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NEW HAMPSHIRE

Line X-178 Rebuild Follow-Up

ISO-NE Planning Advisory Committee
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October 23, 2024

Summary

- Eversource previously presented the proposed X-178 rebuild to PAC on February 28 and June 20

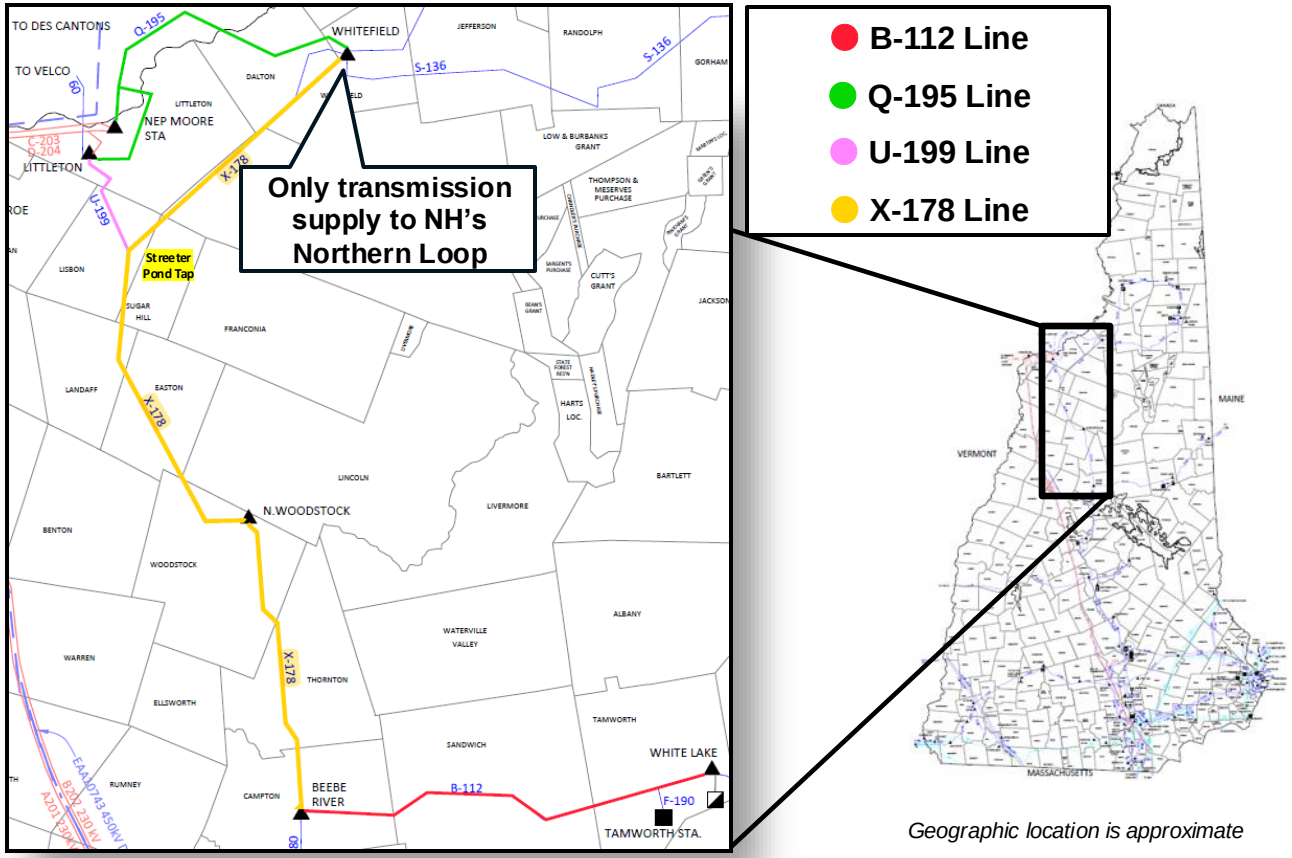
- After the June 20 PAC meeting, Eversource:
  - Received comments from the New England States Committee on Electricity (NESCOE) and the Consumer Advocates of New England (CANE)
  - Completed the next regular drone inspection cycle on the X-178, which identified a significantly larger number of structures that need to be replaced due to deterioration
  - Performed additional analysis based on the comments received and the 2024 drone inspections

- This presentation:
  - Provides additional information requested by NESCOE and CANE
  - Provides an updated alternatives analysis based on the results of the 2024 inspections

- Updated analysis continues to show that a full rebuild of the line is necessary and the most cost-effective solution for customers

Project Background

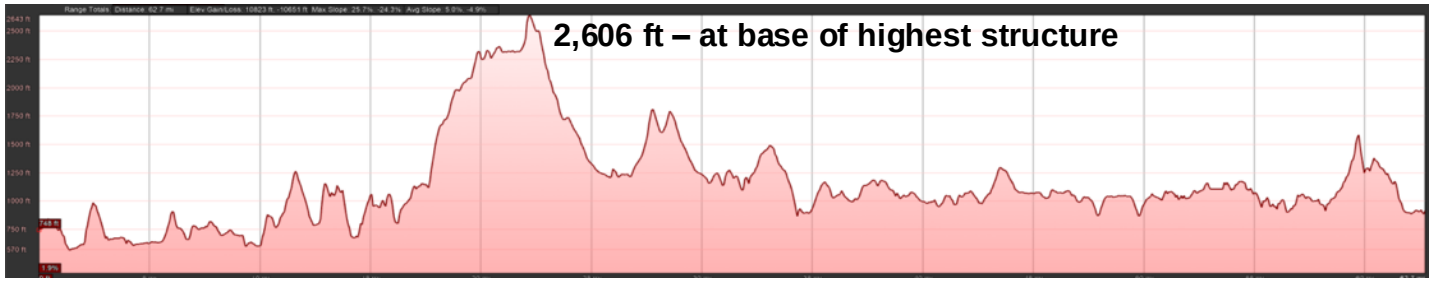
- The X-178 115 kV line connects Beebe River substation in Campton and Whitefield substation in Whitefield, New Hampshire
  - Constructed in early 1950s, with rebuilds in 1969 and 1985 (depending on section)
  - Overall length: 49 miles
  - Structures: 594 structures – 13 steel, 2 laminated wood, 579 natural wood
    - Average age is 45 years
  - Provides service to approximately 30,000 customers in Northern NH
  - Conductor: Primarily 795 ACSR
  - Shield wire: 2 runs consisting of 7/16” Steel or 7#8 Alumoweld



Geographic location is approximate

X-178 is a vulnerable transmission line in a challenging location

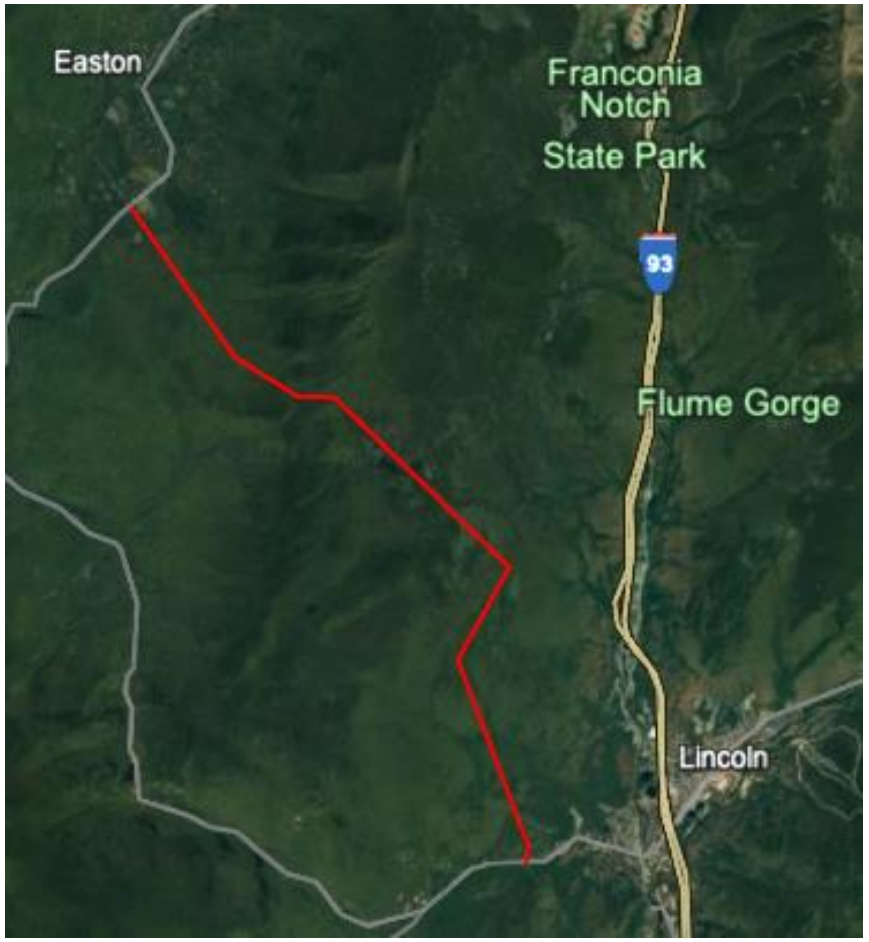
- Long stretches of the line have no access points and are located in challenging terrain
- Crosses White Mountains southwest of Franconia Notch
  - 112 structures are located within the White Mountain National Forest
  - Remote, isolated area; high elevation; and frequently exposed to severe weather
- Outages restrict generation in Northern New Hampshire and Maine
  - Most construction must be performed using complex live-line methods to avoid outages



Elevation profile along route

Typical live-line conductor replacement

X-178 line crosses White Mountains with limited access points for construction equipment



9+ mile section with no crossings/entry points across White Mountain National Forest

Highest point (2,606 ft) at crossing of Appalachian Trail is 4+ miles from closest road in either direction

2024 inspections and emergency work show increased structure deterioration

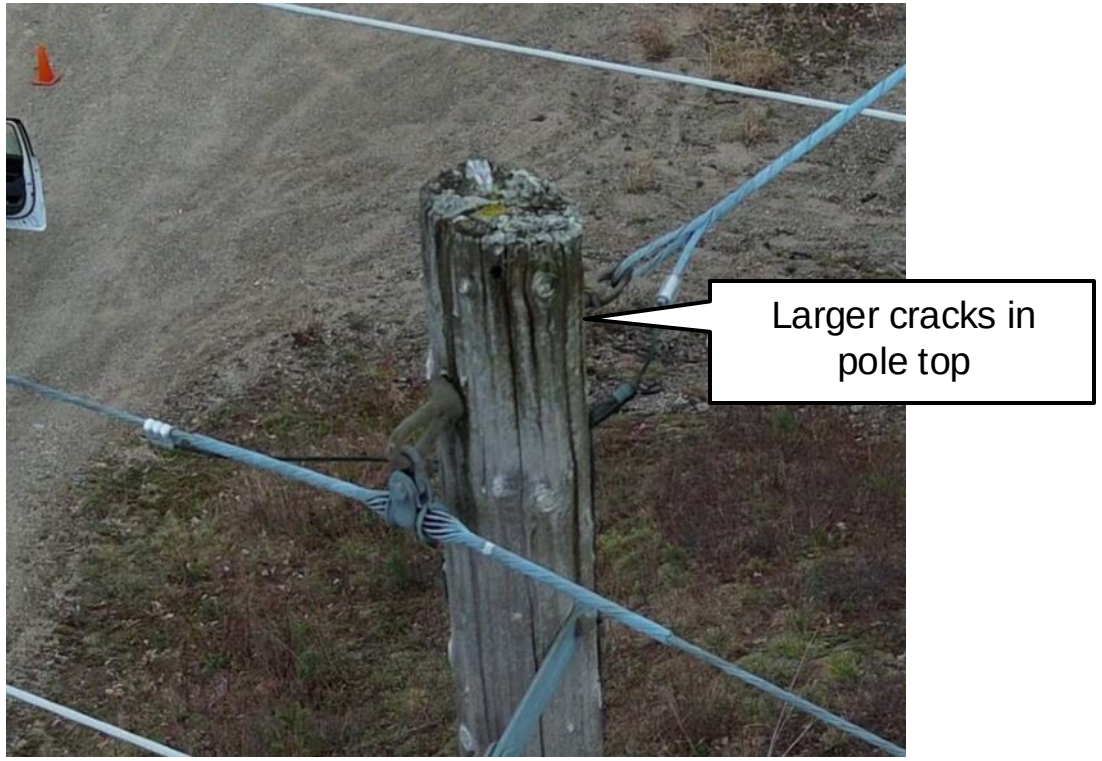
- Eversource performs aerial drone inspections of its 115 kV transmission lines every two years
  - The X-178 was inspected in 2022 and 2024
- The 2024 inspections of the X-178 line were performed by a third-party drone contractor between April and June
  - Approx. 12,000 photographs were taken
- Structure ratings were assigned based on review of photographs by drone contractor, third-party engineering consultant, and Eversource's own engineering staff
  - Reviews completed on August 22, 2024
- Photographs identified 7 structures requiring emergency repairs (Category D structures)
  - Repairs were performed during emergency line outages during week of September 23, 2024
  - 6 structures upgraded to Category C after repairs
  - 1 structure required complete replacement with a new steel structure

Emergency replacement of Structure 393 in Sugar Hill, NH on September 25, 2024

Additional structure deterioration identified in 2024 inspections

- Additional pole-top deterioration identified on Structure 227
- Crossarm replaced via helicopter during week of September 23, 2024

2022 Photo

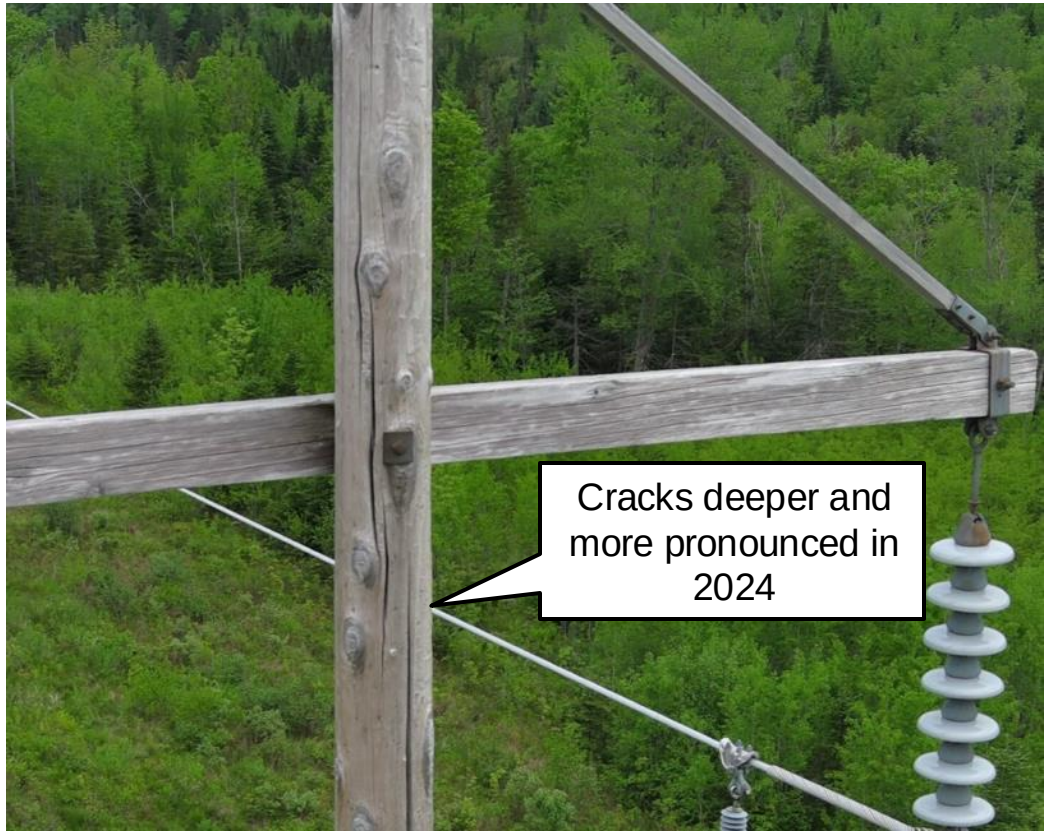


2024 Photo

Additional structure deterioration identified in 2024 inspections (continued)

- Larger cracks in pole on Structure 350
- Structure was rated Category B in 2022 and is now rated Category C

2022 Photo



2024 Photo

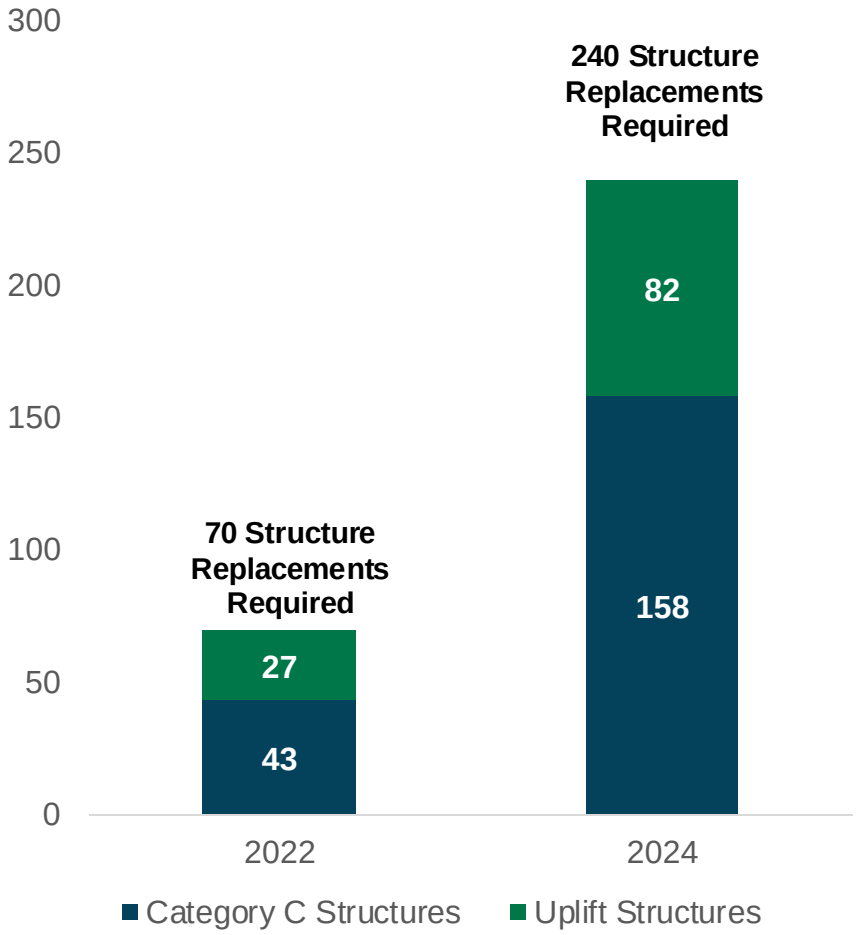
Additional structure deterioration identified in 2024 inspections (continued)

- Increased rot visible at base of Structure 64
- Structure was rated Category B in 2022 and is now rated Category C

2022 Photo

2024 Photo

Latest inspections now identify 240 structures that must be replaced



- 158 structures* must be replaced due to deterioration
  - 115 more than in 2022
  - Structures are graded "Category C" under Eversource's structure grading methodology and Appendix C to New England Transmission Owner Asset Condition Process Guide
  - Some Category C structures will need to be replaced with taller structures to meet current National Electric Safety Code requirements
- 82 "uplift" structures must also be replaced to ensure integrity of line after Category C structures are replaced
  - Taller structures will create "uplift" overstress on some adjacent structures due to changes in conductor and/or shield wire tensions
  - Overstress is identified by engineering analysis performed whenever structures are replaced
  - Number of uplift structures varies from project to project depending on voltage level, new structure heights, terrain, design standards used at time of construction, etc.

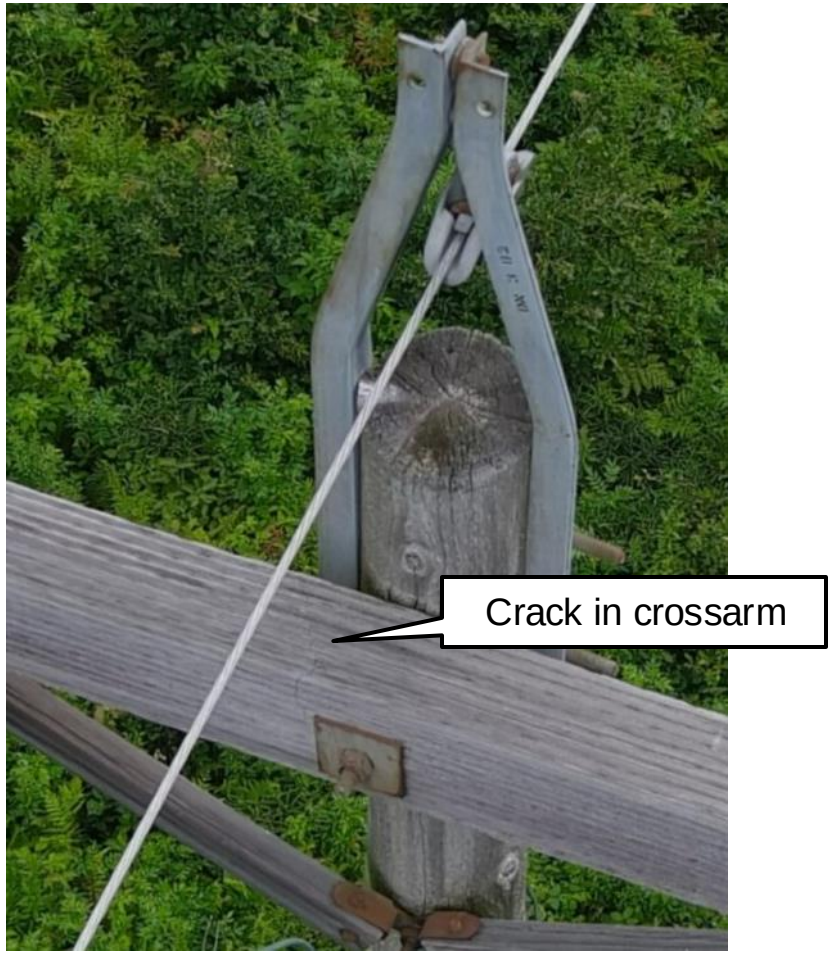
*Excludes one Category D-rated structure that was replaced during the week of 9/23/2024

Continued deterioration indicates that line is reaching end of useful life

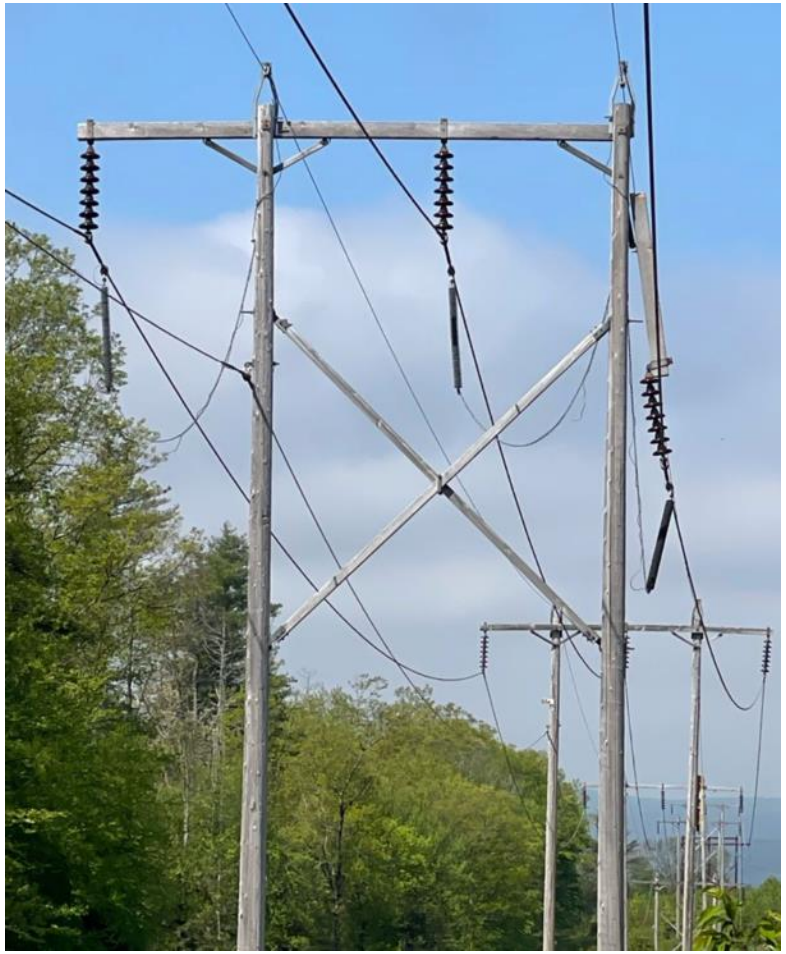
- Average useful life of Eversource's 115 kV transmission structures in NH is 52 years
  - Within typical life expectancy of 40 to 60 years for wood transmission structures across industry
- Average age of existing structures on X-178 line is 45 years
- Deterioration appears to be occurring more quickly than average but within normal range for 115 kV transmission structures
  - Eversource performs treatments on all 115 kV wood structures every 8 years
  - Maintenance on X-178 line has followed standard cycle
- Severe weather in White Mountains likely contributing to deterioration rate
  - More frequent exposure to ice, snow, wind, and freeze-thaw cycles
  - Deterioration is non-linear and accelerates once structures are compromised by cracks, woodpecker holes, or moss/lichen growth
- Additional experience with drone photography has improved quality of inspections
  - All 2024 photographs were reviewed by Eversource personnel in 2024 versus subset reviewed in 2022
  - Reviewers better able to identify failure risks with more experience and lessons learned from other inspections

Even with high-resolution drone photographs, structure damage is difficult to detect

Structure on A-152 line photographed in August 2023, rated Category C, and scheduled for replacement



Crossarm failed 8 months later, in May 2024, before structure was replaced



Additional analysis performed since June PAC meeting

- Eversource estimated cost of “base alternative,” replacing only Category C and uplift structures
  - Estimates developed based on 2022 inspection results (70 structure replacements required) and 2024 inspections results (240 structure replacements required)
  - 2024 inspection results now supersede 2022 inspection results
- To better understand potential efficiencies of a full rebuild, Eversource obtained contractor bids
  - Cost estimate for full rebuild has been reduced from $384.6 M to $360.6 M based on bids received
    - These estimates include escalation
  - Reduction reflects better estimate of savings due to efficiency of full rebuild and does not affect estimates of other project alternatives
- Eversource developed estimates for new alternatives and quantified access-related costs
- Eversource performed additional comparative analysis of alternatives:
  - Using current-year dollars, and
  - Using net present value (NPV) analysis

Project Alternatives Compared Using Current-Year Dollars

(All estimates exclude escalation/inflation)

Alternative	Initial project	+5 years	+13 years	Total	
Alt 1 *New "Base Alternative"*	Replace only immediate replacement and uplift	Replace ~50% of remaining wood structures	Replace all remaining wood structures, install new conductor and OPGW		
Using 2022 inspection results	**$42.8 M** *70 structures*	**$131.0 M**	**$270.7 M**	**$444.5 M**	New analysis
Using 2024 inspection results	**$106.2 M** *240 structures*	**$77.9 M**	**$236.2 M**	**$420.3 M**	New analysis
Alt 2 *From June 20 PAC meeting*	**$91.7 M** *170 structures (70 structures, plus 100 "opportunity" structures)*	**$110.6 M** Replace ~50% of remaining wood structures	**$234.3 M** Replace all remaining wood structures, install new conductor and OPGW	**$436.6 M**	Prior analysis (June 20 PAC)
Alt 3 *From June 20 PAC meeting*	**~~$360.8 M~~ $330.0 M** Full rebuild over 3 yrs – replace all wood structures, install new conductor and OPGW	None	None **Revised based on contractor bids**	**~~$360.8 M~~** **$330.0 M**	Prior analysis (June 20 PAC)
Alt 4	**$259.4 M** Replace all wood structures				New analysis
		$186.5 M Reconductor and install OPGW using live-line methods			New analysis
			Total to replace all structures as part of one project and install conductor and OPGW as a second project:	**$445.9 M**	New analysis

Project Alternatives Compared Using NPV

(All estimates include escalation/inflation)

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Assumptions

- NPV calculated over 40-year revenue requirement
- Discount rate of 7.895%
- Tested sensitivities with capital cost escalation (inflation) rate of 3% to 5% per year
  - Historical inflation rates for utility construction costs have trended around 3% per year
  - However, rates have exceeded 10% in some recent years

Alternative	Initial project	+5 years	+13 years	NPV (Range representations inflation rates from 3% to 5% per year)
Alt 1 *New "Base Alternative" using 2024 inspection results*	Replace only immediate replacement and uplift	Replace ~50% of remaining wood structures	Replace all remaining wood structures, install new conductor and OPGW	**$467.5 M to $549.8 M**
Alt 2	*Not analyzed further*			
Alt 3	Full rebuild over 3 yrs – replace all wood structures, install new conductor and OPGW	None	None	**$481.0 M to $509.6 M**
Alt 4	Replace all wood structures		Reconductor and install OPGW using live-line methods	**$541.2 M to $614.1 M**

Costs of base alternative and full rebuild are comparable on NPV basis

Access and mobilization costs

- Total cost of piecemeal options, excluding escalation, on prior slide ranges from approximately $420 M to $446 M depending on approach, compared to $330 M for full rebuild
- Rebuilding line as a single project saves $90 M to $116 M in duplicative access and mobilization costs
  - Also avoids inflationary risk and avoids repeat environmental impacts to sensitive ecological areas, including the White Mountain National Forest

Access-related costs

- Access costs estimated at $1.2 M per mile outside of the White Mountain National Forest
  - 41% higher than other 115 kV lines in Northern New Hampshire
- Access costs within the National Forest are under review with contractors, but will be higher
- 23 structures within the National Forest can only be accessed via helicopter

Recommendation - Full Rebuild

- At the February and June PAC meetings, we proposed a full rebuild for the following reasons:
  - Replace all deteriorating poles and equipment at once to significantly improve reliability for all customers and generators served by the X-178 line
  - Limit environmental impacts and disruption to abutters from repeated ROW re-entry, including building and restoring repeated access roads to hard-to-reach areas
  - Lower costs associated with ROW re-entry
  - Reduce the number of times live-line work is needed
  - Ensure that all customers who are paying for the line's improvements see its full benefits sooner
- Updated analysis continues to show that full rebuild is the most cost-effective solution with the lowest impact to abutters and the environment over time
  - Cost is lower than piecemeal alternatives on an absolute basis, and comparable on a present-value basis

- **PTF Cost Estimate: $360.6 M (-25% / +50%), including escalation**

- **Start of Construction:** Tentatively Q1 2025, pending resolution of NH Public Utilities Commission and Site Evaluation Committee proceedings
- **In-Service Date:** Q4 2027 (tentative)

Questions

- Please submit questions and comments to PAC.Responses@eversource.com and pacmatters@iso-ne.com by November 13

Appendix

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Prior communications

- February 28, 2024 – Initial PAC Presentation, Link
- June 12, 2024 – Eversource Response to Stakeholder Feedback, Link
- June 20, 2024 – Second PAC Presentation, Link