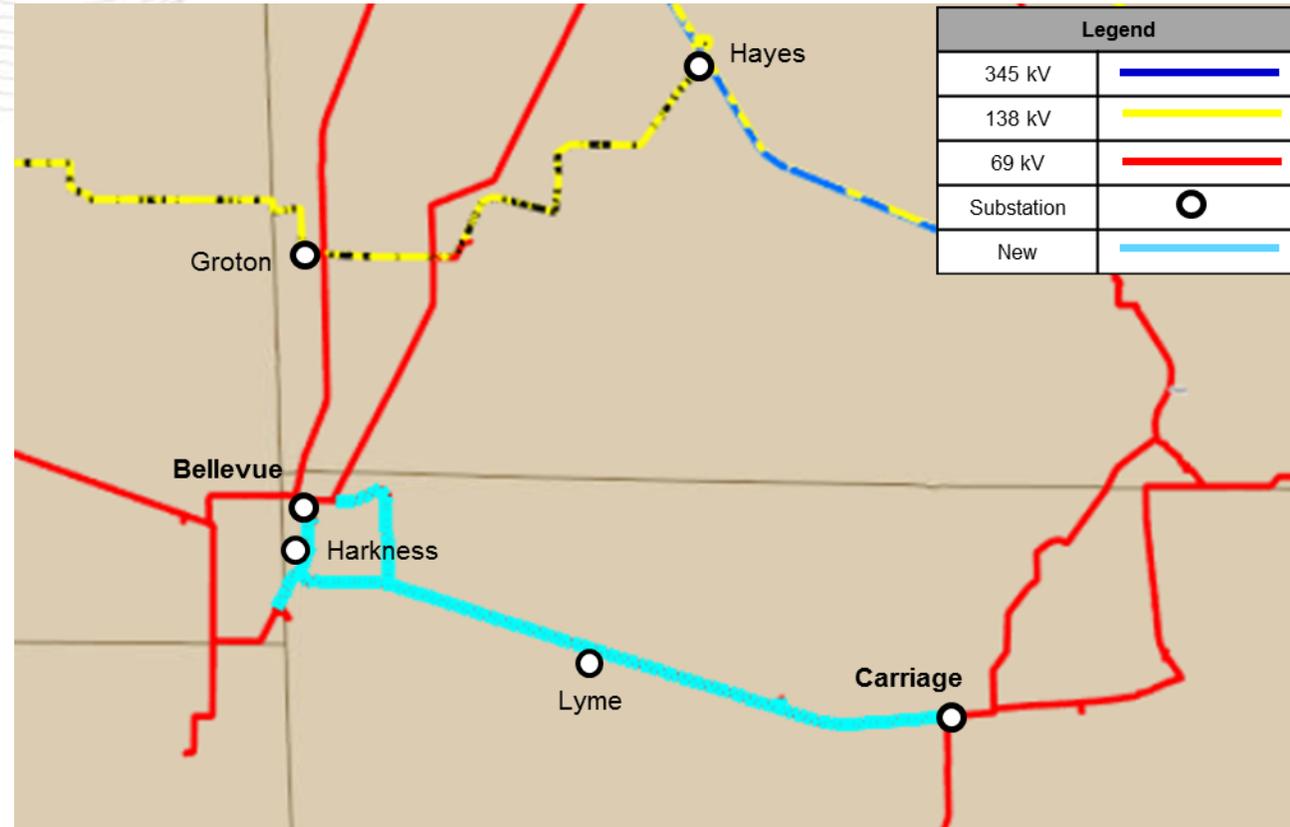
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

### Problem Statement

#### Bellevue-Carriage 69 kV Condition Assessment (Approximately 13 miles)

- Identified obsolete and deteriorated equipment.
  - 48 year old construction; poor inspection results, 62 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 9 repair records over the past 5 years; increasing trend.
  - Sections of older 3/0 CU conductor.
- Multiple transmission delivery points (7) impacted.
- Need to upgrade to current standards

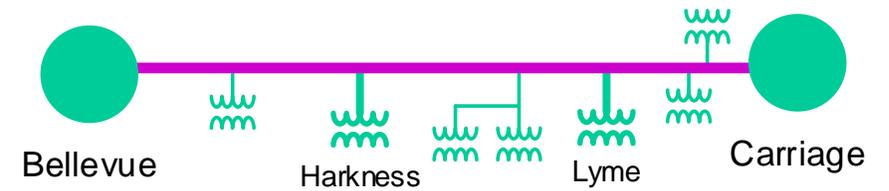


Need Number: ATSI-2018-015

Proposed Solution:

**Bellevue-Carriage 69 kV Line**

- Rebuild/reconductor ~9.7 miles of the existing Bellevue-Carriage 69 kV Line with 336 ACSR (existing conductor 3/0 ACSR, 336 ACSR and 4/0 CU); replace existing line switches at Harkness (A50 & A51) and Lyme (A1 & A2) substations.
- Existing line rating: 45 MVA SN / 54 MVA SE
- New line rating: 76 MVA SN / 92 MVA SE



Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$13.8 M

Projected IS Date: 6/1/2020

Status: Engineering

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

Need Number: ATSI-2018-016  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

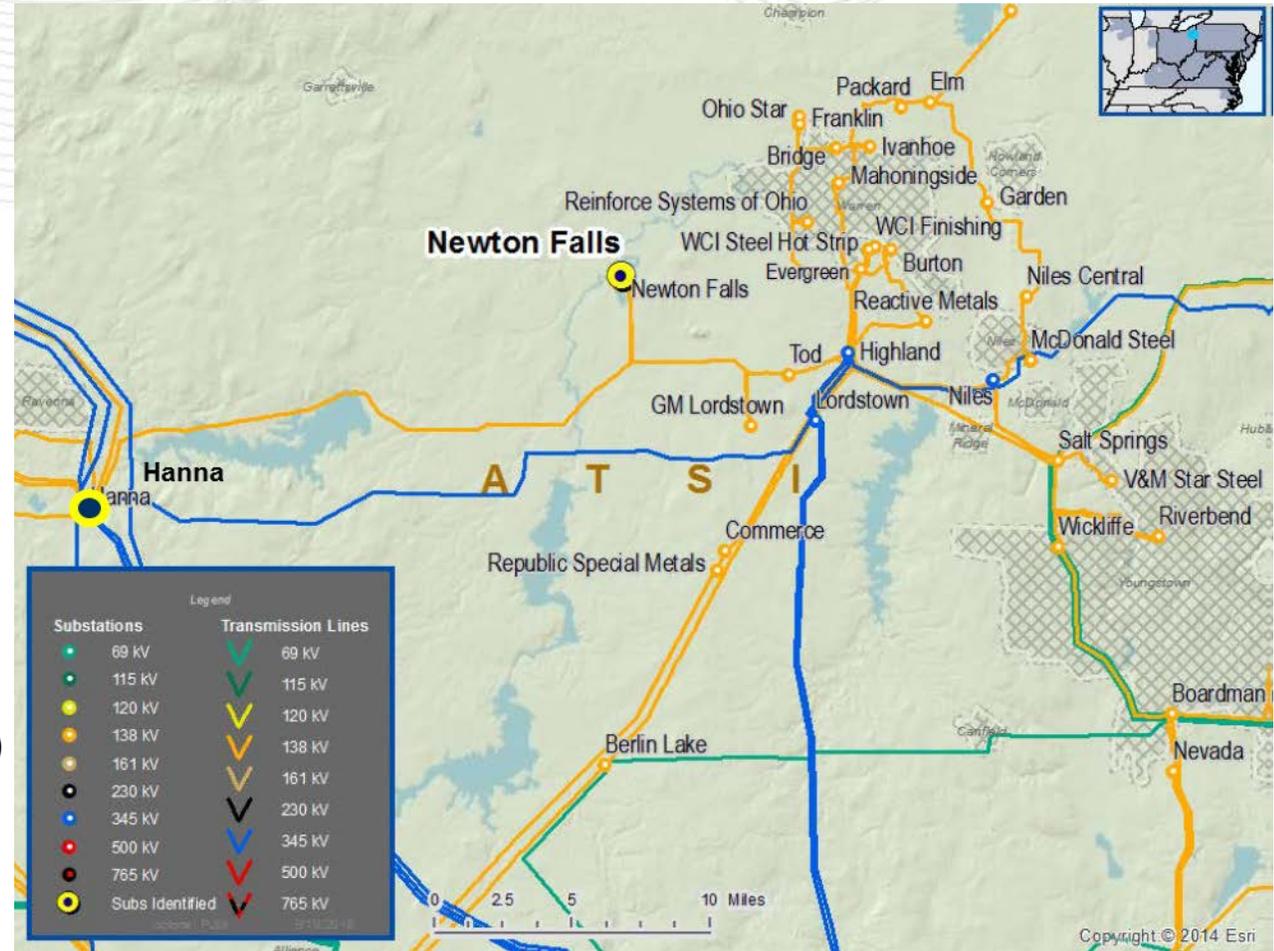
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

## Problem Statement

Hanna-Newton Falls 138 kV Condition Assessment (Approximately 20 miles)

- Identified obsolete and deteriorated equipment.
  - 62 year old construction; poor inspection results, 87 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 45 repair records over the past 5 years; increasing trend.
- Need to upgrade to current standards



Need Number: ATSI-2018-016

Proposed Solution:

**Hanna-Newton Falls 138 kV Line**

- Rebuild/reconductor ~20 miles of the existing Hanna-Newton Falls 138 kV Line with 795 ACSR (existing conductor 477 ACSR and 605 ACSR)

*Hanna 138 kV Substation – Terminal equipment to be replaced includes:*

- Circuit breaker B4, CCVT's, disconnect switches, line relaying, and line metering

*Newton Falls 138 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor, disconnect switches, and line relaying

- Existing line rating: 169 MVA SN / 208 MVA SE
- New line rating: 275 MVA SN / 333 MVA SE

Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$29.2 M

Projected IS Date: 6/1/2021

Status: Engineering



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

Need Number: ATSI-2018-017  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

Project Driver(s):  
*Equipment Material Condition, Performance and Risk  
 Operational Flexibility and Efficiency*

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

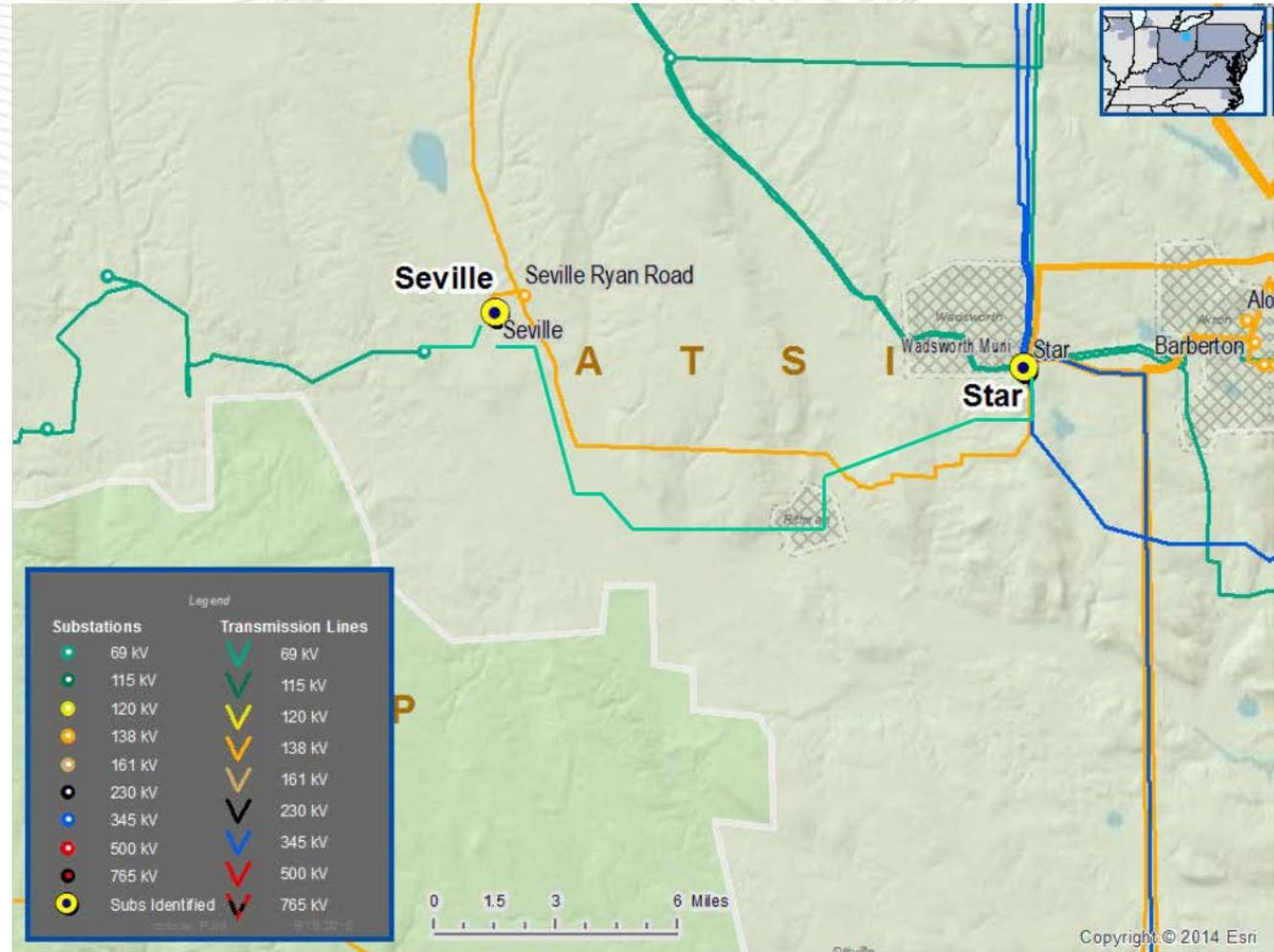
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

Network Radial Transmission Line

- Radial lines that serve multiple delivery points.

CONTINUED NEXT SLIDE...



NOTE: Added general location of the Star-Seville (Rittman) 69kV to PJM Map

Need Number: ATSI-2018-017 (Continued)  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

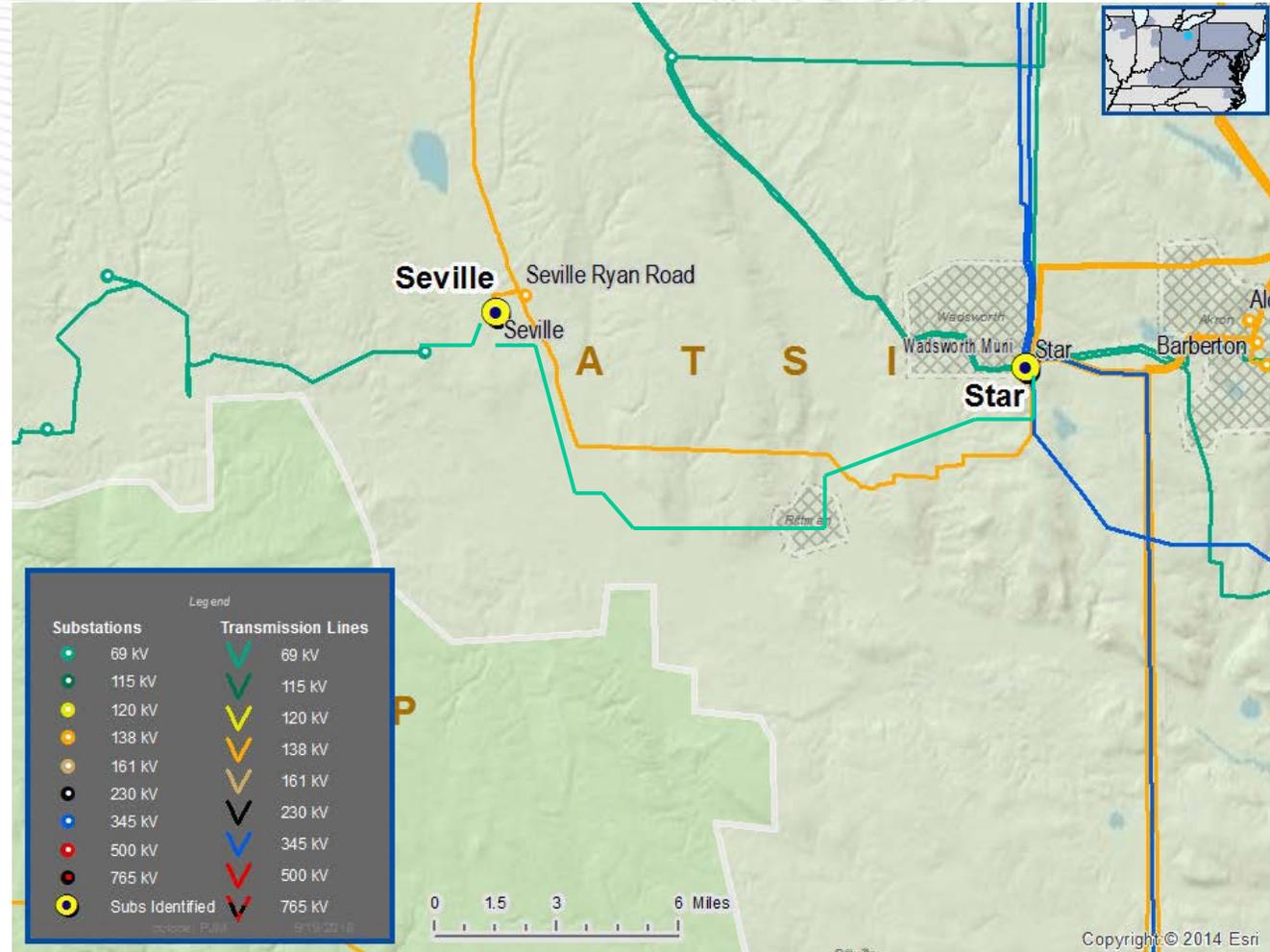
Project Driver(s):  
*Equipment Material Condition, Performance and Risk*  
*Operational Flexibility and Efficiency*

CONTINUED FROM PREVIOUS SLIDE...

### Problem Statement

Star-Seville (Rittman) 69 kV Condition Assessment (Approximately 18 miles)

- Identified obsolete and deteriorated equipment.
  - 56 year old construction; poor inspection results, 82 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 30 repair records over the past 5 years; increasing trend.
- Multiple transmission delivery points (3) impacted.
- Radial 69 kV transmission line with approximately 30 MWs and approximately 7,700 customer at risk.



NOTE: Added general location of the Star-Seville (Rittman) 69kV to PJM Map

Need Number: ATSI-2018-017

**Proposed Solution:**

**Star-Seville (Rittman ) 69 kV Line**

- Rebuild/reconductor approximately 18 miles of the existing Star-Seville (Rittman) 69 kV Line with 336 ACSR (existing conductor 1/0 CU and 3/0 ACSR)

*Rittman 69 kV Substation – Terminal equipment to be replaced includes:*

- Spark gap arresters, substation conductor, and disconnect switch

*Star 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor

- Existing line rating: 44 MVA SN / 45 MVA SE
- New line rating: 76 MVA SN / 92 MVA SE

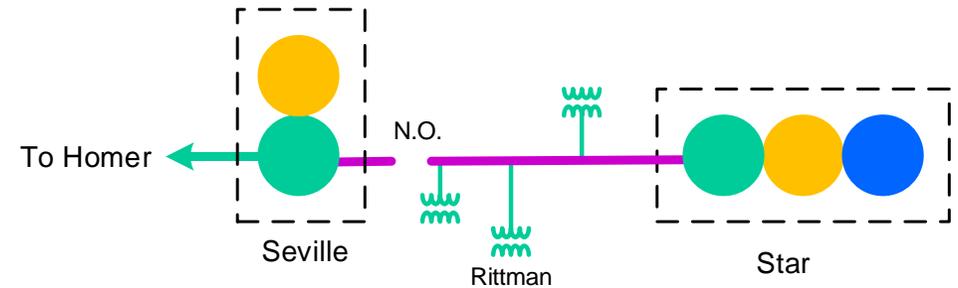
**Alternatives Considered:**

- Maintain existing condition and elevated risk of failure.

Estimated Project Cost: \$18.6 M

Projected IS Date: 12/31/2021

Status: Conceptual



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



Need Number: ATSI-2018-018  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

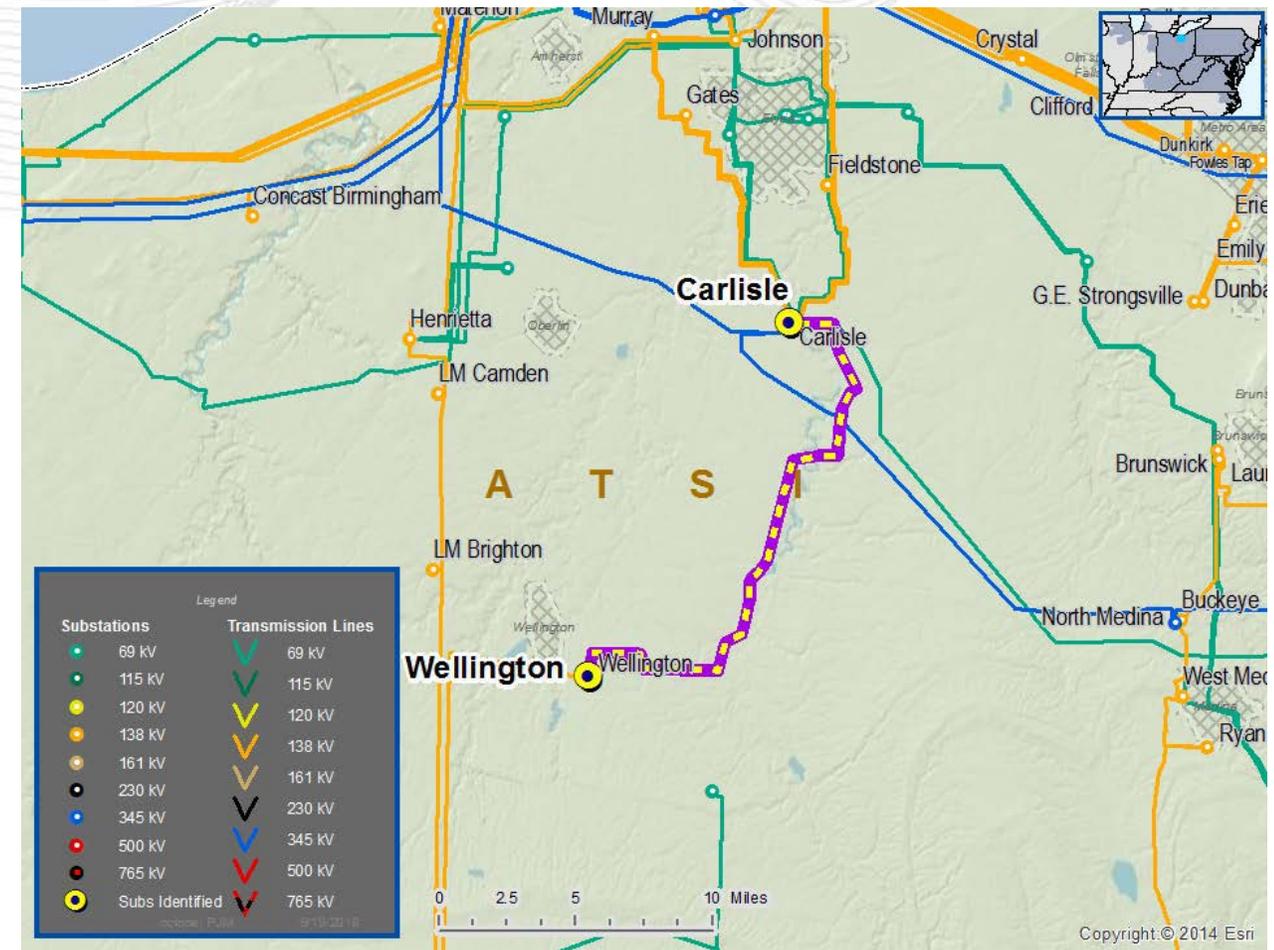
- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

**Problem Statement**

**Carlisle-Wellington 69 kV Condition Assessment (Approximately 29 miles)**

- Identified obsolete and deteriorated equipment.
  - 50-75 year old construction; poor inspection results, 75 % rejection rate.
  - Negative outage history over past 5 years;
  - Approximately 29 repair records over the past 5 years; increasing trend.
- Multiple transmission delivery points (9) impacted.

ATSI Transmission Zone



Need Number: ATSI-2018-018

Proposed Solution:

**Carlisle-Wellington 69 kV Line**

- Rebuild/reconductor ~29 miles of the existing Carlisle-Wellington 69 kV Line with 477 ACSR (existing conductor 605 ACSR and 336 ACSR)
- Replace line switches A-37, A-48, A-49, A-50, and A-70

*Wellington 69 kV Substation – Terminal equipment to be replaced includes:*

- Circuit breaker B34 and relays and controls
- Existing line rating: 76 MVA SN / 92 MVA SE
- New line rating: 100 MVA SN / 121 MVA SE

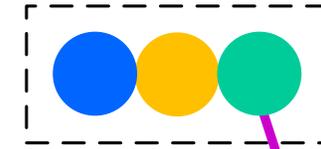
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

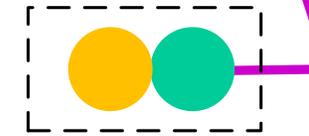
Estimated Project Cost: \$27.9 M

Projected IS Date: 3/1/2022

Status: Conceptual



Carlisle



Wellington

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

Need Number: ATSI-2018-019  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

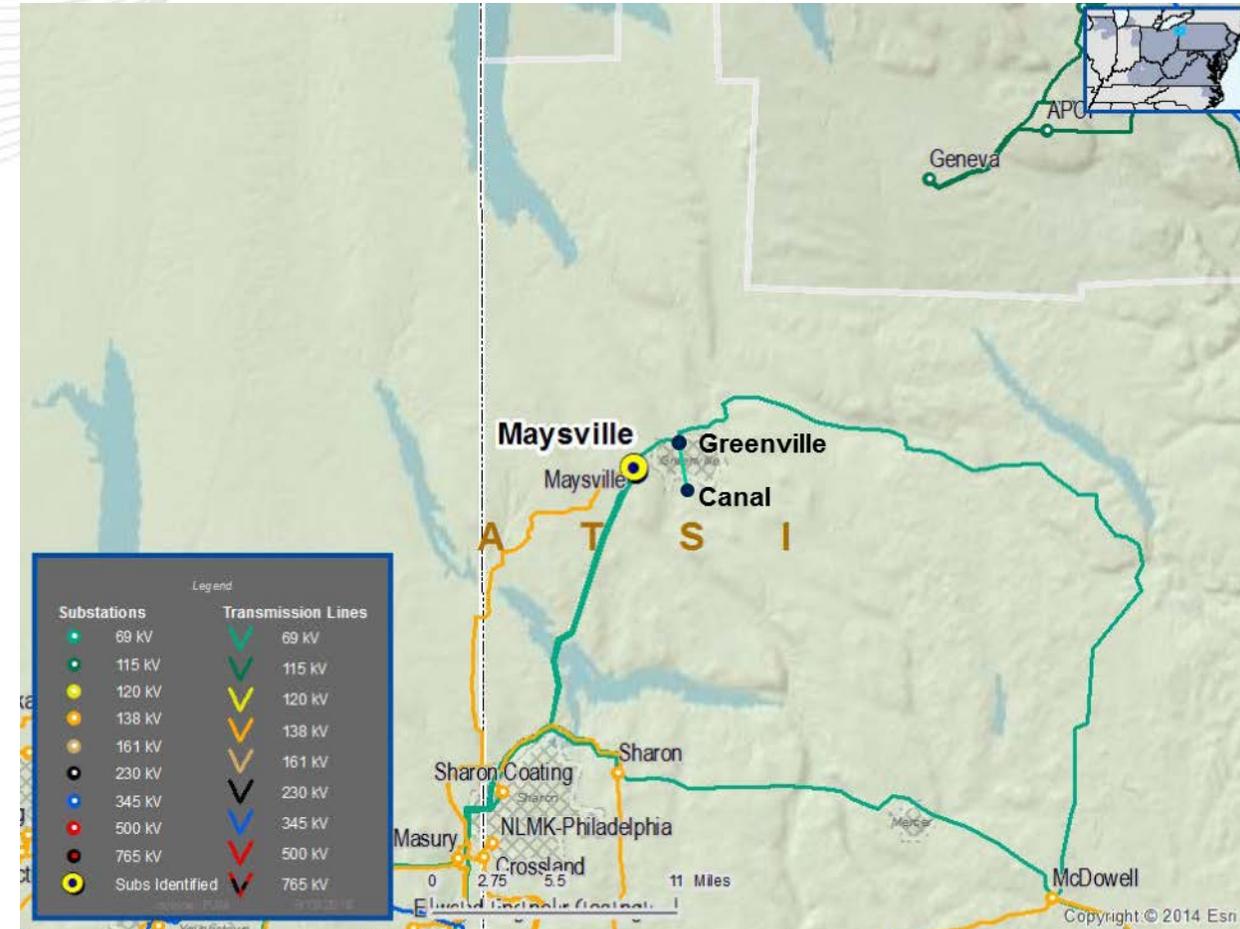
Network Radial Transmission Line

- Radial lines that serve multiple delivery points.

Problem Statement

**Maysville-Canal (Greenville) 69 kV Condition Assessment (Approximately 1.5 miles)**

- Identified obsolete and deteriorated equipment.
  - 61 year old construction; poor inspection results, 100 % rejection rate.
  - Approximately 4 repair records over the past 5 years.
- Radial 69 kV transmission line with 16 MWs and approximately 6,800 customer at risk.



NOTE: Added general location of the Maysville-Canal (Greenville) 69kV to PJM Map

Need Number: ATSI-2018-019

Proposed Solution:

Canal-Maysville 69 kV Line

- Rebuild/reconductor ~1.5 miles of the existing Canal-Maysville 69 kV Line with 336 ACSR (existing conductor 336 ACSR and 3/0 ACSR)
- Replace line switches A-234 and A-235

*Greenville 69 kV Substation – Terminal equipment to be replaced includes:*

- Substation conductor
- Existing line rating: 47 MVA SN / 56 MVA SE
- New line rating: 80 MVA SN / 96 MVA SE

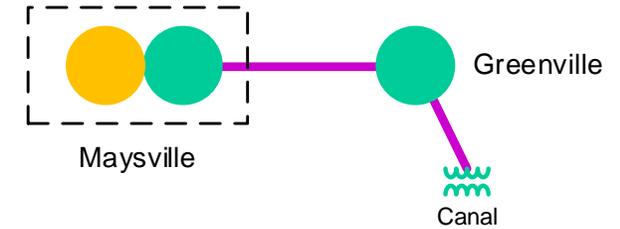
Alternatives Considered:

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$1.7 M

Projected IS Date: 12/31/2019

Status: Engineering



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

Need Number: ATSI-2018-020  
 Process Stage: Solution Meeting  
 Need Presented: 9/28/2018

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

Specific Assumption Reference(s)  
 Line Condition Rebuild / Replacement

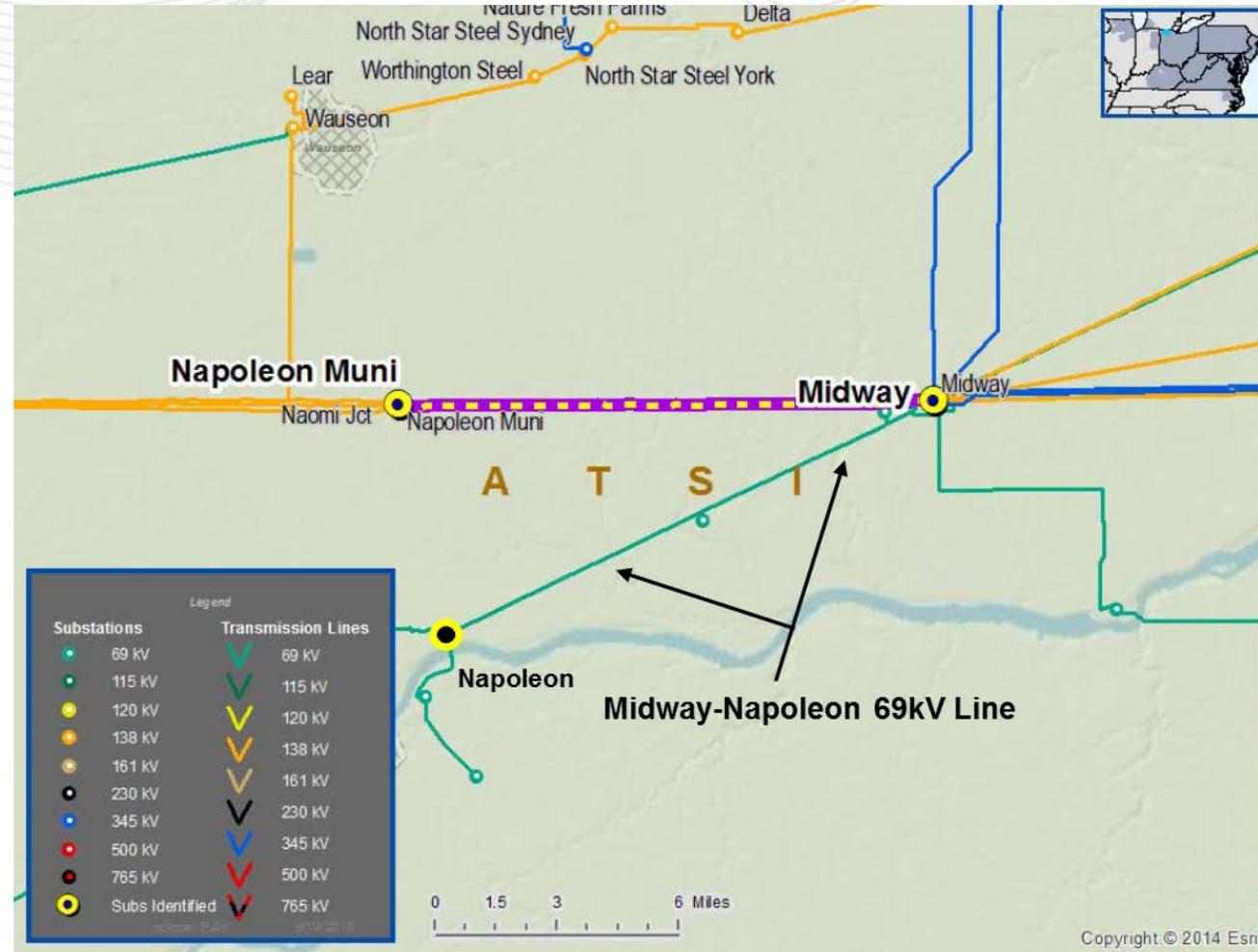
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- Aged or deteriorated wood pole transmission line structures.
- Negatively impact customer outage frequency and/or durations.
- Demonstrate an increasing trend in maintenance findings and/or costs

### Problem Statement

#### Midway-Napoleon 69 kV Condition Assessment (Approximately 11 miles)

- Identified obsolete and deteriorated equipment.
  - 42-52 year old construction; poor inspection results, 60 % rejection rate.
  - Approximately 8 repair records over the past 5 years; increasing trend.
  - 4/0 ACSR conductor



Need Number: ATSI-2018-020

**Proposed Solution:**

**Midway – Napoleon 69 kV Line Reconductor**

- Rebuild/reconductor existing Midway – Napoleon 69 kV Line with 477 ACSR.
- Existing conductor is 4/0 ACSR.

*Midway 69 kV Substation – Terminal equipment to be replaced includes:*

- Replace 69kV breaker B6876, disconnect switches, line CVT, line trap, line tuner, and associated relaying.

*Napoleon 69 kV Substation – Terminal equipment to be replaced includes:*

- Disconnect switches, line CVT, line trap, line tuner, and associated relaying.

- Existing line rating: 53 MVA SN / 64 MVA SE
- New line rating: 100 MVA SN / 120 MVA SE

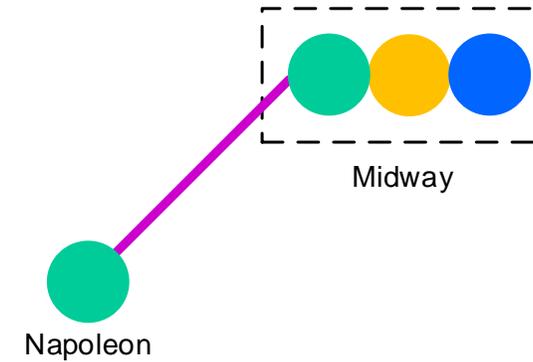
**Alternatives Considered:**

- Maintain existing condition and elevated risk of failure

Estimated Project Cost: \$19.6 M

Projected IS Date: 12/31/2019

Status: Engineering



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



# Revision History

10/16/2018 – V1 – Original version posted to pjm.com

10/19/2018 – V2 – Updated maps on slides 27 and 33