Subregional RTEP Committee – Western
FirstEnergy Supplemental Projects

March 17, 2023

Needs

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

ATSI Transmission Zone M-3 Process
Krendale-Maple 138 kV New Customer

Need Number: ATSI-2023-001

Process Stage: Need Meeting – 03/17/2023

Project Driver(s):

Customer Service

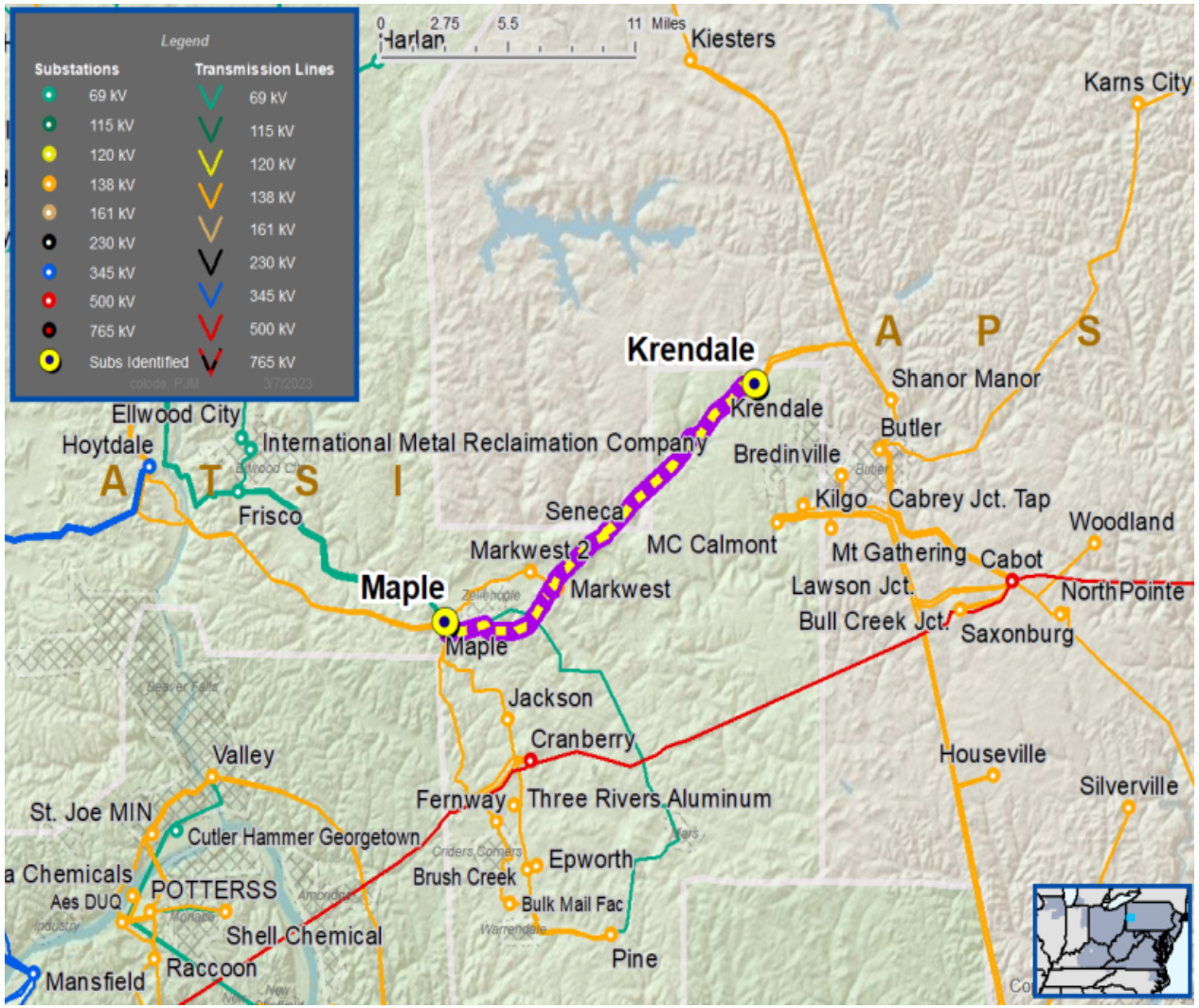
Specific Assumption Reference(s)

New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection - Penn Power Distribution has requested a new 138 kV delivery point near the Krendale-Maple 138 kV line. The anticipated load of the new customer connection is 11 MVA.

Requested in-service date is 06/01/2024.



ATSI Transmission Zone M-3 Process
London-Tangy 138 kV Customer

Need Number: ATSI-2023-004

Process Stage: Need Meeting – 03/17/2023

Project Driver:

Customer Service

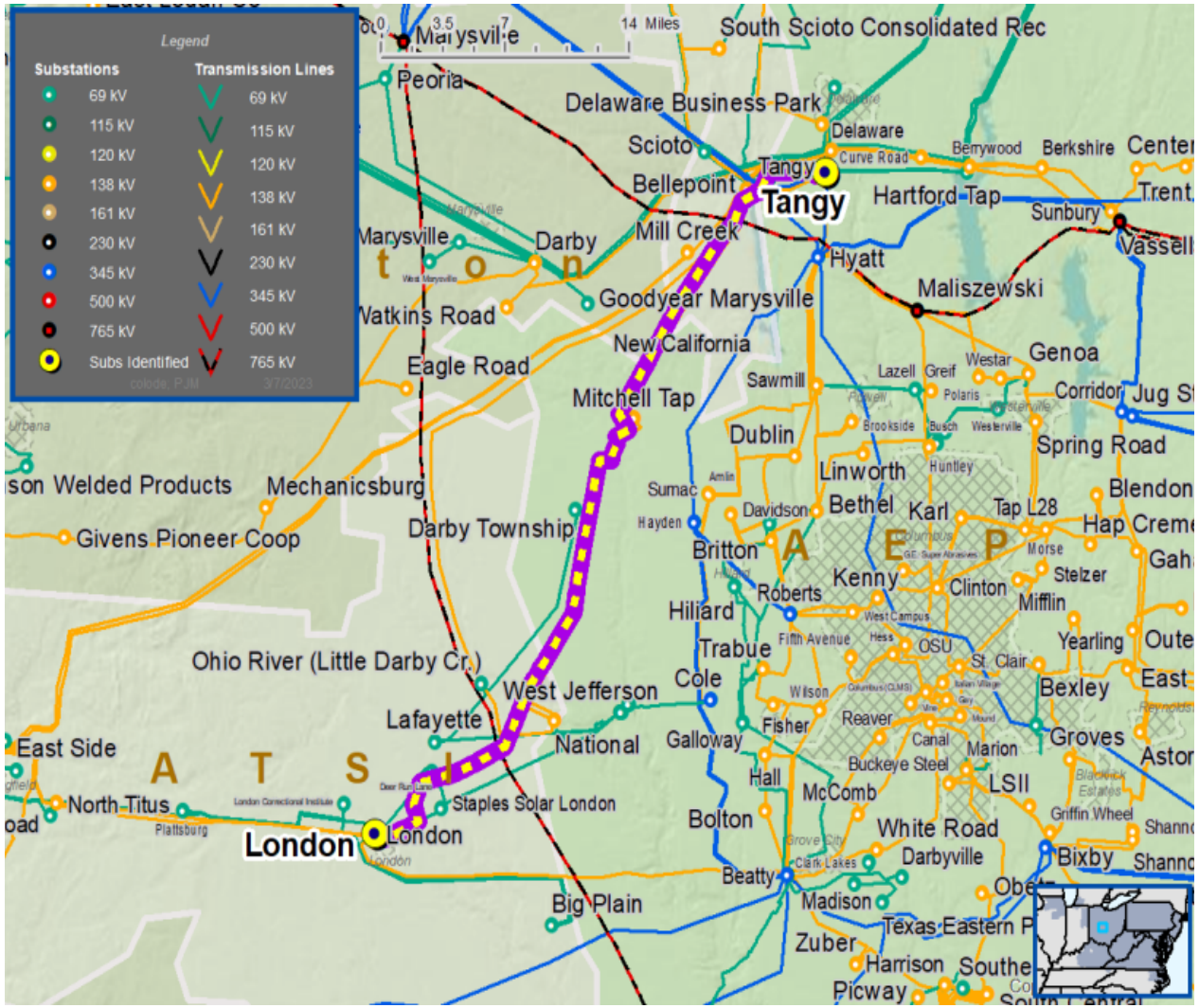
Specific Assumption Reference:

Customer request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement:

Modified Customer Connection – Ohio Edison Distribution has requested to provide a second 138 kV service to an existing delivery point served from the London-Tangy 138 kV line due to load growth in the area. The anticipated load is approximately 14 MVA.

Requested in-service date is 6/1/2024



Solution

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
Leroy Center - Mayfield Q3 138 kV

Need Number: ATSI-2021-016
Process Stage: Solution Meeting – 03/17/2023
Presently Presented: Need Meeting – 08/16/2021

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

Specific Assumption Reference(s):
Global Factors

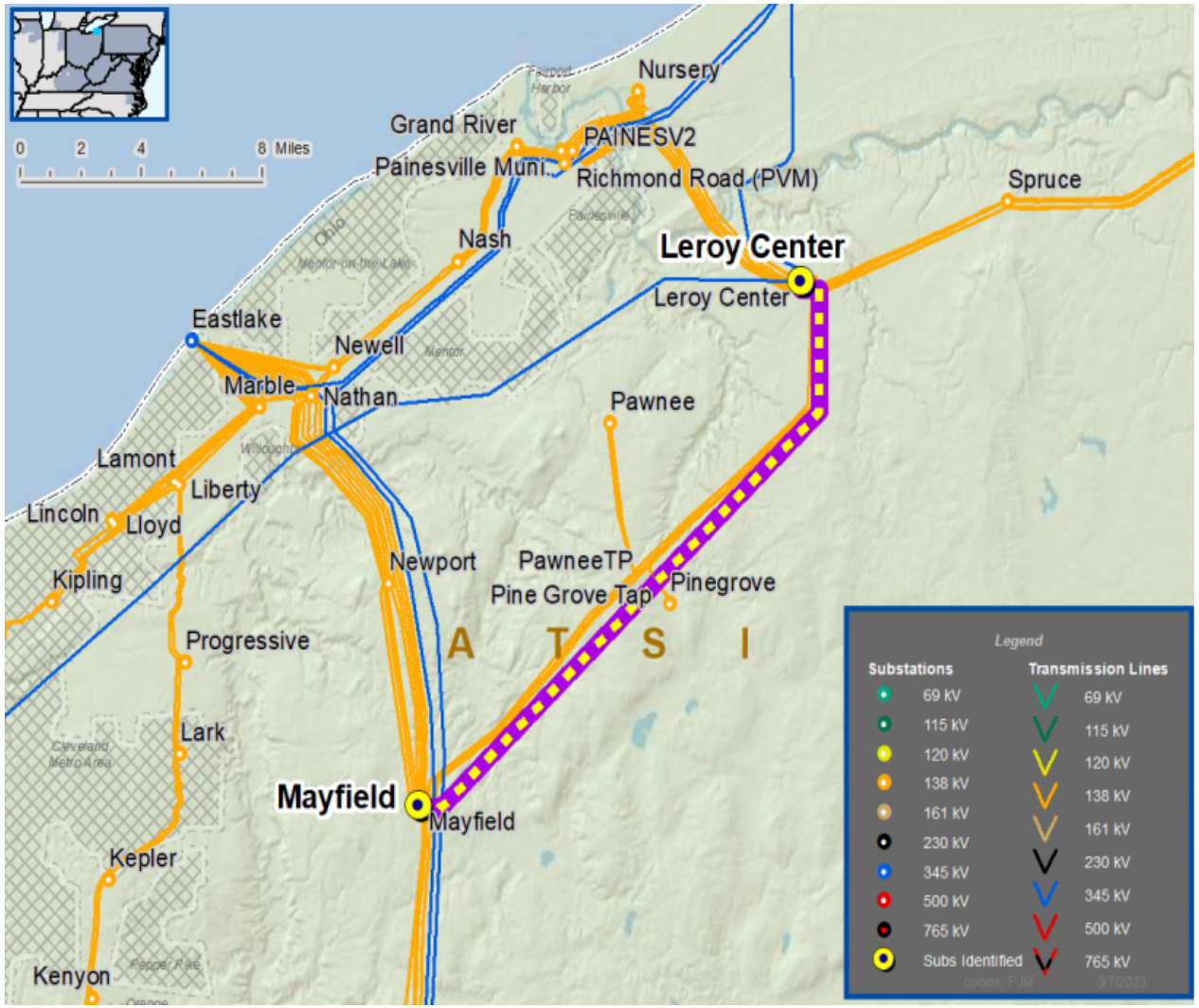
- System Reliability and Performance
- Load at risk in planning and operational scenarios
- Increase line loading limits
- Age/condition of transmission line conductors

Line Condition Rebuild/Replacement

- Transmission lines with loading at 80% or greater

Problem Statement

- The Leroy Center – Mayfield Q3 138 kV line loads to 89% under contingency conditions in the latest RTEP Case.
- The Leroy Center – Mayfield Q3 138 kV line feeds 4,938 customers and 21 MW at the Pinegrove Substation.
- The existing conductor is 4/0 CU and can cause protection issues due to not being able to handle the short circuit current for faults.
- Age/condition of transmission line conductors and hardware (mid 1940s).



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q3 138 kV

Need Number: ATSI-2021-016
Process Stage: Solution Meeting – 03/17/2023

Proposed Solution:

- Reconductor approximately 7.7 miles 138 kV line section from Mayfield to Pinegrove with 336 ACSS, insulators and cold end attachments will be replaced, as needed.
- Relay setting changes at Mayfield

Estimated Cost: $16.0M
Projected In-Service: 06/01/2025

- Reconductor approximately 8.1 miles 138 kV line section from Leroy Center to Pinegrove with 336 ACSS, insulators and cold end attachments will be replaced, as needed.
- Relay setting changes at Leroy Center

Estimated Cost: $15.7M
Projected In-Service: 06/01/2024

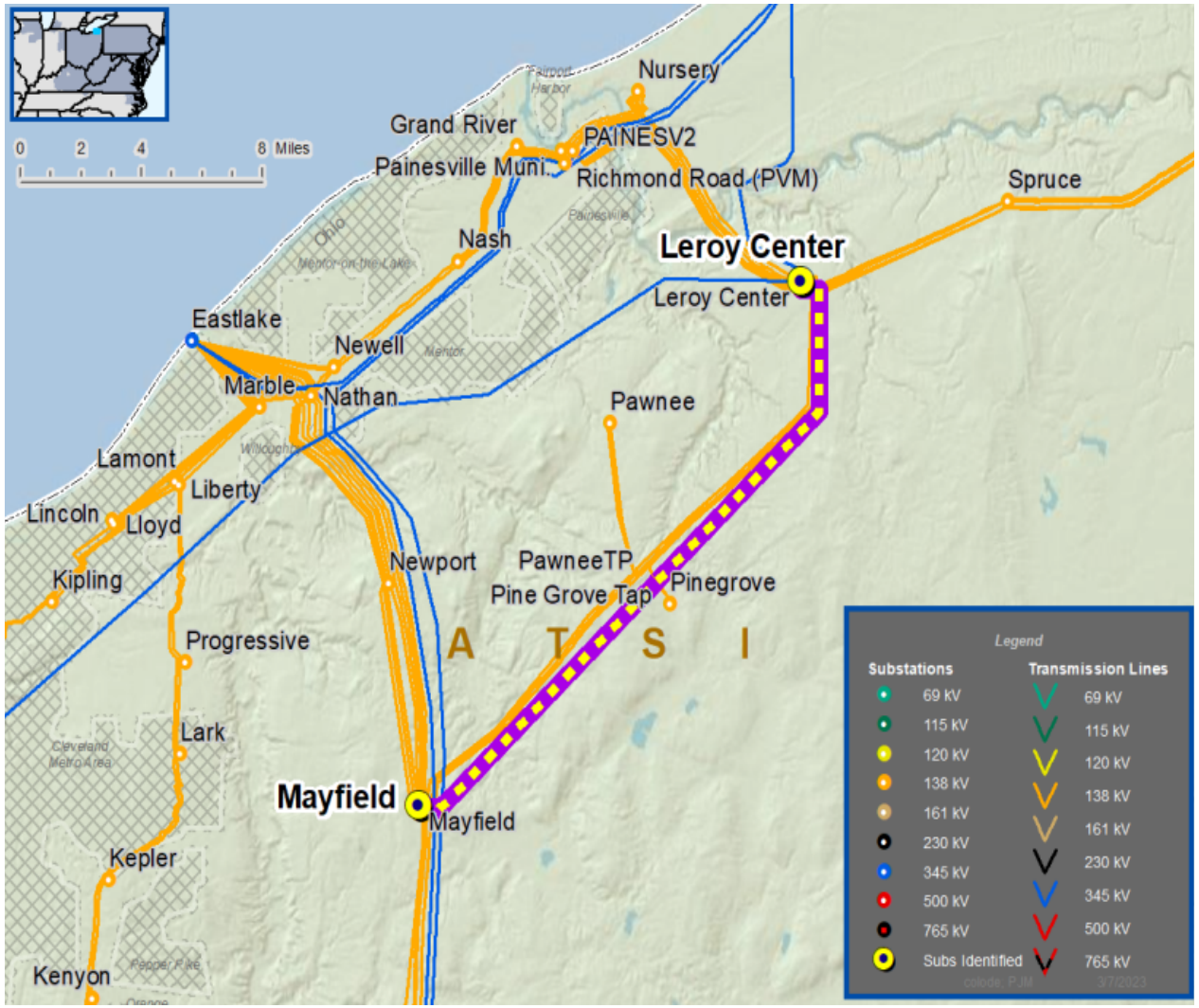
Transmission Line Ratings:

- Leroy Center – Mayfield 138 kV Line
  - Before Proposed Solution: 148 MVA SN/ 151 MVA SE
  - After Proposed Solution: 252 MVA SN / 291 MVA SE

Alternatives Considered:

- No alternatives considered for this project to reconductor the line

Total Estimated Project Cost: $31.7M
Status: Engineering
Model: 2020 Series 2025 Summer RTEP 50/50



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q1 138

Need Number: ATSI-2022-007
Process Stage: Solution Meeting – 03/17/2023
Presently Presented: Need Meeting – 03/18/2022

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

Specific Assumption Reference(s):
Global Factors

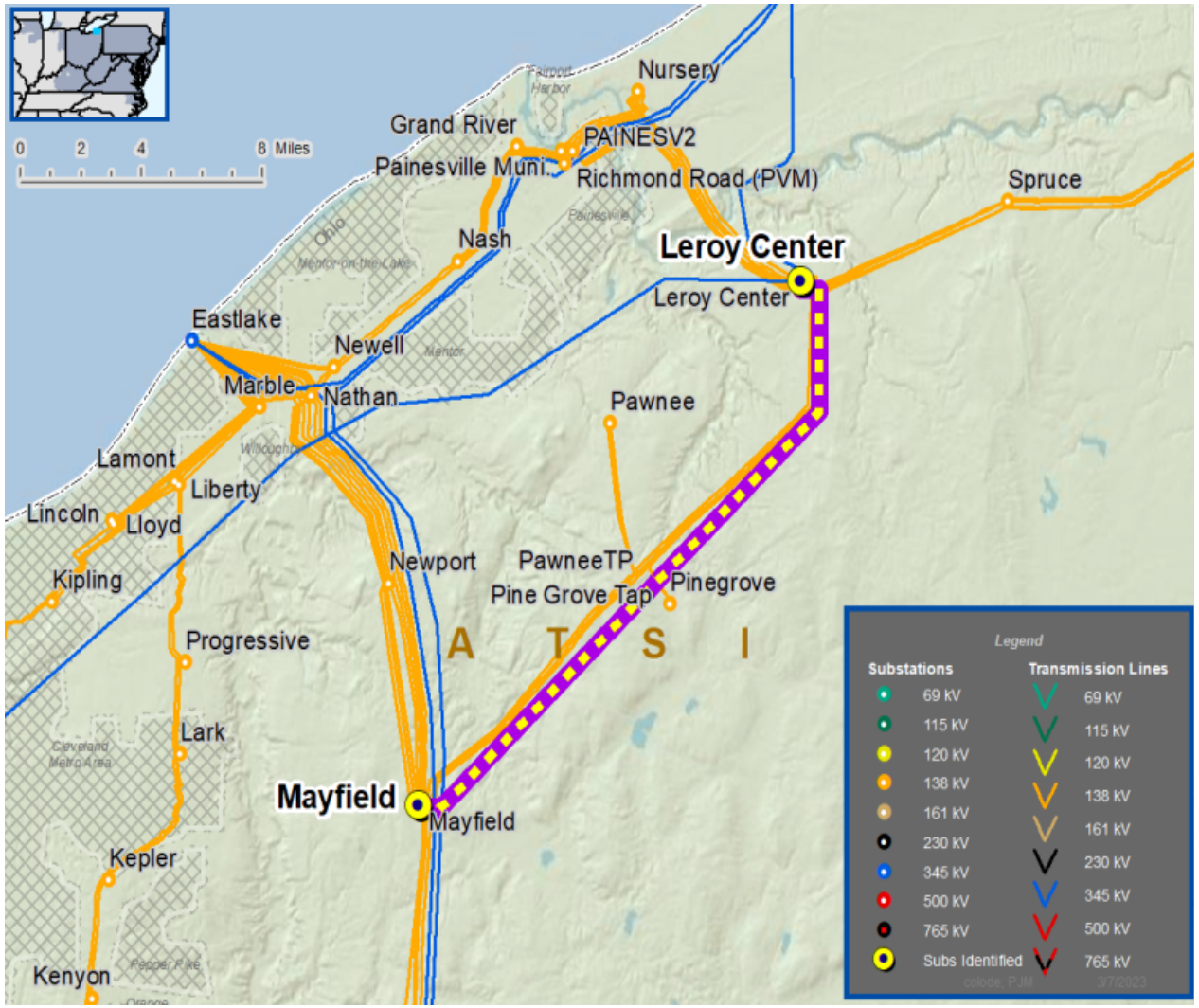
- System Reliability and Performance
- Increasing negative trend in maintenance findings
- Age/condition of transmission line conductors and hardware

Line Condition Rebuild/Replacement

- End of Life Methodology

Problem Statement

- The Leroy Center – Mayfield Q1 138 kV Line (~16.1 miles) originally constructed mid-1940's, and all structures are similar vintage.
- Leroy Center – Pawnee Tap Q1 138 kV line section (~8.4 miles) is being reconductored and addressed under RTEP# b3152
- Pawnee Tap – Mayfield Q1 138 kV line (~7.7 miles) section:
  - 71 of 119 structures inspected had measurable cold end attachment plate wear with instances of mounting holes being 75% worn.
  - Age/condition of transmission line conductors and hardware (mid 1940s).



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q1 138

Need Number: ATSI-2022-007

Process Stage: Solution Meeting – 03/17/2023

Proposed Solution:

- Reconductor approximately 7.7-mile 138 kV line section from Pawnee tap to Mayfield (Q1) with 336 ACSS. Replace tower structures, insulators and hardware as needed to address condition items and support new conductor.
- Revise relay settings at Mayfield, Leroy Center, and Pawnee
- Leroy Center – Pawnee Q1 138 kV line section is being reconductored under baseline project RTEP b3152

Transmission Line Ratings:

- Pawnee Tap - Mayfield Q1
  - Before Proposed Solution: 115 MVA SN/ 115 MVA SE
  - After Proposed Solution: 252 MVA SN / 291 MVA SE

Alternatives Considered:

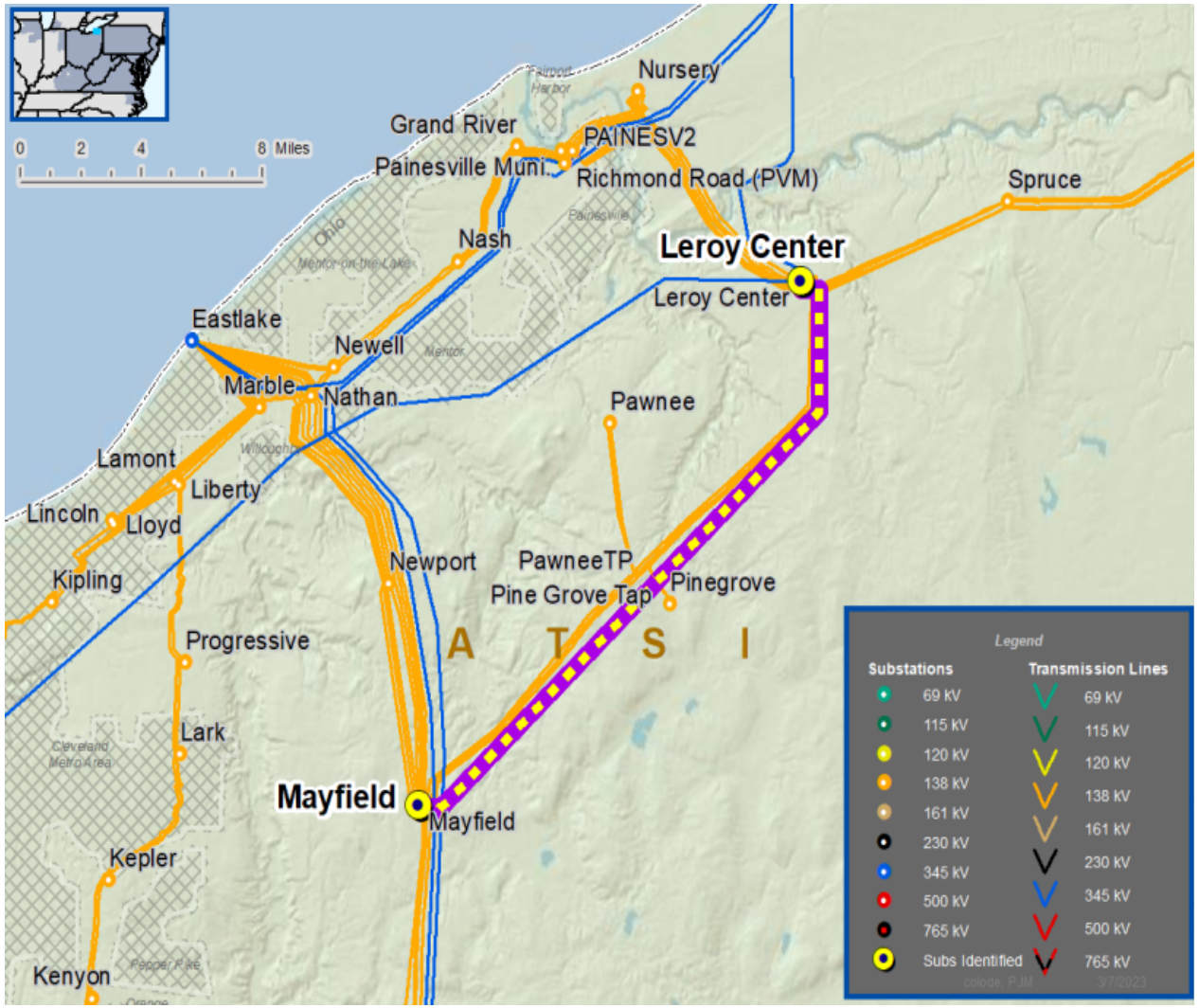
- No alternatives considered for this project to reconductor the line

Estimated Project Cost: $15.2M

Projected In-Service: 06/01/2026

Status: Engineering

Model: 2020 Series 2025 Summer RTEP 50/50



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q4 138 kV

Need Number: ATSI-2022-008
Process Stage: Solution Meeting – 03/17/2023
Presently Presented: Need Meeting – 03/18/2022

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

Specific Assumption Reference(s):
Global Factors

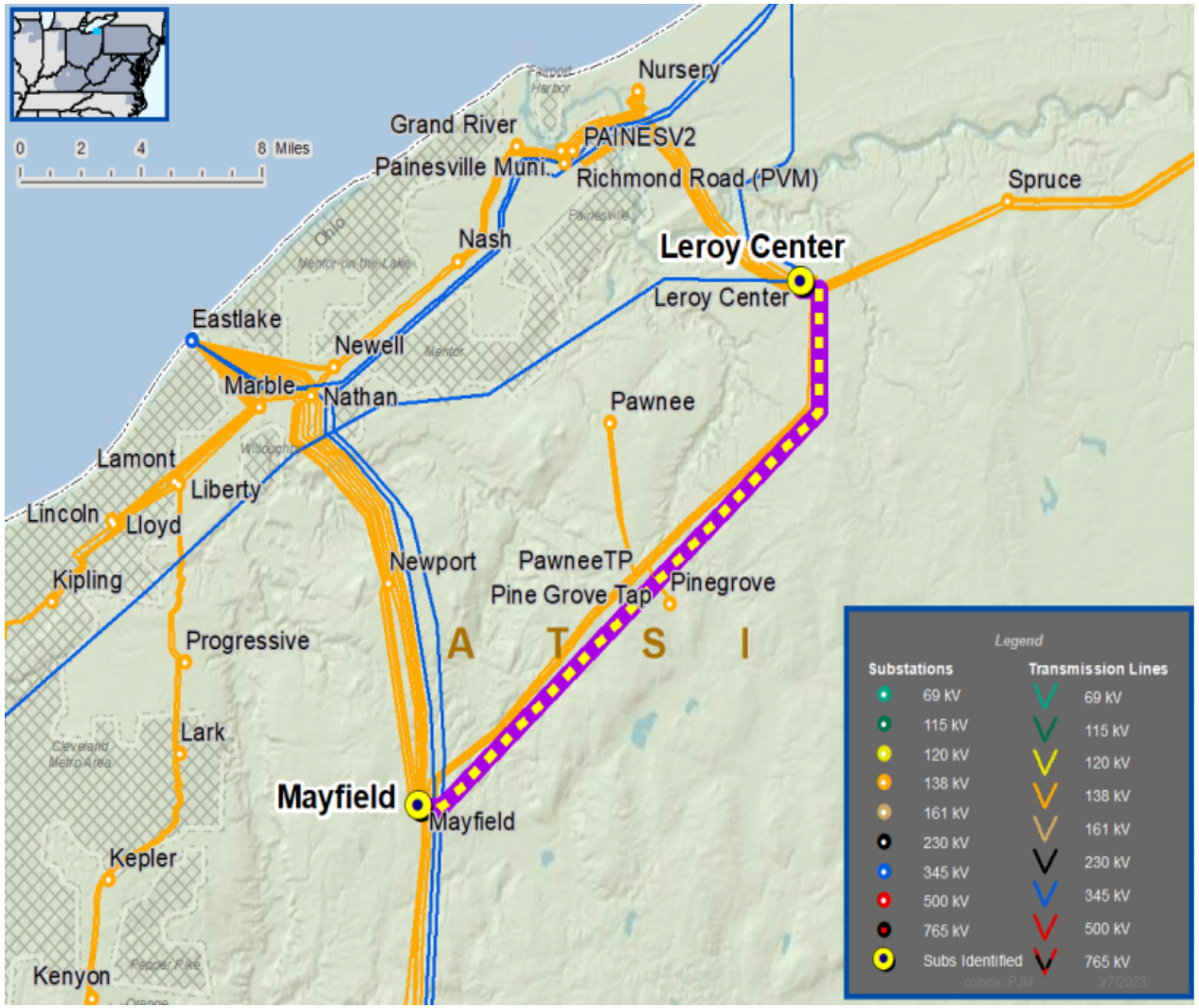
- System Reliability and Performance
- Increasing negative trend in maintenance findings
- Age/condition of transmission line conductors and hardware

Line Condition Rebuild/Replacement

- End of Life Methodology

Problem Statement

- The Leroy Center – Mayfield Q4 138 kV Line (~16.1 miles) originally constructed mid-1940's, and all structures are similar vintage:
  - 54 of 119 structures inspected had measurable cold end attachment plate wear with instances of mounting holes being 75% worn.
- Age/condition of transmission line conductors and hardware (mid 1940s).



ATSI Transmission Zone M-3 Process
Leroy Center - Mayfield Q4 138 kV

Need Number: ATSI-2022-008
Process Stage: Solution Meeting – 03/17/2023

Proposed Solution:

- Reconductor approximately 16.1 miles of the Leroy Center – Mayfield Q4 138 kV Line with 336 ACSS. Replace tower structures, insulators and hardware as needed to address condition items and support new conductor.
- Revise relay settings at Mayfield, Leroy Center, and Pinegrove

Transmission Line Ratings:

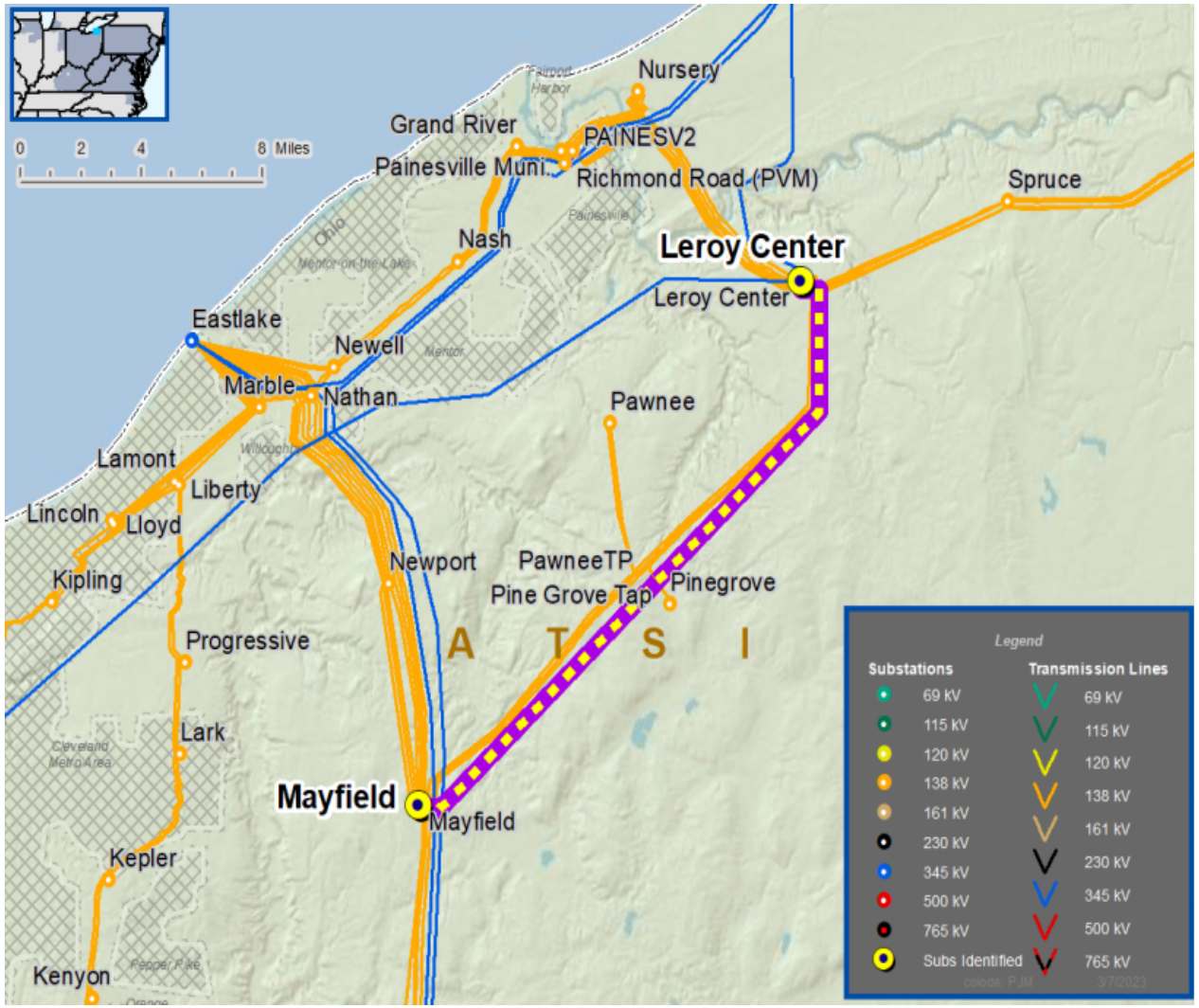
Leroy Center – Mayfield Q4 138 kV Line

- Before Proposed Solution: 148 MVA SN/ 151 MVA SE
- After Proposed Solution: 252 MVA SN / 291 MVA SE

Alternatives Considered:

- No alternatives considered for this project to reconductor the line

Estimated Project Cost: $33.5M
Projected In-Service: 03/01/2027
Status: Engineering
Model: 2020 Series 2025 Summer RTEP 50/50



ATSI Transmission Zone M-3 Process
Shenango 345/138 kV Transformers No. 1 and No. 2

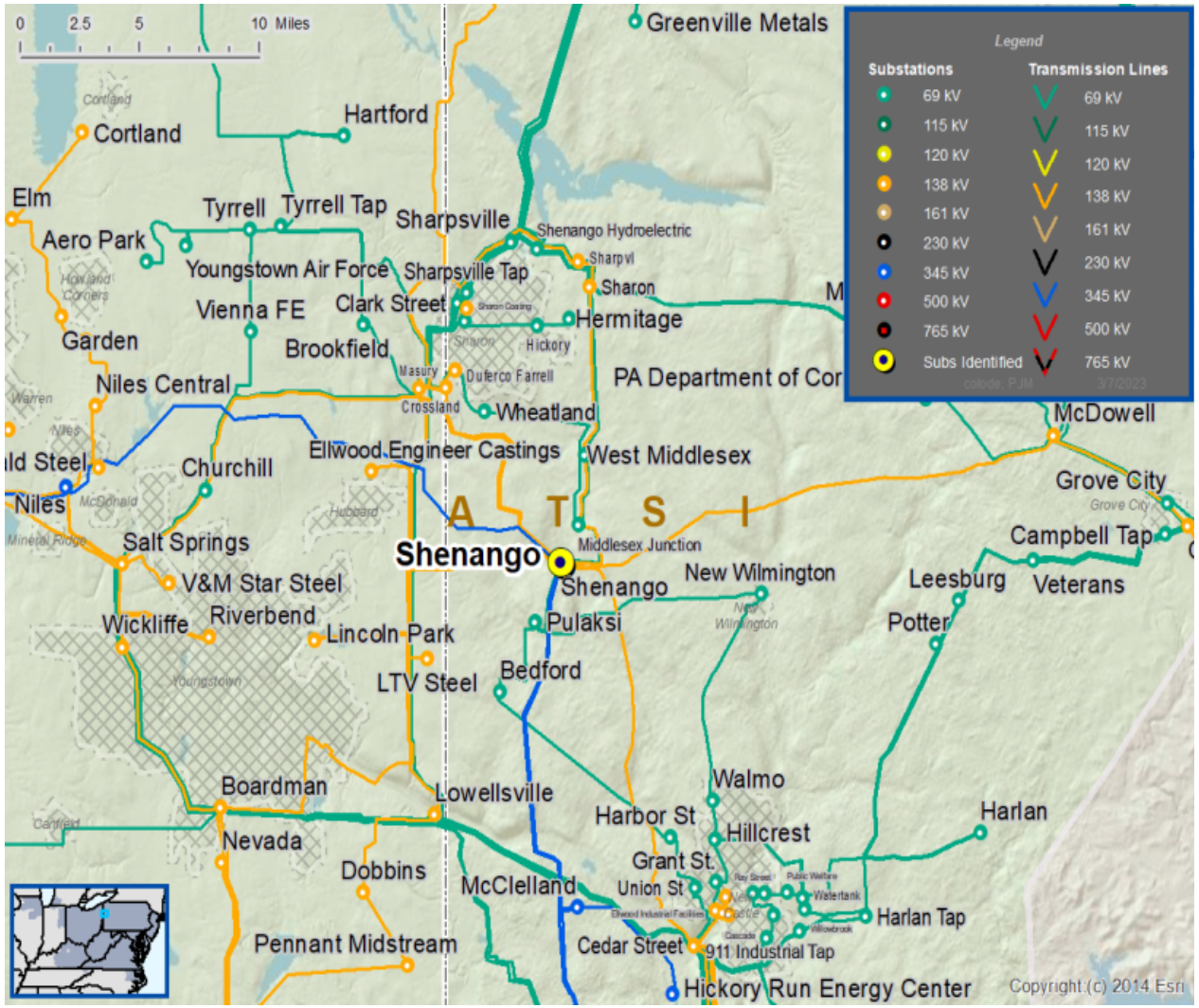
Need Number: ATSI-2021-024
Process Stage: Solution Meeting – 03/17/2023
Previously Presented: Need Meeting – 10/15/2021

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

Specific Assumption Reference(s):
Global Factors
- System Reliability and Performance
- Substation/line Equipment Limits

Substation Equipment Replacement
- Circuit breakers and other fault interrupting devices
- Switches and relays

Problem Statement
- The existing protection scheme on the Shenango 345/138 kV Transformers No. 1 and No. 2 is sensitive to neutral overcurrent inrush, which may cause unnecessary trips.
- Transformer circuit ratings are limited by disconnect switches, CT's, breakers, and substation conductor.
- Approximately 1154 customers and 400 MVA of load served
- Since 2017, Shenango 138 kV lines had eight (8) sustained outages



ATSI Transmission Zone M-3 Process
Shenango 345/138 kV Transformers No. 1 and No. 2

Need Number: ATSI-2021-024
Process Stage: Solution Meeting – 03/17/2023

Proposed Solution:

Shenango Sub – Update TR No 1 and TR No 2 Relaying

- TR No 1 (345/138 kV):
  - Replace 345/138 kV transformer grounding relay with SEL-587
  - Replace 138 kV disconnect switch D1, D3, D4, D5 & D7 and breaker B2 with 3000A equipment.
  - Replace BFT relaying for breakers B2 and B6 with SEL-451
- TR No 2 (345/138 kV):
  - Replace 345/138 kV transformer grounding relay with SEL-587
  - Replace 138 kV disconnect switch D63, D65, D66, D67 & D69 with 3000A equipment.
  - Replace conductor from transformer bushing to disconnect switch
  - Modify relaying settings

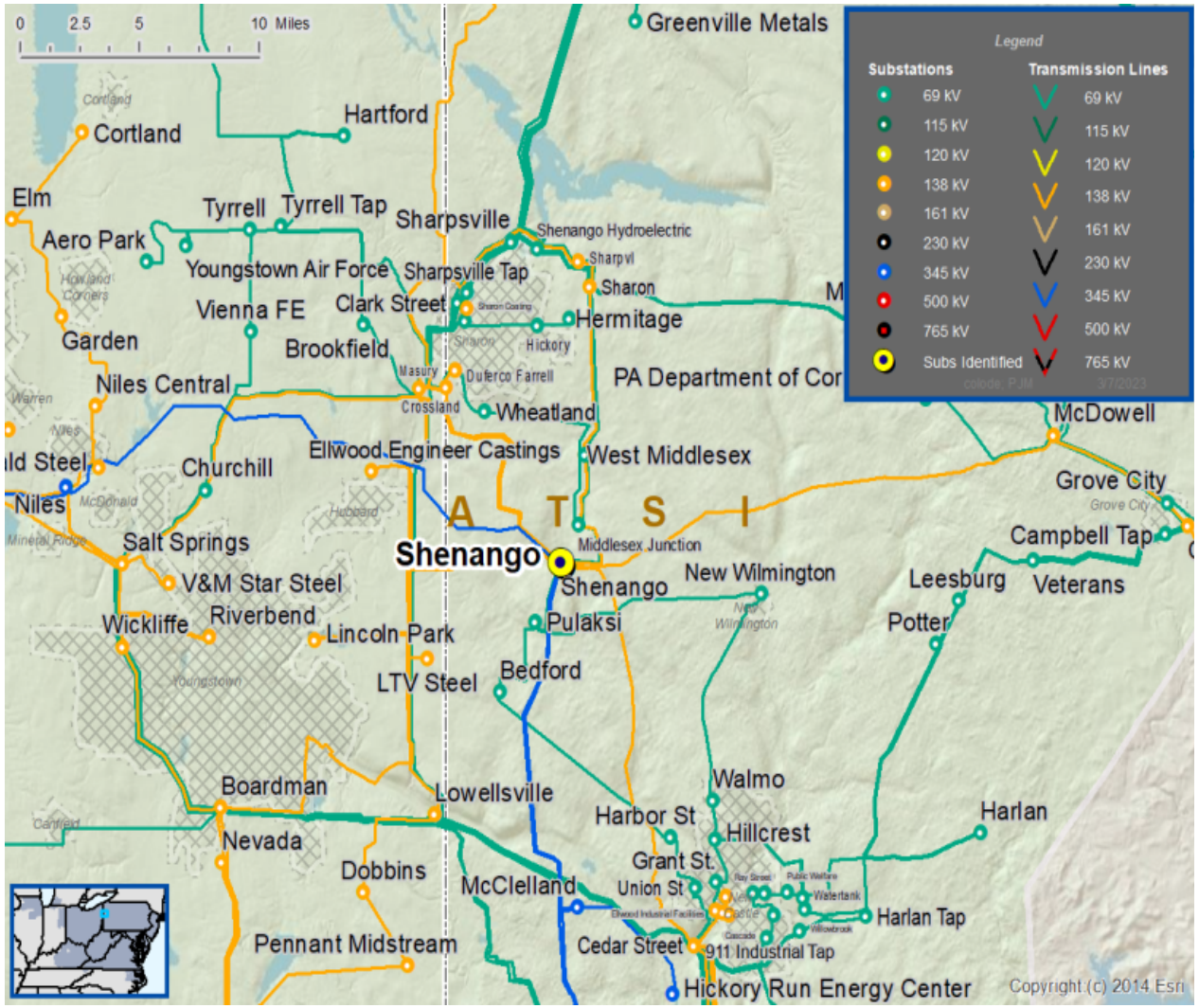
Transmission Transformer Ratings:

- TR No 1 (345/138KV):
  - Before Proposed Solution: 548 MVA SN / 688 MVA SSTE / 721 MVA WN / 826 MVA WSTE
  - After Proposed Solution: 623 MVA SN / 710 MVA SSTE / 768 MVA WN / 837 MVA WSTE
- TR No 2 (345/138KV):
  - Before Proposed Solution: 548 MVA SN / 659 MVA SSTE / 679 MVA WN / 753 MVA WE
  - After Proposed Solution: 620 MVA SN / 710 MVA SSTE / 743 MVA WN / 834 MVA WSTE

Alternatives Considered:

No alternatives considered for this relay protection replacement

Estimated Project Cost: $1.4 M
Projected In-Service: 12/30/2023
Project Status: Engineering
Model: 2020 Series RTEP Model for 2025 Summer



Re-Present 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
Carlisle-Wellington 69 kV Line

Need Number: ATSI-2018-018 (s1803)

Process Stage: Re-present Solution Meeting – 3/17/2023

Previously Presented: Solution Meeting – 10/26/2018

Need Meeting – 09/28/2018

Original Problem Statement and Solution

Supplemental Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild / Replacement

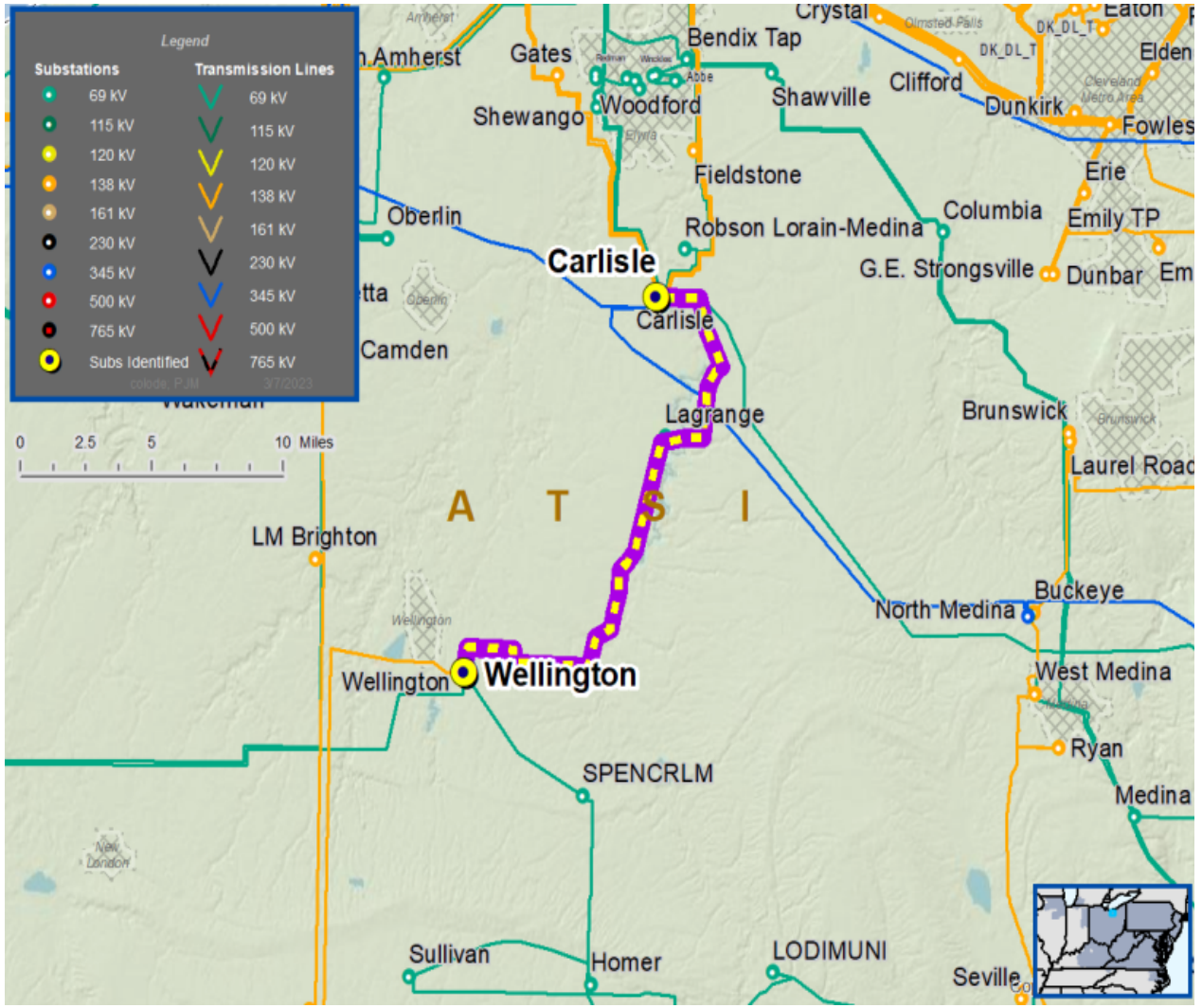
Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

- 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.



Continued on next slide…

ATSI Transmission Zone M-3 Process
Carlisle-Wellington 69 kV Line

Need Number: ATSI-2018-018 (s1803)

Process Stage: Re-present Solution Meeting – 3/17/2023

Previously Presented: Solution Meeting – 10/26/2018

Need Meeting – 09/28/2018

Problem Statement

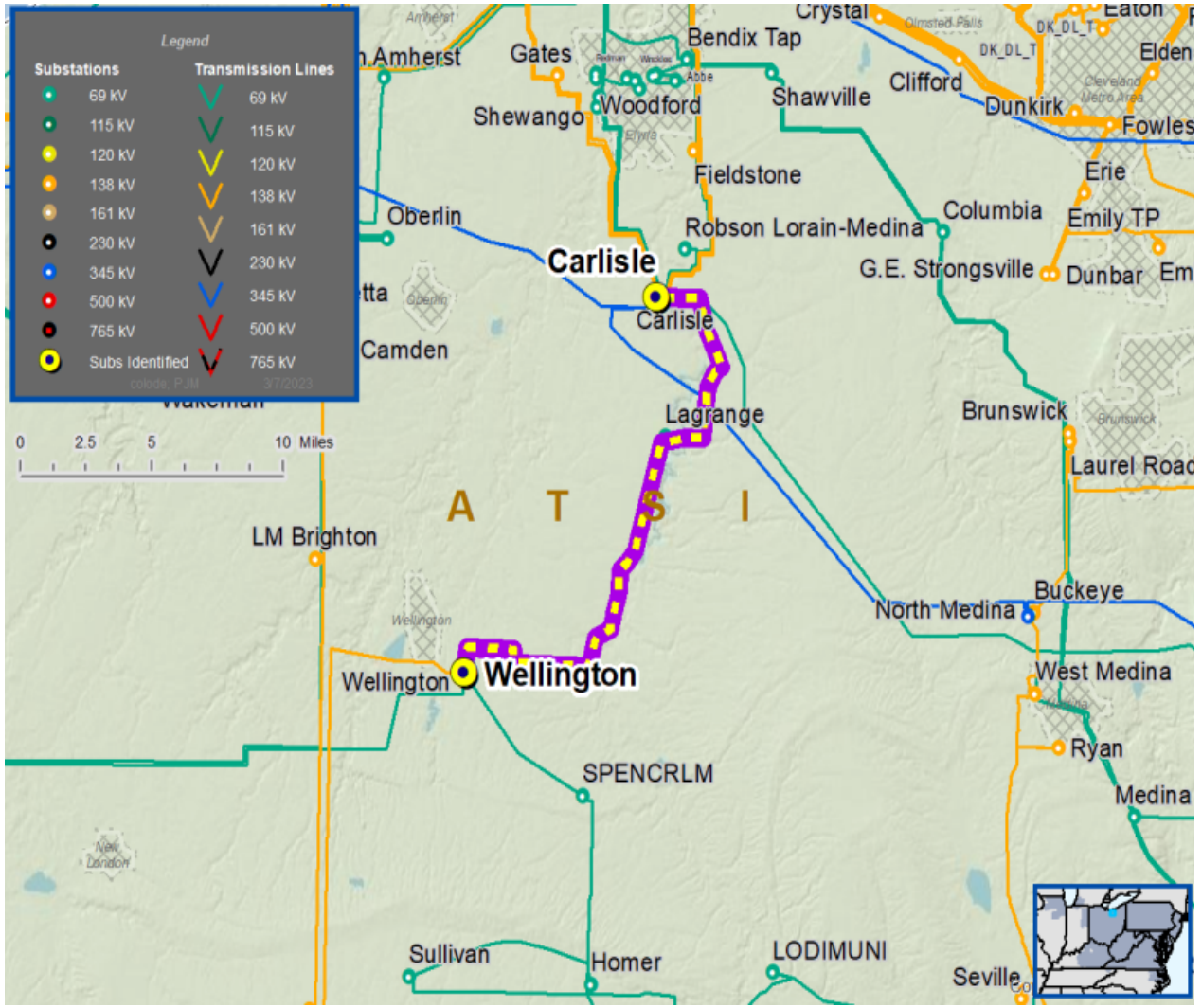
Carlisle-Wellington 69 kV Condition Assessment Update (Approximately 22.4 miles)

- From Carlisle substation to structure #19 (Larson tap)
  - Pole Condition failure 69%; Condition plus age failure 83%.
- From Wellington substation to structure #69 (excluding Litchfield tap)
  - Pole condition failure 20%; Condition plus age failure 91%.
- From Larson tap (structure #19) to Litchfield tap (structure #69)
  - Pole condition failure 16%; Condition plus age 33%;

- Note: condition failures identified would impact the integrity of the structure such as cracking/splitting, large holes due to woodpecker damage, sign of pole rot, damage to or splitting of bayonets or crossarms, etc.

- Outage history from 2017-2023YTD: sixteen total outages; seven momentary and nine sustained outages with average sustained outage duration of 29 minutes

- Approximately 26,075 customers and 58 MW of load impacted



Continued on next slide…

ATSI Transmission Zone M-3 Process
Carlisle-Wellington 69 kV Line

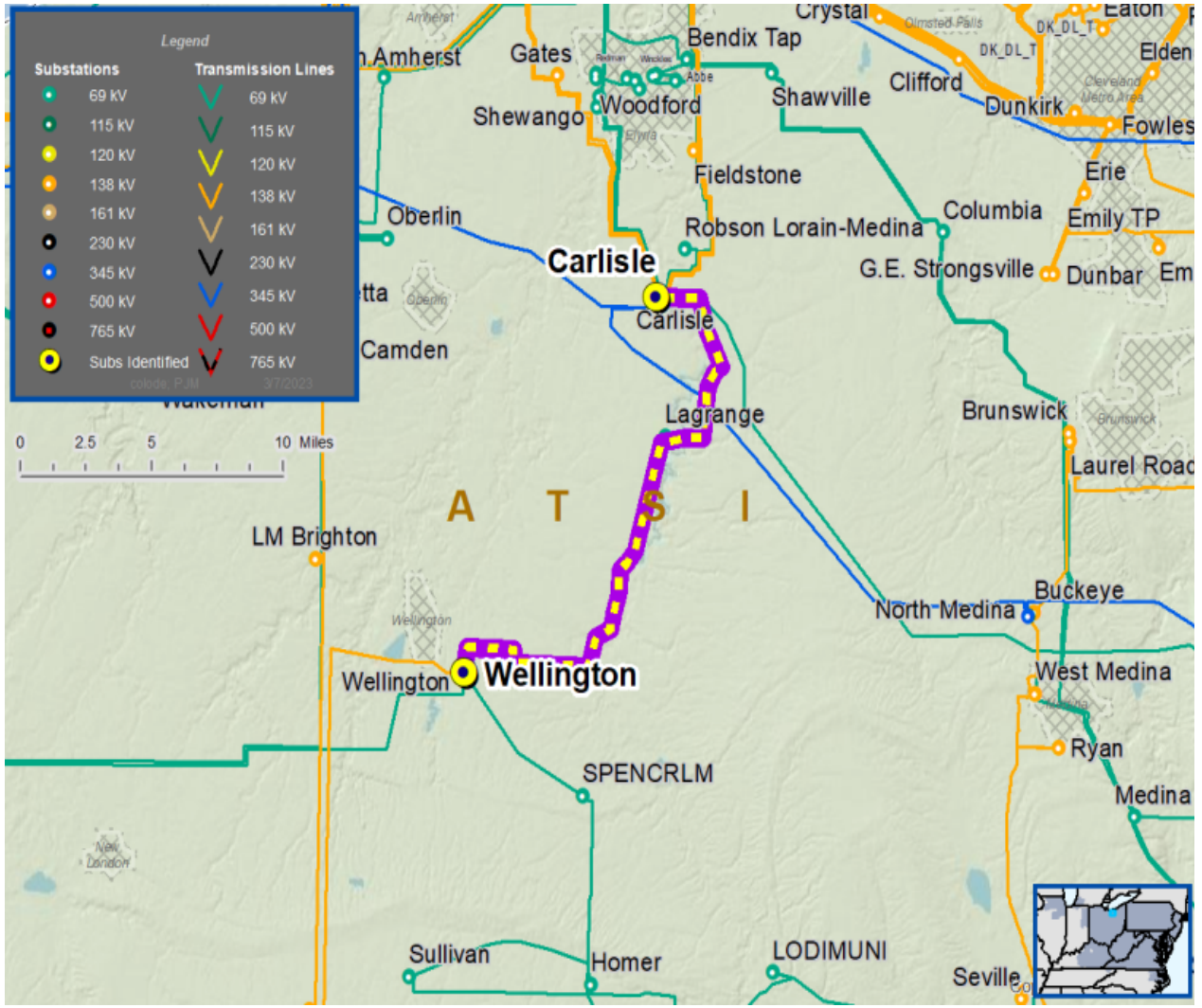
Need Number: ATSI-2018-018 (s1803)
Process Stage: Re-present Solution Meeting – 3/17/2023
Previously Presented: Solution Meeting – 10/26/2018
Need Meeting – 09/28/2018

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)~~
- Rebuild the section of line from structure #70 to structure #19 including the loop to the Carlisle substation, ~3.8 miles using 556 kcmil 26/7 ACSR conductor
- Rebuild the section of line from the Wellington substation to structure #67 (excluding Litchfield tap), ~4.8 miles using 556 Kcmil 26/7 ACSR conductor
- Rehab the section of the line from the Larson tap (structure #19) to the Litchfield tap (structure #69), ~13.8 miles using existing conductor will be used. The rehab will include the Webster and Grafton Muni taps.
- Replace line switches A-37, A-40, A-41, A-48, A-49, A-50, A-69, and A-70
- Install underground fiber cable from Carlisle substation to Wellington substation
- At Carlisle replace relays and controls.
- At Wellington, replace Disconnect D-33, D-35 & A-36.
- At Lagrange reconductor main bus.

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

- ~~Circuit breaker B34 and relays and controls Replaced due to failure~~



Continued on next slide…

ATSI Transmission Zone M-3 Process
Carlisle-Wellington 69 kV Line

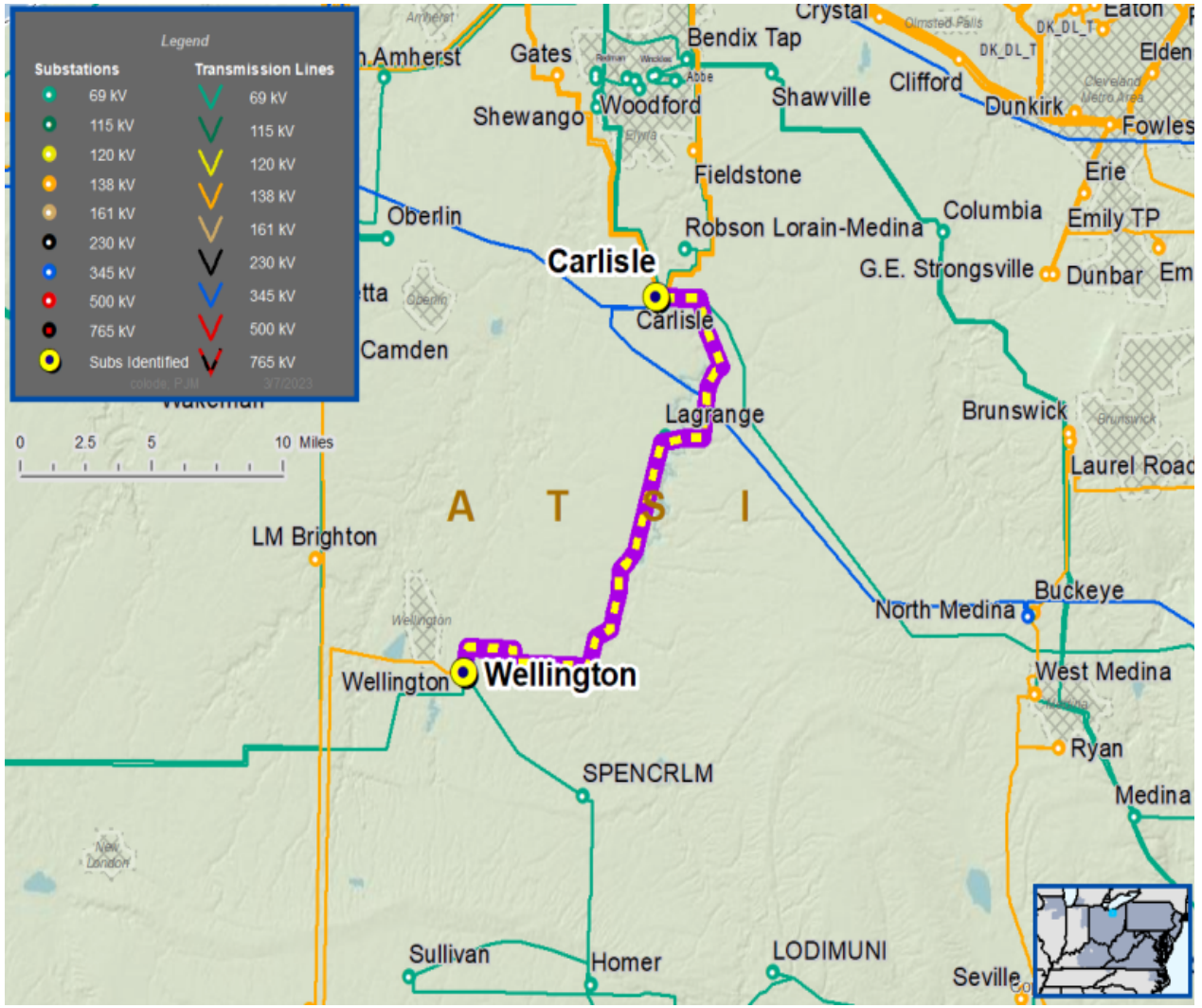
Need Number: ATSI-2018-018 (s1803)
Process Stage: Re-present Solution Meeting – 3/17/2023
Previously Presented: Solution Meeting – 10/26/2018
Need Meeting – 09/28/2018

Proposed Solution:
Transmission Line Ratings:

- ~~Existing line rating: 76 MVA SN / 92 MVA SE~~
- ~~New line rating: 100 MVA SN / 121 MVA SE~~

Carlisle-Wellington 69 kV Line:

- Carlisle-Carlisle tap section:
  - Existing line rating: 108 MVA SN / 108 MVA SE /118 MVA SLD
  - New line rating: 111 MVA SN / 134 MVA SE /151 MVA SLD
- Carlisle tap-Larson tap section:
  - Existing line rating: 76 MVA SN / 92 MVA SE /104MVA SLD
  - New line rating: 111 MVA SN / 134 MVA SE /151 MVA SLD
- Wellington-Wellington Muni section:
  - Existing line rating: 76 MVA SN / 92 MVA SE /95 MVA SLD
  - New line rating: 111 MVA SN / 134 MVA SE /151 MVA SLD
- Wellington Muni-LMREC Central section:
  - Existing line rating: 76 MVA SN / 92 MVA SE /104 MVA SLD
  - New line rating: 111 MVA SN / 134 MVA SE /151 MVA SLD
- LMREC Central-Litchfield tap section:
  - Existing line rating: 76 MVA SN / 92 MVA SE /104 MVA SLD
  - New line rating: 111 MVA SN / 134 MVA SE /151 MVA SLD



Continued on next slide…

ATSI Transmission Zone M-3 Process
Carlisle-Wellington 69 kV Line

Need Number: ATSI-2018-018 / (s1803)

Process Stage: Re-present Solution Meeting – 3/17/2023

Previously Presented: Solution Meeting – 10/26/2018
Need Meeting – 09/28/2018

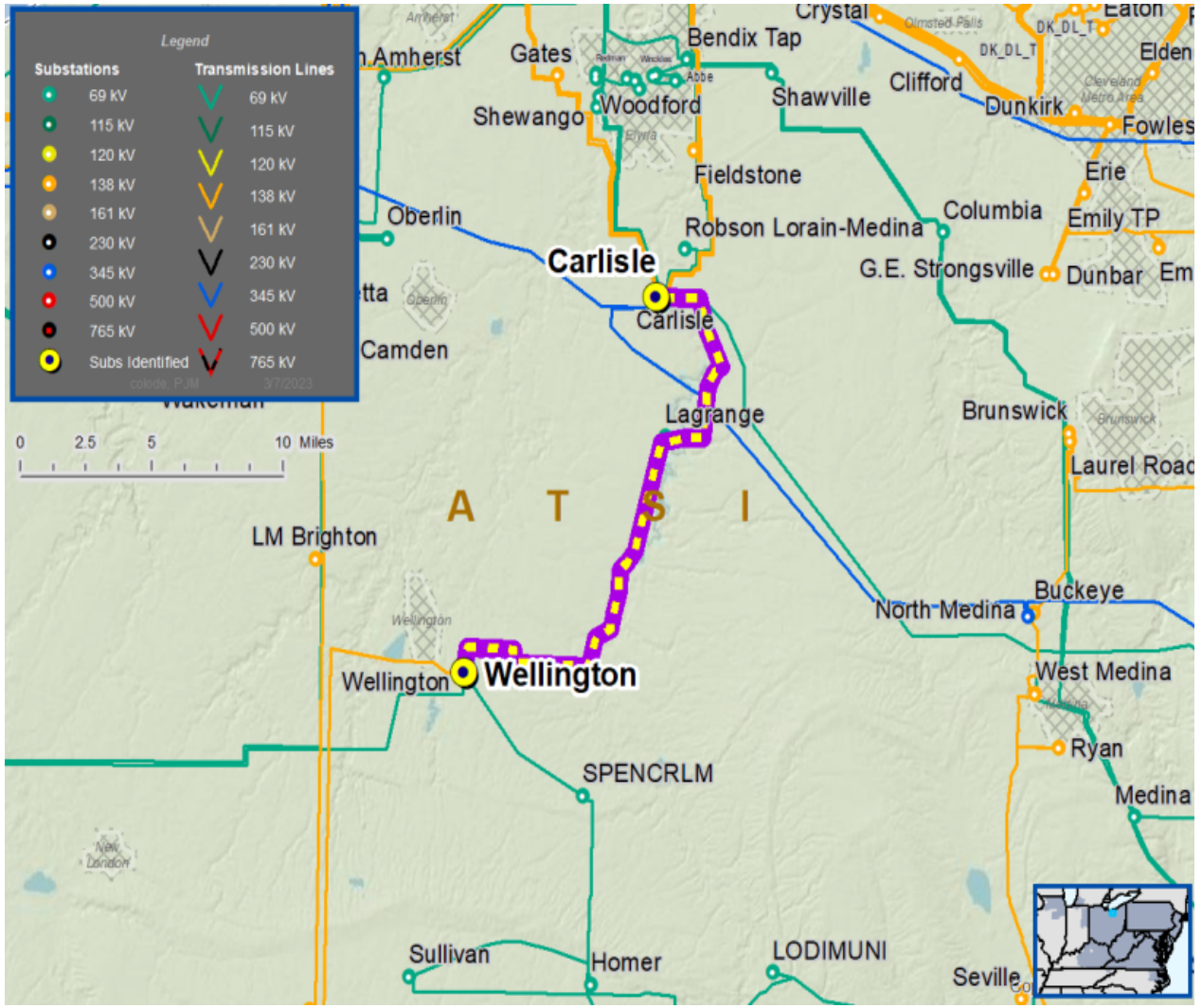
Alternatives Considered:

- Rebuild entire line. This was not considered since the condition of some structures along the transmission line are in good condition and do not require replacement.
- Maintain existing condition and elevated risk of failure

Estimated Project Cost: ~~$27.9M~~ $18.8M

Projected IS Date: ~~3/1/2022~~ 12/4/2023

Status: ~~Conceptual~~ 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/xx/2022– V1 – Original version posted to pjm.com