Sub Regional RTEP Committee
Mid-Atlantic
First Energy MAAC

September 21, 2018

Penelec Transmission Zone

Need Number: PN-2018-001
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Substation/Line Equipment Limits

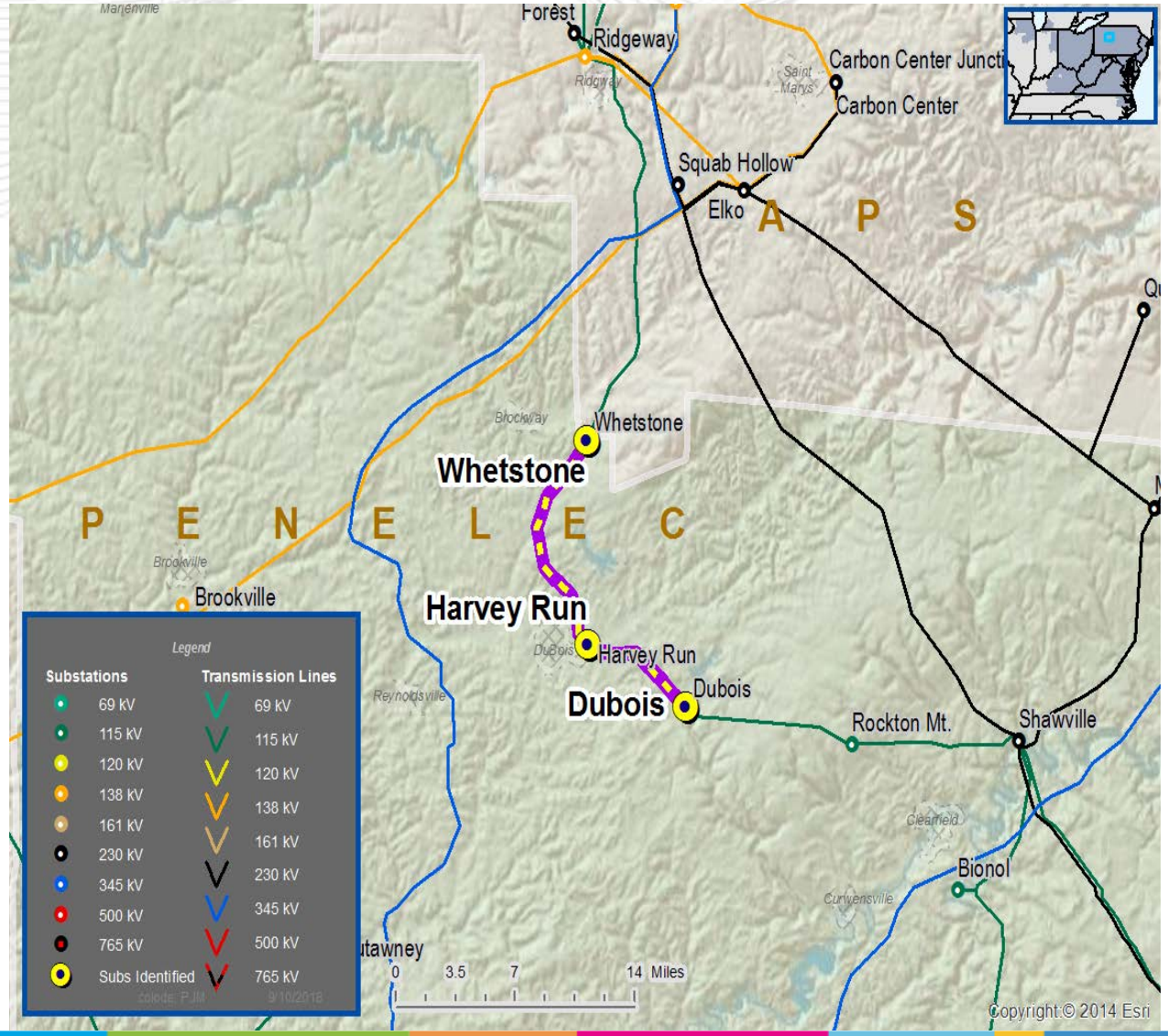
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Maintenance/rehab work will be performed on the Dubois-Harvey Run-Whetstone 115 kV line.

Transmission line rating limited by terminal equipment.

- Dubois – Harvey Run 115 kV line: Existing emergency line rating is 179 MVA. Existing conductor emergency rating is 245 MVA.
- Harvey Run – Whetstone 115 kV line: Existing emergency line rating is 172 MVA. Existing conductor emergency rating is 245 MVA.



Penelec Transmission Zone

Need Number: PN-2018-002
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Equipment Material Condition, Performance and Risk
Specific Assumption Reference(s)
Line Condition Rebuild/Replacement

- Equipment characteristics are near or beyond existing service life or contain components that are obsolete.

Substation/Line Equipment Limits

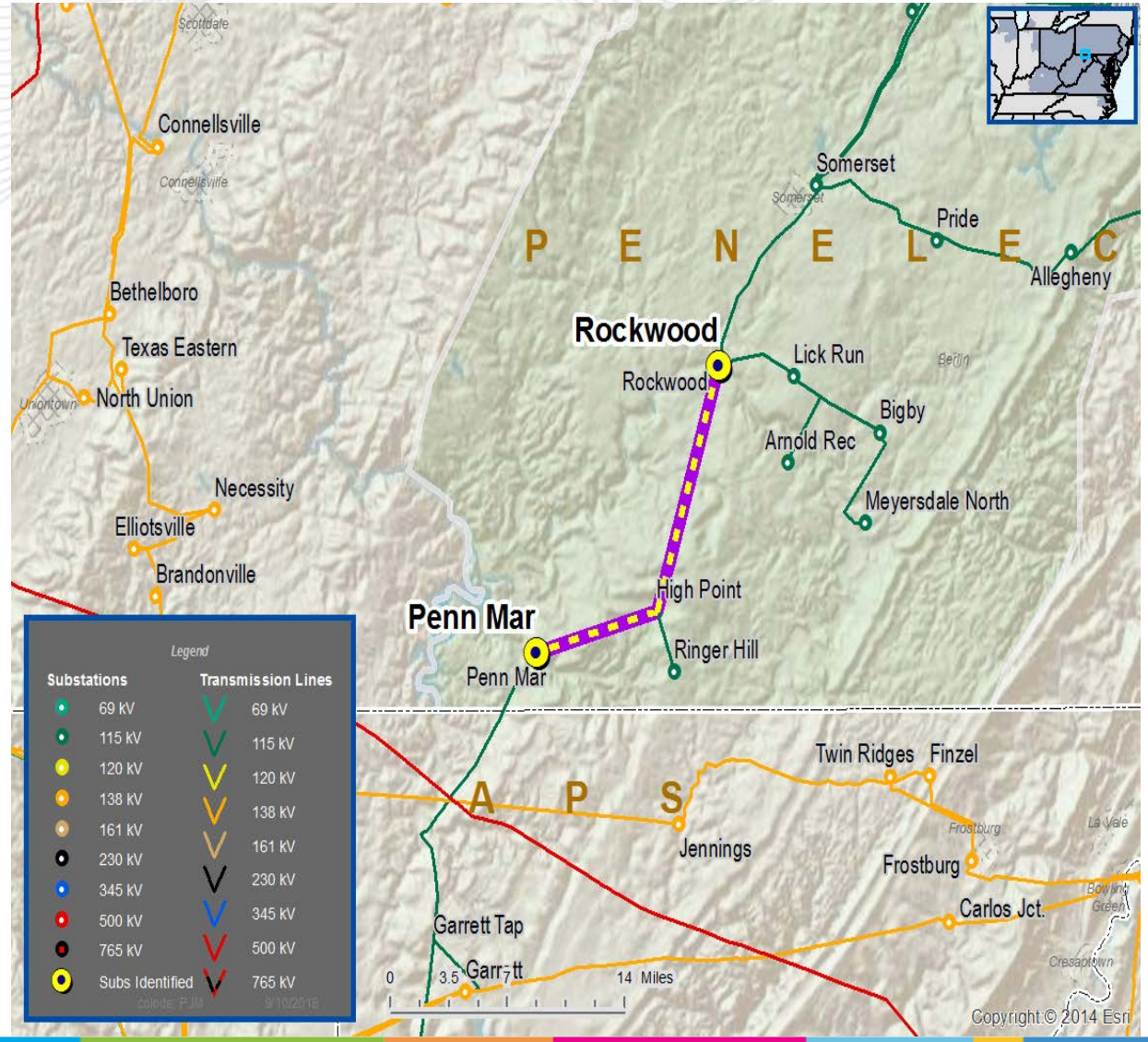
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Reconductor/Rebuild Transmission Lines

- Transmission lines with high loading while factoring in its overall condition assessment.

Problem Statement

- Entire Penn Mar-Rockwood 115 kV line is at or beyond service life. Transmission line loading exceeds 90% under N-1 contingency.
- Transmission line rating limited by terminal equipment.
- Penn Mar – High Point 115 kV line: Existing emergency line rating is 174 MVA. Existing conductor emergency rating is 179 MVA.
- High Point – Rockwood 115 kV line: Existing emergency line rating is the existing conductor emergency rating.



Penelec Transmission Zone

Need Number: PN-2018-003
Process Stage: Need Meeting
Date: 9/21/2018

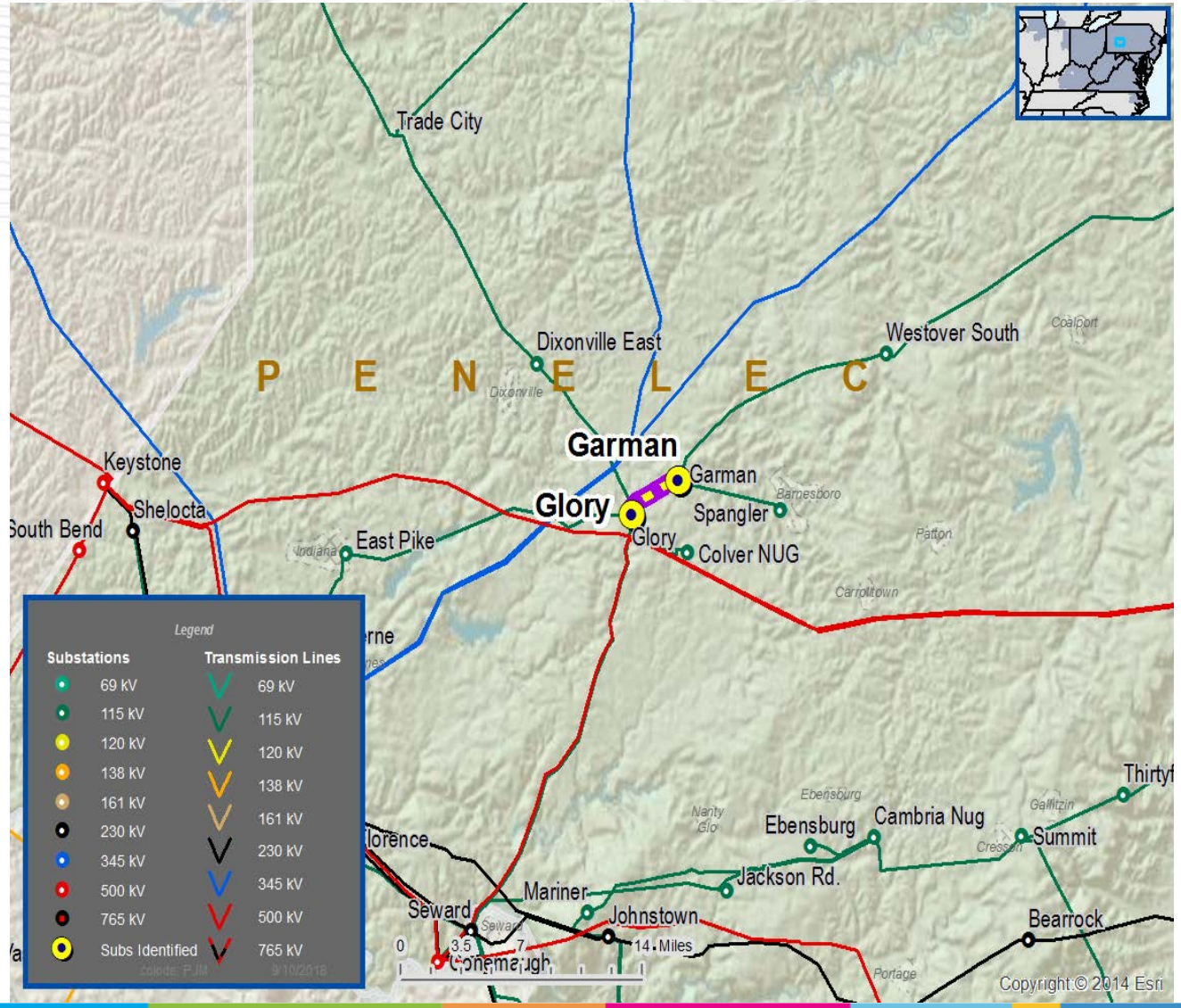
Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)
Upgrade Relay Schemes
- Upgrade relay schemes that have historically high percentage of misoperation.

Substation/Line Equipment Limits
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
- Relays on Garman – Glory 115 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing emergency line rating is 233 MVA. Conductor emergency rating is 282 MVA.



Penelec Transmission Zone

Need Number: PN-2018-004
Process Stage: Need Meeting
Date: 9/21/2018

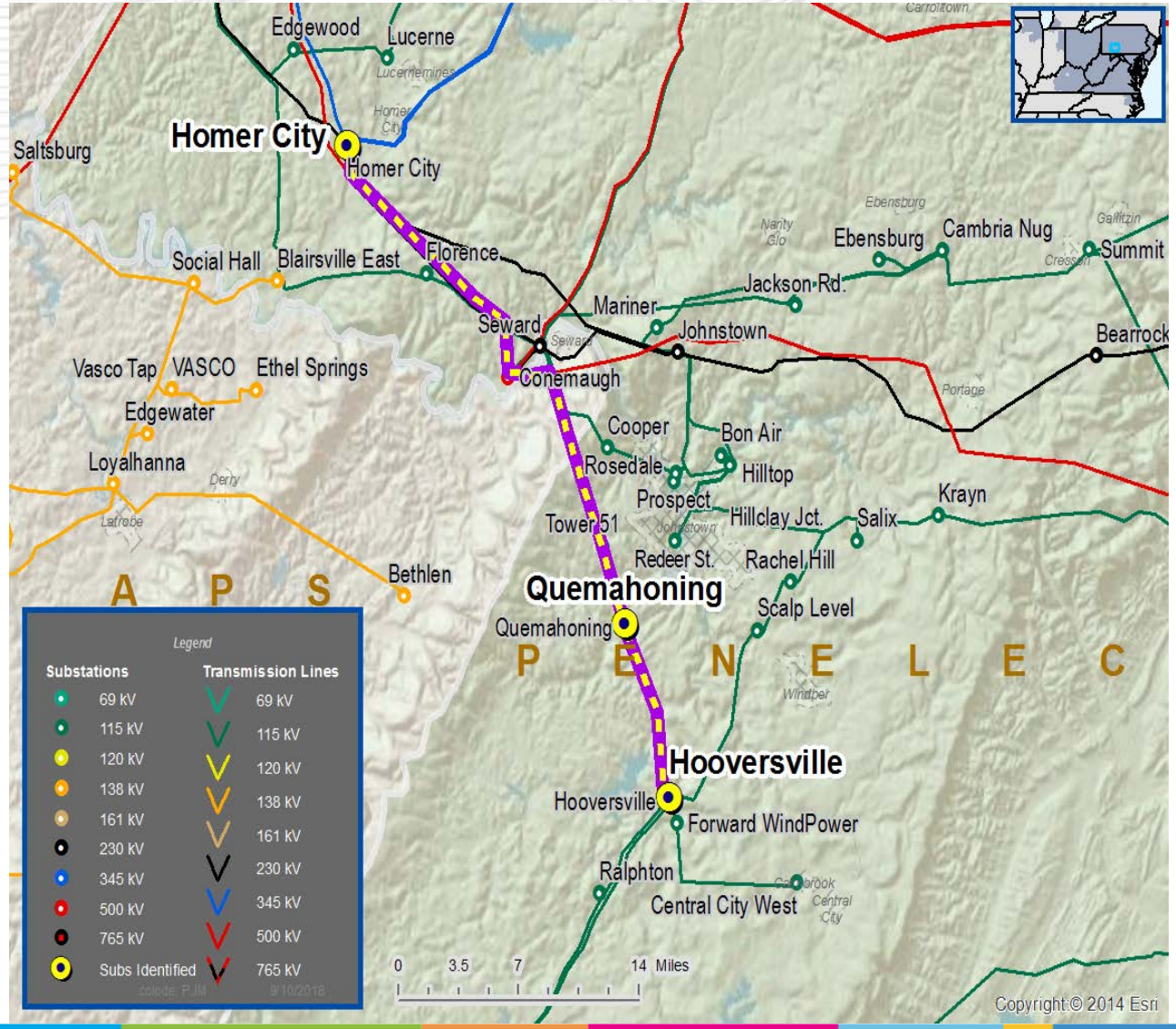
Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Critical Updates to Standards

- Elimination of Ground Switches – Where high-speed ground switches exist, a circuit breaker should be considered for installation to protect the transformer and not trip the line, thereby eliminating outages to customers on the transmission line.
- Line Switches – Switches should be considered for replacement to allow for desired operations (i.e. line charging, loop splitting, etc.).

Problem Statement

- Planned maintenance on the Homer City – Hooverville 230 kV line results in the interruption of service for a large industrial customer served out of Quemahoning Substation. The line sectionalizing devices at Quemahoning are inadequate to interrupt charging current on the Homer City side of the substation. At Hooversville, the transformer breaker failure scheme utilizes a ground switch on the high side of the 230/115 kV transformer.



Penelec Transmission Zone

Need Number: PN-2018-005
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Operational Flexibility and Efficiency

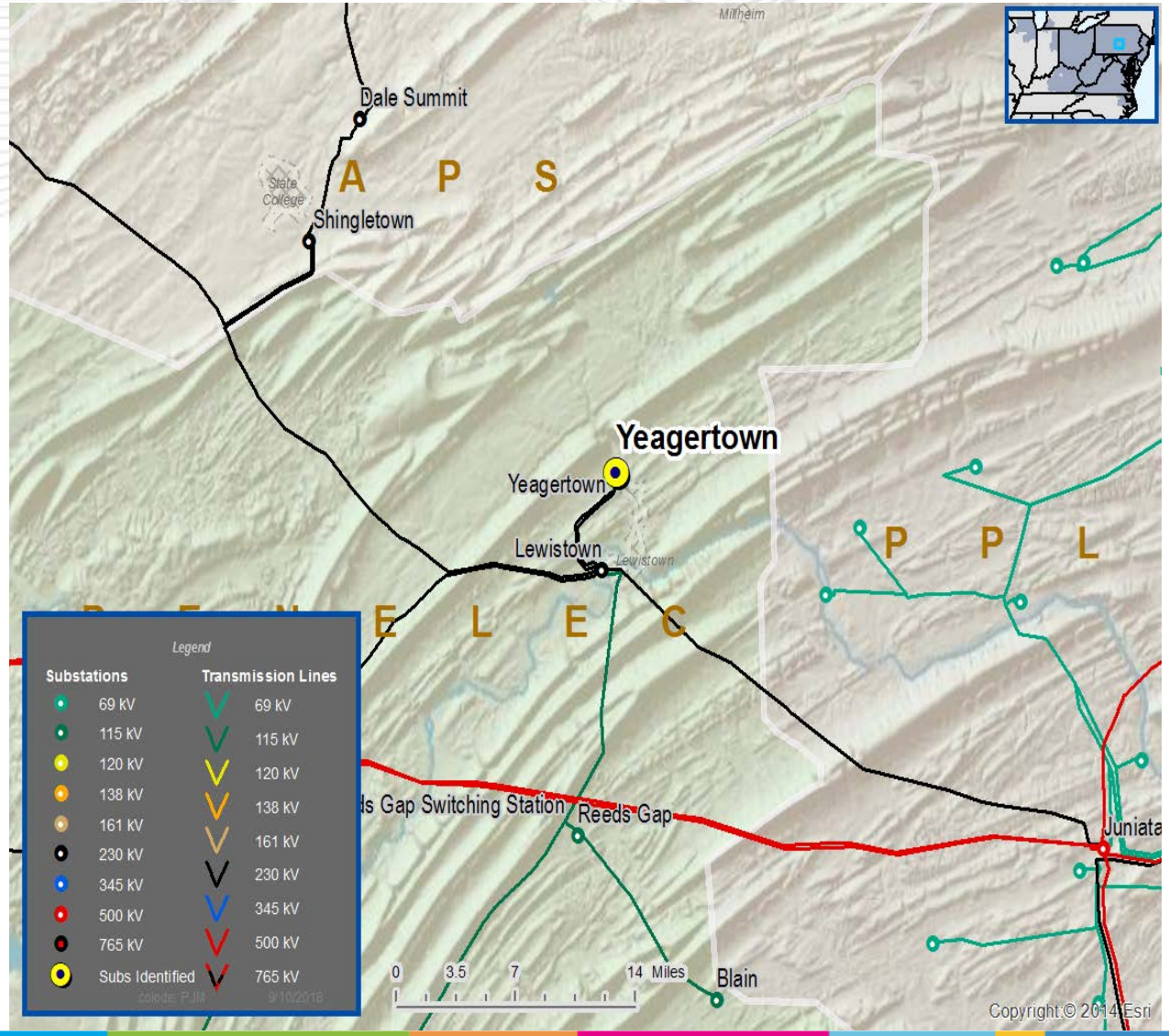
Specific Assumption Reference(s)
Add/Expand Bus Configuration

- Loss of substation bus adversely impacts transmission system performance.
- Reduce the amount of exposed potential local load loss during contingency conditions.
- Eliminate simultaneous outages to multiple networked elements for stuck breakers, bus outages, N-2 events, etc.

Problem Statement

- At Yeagertown, in the event of a stuck 230 kV bus tie breaker, both 230 kV feeds from Lewistown are outaged, along with two 230-46 kV transformers feeding a large industrial customer and a 230/34.5 kV transformer.

- In the current configuration, the 230 kV feeds the 34.5 kV bus via a 230/34.5 kV transformer. The 34.5 kV bus then feeds the 46 kV system via a 46-34.5 kV transformer. This arrangement creates a transmission path through a distribution facility.



Penelec Transmission Zone

Need Number: PN-2018-006
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Substation Condition Rebuild/Replacement

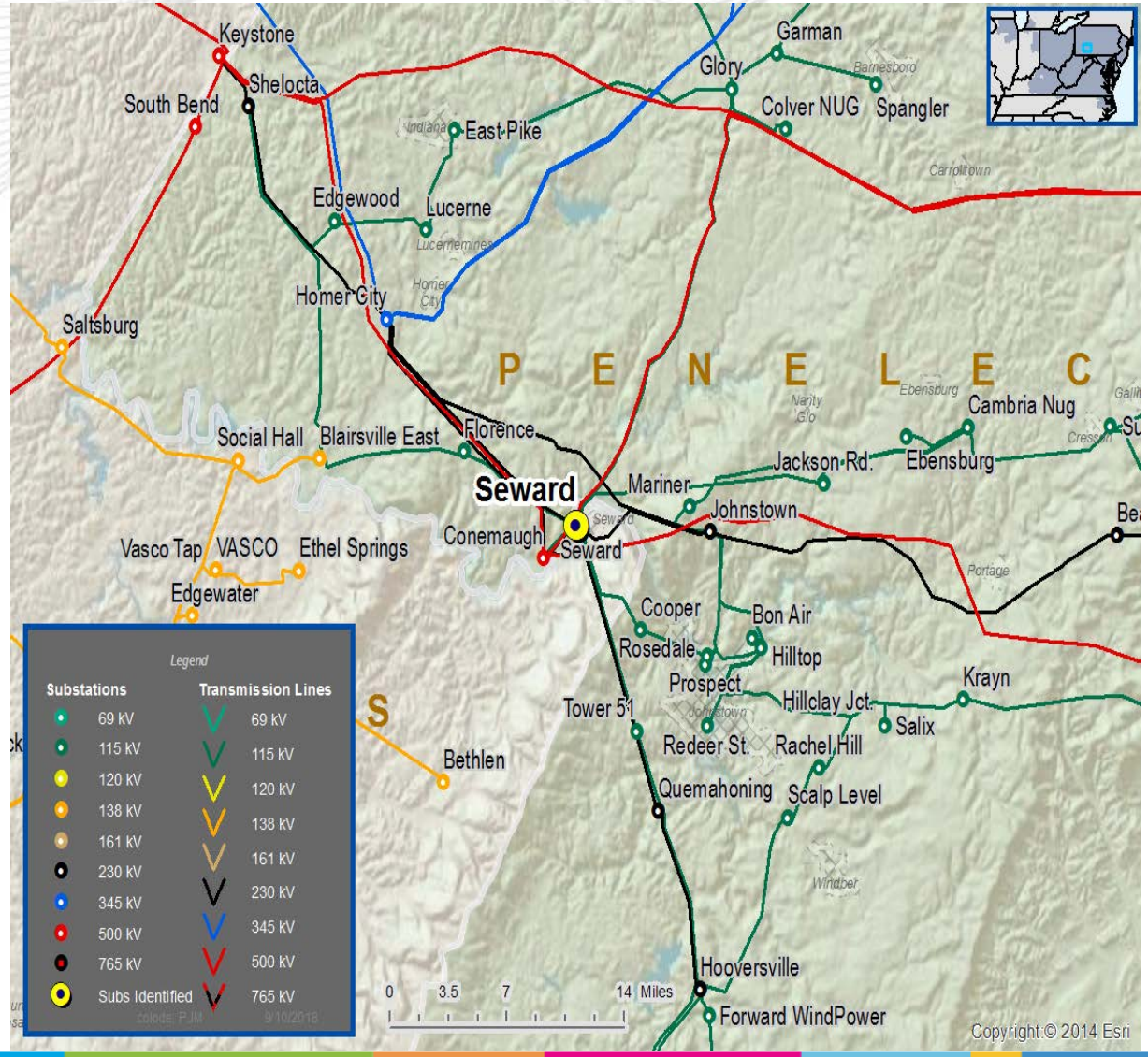
- Show an increasing negative trend in maintenance findings and/or costs.
- Are at a higher risk for failure based on asset design characteristics, or historical industry/company performance data, or application design error.
- Are near or beyond expected service life or obsolete.

Add/Expand Bus Configuration

- Eliminate simultaneous outages to multiple networked elements under N-1 analysis.

Problem Statement

- A fault on the Seward #9 230/115 kV transformer outages the Seward #11 230/115 kV transformer or a fault on the Seward #11 230/115 kV transformer outages the Seward #9 230/115 kV transformer.
- Seward #9 230/115 kV transformer has an increased failure probability due to aging/deteriorating bushings, components and fluid. The transformer was manufactured in 1971.



Penelec Transmission Zone

Need Number: PN-2018-007
Process Stage: Need Meeting
Date: 9/21/2018

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

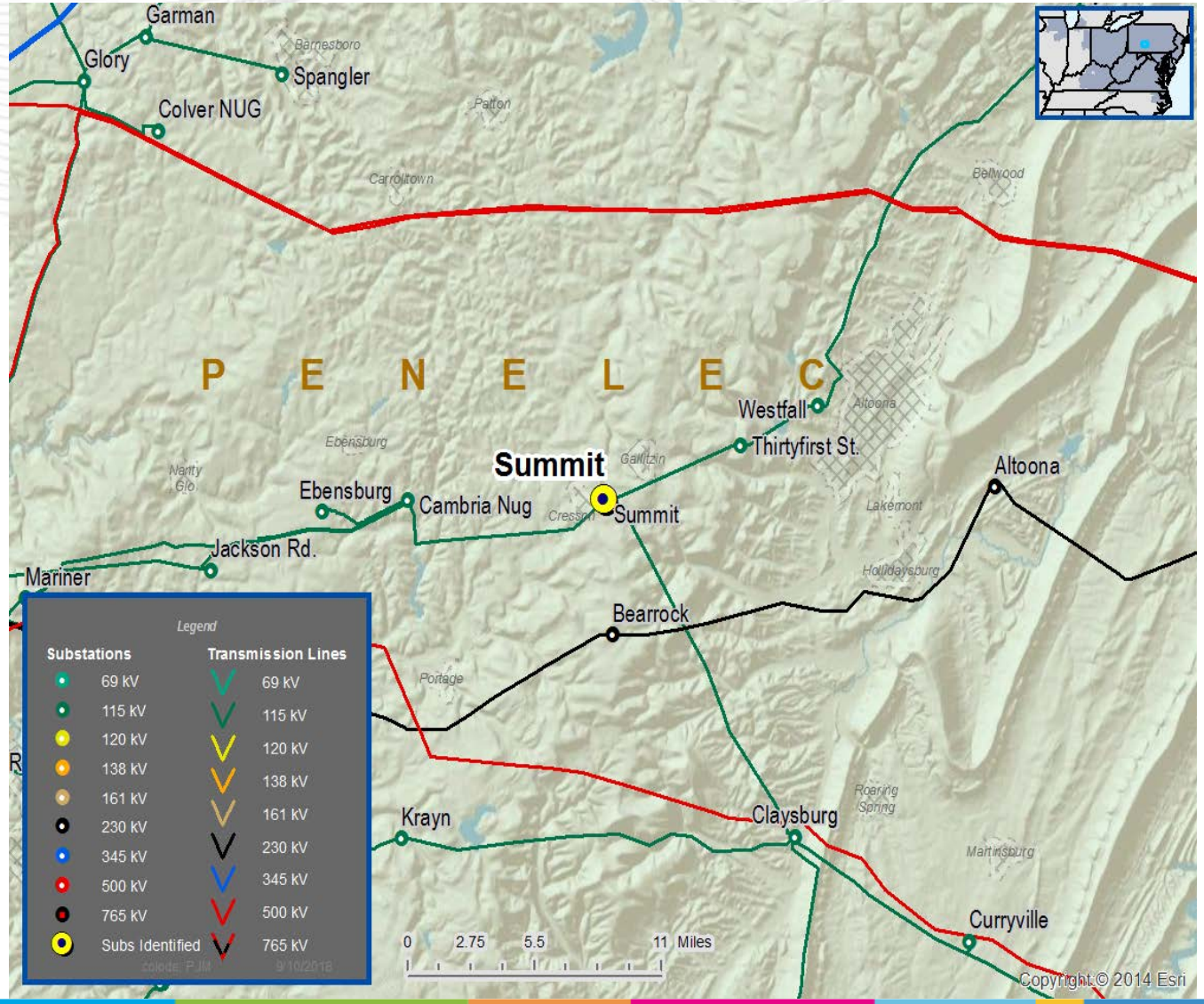
Specific Assumption Reference(s)
Substation Condition Rebuild/Replacement
- Show an increasing negative trend in maintenance findings and/or costs.
- Are near or beyond expected service life or obsolete.

Add/Expand Bus Configuration
- Loss of substation bus adversely impacts transmission system performance.
- Eliminate simultaneous outages to multiple networked elements for stuck breakers, bus outages, N-2 events, etc.

Problem Statement
- In the event of a Summit #1 or #2 115-46 kV transformer fault, the line exit breakers and the bus tie breaker are relied upon to clear the fault. The corresponding section of the bus is cleared, creating transfer and thermal issues.

- A stuck 115 kV bus tie breaker at Summit will clear the entire 115 kV station.

- Summit #1 and #2 115-46 kV transformers have an increased failure probability due to aging/deteriorating bushings, components and fluid. The #1 transformer was manufactured in 1937. The #2 transformer was manufactured in 1971.



Penelec Transmission Zone

Need Number: PN-2018-008
Process Stage: Need Meeting
Date: 9/21/2018
Project Driver(s):
Operational Flexibility and Efficiency
Equipment Material Condition, Performance and Risk
Specific Assumption Reference(s)
Substation Condition Rebuild/Replacement

- Show an increasing negative trend in maintenance findings and/or costs.
- Are near or beyond expected service life or obsolete.

Add/Replace Transformers

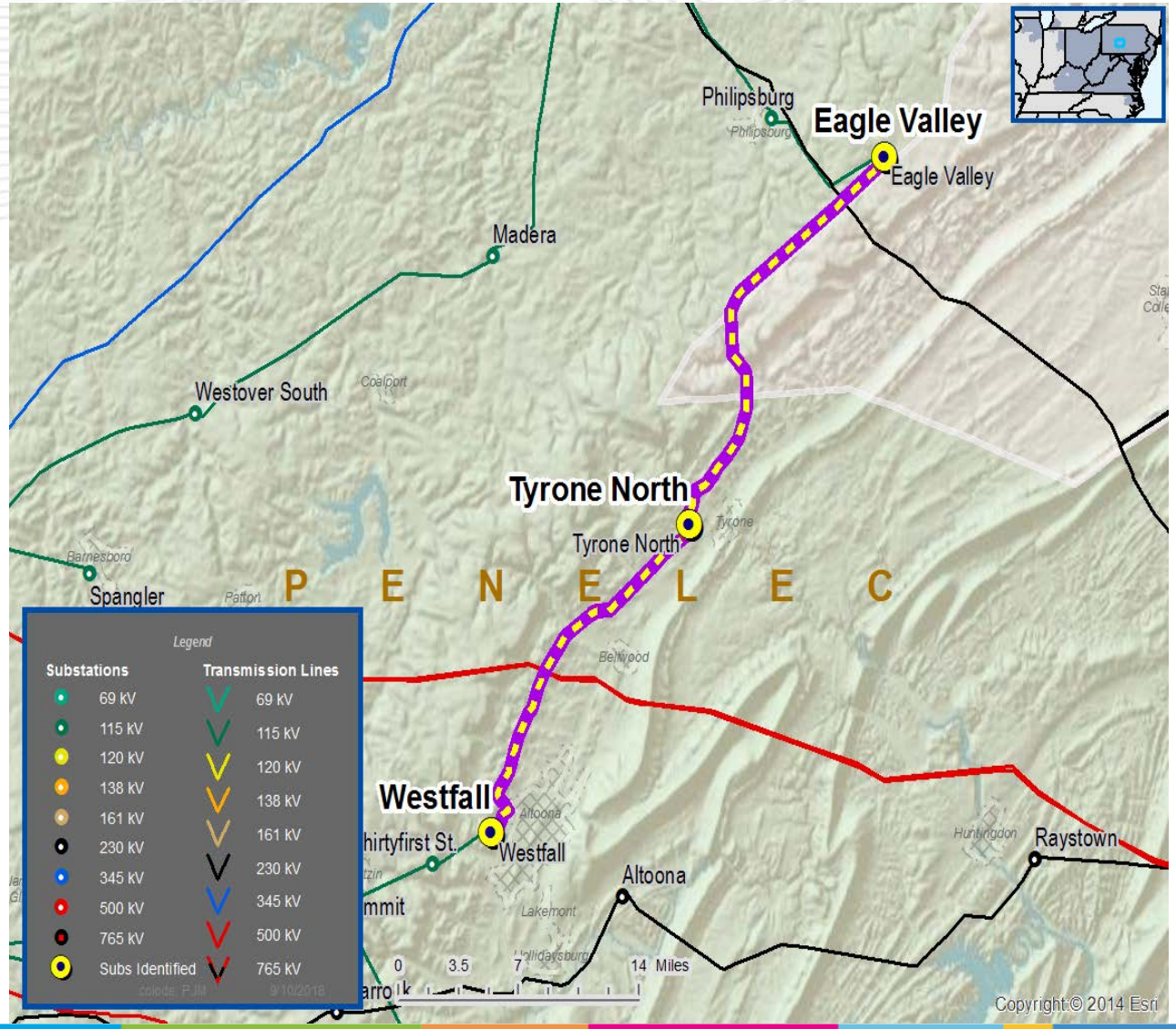
- Transformer that if added or replaced would alleviate loading conditions under contingency scenarios.

Add/Expand Bus Configuration

- Loss of substation bus adversely impacts transmission system performance.
- Reduce the amount of exposed potential local load loss during contingency conditions.
- Eliminate simultaneous outages to multiple networked elements under N-1 analysis.

Problem Statement

- Tyrone North 115 kV switching station serves ~50 MW of radial load and relies on breakers at Eagle Valley and Westfall 115 kV substations for remote clearing of fault conditions. Transformer or line faults result in interruption of the entire network path and interruption of service to both the #1 and #2 115-46 kV transformers with limited network transfer capability. In the event of a #1 115-46 kV transformer fault, all load cannot be served by the #2 115-46 kV transformer (the transformer loads to 123% of its 41 MVA summer emergency rating during restoration efforts under peak conditions).
- Tyrone North #2 115-46 kV transformer has an increased failure probability due to aging/deteriorating bushings, components and fluid. The transformer was manufactured in 1950.



Penelec Transmission Zone

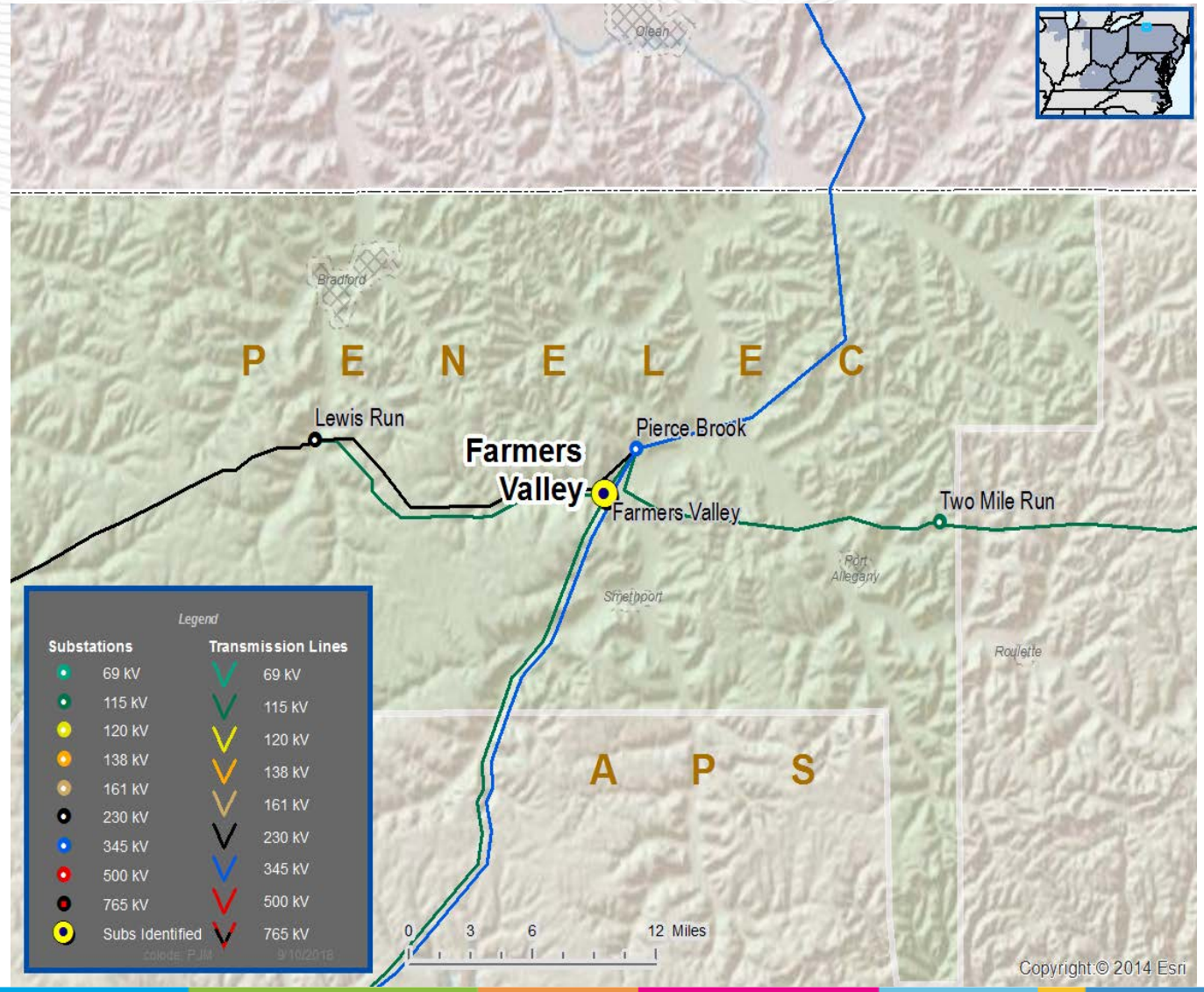
Need Number: PN-2018-009
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Add/Expand Bus Configuration

- Reduce the amount of exposed potential local load loss during contingency conditions.
- Eliminate simultaneous outages to multiple networked elements (excluding capacitor banks) under N-1 analysis.
- If substation bus configurations limit the ability to perform substation maintenance, the substation and/or transmission lines should be evaluated for reconfiguration.

Problem Statement
Farmers Valley 115 kV bus #1 does not have a transmission source, while Farmers Valley 115 kV bus #2 has two sources. Bus maintenance or outages result in loss of both 115-34.5 kV transformers impacting approximately 3,377 customers and approximately 10 MW of load.



Penelec Transmission Zone

Need Number: PN-2018-010
Process Stage: Need Meeting
Date: 9/21/2018

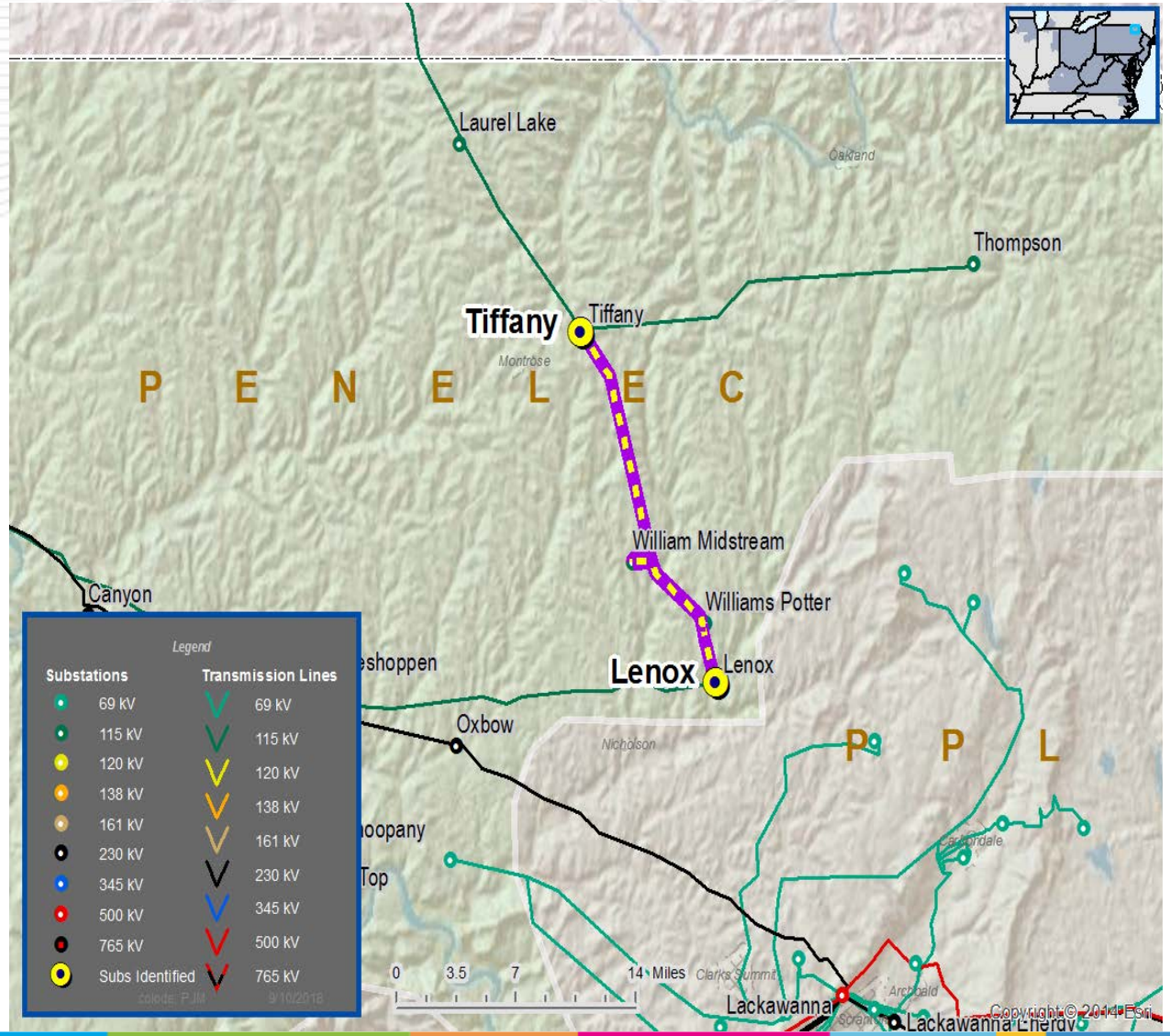
Project Driver(s):
Customer Service

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 – A customer requested 115 kV service for load of approximately 16 MW near the Lenox – Tiffany 115 kV line. Requested in-service date is 7/2019.



Penelec Transmission Zone

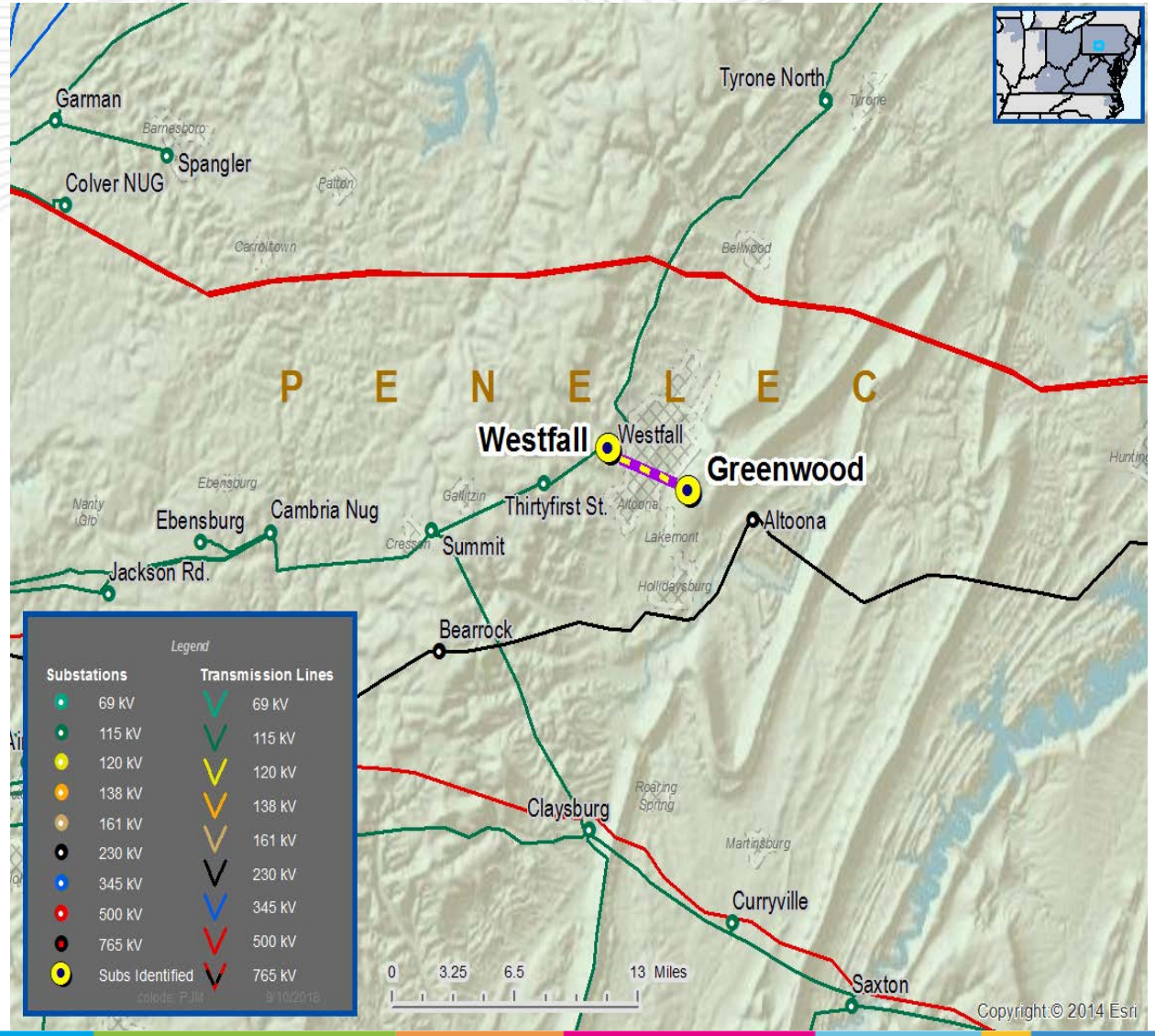
Need Number: PN-2018-011
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Substation/Line Equipment Limits
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Critical Upgrade to Standards
- Line Switches – Switches should be considered for replacement to allow for desired operations (i.e. line charging, loop splitting, etc.).

Problem Statement
- Existing terminal equipment significantly derate the thermal capability of the Greenwood – Westfall 46 kV line. The line sectionalizing devices at East Altoona and Fairview are not capable of loop splitting.
- Transmission line rating limited by terminal equipment.
- Westfall – Fairview 46 kV line: Existing emergency line rating is 69 MVA. Existing conductor emergency rating is 81 MVA
- Fairview – East Altoona 46 kV line: Existing emergency line rating is 69 MVA. Existing conductor emergency rating is 71 MVA.
- East Altoona – Greenwood 46 kV line: Existing emergency line rating is 33 MVA. Existing conductor emergency rating is 81 MVA.



Penelec Transmission Zone

Need Number: PN-2018-012
Process Stage: Need Meeting
Date: 9/21/2018

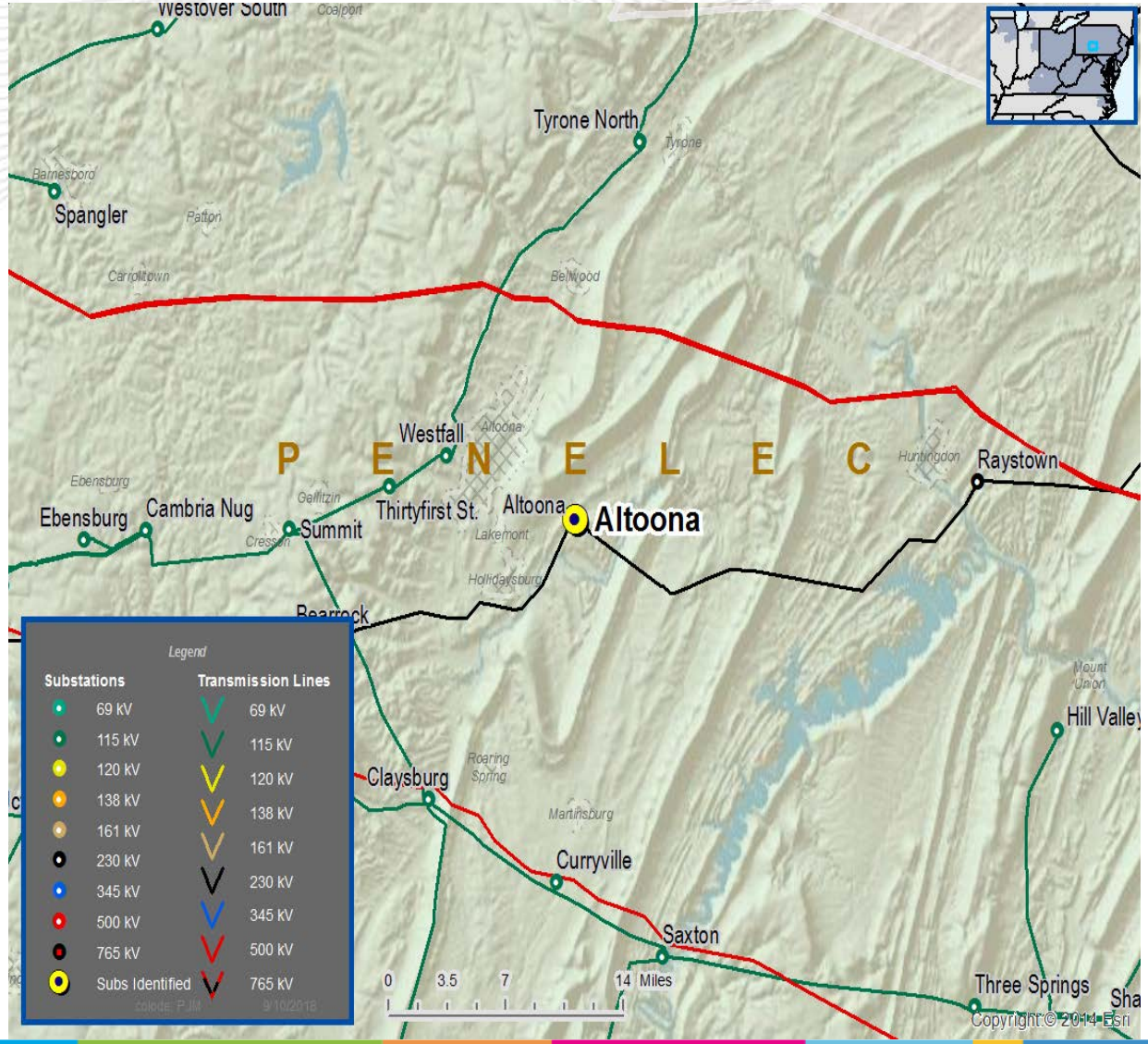
Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Global Consideration
- Assess the risk associated with bus, stuck breaker, and N-2 contingencies to improve FERC tariffed Transmission < 100 kV facilities.

Network Radial Lines
- Radial lines will be evaluated based on load at risk and/or customers impacted along with its proximity to other networked facilities.

Build New Transmission Line
- Network radial lines.

Problem Statement
- If both Altoona 230/46 kV transformers out of service (N-1-1), voltage on the surrounding 46 kV system is less than 0.80 p.u.



Penelec Transmission Zone

Need Number: PN-2018-013
Process Stage: Need Meeting
Date: 9/21/2018

Project Driver(s):
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Global Consideration

- Assess the risk associated with bus, stuck breaker, and N-2 contingencies to improve FERC tariffed Transmission < 100 kV facilities.

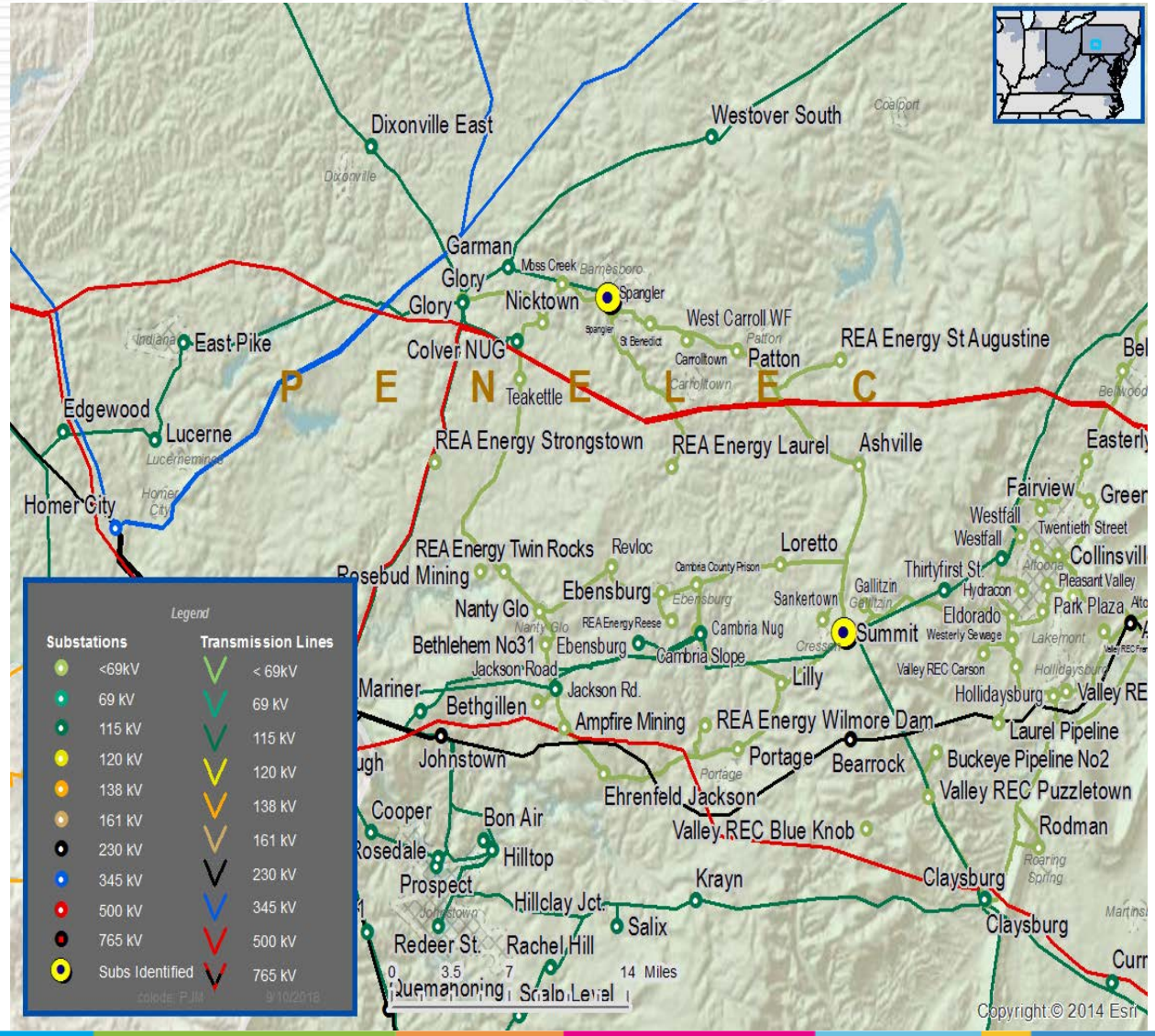
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- For the loss of Spangler 115-46 kV transformer and SGC Tap – Summit 46 kV line, the Nanty-Glo – Twin Rock 46 kV line loads to greater than 120% of its 44 MVA STE rating.

- Transmission line rating limited by terminal equipment. Existing emergency line rating is 44 MVA. Existing conductor emergency rating is 81 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-001
Process Stage: Need Meeting
Date: 9/21/2018

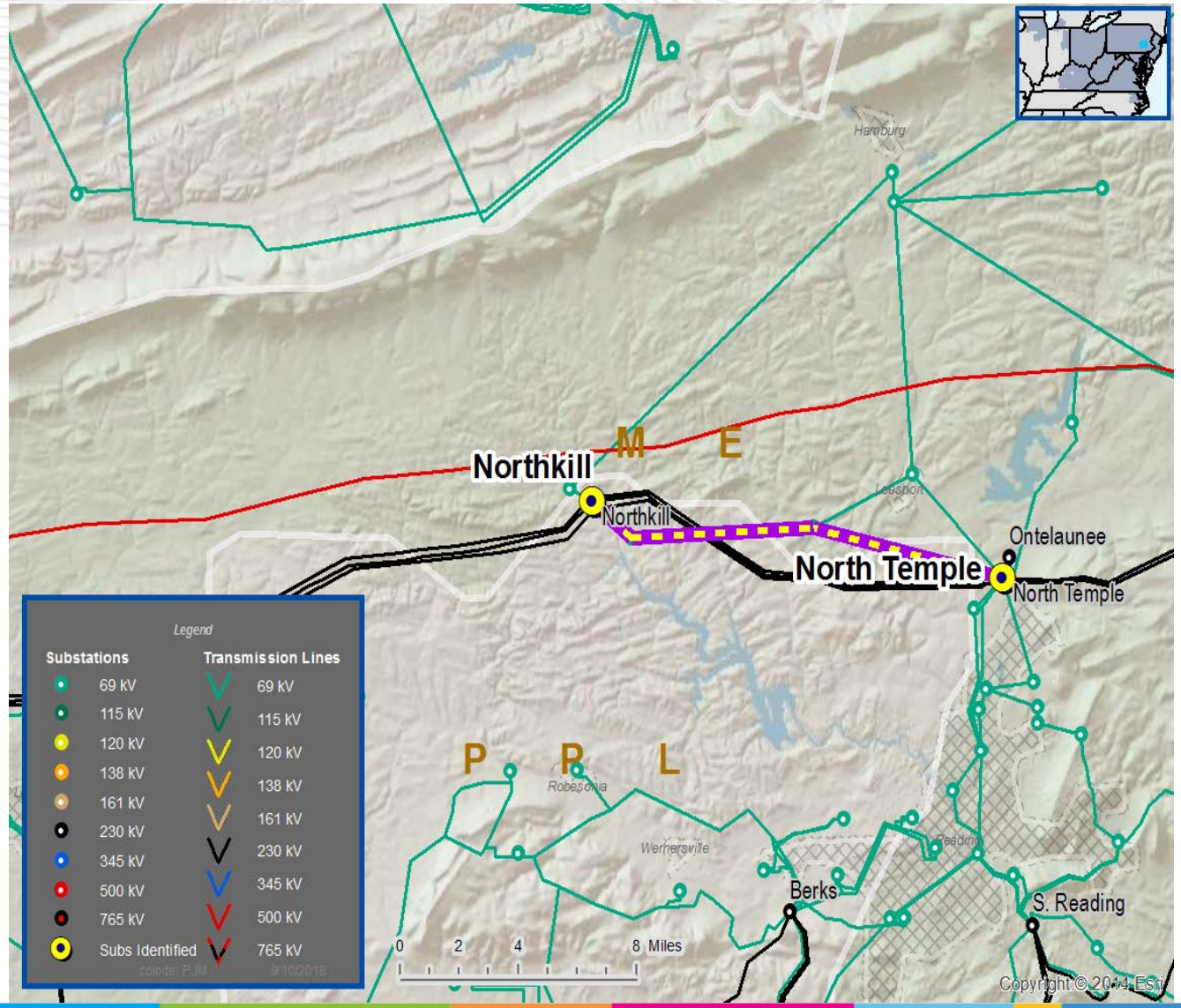
Project Driver(s):
Customer Service

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 - A customer requested 69 kV service for load of approximately 17 MVA near the North Temple – Northkill 69 kV line. Requested in-service date is 12/2019.



Met-Ed Transmission Zone

Need Number: ME-2018-002
Process Stage: Need Meeting
Date: 9/21/2018

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

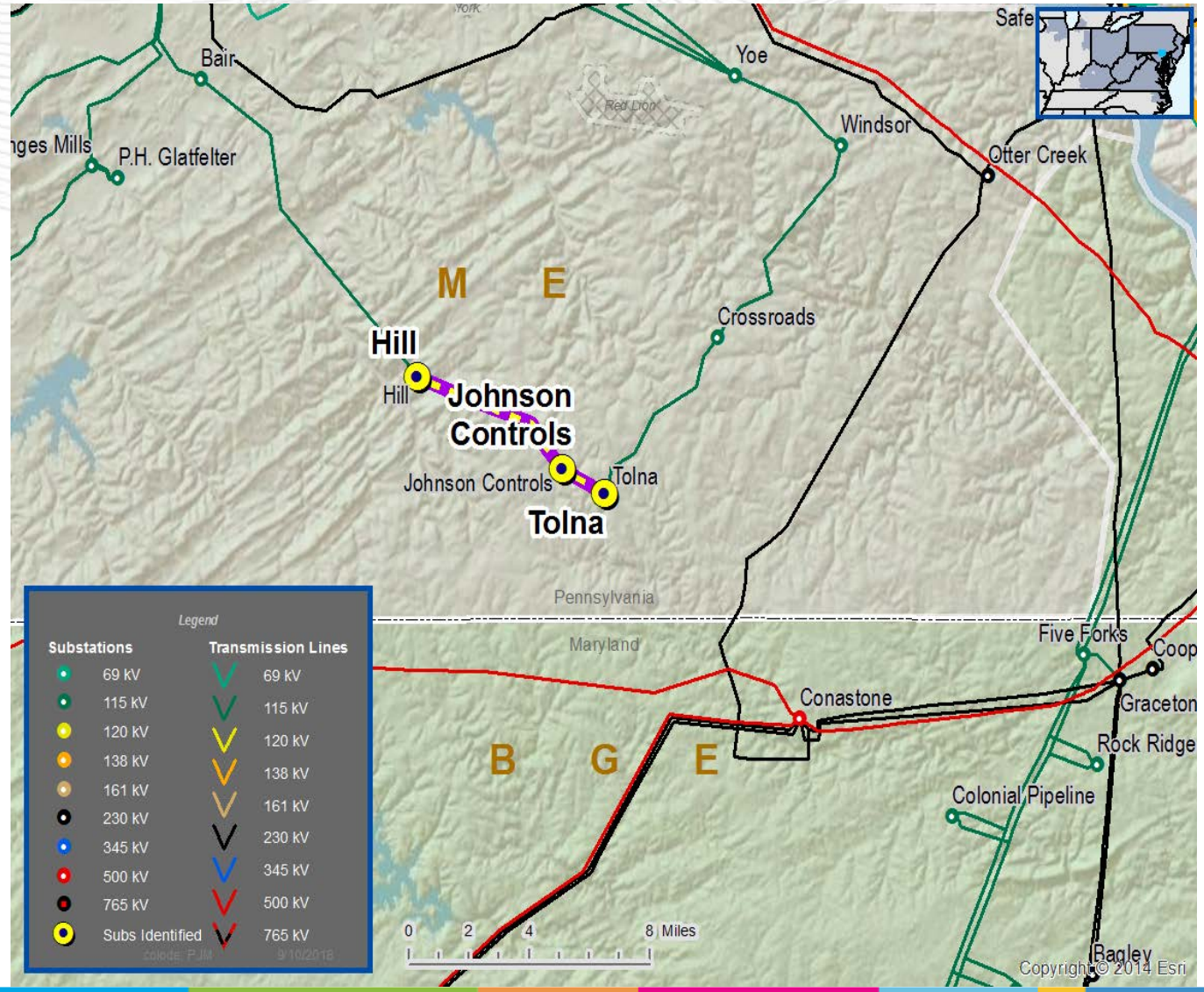
Specific Assumption Reference(s)
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
Maintenance/rehab work will be performed on the Hill-Tolna 115 kV line.

Transmission line rating limited by terminal equipment.

- Hill – Johnson Controls 115 kV line: Existing emergency line rating is 150 MVA. Existing conductor emergency rating is 223 MVA.
- Johnson Controls – Tolna 115 kV line: Existing emergency line rating is 208 MVA. Existing conductor emergency rating is 223 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-003
Process Stage: Need Meeting
Date: 9/21/2018

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

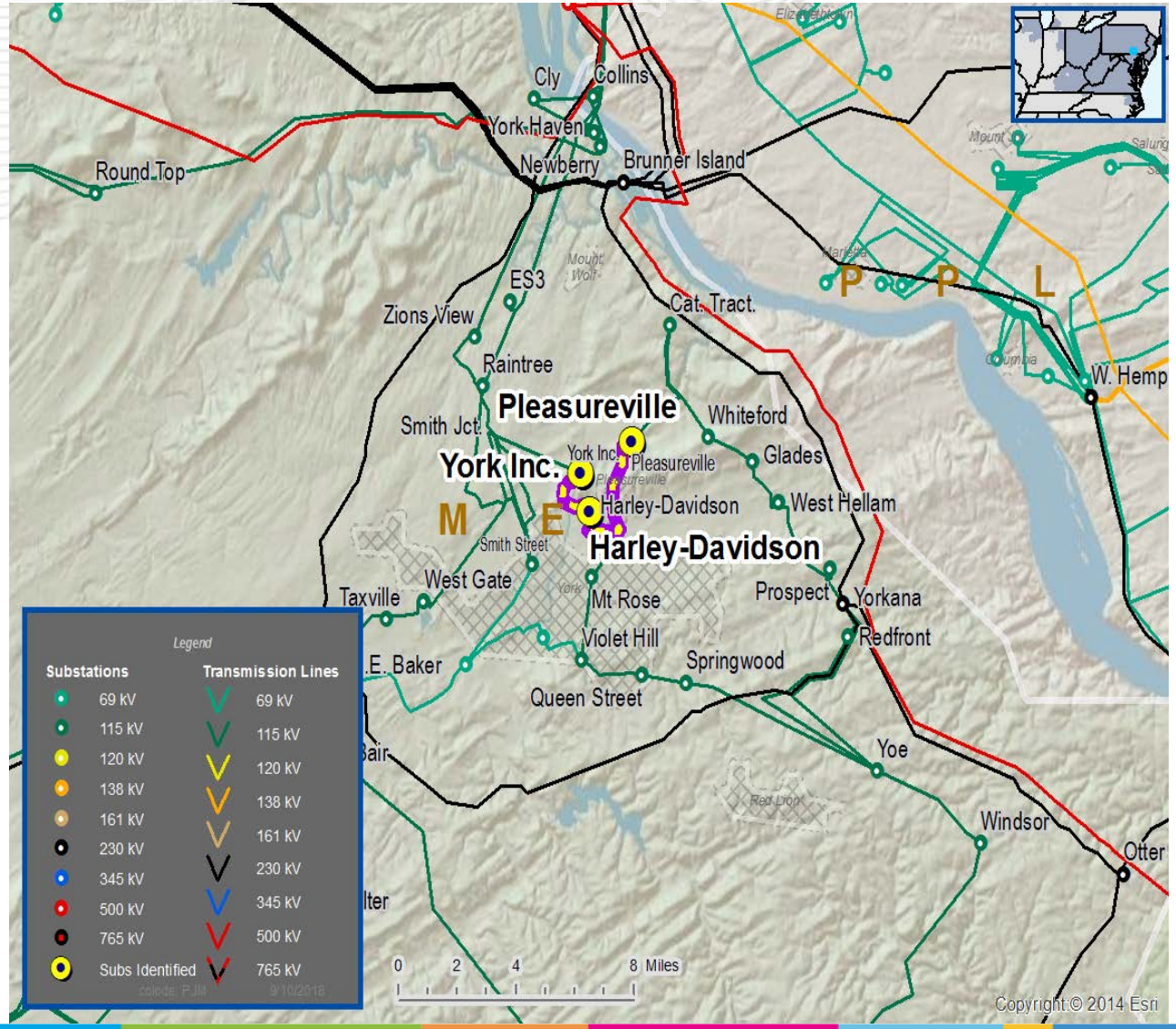
Specific Assumption Reference(s)
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
Maintenance/rehab work will be performed on the Pleasureville-Harley Davidson-York Solid Waste 115 kV line.

Transmission line rating limited by terminal equipment.

- Pleasureville – Harley Davidson 115 kV line: Existing emergency line rating is 263 MVA. Existing conductor emergency rating is 430 MVA.
- Harley Davidson – York Inc. 115 kV line: Existing emergency rating is 263 MVA. Existing conductor emergency rating is 282 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-004
Process Stage: Need Meeting
Date: 9/21/2018

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

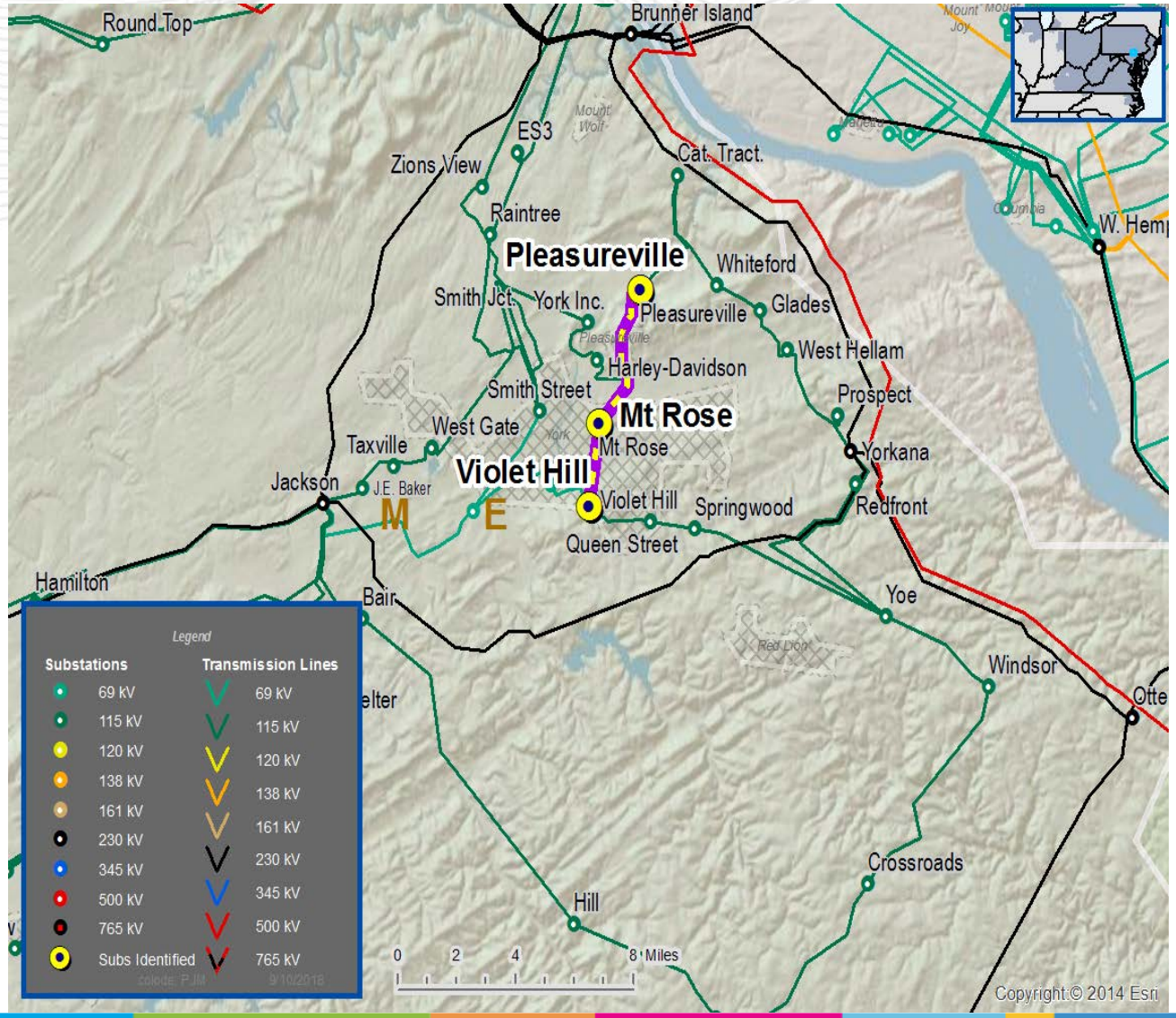
Specific Assumption Reference(s)
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
Maintenance/rehab work will be performed on the Pleasureville-Mt. Rose-Violet Hill 115 kV line.

Transmission line rating limited by terminal equipment.

- Pleasureville – Mt. Rose 115 kV line: Existing emergency line rating is the existing conductor emergency rating.
- Mt. Rose – Violet Hill 115 kV line: Existing emergency line rating is 266 MVA. Existing conductor emergency rating is 282 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-005
Process Stage: Need Meeting
Date: 9/21/2018
Project Driver(s):
Equipment Material Condition, Performance and Risk
Specific Assumption Reference(s)
Line Condition Rebuild/Replacement

- Equipment characteristics are near or beyond existing service life or contain components that are obsolete.

Reconductor/Rebuild Transmission Lines

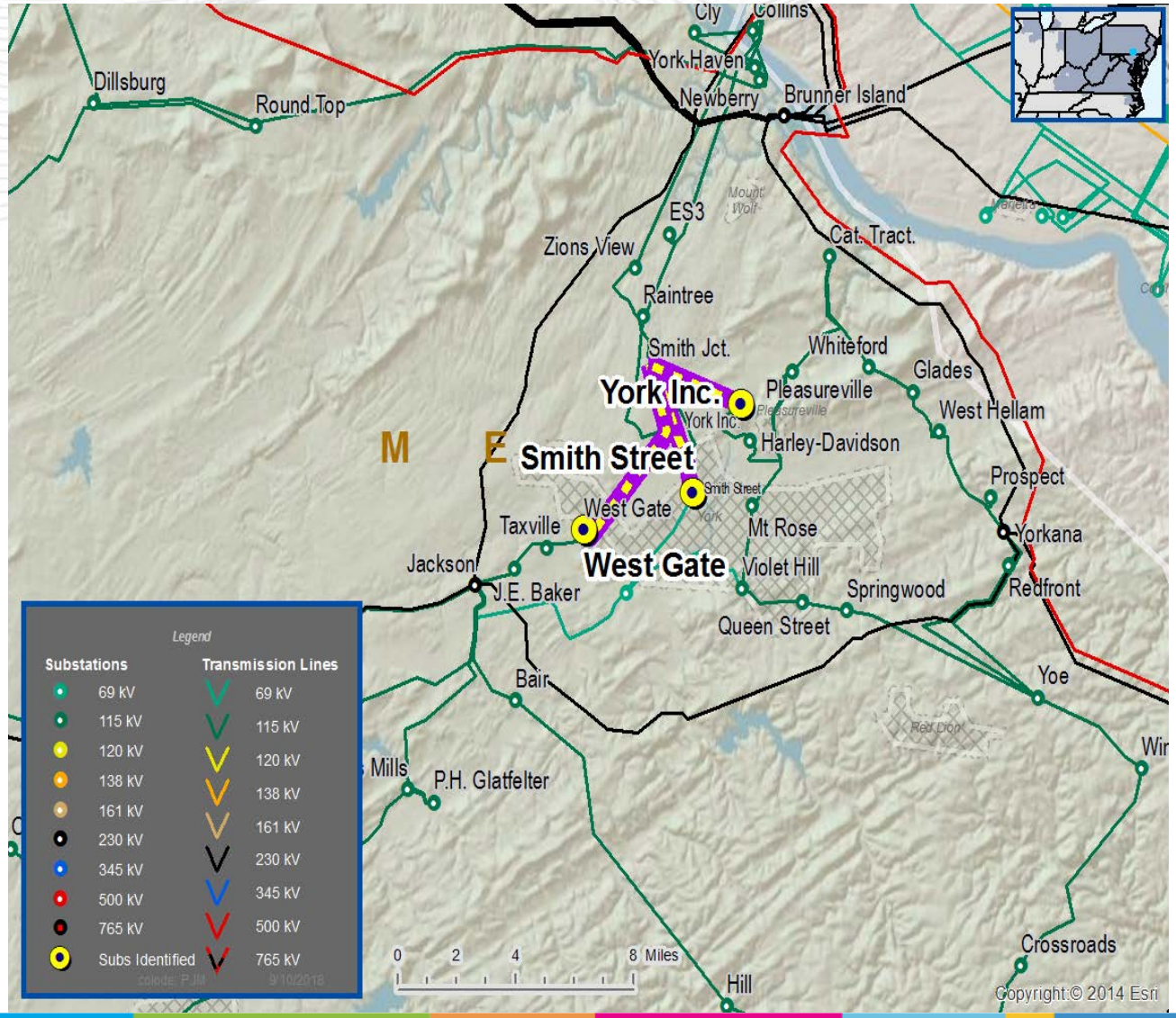
- Transmission lines with high loading while factoring in its overall condition assessment.

Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
Segments of Smith Street-Westgate-York Solid Waste 115 kV line are at or beyond service life.
Transmission line rating limited by terminal equipment.

- Smith Street – Smith Street Tap 115 kV line: Existing emergency line rating is 152 MVA. Existing conductor emergency rating is 223 MVA.
- Westgate – Smith Street Tap 115 kV line: Existing emergency line rating is 263 MVA. Existing conductor emergency rating is 282 MVA.
- York Inc. – Smith Street Tap115 kV line: Existing emergency line rating is the existing conductor emergency rating.



Met-Ed Transmission Zone

Need Number: ME-2018-006

Process Stage: Need Meeting

Date: 9/21/2018

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

Substation/Line Equipment Limits

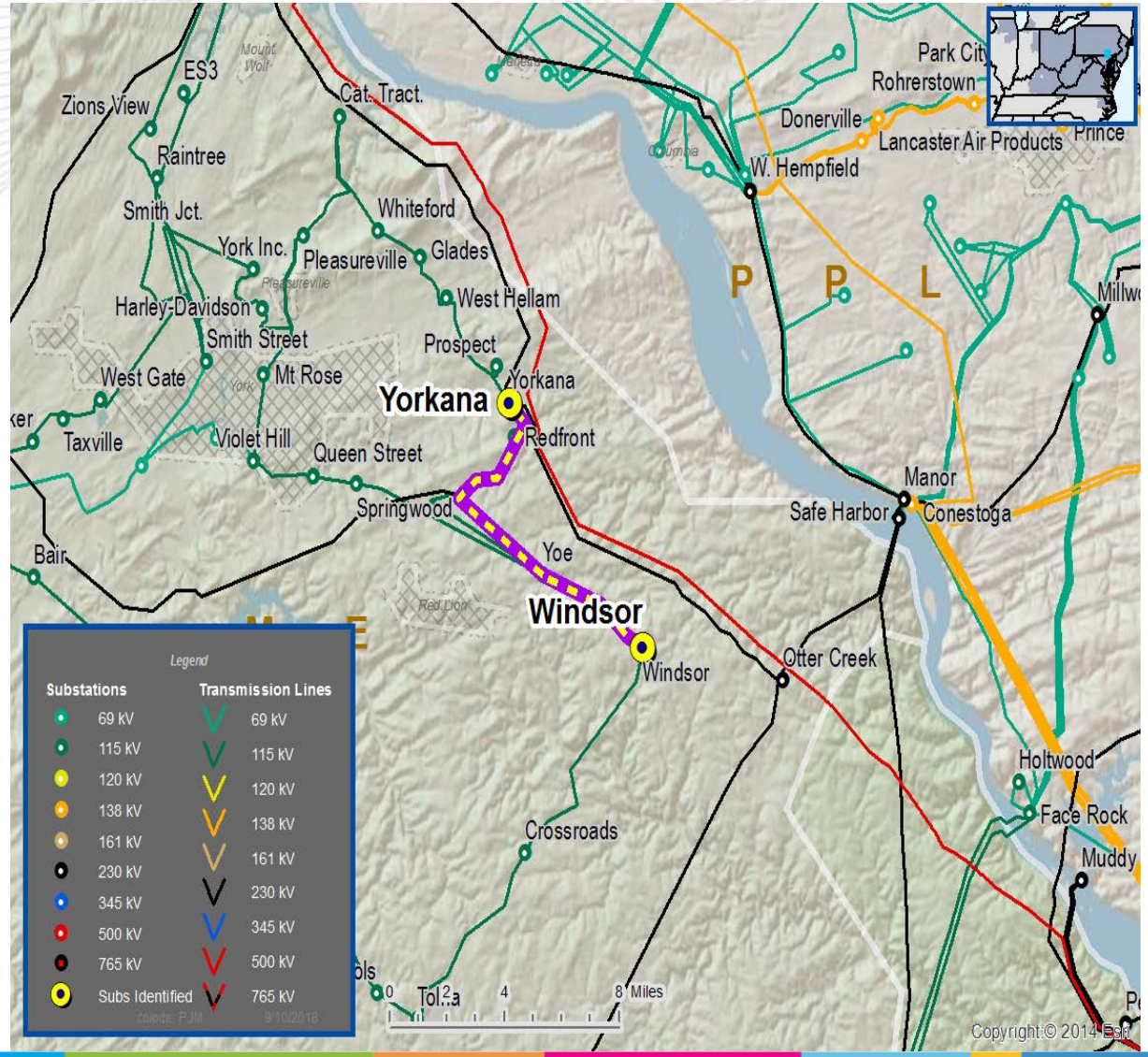
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

Maintenance/rehab work will be performed on the Windsor-Yorkana Tap 115 kV line.

Relays on Windsor – Yorkana 115 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or in a degraded condition.

Transmission line rating limited by terminal equipment. Existing emergency line rating is 277 MVA. Existing conductor emergency rating is 282 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-007
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

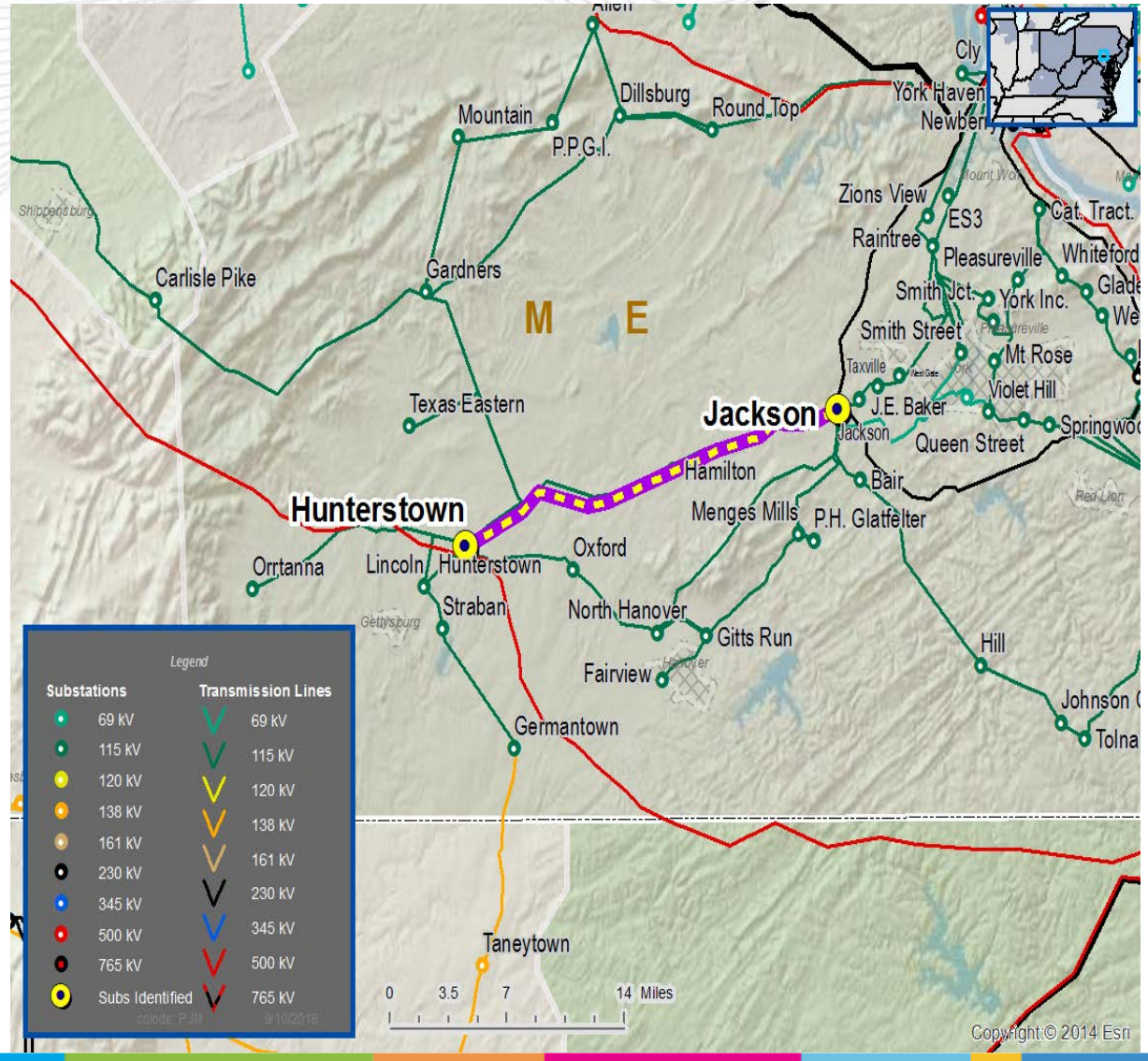
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Relays on Hunterstown – Jackson 230 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing normal line rating is 678 MVA. Conductor normal rating is 709 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-008
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

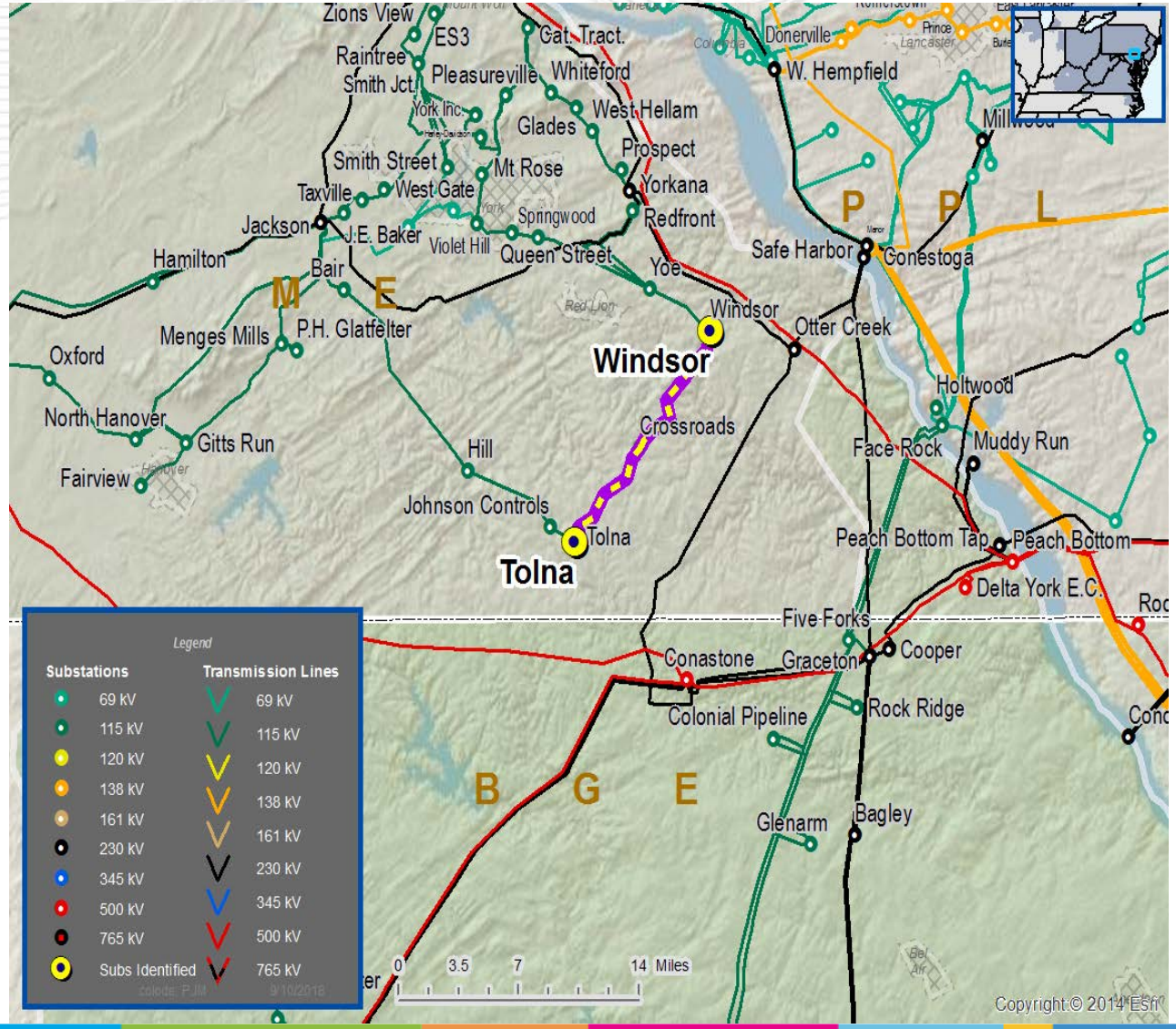
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Relays on Tolna – Windsor 115 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing emergency line rating is 277 MVA. Conductor emergency rating is 282 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-009
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

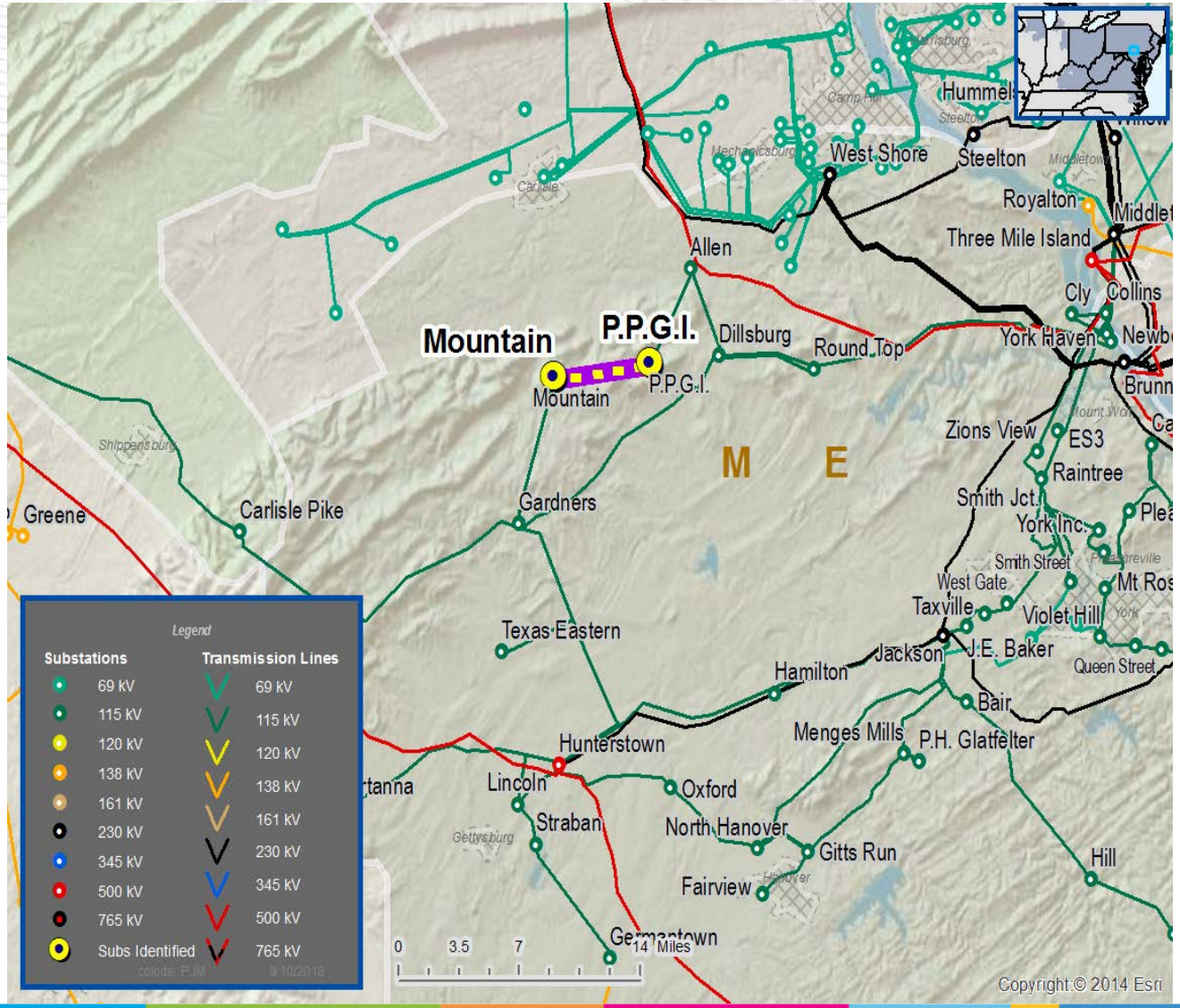
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Relays on Mountain – P.P.G.I. 115 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing normal line rating is 159 MVA. Conductor normal rating is 184 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-010
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

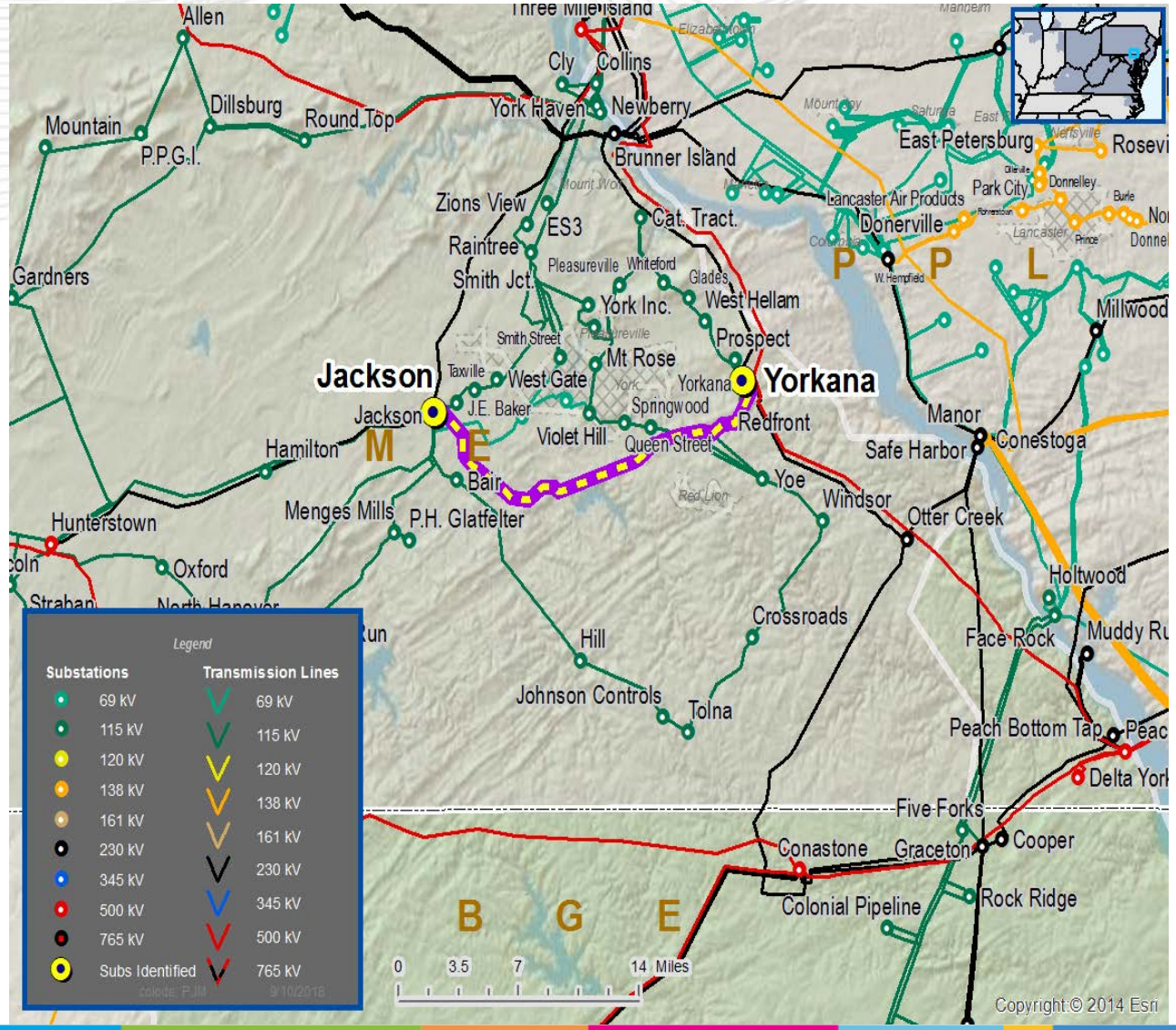
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Relays on Jackson – Yorkana 230 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing normal line rating is 650 MVA. Conductor normal rating is 709 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-011
Process Stage: Need Meeting
Date: 9/21/2018

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

Specific Assumption Reference(s)
Upgrade Relay Schemes

- Upgrade relay schemes that have historically high percentage of misoperation.

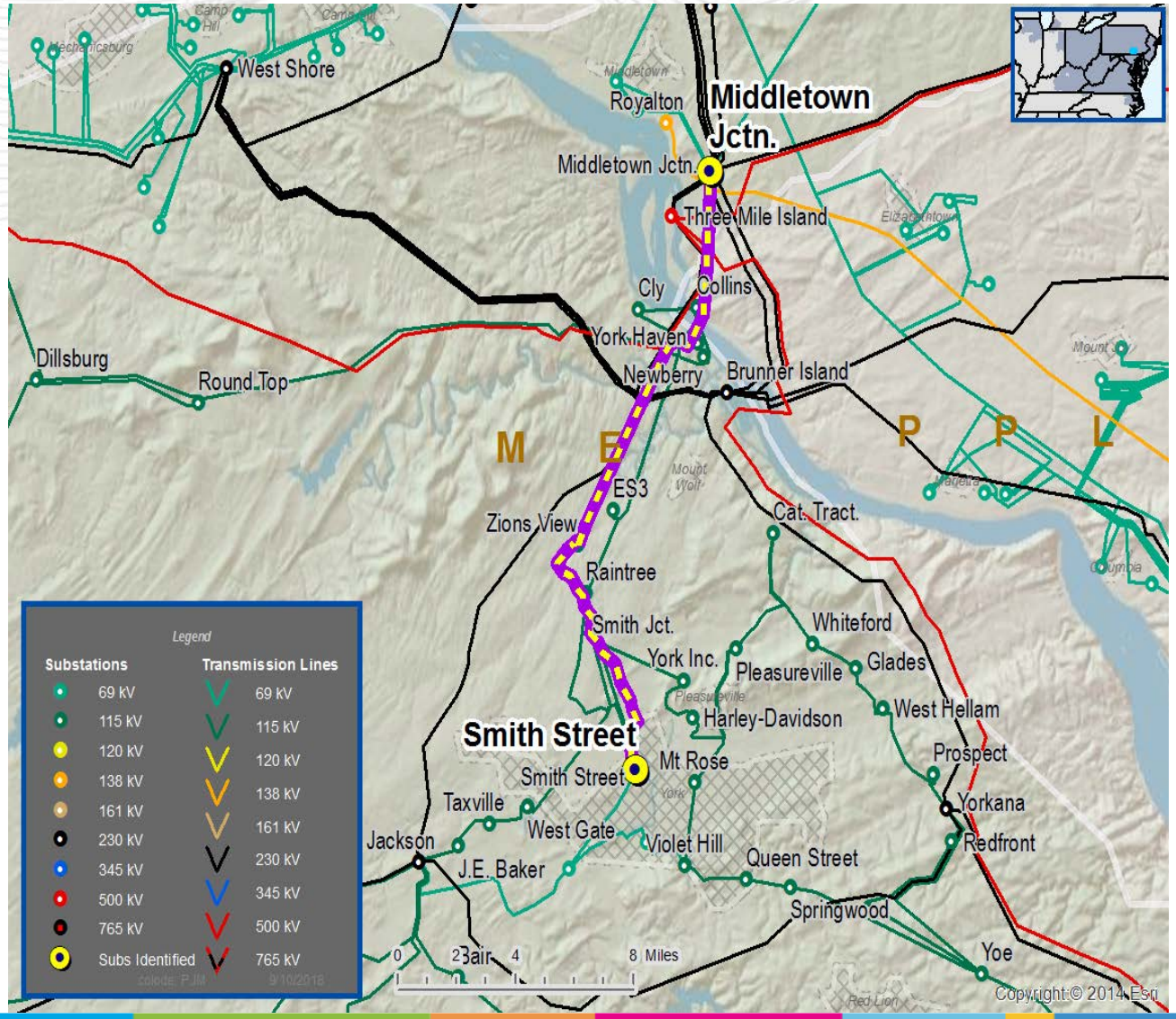
Substation/Line Equipment Limits

- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement

- Relays on Middletown Junction – Smith Street (978) 230 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing normal line rating is 103 MVA. Conductor normal rating is 129 MVA.



Met-Ed Transmission Zone

Need Number: ME-2018-012
Process Stage: Need Meeting
Date: 9/21/2018

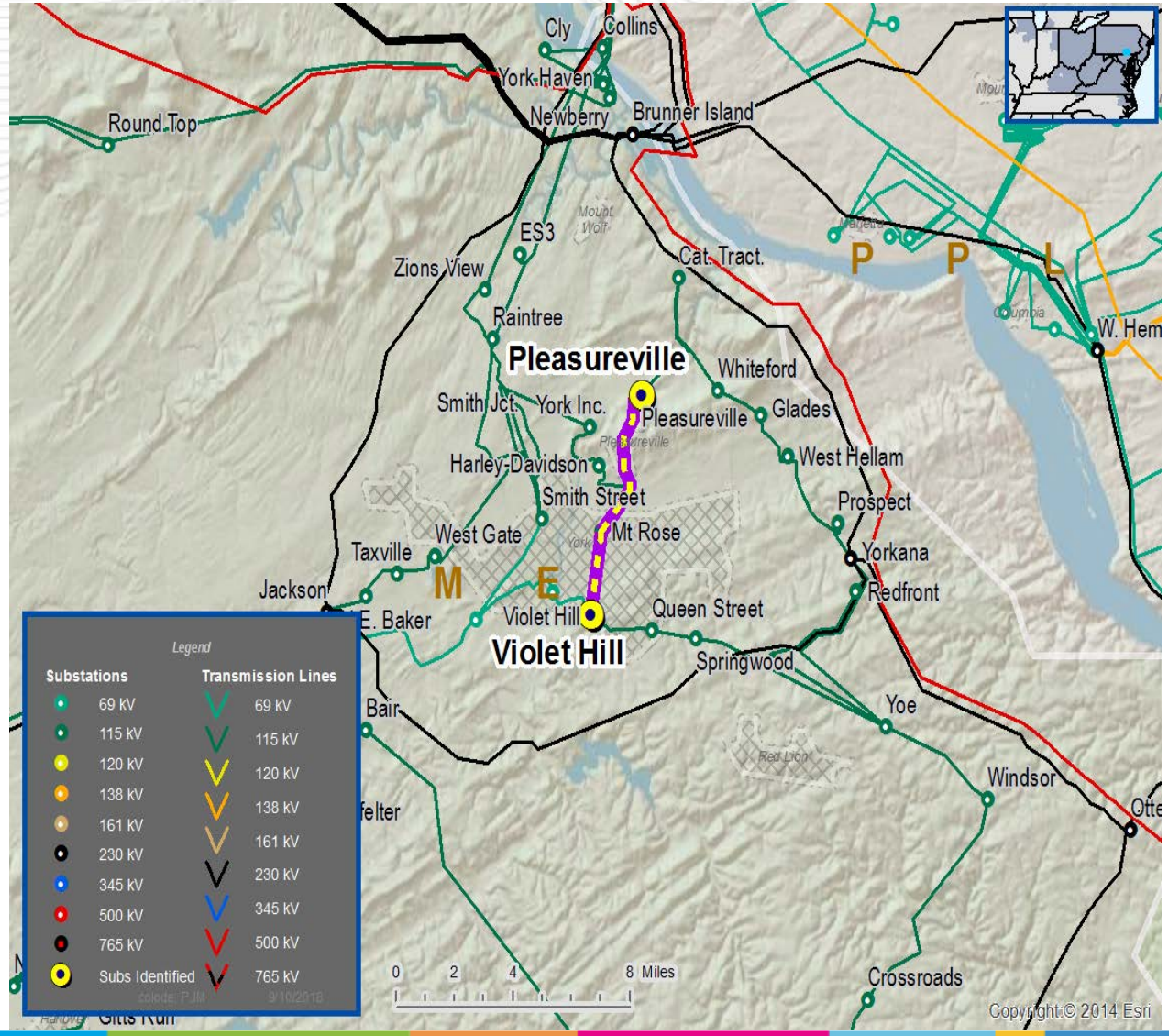
Project Driver(s):
Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)
Upgrade Relay Schemes
- Upgrade relay schemes that have historically high percentage of misoperation.

Substation/Line Equipment Limits
- Consider upgrading transmission line equipment (switches, conductor, splices, etc.) as well as terminal and protection equipment to meet or exceed the transmission line conductor rating.

Problem Statement
- Relays on Pleasureville – Violet Hill 115 kV line evaluated by Transmission Planning and Protection and determined to be obsolete and/or degraded condition.

- Transmission line rating limited by terminal equipment. Existing normal line rating is 204 MVA. Conductor normal rating is 232 MVA.



Revision History

9/11/2018 – V1 – Original version posted to pjm.com

9/19/2018 - V2 – Re-arranged the slides according to the need number

Changed manufactured date for the Summit #1 transformer (current slide #8)