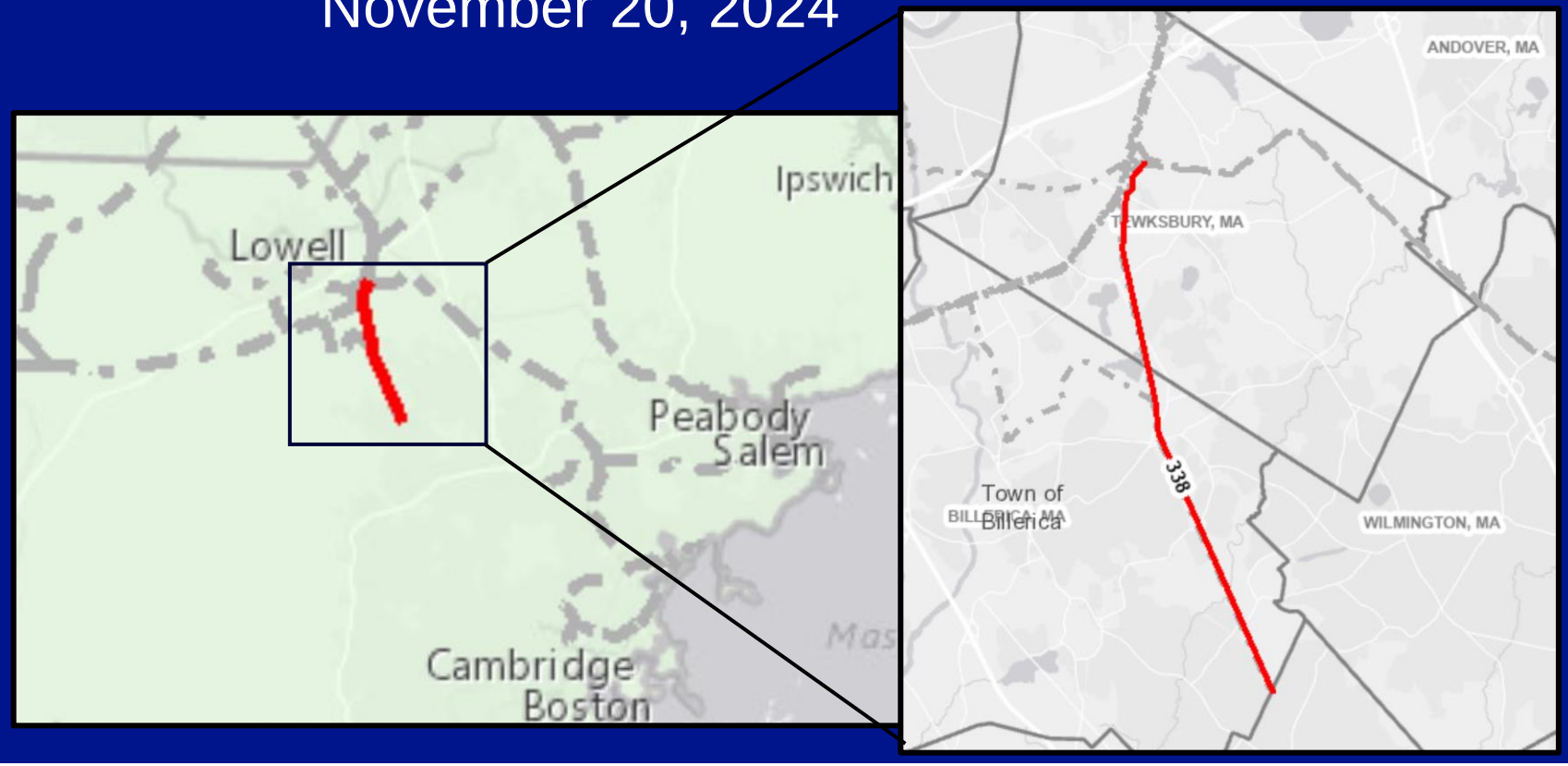
338 345 kV Line
Asset Condition Refurbishment

Rafael Panos

National Grid

November 20, 2024



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Project Summary

Project Drivers
Asset Condition

Alternatives Considered		
Alternative	*Description*	*Cost Estimate*
Base Alternative	Replace Wood Structures, and Install OPGW	$36.338M PTF: $36.338M non-PTF: $0.000M (+50%, -25%)
Alternative 2	Replace All Structures, Reconductor and Install OPGW	$53.520M PTF: $53.520M non-PTF: $0.000M (+50%, -25%)

Project Summary

Preferred Alternative		
Alternative	*Reason for Recommendation*	*Cost Estimate*
Alternative 2	• Minimizes potential future projects and damage failure replacements by performing a full rebuild • Addresses reliability need identified by Boston 2033 Needs Assessment on the New England Power portion of the 338 line • OPGW will extend a private communication network that will also connect National Grid to Eversource networks • Provides refreshed access to assets for maintenance and emergencies resulting in improved restoration times	$53.520M PTF: $53.520M non-PTF: $0.000M (+50%, -25%)

Background Information – 338 345 kV Line

Key Details	
Location	From: Tewksbury 22A To: Billerica, MA/Burlington, MA Town Line
Line length	6.69 miles
Operating Voltage	345 kV
Age and upgrade history	• Originally constructed in 1976 • One shieldwire replaced with Crown Castle owned OPGW installed in 2003 • Majority of wood crossarms replaced with steel in 2005 • This line is 100% PTF
Prior PAC presentations	• None

Existing structures			
Material	*Configuration*	*Number*	*Avg. age*
Line Section 1			
Wood	H-frame	45	48 years
Wood	Pulloff	2	48 years
Wood	Polearm	2	48 years
Steel	H-frame	14	48 years

Existing conductor		
Type	*Length*	*Avg. age*
Line Section 1		
Bundled 954 kcmil 45/7 ACSR “Rail”	6.69 miles	48 years
1 7#9 Alumoweld Shieldwire	6.69 miles	48 years
1 Crown Castle Owned OPGW	6.69 miles	21 years

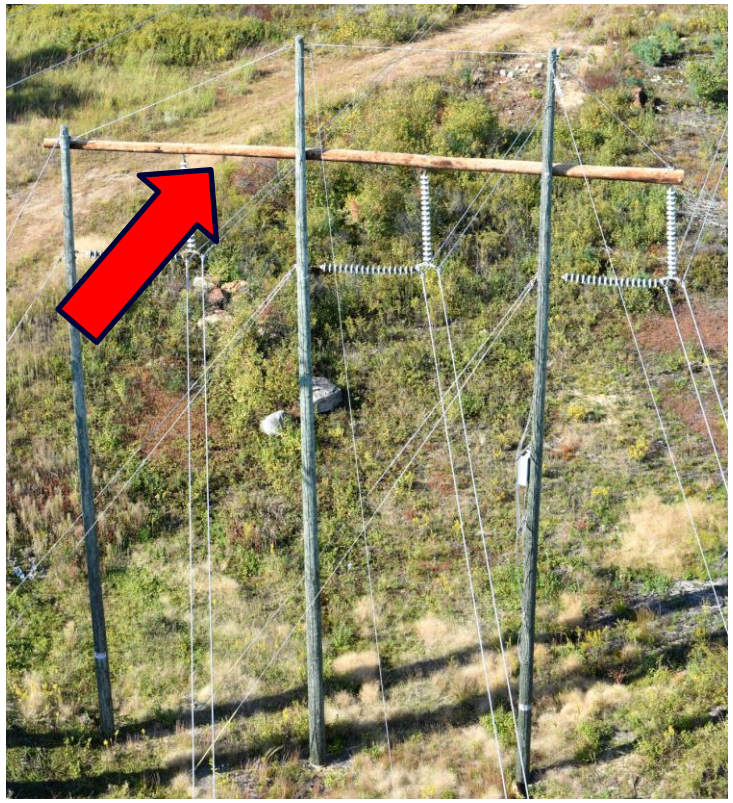
Project Needs and Drivers – Structures

Structure Concerns	
Primary Concerns (must be addressed)	
Wood structure condition	• Inspections performed in 2019 and 2020 have identified wood structures with woodpecker damage, excess checking, insect damage, deteriorating wood crossarms and rusting on steel crossarms and x-braces. Groundline calculations show 36 structures are showing signs of strength loss. • These structures must be replaced to maintain reliability and ensure ongoing integrity of the line • Affected structures average 48 years old and are beyond the end of the typical useful life for natural wood structures (40 – 45 years) • Woodpecker damage is a concern for pole failure across the entire circuit • Three remaining structures have wood pole arm crossarms that represent a failure concern
Steel structure performance	• Minor corrosion and concrete foundation spalling was observed at steel structures
Secondary concerns (may be addressed)	
N/A	

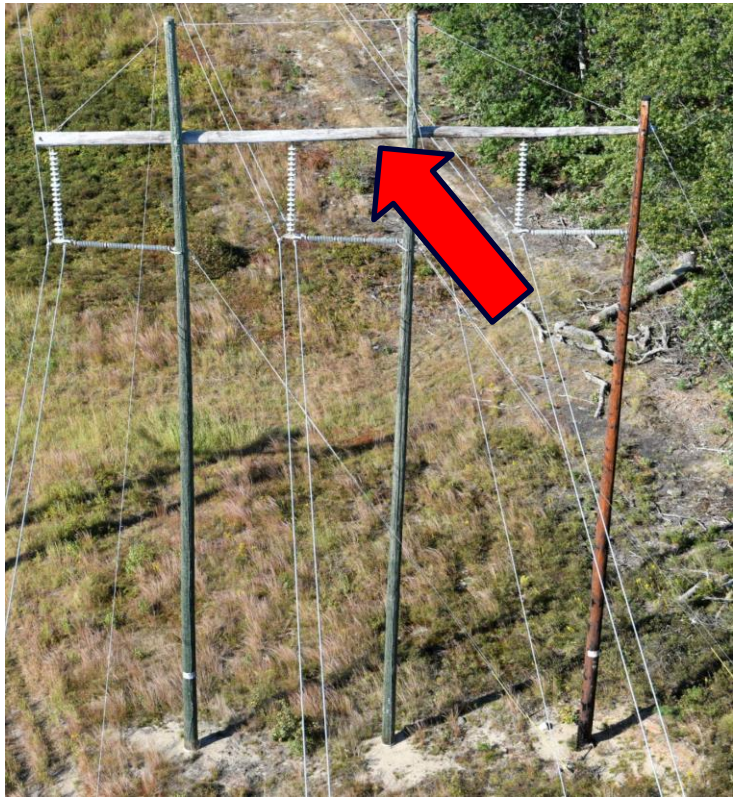
Project Needs and Drivers – Structures

Summary of Current Structure Grades		
Category	Recommended Action	Number of structures
A	No replacement required due to deterioration	14
B	Consider replacement in conjunction with other structure replacements	10
C	Initiate planned structure replacement project or Replace as part of upcoming structure replacement project	39
D	Replace immediately (emergency replacement)	0
Total		63

Project Needs and Drivers – Pole Arm Crossarms



Str. 95



Str. 99

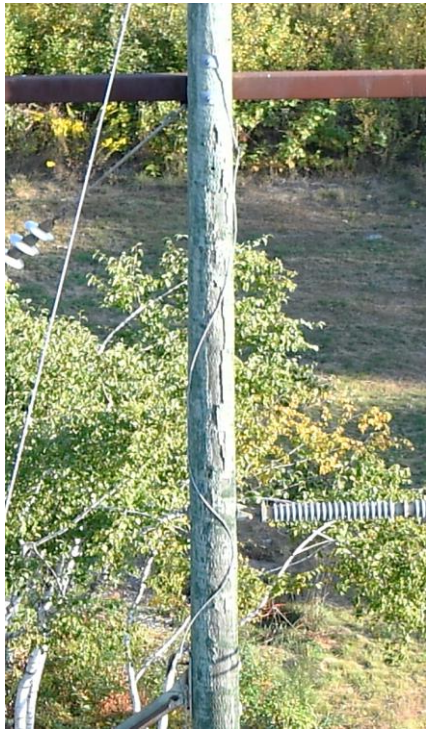
Str. 117

These structures use a wood pole as a crossarm which is prone to failure. Water collects in the side grain on the upper side of the arm and rots the wood prematurely.

Project Needs and Drivers – Deteriorated Poles

Woodpecker, checking, deterioration

Str 67



Str 110

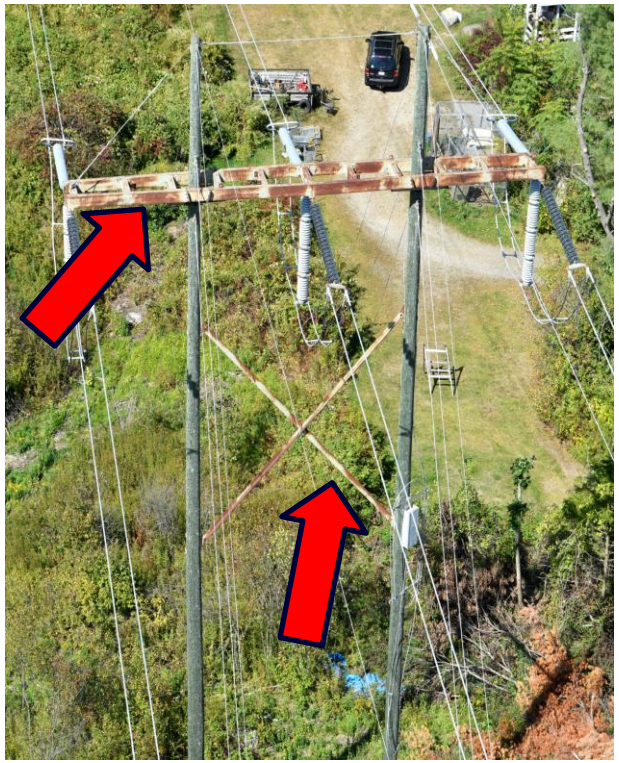
Str 70

Str 111

Woodpeckers pose a significant threat to wood poles of any age. Their increasing population is accelerating the degradation experienced by wood poles. While moisture-based decay happens near groundline, damage from woodpeckers occurs higher up on structures where they can be more difficult to identify.

Project Needs and Drivers - Rusting

Rust on steel crossarms and x-braces



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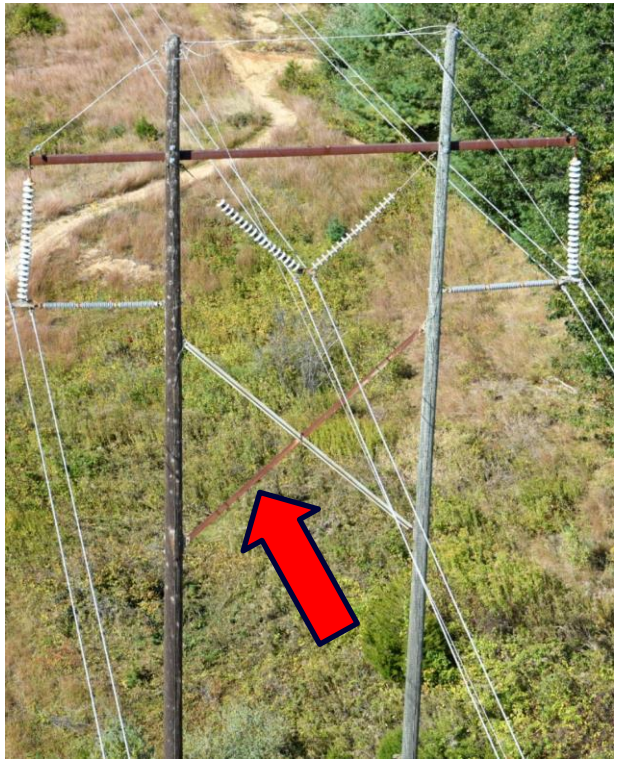


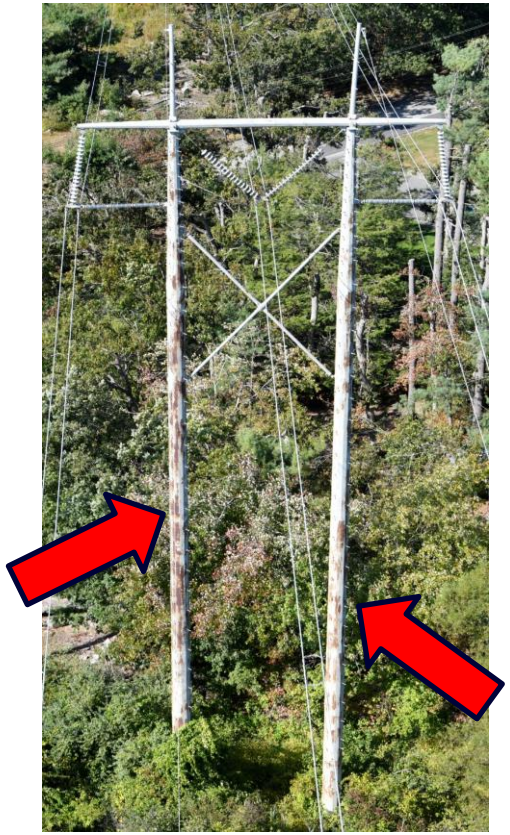
Str 72

Str 75

Rust on crossarms and x-braces increase the chances of structure failure and must be addressed to ensure reliable performance of the line

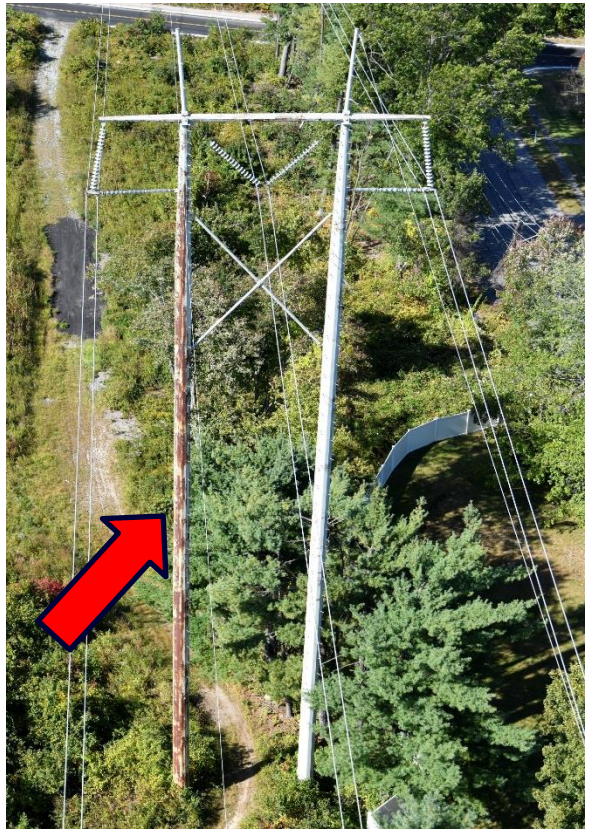
Project Needs and Drivers - Rusting

Rust on steel structures



Str 78

Str 81



Str 84

Project Needs and Drivers
System Planning

Planning Concerns	
Primary Concerns	
Summary	• **In the ISO-NE Boston 2033 Needs Assessment Study, line 338 was loaded to 115.4% of its LTE rating for the study year 2033.** • **Upgrading this line is a required network upgrade for the interconnection of QP 1252**
Secondary concerns	
None	

Discussion and Additional Information
N/A

Project Needs and Drivers

Conductor

Conductor Concerns	
Primary Concerns	
Summary	• **Structure replacements would require the addition of numerous additional splices to an already aged conductor, greatly increasing the risk of failure**
Secondary concerns	
Summary	• **A reliability need has been identified which would also require conductor replacement at a later date if not pursued by this asset condition project**

Discussion and Additional Information

N/A

Project Needs and Drivers

Shieldwire

Shield Wire Concerns	
Primary Concerns	
Summary	• **Shieldwire is original vintage close to 50 years old. Alumoweld Shieldwire is no longer NEP standard and is recommended to be replaced**
Secondary concerns	
Summary	• **Existing shieldwire does not address communications needs**

Discussion and Additional Information

N/A

Project Needs and Drivers

Telecommunications

Telecommunication Concerns	
Primary Concerns	
Summary	• **Fiber along this path will provide additional fiber capacity without constraint from the Tewksbury Substation along this route and to areas that are connected to Tewksbury and beyond.** • **Installing OPGW will improve the private communications network.**
Secondary concerns	
Summary	• **New England Power (NEP) is seeking additional opportunities to make fiber connections into surrounding areas/regions to support the development of a more robust fiber sharing network. This network will strengthen communications ties to our partners and create greater network redundancy.** • **The 338 line carries a 144-strand fiber managed by Crown Castle. We are granted private network use of 12 strands through our contract with Crown Castle. Since our network generally utilizes a minimum of 48 strands of fiber this creates scarcity along this section of right-of-way and extends scarcity to any fibers connected to this segment.**

Discussion and Additional Information

N/A

Project Needs and Drivers

Insulators

Insulator Concerns	
Primary Concerns	
Summary	• **Insulation on the line is original vintage from 1976 and is recommended for replacement due to age**
Secondary concerns	
None	

Discussion and Additional Information

N/A

Review of Relevant Transmission Studies

Transmission Study Status
Was this line overloaded in recent Attachment K studies (Reliability Needs Assessments, Longer-Term Transmission Studies, etc.) or other recent studies?
• In the ISO-NE Boston 2033 Needs Assessment Study, line 338 was loaded to 115.4% of its LTE rating for the study year 2033. • The line was overloaded in the 2050 Transmission Study
Have modifications or upgrades to this line been identified as potential solutions in any of those studies?
No
Have modifications or upgrades within this ROW been identified as potential solutions in any of those studies?
No

Evaluated Solution Alternatives

Base Alternative

Replace Wood Structures, and Install OPGW	
Description	• Replace 49 wood structures with steel H-frame • Replace insulation at 49 structures • Remove approximately 6.7 miles of shieldwire and install (1) ½" OPGW
Primary Needs Addressed	Structure, Shieldwire, Insulators, Telecommunications
Secondary Needs Addressed	None
Advanced transmission technologies to be considered	None
Cost Estimate and Accuracy	$36.388M PTF: $36.388M non-PTF: $0.000M (+50% / -25%)
Longer-term transmission needs addressed	No, this option does not address the need identified as part of the following • Boston 2033 Needs Assessment study on NEP owned portion of 338 line • The 2050 Transmission Study • Required network upgrade for interconnection of QP 1252
Key standards or criteria affecting design if different than current design	NESC-Heavy

Evaluated Solution Alternatives
Alternative 2

Replace All Structures, Reconductor and Install OPGW	
Description	• Replace 49 wood structures with steel • Replace 14 steel structures • Replace insulation at all 63 structures • Remove approximately 6.7 miles of existing conductor and install bundled 1590 kcmil 54/19 ACSS “Falcon” conductor • Remove approximately 6.7 miles of shieldwire and install (1) ½” OPGW
Primary Needs Addressed	Structure, Shieldwire, Insulators, Telecommunications
Secondary Needs Addressed	Conductor
Advanced transmission technologies to be considered	Use of enhanced conductors
Cost Estimate and Accuracy	$53.520M PTF: $53.520M non-PTF: $0.000M(+50%, -25%)
Longer-term transmission needs addressed	Yes, this option does address the need identified as part of the following • Boston 2033 Needs Assessment study on NEP owned portion of 338 line • The 2050 Transmission Study • Required network upgrade for interconnection of QP 1252
Key standards or criteria affecting design if different than current design	NESC-Heavy

Comparative Analysis of Alternatives

Comparison		
Key Criteria	**Base Alternative**	**Alternative #2**
Addresses Primary Need(s)	Yes	Yes
Secondary Needs Addressed	No	Yes
Cost	$36.388M PTF: $36.388M	$53.520M PTF: $53.520M
Constructability concerns or advantages	Intermittent structure replacement stresses remaining assets.	Uniform construction parameters do not cause stress points on circuits.
Siting, Environmental and regulatory issues	Less permitting without reconductoring	Slightly more permitting for reconductoring
Governmental or Community Goals addressed	Same for both options	Same for both options
Future-Proofing	Does not address Boston 2033 Needs Assessment, 2050 Transmission Study and interconnection need of QP 1252	Addresses Boston 2033 Needs Assessment, 2050 Transmission Study and interconnection need of QP 1252
Schedule and Outage Coordination	Outage windows are similar. Slightly less time required to not reconductor	Outage windows are similar. Slightly more time required to reconductor
Other Criteria		

Conclusions: The Base Alternative does not address constructability concerns impacting the conductor and future projects will be required to address reliability needs. Base Alternative replaces wood structures and replacement of remaining assets on the line will need to be addressed in the future and is not cost efficient. That is the reason Alternative 2 is the preferred option.

Schedule

Planned Schedule	
Comment Deadline	December 4th, 2024
Contact	Rafael Panos: rafael.panos@nationalgrid.com ISO-NE: pacmatters@iso-ne.com
Follow-up PAC Presentation	Yes
Start of Major Construction	Q3 2028
Project in Service	Q4 2030

Questions

338 345 kV Line Asset Condition Refurbishment

This document has been reviewed and does not contain Critical Energy/Electric Infrastructure Information (CEII).

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