

Eversource 115-kV and 345-kV Structure Replacements

Planning Advisory Committee Meeting

December 15, 2021

Agenda

- Project Background
- Project Drivers
 - Wood Pole Asset Condition
 - Shield Wire Asset Condition
 - OPGW
- Project Geographic Locations
- Summary of Work
- Conclusion
- Appendix I: Inspection Photos

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
- Inspections show significant signs of age-related degradation on our wood poles
- This presentation covers additional wood pole and associated shield wire replacement projects on Eversource's 115-kV and 345-kV lines
 - [December 2019 PAC presentation \(rev 1\)](#) included 33 projects, and an additional five were presented in the [June 2021 PAC presentation \(rev 1\)](#)
 - This presentation identifies eight additional projects
 - Additional projects will be brought to PAC in the future as needed

Project Background (Cont'd)

- Degrading wood poles show signs of damage such as:
 - Significant cracking along the sides of structures
 - Woodpecker damage
 - Insect damage
 - Rotted pole tops
 - General decay
 - Other indicators of aging structures
- Refer to Slide 16 for details on existing facilities and proposed replacements
- See Appendix I: Wood Structure Inspection Photos for additional photos



Line 191 Structure 27 –
Age, Decay, Rotted Pole Tops

Project Drivers – Wood Pole Asset Condition

- Inspections have indicated significant degradation and decreased load carrying capacity of wood structures
- Replacing the structures with light duty steel pole equivalents resolves multiple structural issues, hardware issues, and supports safe and reliable operation
- If not addressed, the issues noted above jeopardize the long-term mechanical and electrical integrity of the transmission system and its continued reliability
- 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 detailed 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 (Cont'd)

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 – Shield Wire Asset Condition

- Existing Copperweld shield wire is obsolete and susceptible to failure due to degradation from environmental factors
- Equipment and parts for the repair of these materials are no longer stocked because the technology is obsolete and no longer manufactured
 - System is currently experiencing hardware failures due to aging
 - When they do fail, replacement hardware is difficult to find
- OPGW Installation Drivers:
 - Up-to-date and readily available hardware
 - Similar cost to replacing with non-fiber shield wire replacement
 - OPGW 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 (cont'd)

- Eversource periodically tests samples of shield wire obtained from existing lines during repairs and maintenance
- Recent test results show loss of strength in Copperweld shield wire
 - Test Results Indicate:
 - Damaged areas and loose strands
 - Excessive elongation in some strands, potentially due to overheating
 - Shield wire failed to exceed 95% of the rated breaking strength by American Society for Testing and Materials (ASTM) standards for hard drawn copper wire (84.2-91.1% depending on sample)
 - Severe corrosion of shield wire
- Failure of Copperweld shield wire presents a safety hazard and creates risks to the reliable operation of the transmission system
- Other obsolete shield wire materials, such as extra-high strength (EHS) steel, also suffer from similar issues

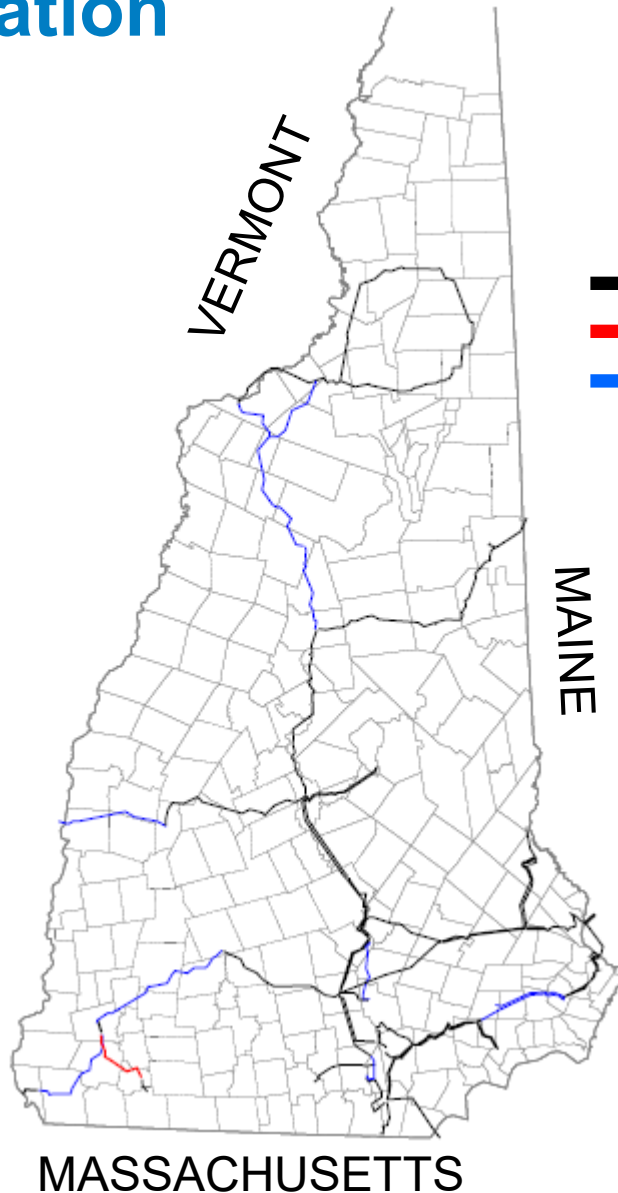
Project Drivers – OPGW

- OPGW installation expands a private Eversource OPGW / Synchronous Optical Networking (SONET) loop
 - This will provide a controlled alternate fiber communication path supporting the long term build out initiative of the fiber optic network. This greatly reduces the reliance on leased services for protection, SCADA and future Phasor Measurement Units (PMU) and Dynamic Disturbance Recorders (DDR) installations (ISO-NE OP-22)
 - A private network is segregated from third-party Telecom services improving the overall reliability and security of the communications path to BES Cyber Systems
- CIP: Fiber provides the necessary bandwidth for physical security monitoring and triaging of alarms for BES Cyber Systems at Medium and Low impact substations

Project Drivers – OPGW (cont'd)

- SCADA Load Shedding procedures are directed by ISO OP-7 and OP-13. SCADA load shedding is required for a rapid response to prevent cascading contingencies and/or equipment damage
 - OPGW provides a dedicated communication path allowing high-speed operations
- The DOE and EPRI recommend fiber as a means to strengthen the security and resilience of critical communication infrastructure on which the nation depends against the consequences of electromagnetic pulse (EMP) attacks
- Fiber optic cable is a non propagating media for electric and magnetic fields (EMF) and therefore is considered generally immune to the effects of geomagnetic disturbances

New Hampshire 115-kV Geographic Location

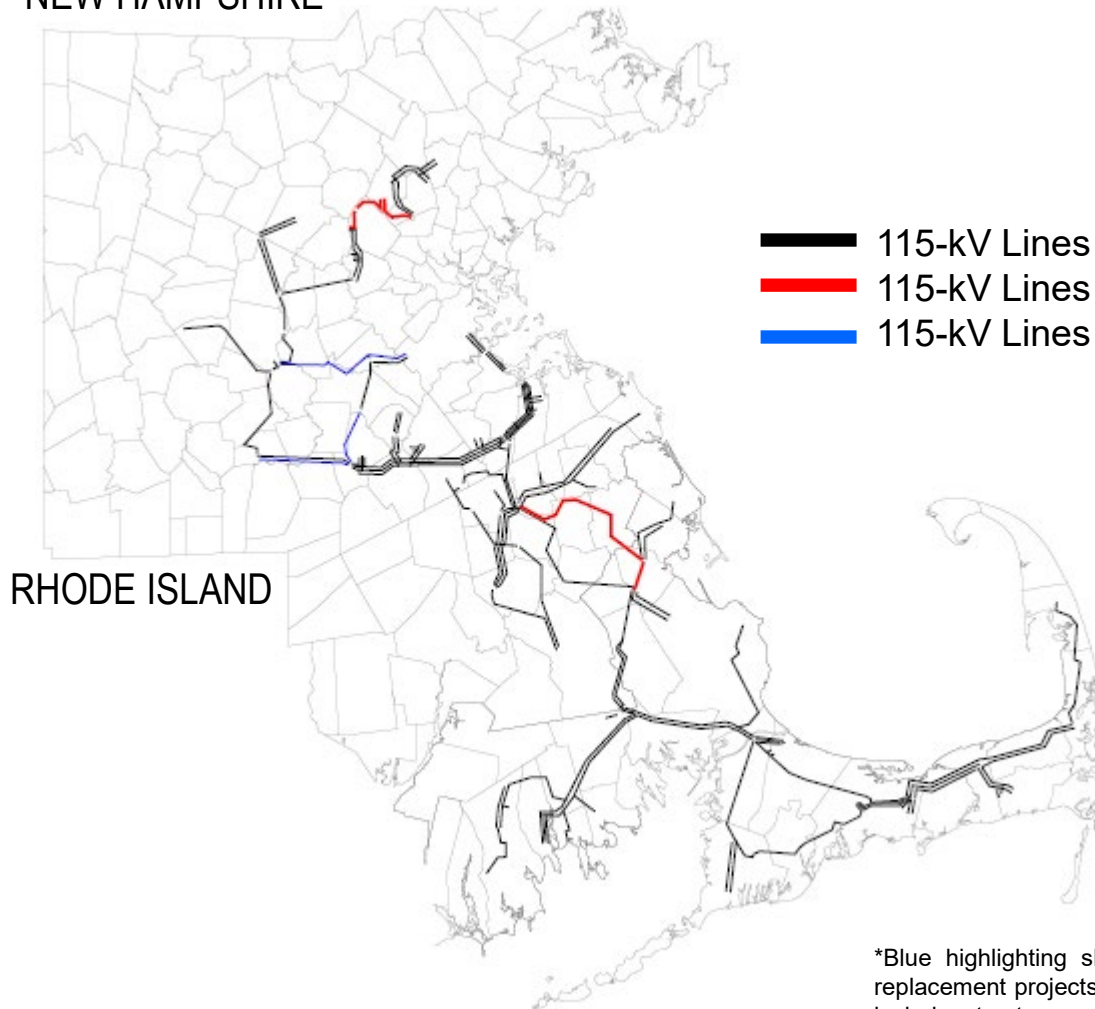


- 115-kV Lines Not in Scope
- 115-kV Lines with Structure Replacements
- 115-kV Lines with Previous Structure Replacements*

*Blue highlighting shows general location of round wood structure replacement projects previously presented to PAC. Other projects that include structure replacements, such as line rebuilds and regional reliability projects, are not shown.

Eastern Massachusetts 115-kV Geographic Locations

NEW HAMPSHIRE

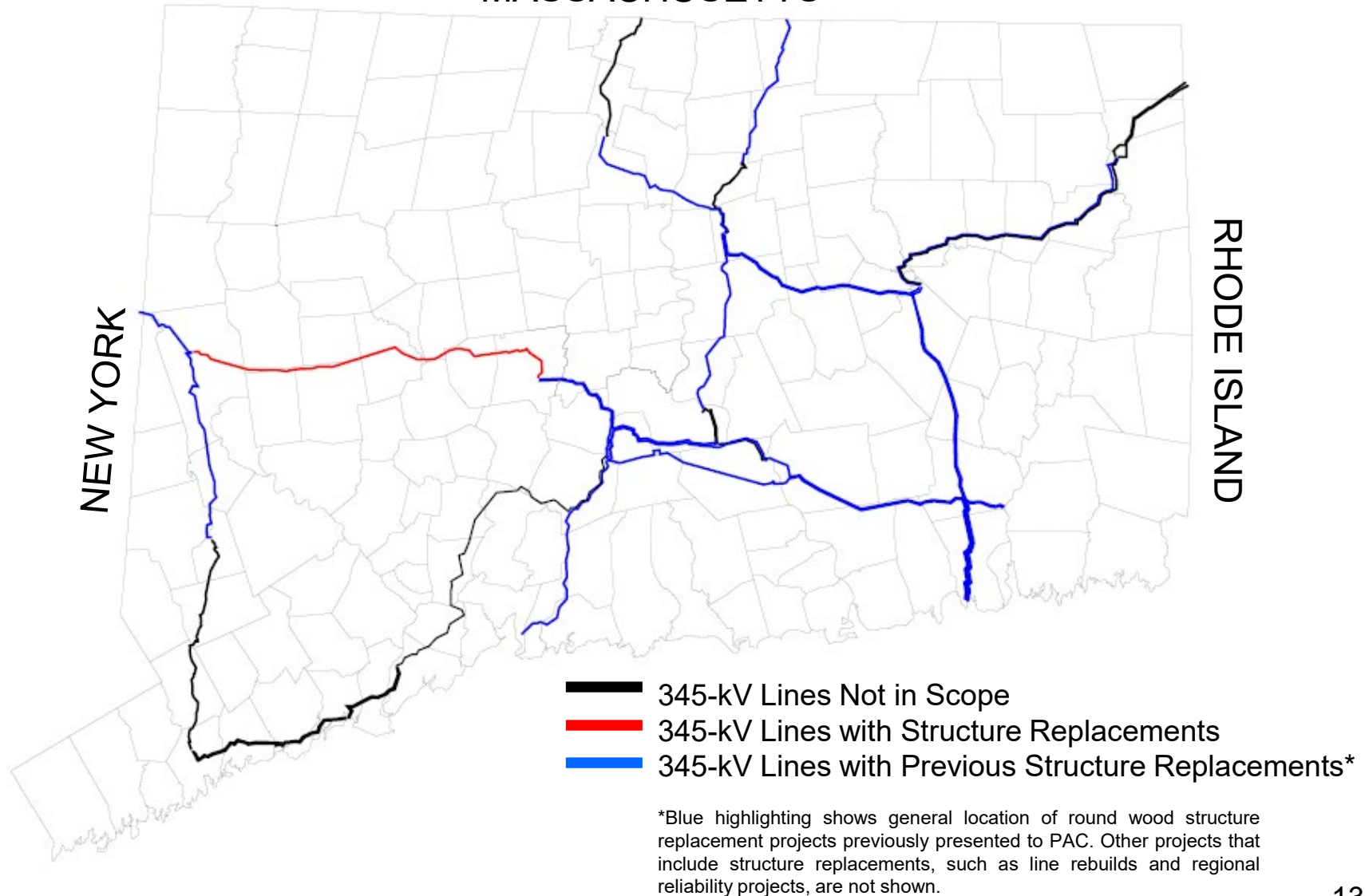


- 115-kV Lines Not in Scope
- 115-kV Lines with Structure Replacements
- 115-kV Lines with Previous Structure Replacements*

*Blue highlighting shows general location of round wood structure replacement projects previously presented to PAC. Other projects that include structure replacements, such as line rebuilds and regional reliability projects, are not shown.

Connecticut 345-kV Geographic Location

MASSACHUSETTS



Summary of Work

Line	Total Length (Miles)	Replacement Structures	Total Structures	Estimated Cost (-25% / +50%)	In-Service Date
New Hampshire					
T198*	11.2	64	154	\$19.1 M	Q2 2022
Massachusetts					
191*	15.4	88	127	\$19.2 M	Q4 2022
117*	3.1	22	27	\$5.9 M	Q4 2022
211-508	3.7	21	40	\$5.8 M	Q2 2022
391-508	2.6	13	33	\$5.0 M	Q3 2022
533-508	1.9	16	22	\$5.0 M	Q3 2022
Connecticut					
329 [†] *	12.5	12	105	\$6.2 M	Q4 2022
352 [†]	20.7	16	160	\$5.8 M	Q3 2022
Total	-	252	668	\$72 M	-

† 345-kV Line

* Scope Includes Installation of Replacement Shield Wire

Conclusion

- Inspections have indicated significant degradation of wood poles
 - Replacing the structures with light duty weathering steel 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 this work is estimated at **\$72 M** (-25% / +50%)

Questions



Appendix I: Wood Structure Inspection Photos



Line 117 –
Structure 118



Line 117 –
Structure 131

Appendix I: Wood Structure Inspection Photos



Line 211-508 –
Structure 359A



Line 211-508 –
Structure 318A

Appendix I: Wood Structure Inspection Photos



Line 391-508 –
Structure 308A



Line 391-508 –
Structure 302A

Appendix I: Wood Structure Inspection Photos



Line 533-508 –
Structure 270A



Line 533-508 –
Structure 280A

Appendix I: Wood Structure Inspection Photos



Line 329 –
Structure 8252



Line 329 –
Structure 8208

Appendix I: Wood Structure Inspection Photos

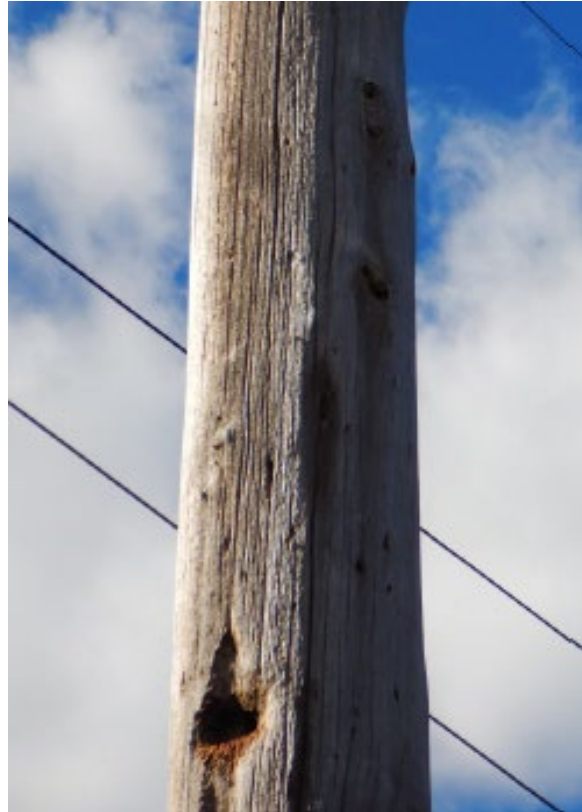


Line 352 –
Structure 8164



Line 352 –
Structure 8190

Appendix I: Wood Structure Inspection Photos



Line T198 –
Structure 130