

Eversource 115-kV Wood Pole and Shield Wire Replacements 2020-2023 – Revision 1

Planning Advisory Committee Meeting

December 19, 2019

Revisions to the December 19, 2019 Presentation

Agenda

- Project Background
 - Transmission system inventory data
- Project Drivers
 - Wood Pole Replacements
 - Inspections, Criteria, Results
 - Shield Wire Replacements
 - Hardware Issues, Planned Remediation
- Scope Summary by Region
- Conclusion

Project Background

- Eversource manages ~4,000 circuit miles of overhead transmission lines including ~3,400 structure miles
 - Nearly 40% of all transmission in New England
 - Eversource maintains over 20,000 115-kV structures
- Inspections show significant signs of age-related degradation on our wood poles
- Multiple lines have experienced shield wire failures due to aging shield wire materials
 - Failing galvanized high strength steel and copperweld shield wire types
- This presentation covers wood pole and associated shield wire replacement projects on Eversource's 115-kV lines planned from 2020 through 2023
 - Any projects not included (e.g. lattice structure replacements, copper conductor replacements) will be brought to PAC on an individual basis

Project Drivers – Wood Pole Asset Condition

- Inspections have indicated significant degradation and decreased load carrying capacity of wood 115-kV structures
- Replacing the structures with light duty steel pole equivalents resolves multiple structural issues, hardware issues, and supports safe and reliable operation
- Structure Inspections:
 - Foot Patrol – line crews walk/drive along line to observe general condition of structures above ground level and general ROW conditions
 - Structure Ground Line – specialized crews excavate ~18” below grade at each structure to determine subsurface integrity of pole and apply treatment as necessary
 - High Resolution Aerial – entire system flown with detail hover review at most structures resulting in high resolution photos
 - Thermography – infra-red camera (typically on helicopter) observes line for hot-spots
 - Comprehensive Drone – combines foot patrol and high resolution aerial aspects of inspection

Project Drivers – Wood Pole Asset Condition (continued)

Asset Condition Inspection Grading & Project Scoping

- Structures are graded in accordance with EPRI Guidelines
 - *A: Nominal Defect – No Action Required*
 - *B: Minimal Defect – Monitor Degradation*
 - *C: Moderate Defect – Repair or Replace under next maintenance*
 - *D: Severe Defect – Repair, Reinforce, or Replace immediately*
- Replace C and D structures in one mobilization
 - Other structures (A/B) may be replaced during scope due to engineering requirements and to minimize costs and environmental impacts
- Engineering provides training to inspectors on appropriate grading criteria
 - Field inspectors provide structure grade while in field and observe the entire structure
 - Results are reviewed by engineering team and field operations

Project Drivers – Wood Pole Asset Condition (continued)

Typical Wood Pole Degradation within Eversource (ES) System



Line 1000
Str 7619
Pole Crack



Line 1080
Str 6351
Pole Crack & Woodpecker Holes



Line 1161
Str 40079
Deep Pole Top Rot

Project Drivers – Wood Pole Asset Condition (continued)

Typical Wood Pole Degradation within ES System



Line K174 Str 119
Pole Base Splitting



Line 1421 Str 32008
Cross Arm Splitting



Line K105 Str 95
Deep Woodpecker Hole

Project Drivers – Wood Pole Asset Condition (continued)

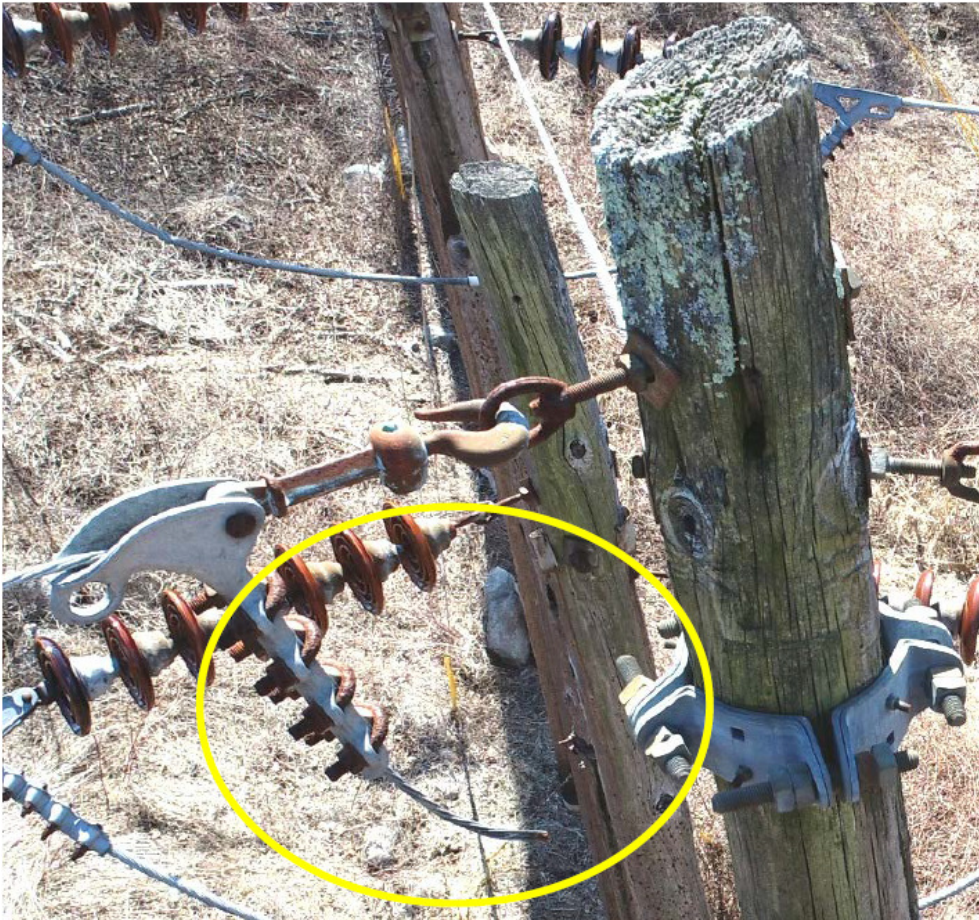
- Engineering analysis identified structures which are projected to be loaded beyond their design capabilities considering the National Electrical Safety Code at the time of construction
- Age of structures and wood deterioration must also be considered
- These structures were identified on 2 lines (K174 & M127) in New Hampshire and represent 1.5% of the structures to be replaced as part of this program

Project Drivers – Shield Wire Asset Condition

- Existing structures currently handling galvanized high strength steel and copperweld shield wire, as well as other obsolete shield wire material
- Issues associated with existing steel and copperweld:
 - System is currently experiencing hardware failures due to aging
 - These material types are outdated in the industry
 - When they do fail, replacement hardware is difficult to find
- Fiber Installation Drivers:
 - Up-to-date and readily available hardware
 - Similar cost to a like-for-like shield wire replacement
 - Fiber will not only shield the lines, but increase communication and reliability within the Eversource system
- Addressing shield wire issues when replacing structures is more efficient than addressing these issues through separate projects

Project Drivers – Shield Wire Asset Condition (continued)

Typical Shield Wire Degradation within ES System

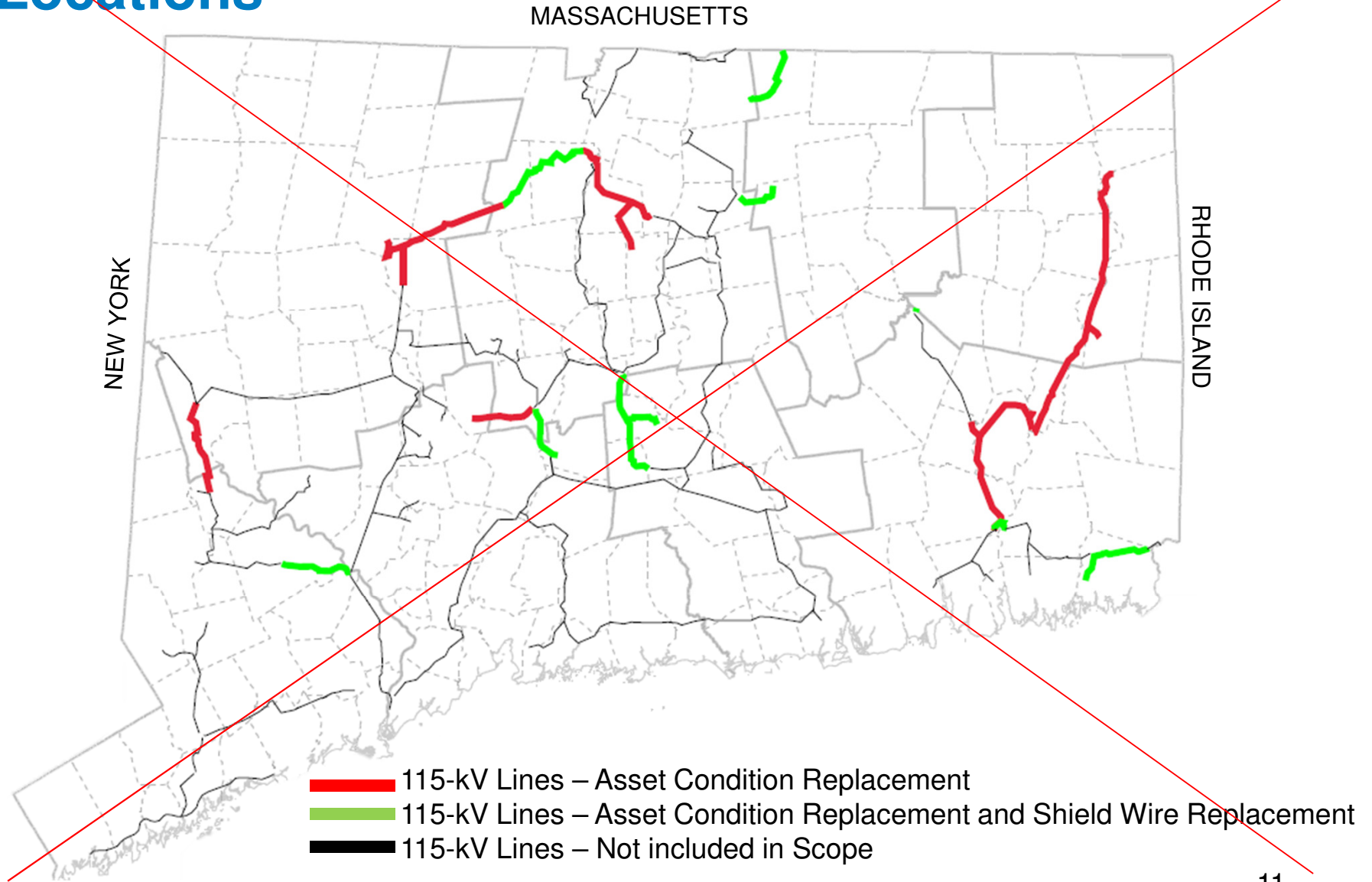


Line 1410
Broken Static Wire

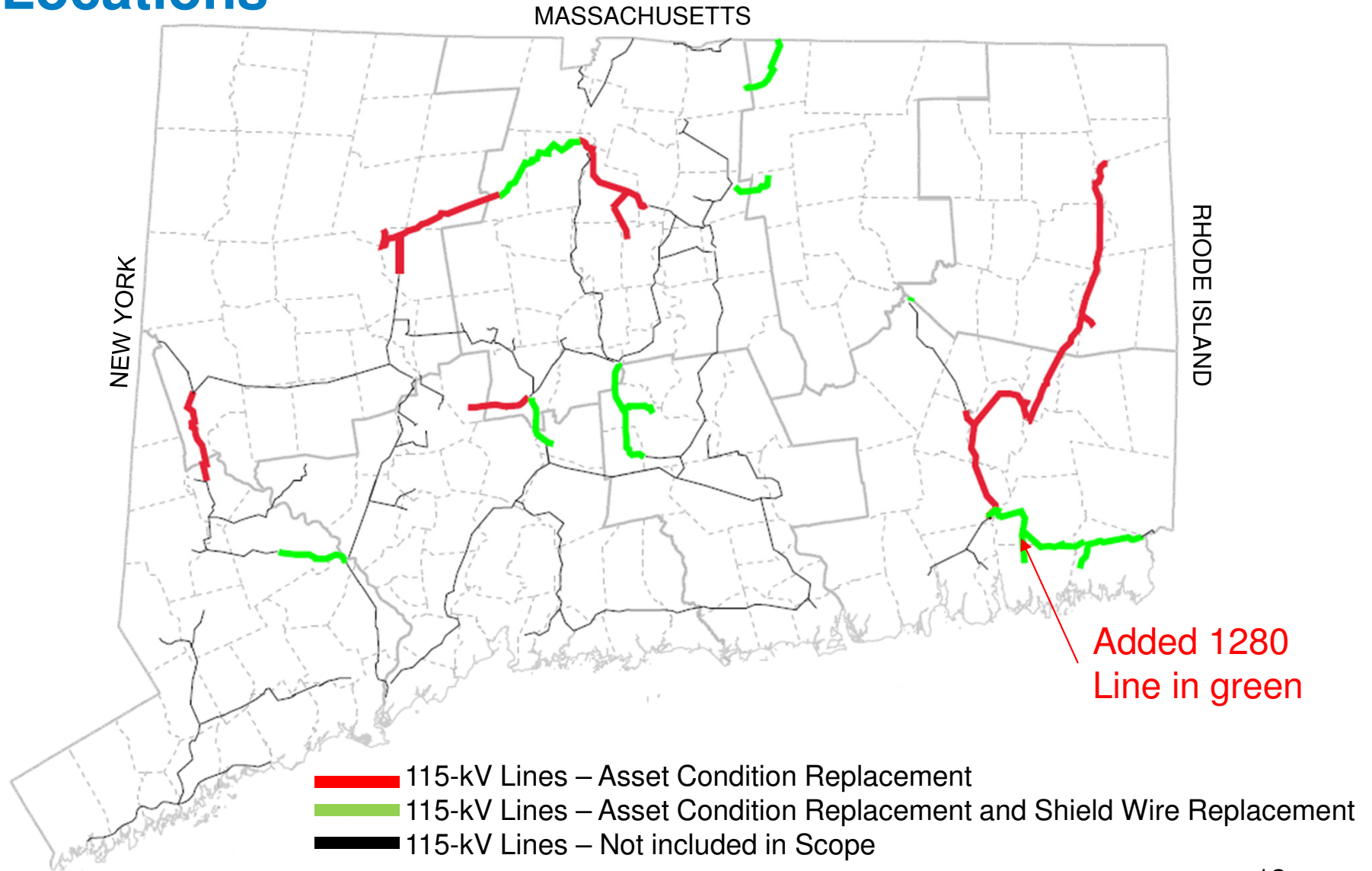


Line 1756
Rusting and Pitting on
Shield wire & Hardware

Connecticut 115-kV Geographic Locations



Connecticut 115-kV Geographic Locations



Connecticut 115-kV Scope Summary

Line	Qty	Cost (\$M)
1000	40	\$ 12.40
1042	19	\$ 6.08
1043*	13	\$ 5.39
1080	78	\$ 24.18
1208	32	\$ 8.96
1232*	18	\$ 6.70
1256*	36	\$ 10.64
1280*†	40	\$ 12.00
1410*†	37	\$ 13.00
1465*	13	\$ 8.77
1505	27	\$ 7.10
1607	28	\$ 7.62
1618*	17	\$ 9.77
1732*	18	\$ 7.90
1751	43	\$ 10.75
1756†	71	\$ 15.00
1765*	42	\$ 14.70
1766*	53	\$ 16.60
1910	26	\$ 10.30
TOTALS	638 651	\$ 199.09 \$ 204.86

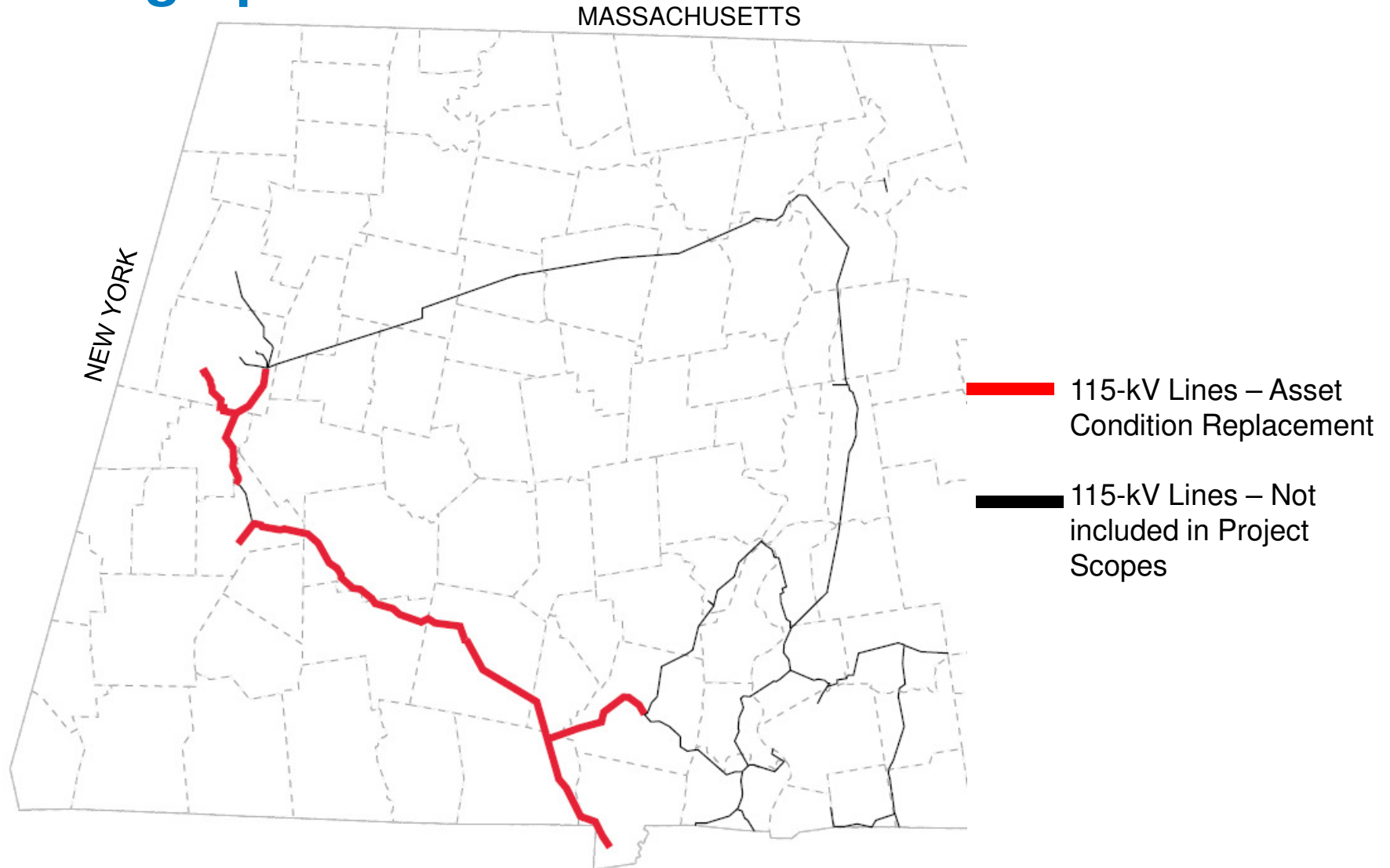
CT Total Cost of Projects:
~~**\$199205M**~~ (-25% / +50%)

Notes

* Lines with shield wire replacements

† Lines carried over from previous ISO-NE PAC presentation made on October 17, 2018. Some of these projects have expanded in scope since the 2018 presentation.

Western Massachusetts 115-kV Geographic Locations



Western Massachusetts and Multi-State Lines 115-kV Scope Summary

Line	Str Qty	Cost (\$M)
1161	76	\$ 17.10
1421	70	\$ 15.75
1512	48	\$ 10.80
TOTAL	194	\$ 43.65

WMA Total Cost of Projects:

\$44M (-25% / +50%)

Line	Qty	Cost (\$M)
1394*	15	\$ 7.07
1858*	33	\$ 11.34
1976*	17	\$ 7.47
TOTAL	65	\$ 25.88

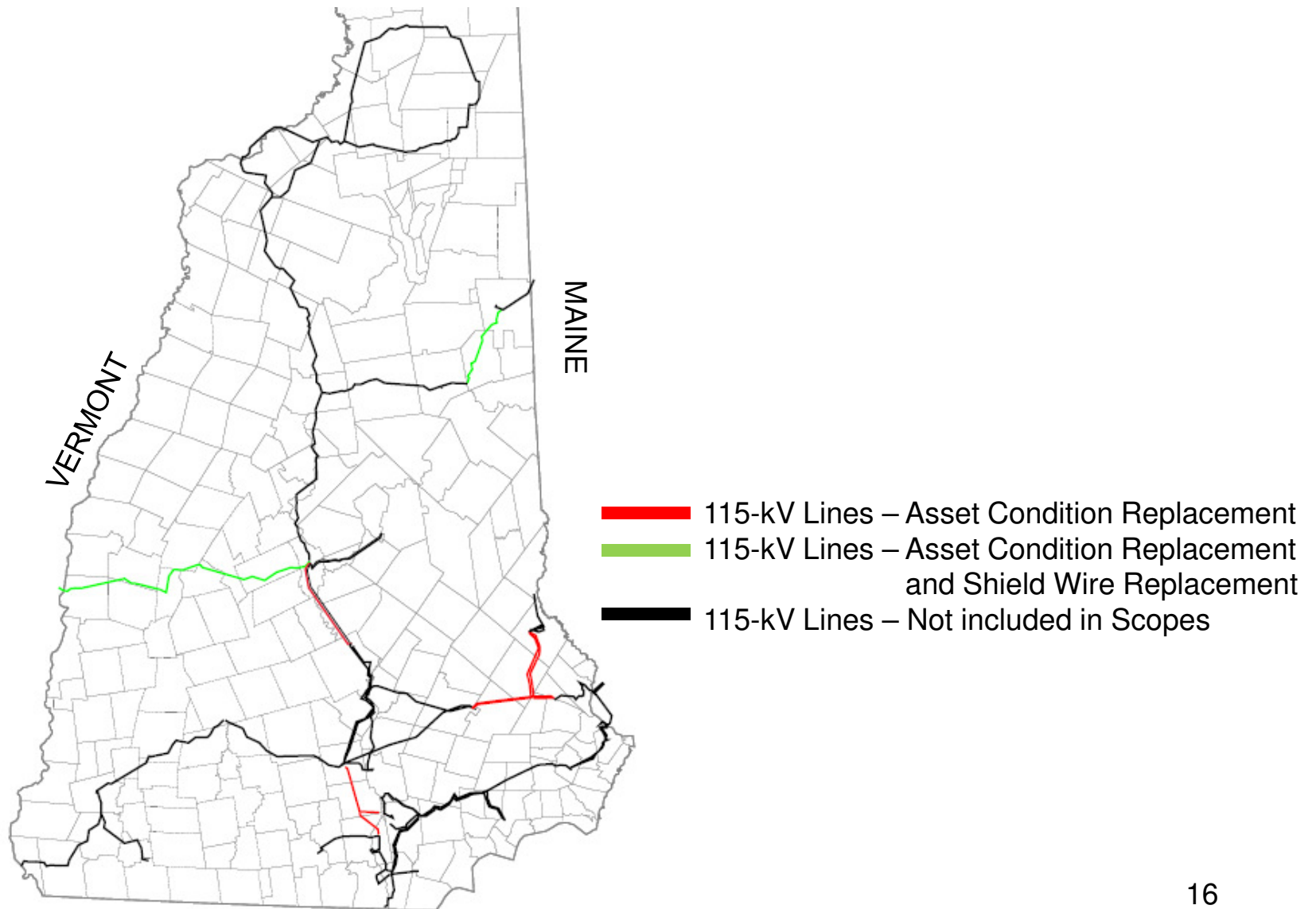
Multi-State Lines Total Cost of Projects:

\$26M (-25% / +50%)

Notes

* Lines with shield wire replacements

New Hampshire 115-kV Geographic Locations



New Hampshire 115-kV Scope Summary

Line	Str Qty	Cost (\$M)
B143	32	\$ 7.41
C129	46	\$ 9.10
F139	39	\$ 8.00
G128	48	\$ 6.91
K105	32	\$ 6.08
K174*	55	\$ 14.74
L175	30	\$ 5.25
M127*	139	\$ 33.43
Y138*	28	\$ 8.49
TOTAL	449	\$ 99.41

Notes

* Lines with shield wire replacements

NH Total Cost of Projects:

\$99M (-25% / +50%)

Conclusion

Service Territory

	Str Qty	Cost (\$M)
<i>CT</i>	638 651	\$ 199.09 204.86
<i>WMA</i>	194	\$ 43.65
<i>NH</i>	449	\$ 99.41
<i>Multi-State Lines</i>	65	\$ 25.88
EVERSOURCE	1346 1359	\$ 368.03 373.80

- Eversource Total Cost of Projects: **\$368 374M** (-25% / +50%)

Conclusion

- Inspections have indicated significant degradation of system-wide 115-kV wood poles
 - Replacing the structures resolves multiple structural and hardware issues to support safe and reliable operation
- System data and recent hardware failures show a need for shield wire replacements
 - Existing shield wire consists of outdated industry materials with associated replacement hardware that is now obsolete
 - Replacement with new OPGW allows for updated hardware, continued line shielding, and increased communication and reliability throughout the system
- All replacements and upgrades will be designed to meet current design criteria
- Proposed scope for 2020-2023 115-kV work is estimated at **\$368**
374M (-25% / +50%)