Benefits to Coastal Resilience from Restoring a Freshwater Wetland Complex at Windswept Bog, Nantucket, MA

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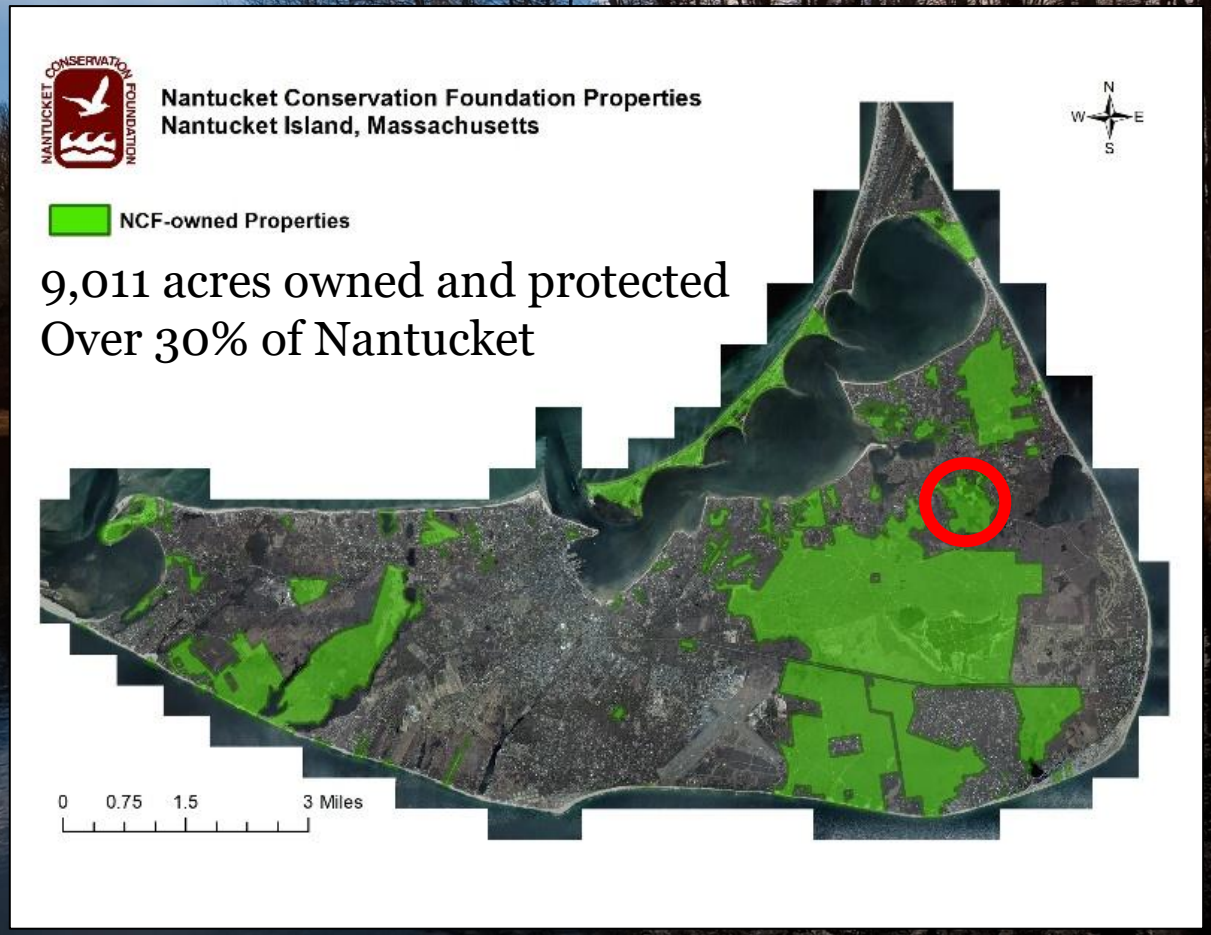
Mission: *The Nantucket Conservation Foundation owns, protects and stewards over 9,000 acres of land and coastal shoreline, conserves Nantucket's rare and significant natural resources, and engages in impactful ecological research to inform resource management and further our knowledge of Nantucket's unique ecosystems and species. We share our environmental expertise with the wider community and provide educational and recreational opportunities to encourage respectful enjoyment and appreciation of our properties.*



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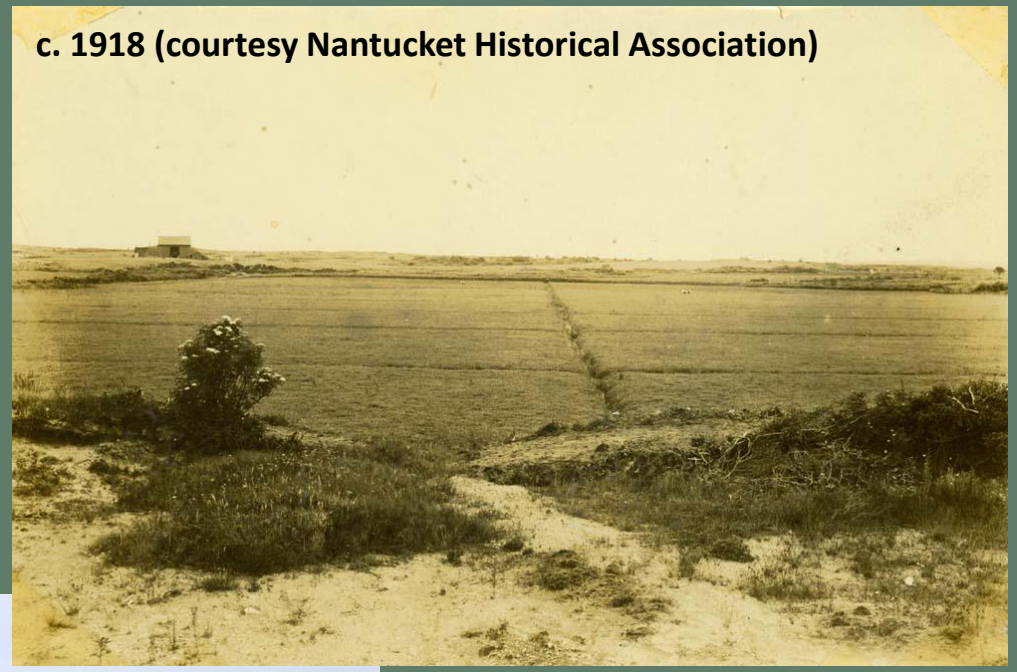
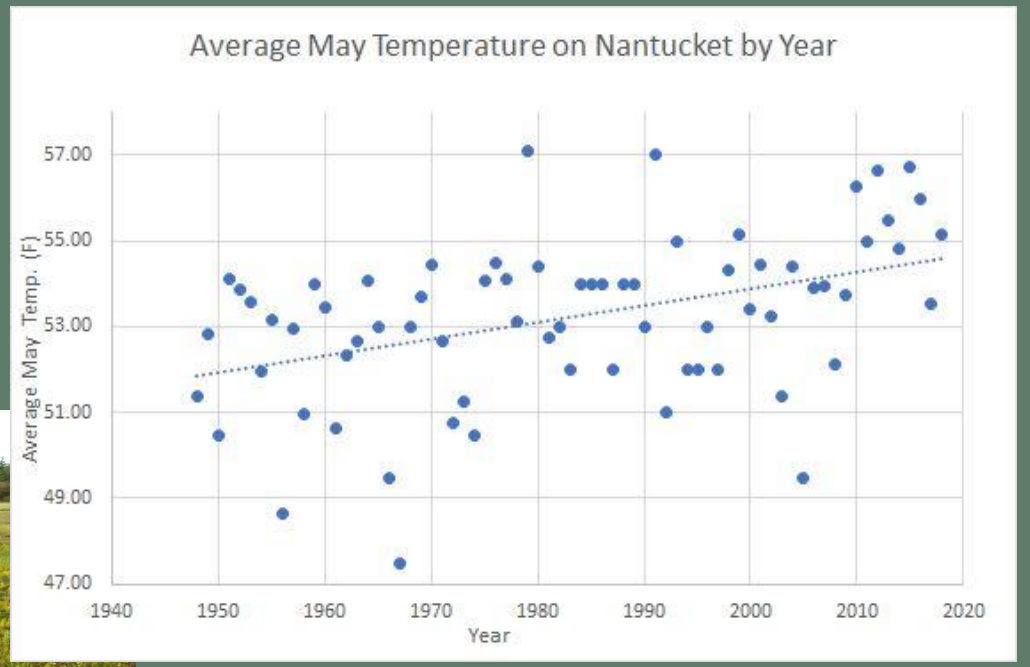
Site Characteristics and History

- Windswept is a former cultivated cranberry bog constructed in early 1900's
- Property purchased by NCF in 1980:
  - 40 acres in 14 individual cultivated bog cells
  - 110 acres of natural wetlands
  - 81 acres of uplands
- Cranberry cultivation was retired in 2017



Reasons for Cranberry Farm Retirement:

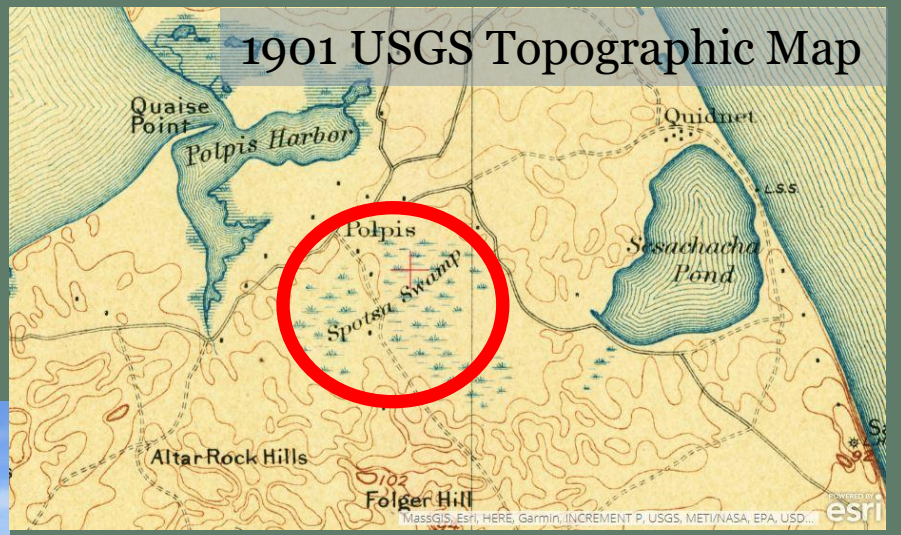
- Climate change impacts
- Newer bogs and better growing conditions in Canada
- Decreased crop values and increased production costs
- Water quality concerns

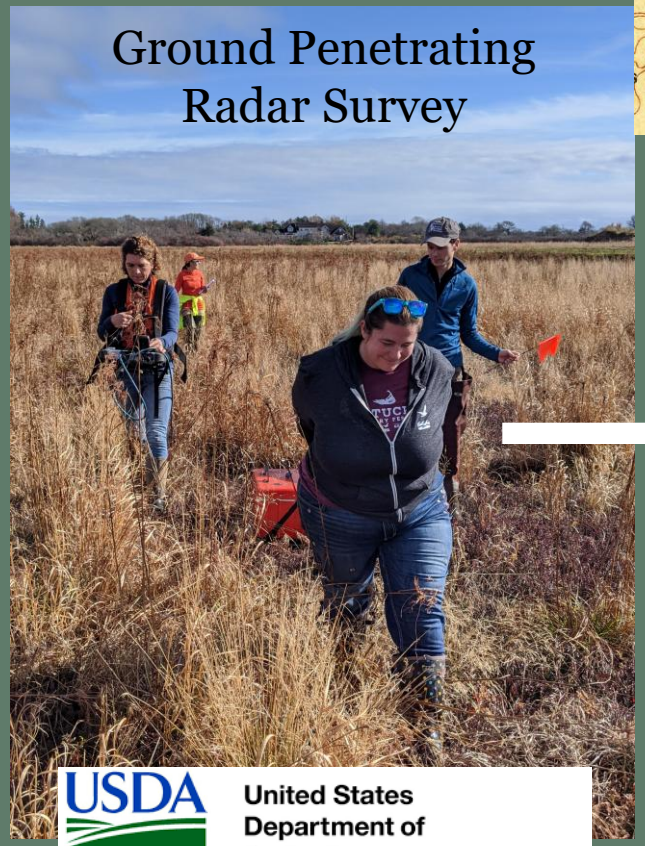


Was Windswept a Wetland Before Cranberry Farming?

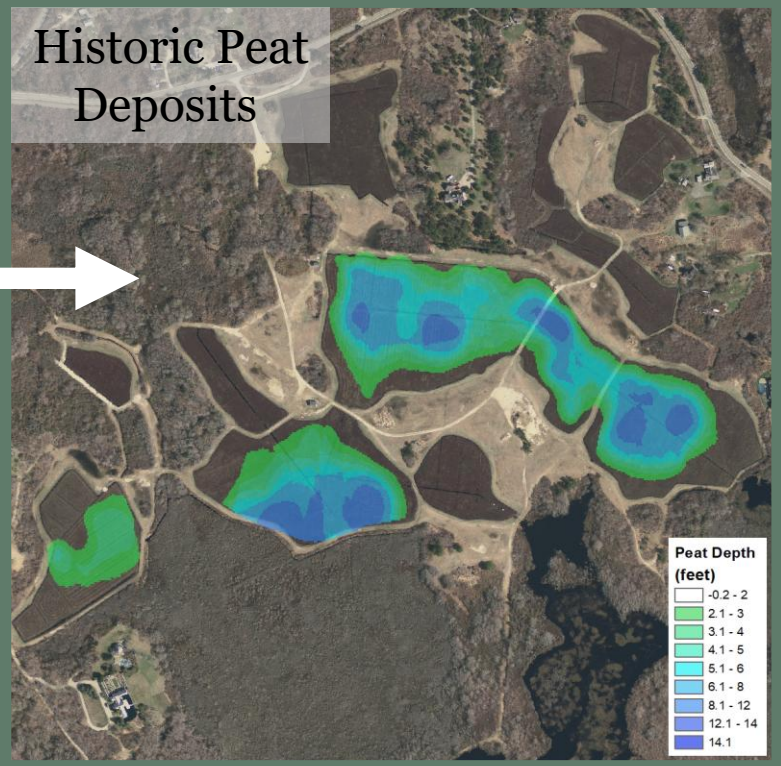
- Ground penetrating radar survey detected 2-14 ft of underlying peat, confirming historic wetlands
- Partnership with Mass. Division of Ecological Restoration Cranberry Bog Program
- Windswept accepted as a “Priority Project” with MassDER in 2021

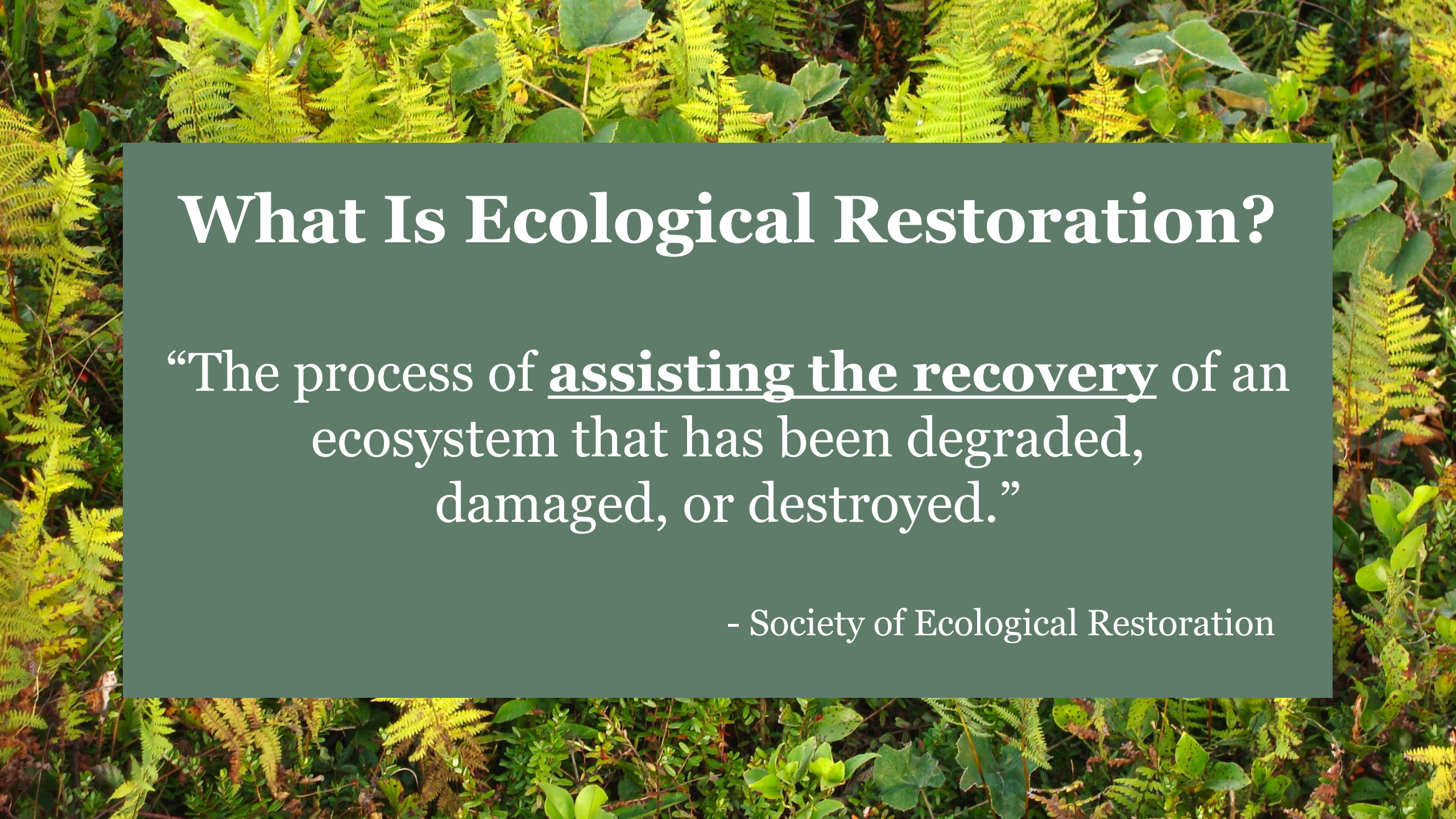
Massachusetts Department of Fish and Game
Division of Ecological Restoration
Invested in Nature and Community





USDA United States Department of Agriculture
Natural Resources Conservation Service





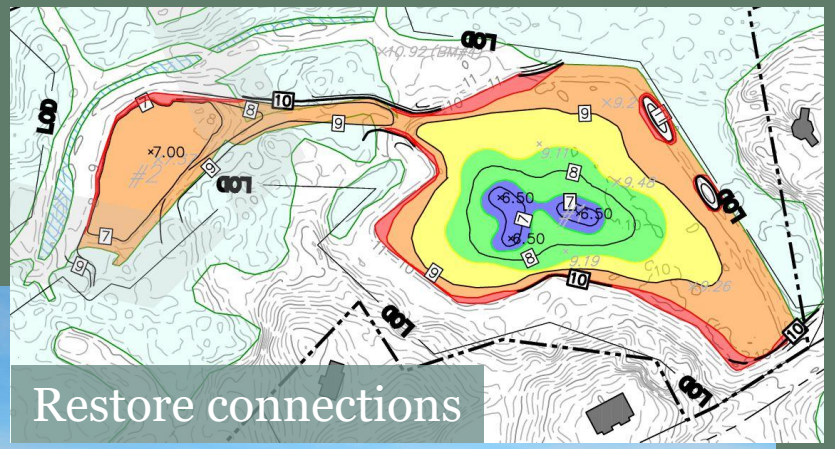
What Is Ecological Restoration?

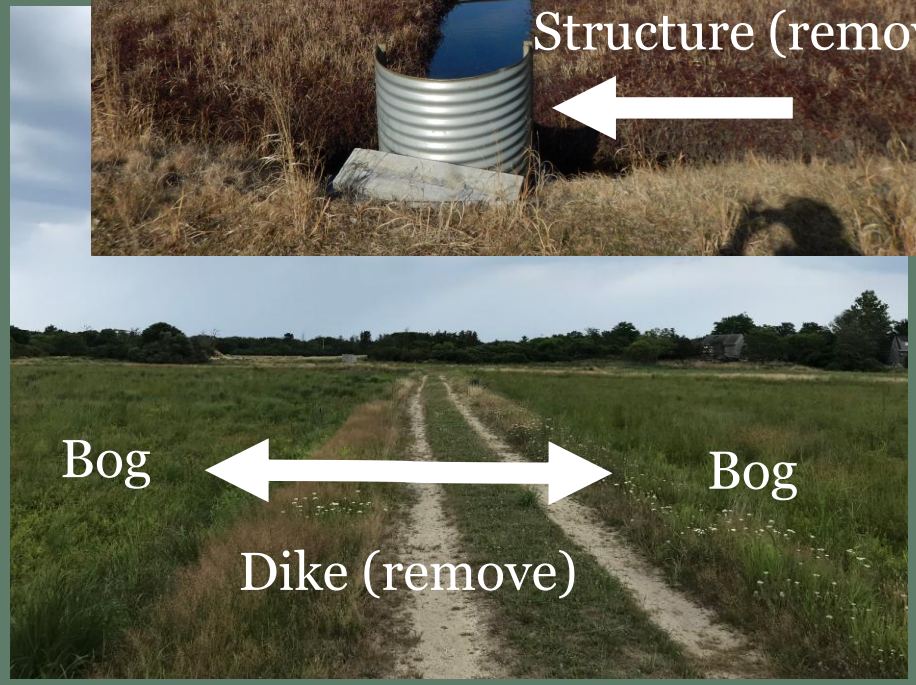
"The process of **assisting the recovery** of an ecosystem that has been degraded, damaged, or destroyed."

- Society of Ecological Restoration

How to Restore a Cranberry Bog 101:

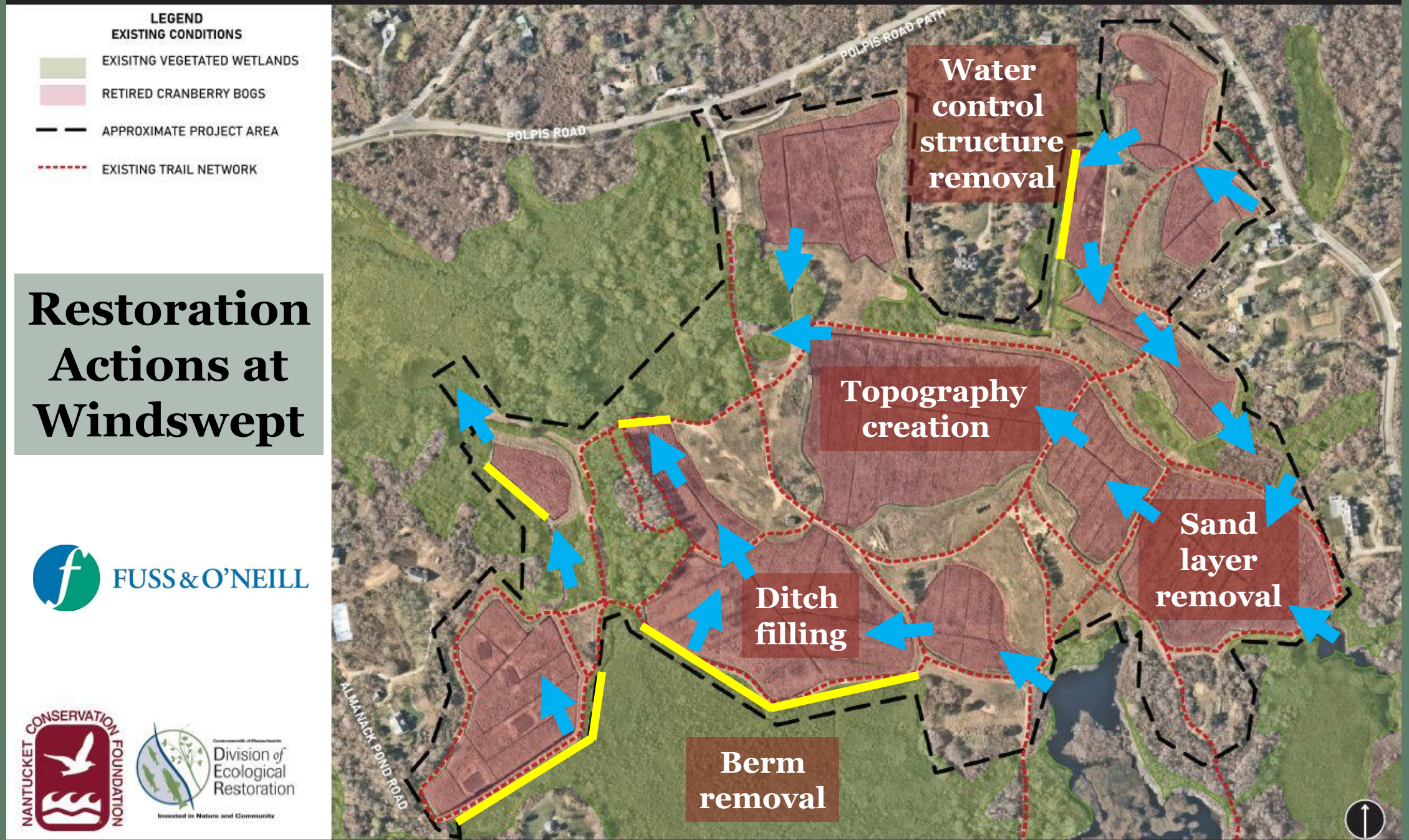
- Remove dikes, berms and water control structures to restore connections and natural flow
- Remove sand layer to reduce elevation and re-connect with groundwater
- Use the sand to fill ditches to reduce channelization and create natural topography
- “Roughen” the bog surface to expose peat and wetland plant seed bank





WINDSWEPT BOG WETLAND RESTORATION
EXISTING CONDITIONS

FUSS & O'NEILL



Restoration Actions at Windswept

FUSS & O'NEILL

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Pre-Restoration Research Informed the Engineering Design and Decision to Phase Construction

- Results of site-wide vegetation inventories:

  - rare communities and species present

- Results of spotted turtle radio-tracking:

  - retired bog cells used during spring through fall, but most turtles left in winter to hibernate in adjacent wetlands

- **Construction timed to minimize impacts: November 1st to March 15th**

Wetland Restoration Design, Timeline and Phasing

- Jan. - March 2024: Phase 1 construction
- April - Oct. 2024: Inter-phase monitoring
- Nov. 2024 - March 2025: Phase 2 construction
- **April 2025: Project completion**

Restoration Results: Before and After

Pre-restoration:
January 2024

Post-restoration:
May 2025

Bog 9

Early April 2024

Bog 11

Late July 2024

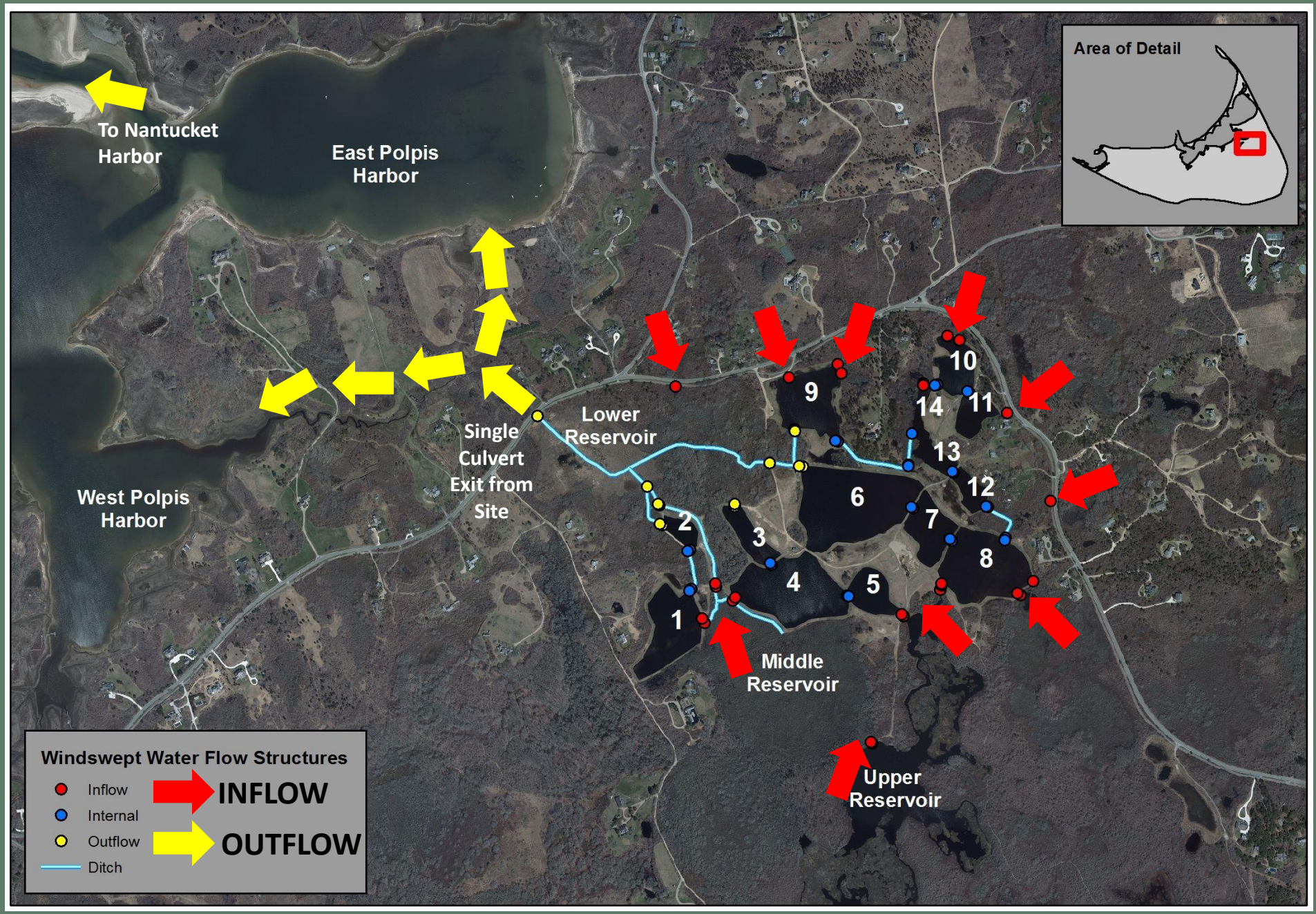
Early April 2024

Bog 1

Late July 2024

How Does Freshwater Wetland Restoration Benefit Coastal Resilience?

- Windswept is a watershed for ~1,000 acres in the northeastern portion of Nantucket Island
- Direct connections to Polpis and Nantucket Harbors



Surface Water Flow Through Site: During Cranberry Farming & Before Wetland Restoration

- Nutrient inputs from ~1,000 acres off-site
- Nutrients inputs from cranberry cultivation (i.e. fertilizers, etc.)
- Simplified landscape: flat topography and deep, efficient drainage ditches
- Water flow concentrated in ditches, increasing flow rates and reducing residence time

Surface Water Flow Through Site: Post-Wetland Restoration

- Still nutrient inputs from off-site, but none from cranberry cultivation
- Landscape diversity and wetland topography restored
- No flat bog surfaces or drainage ditches- only diffuse flow paths
- Slower water flow and increased retention

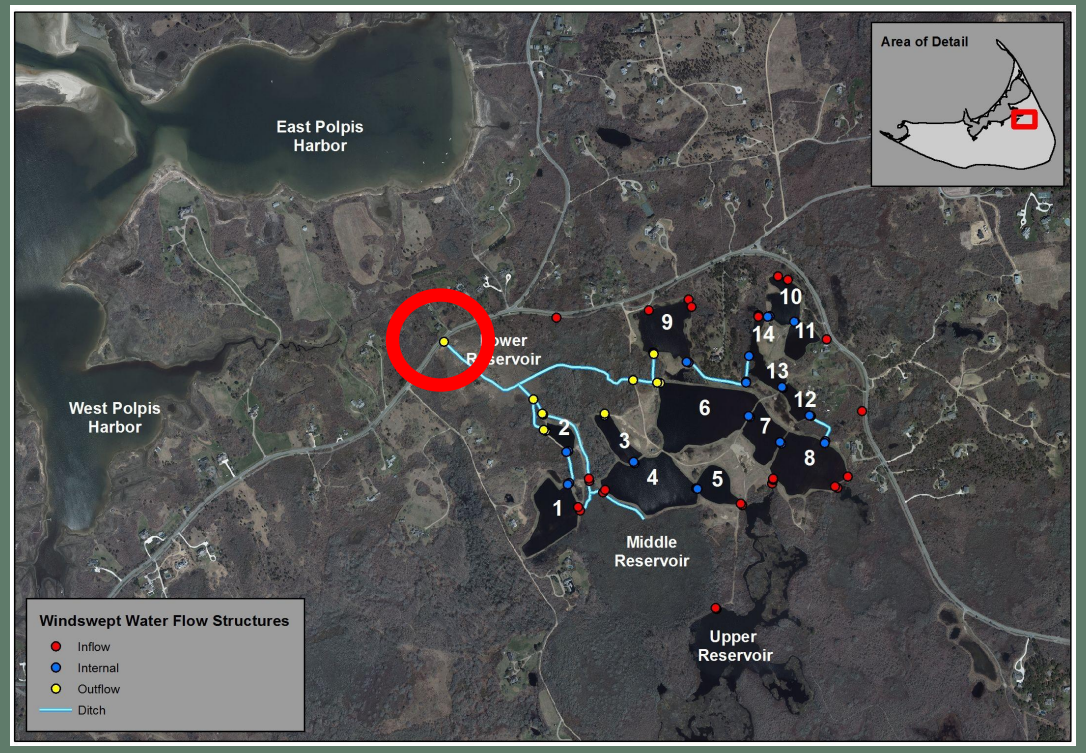
THEORY: Natural, slow movement of surface water through restored wetlands →

Uptake of excess nutrients by native wetland vegetation →

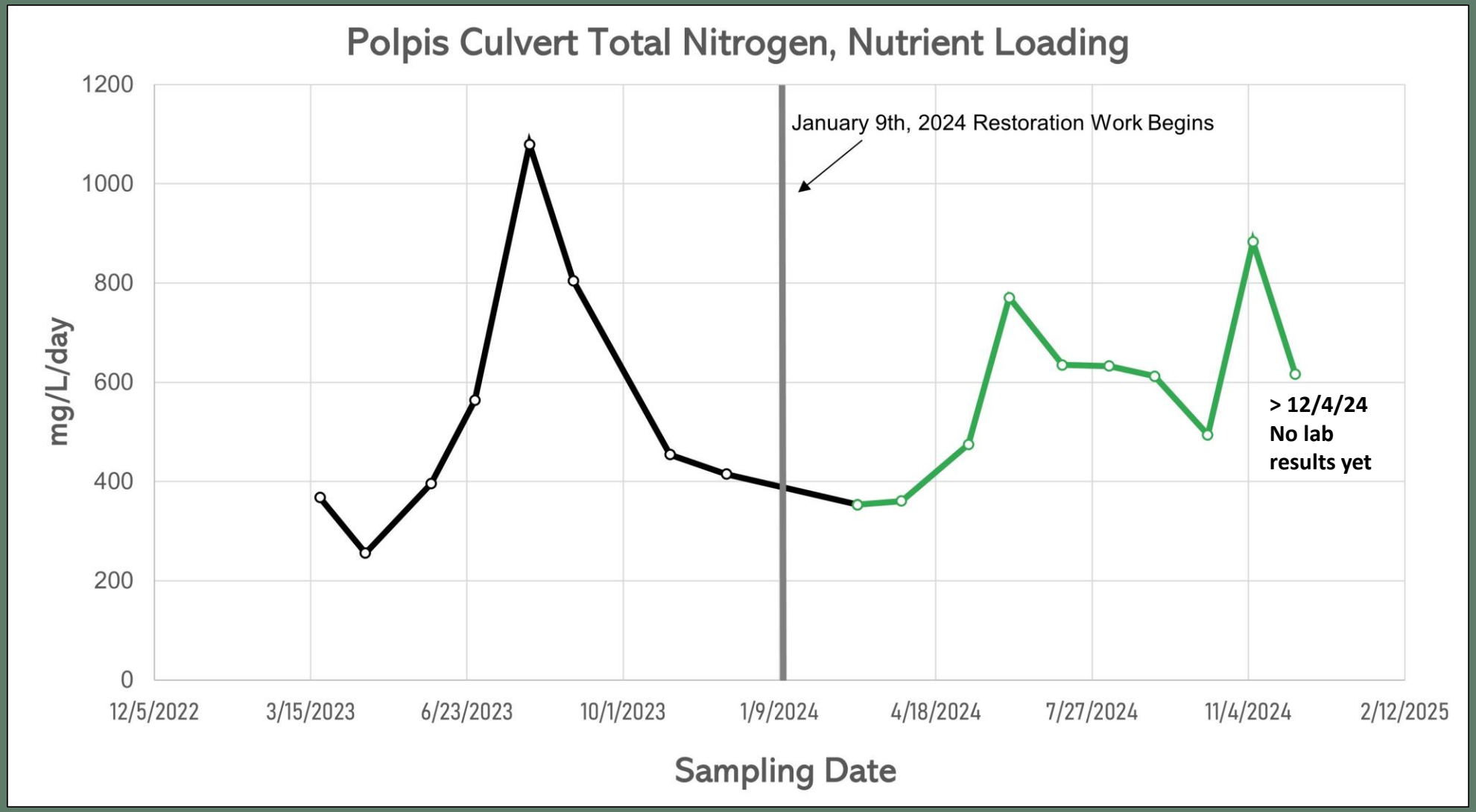
Improved water quality

Water Quality Sampling at Windswept Exit Culvert

- NCF is conducting ongoing nutrient sampling (monthly, year-round) beginning in March 2023
- Data analyzed and reported by SMAST Lab: Salinity,Conductivity, uM PO4, uM TP, uM NH4, uM NOx, uM DIN, uM DON, uM TDN, uM POC, uM PON, C/N Ratio, uM TON, uM TN, Chla, Phaeo, Total Pig

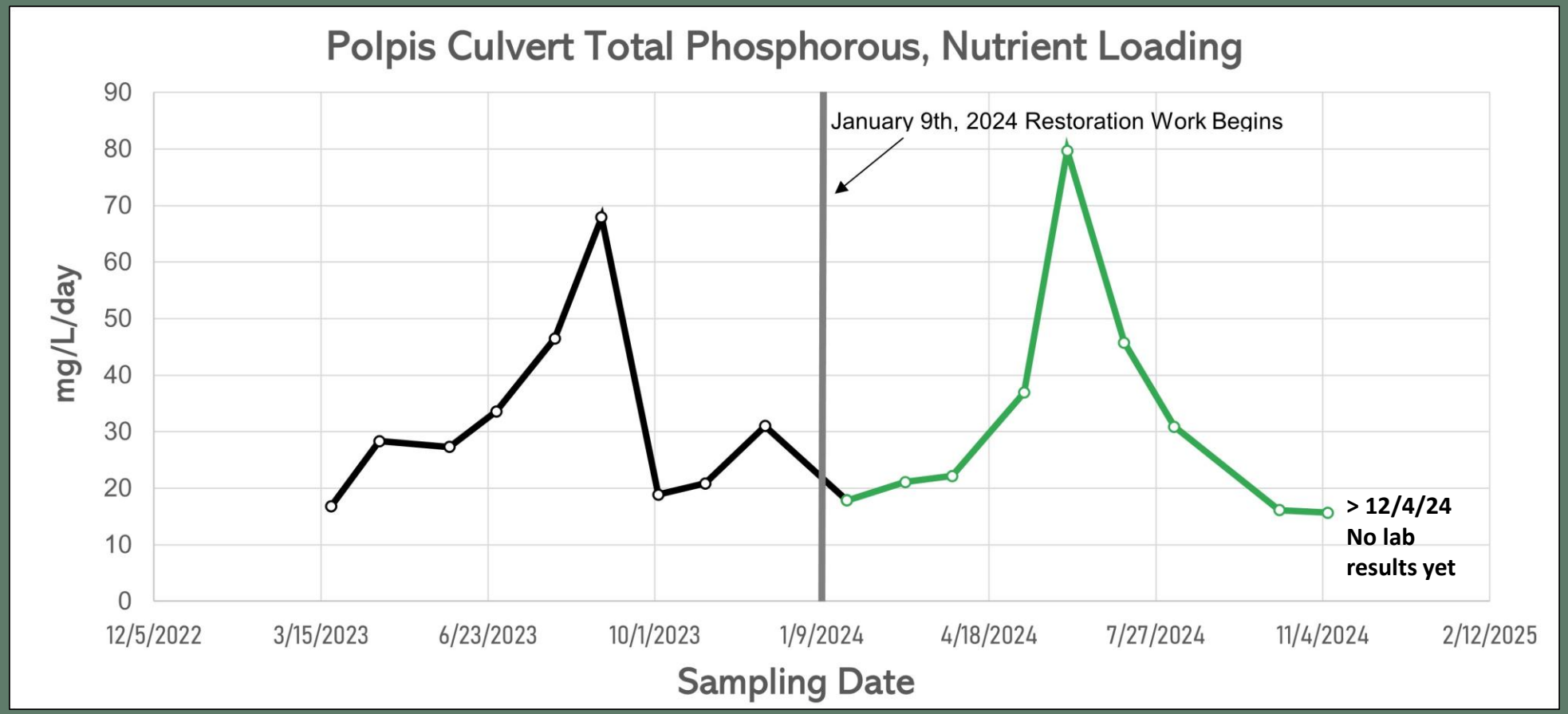


Very Preliminary Nitrogen Loading Results*



*This graph represents nutrient loading for Total Nitrogen during 2023 and 2024. Samples were taken monthly at the Polpis Road culvert exiting the Windswept site. Due to a lack of discharge data, an average discharge value was calculated in May and June of 2025 and is approximately 500 cubic meters/day. This may affect the nutrient loading values for this study site but still provides information into the changing nutrient profiles pre and post restoration.

Very Preliminary Phosphorus Loading Results*



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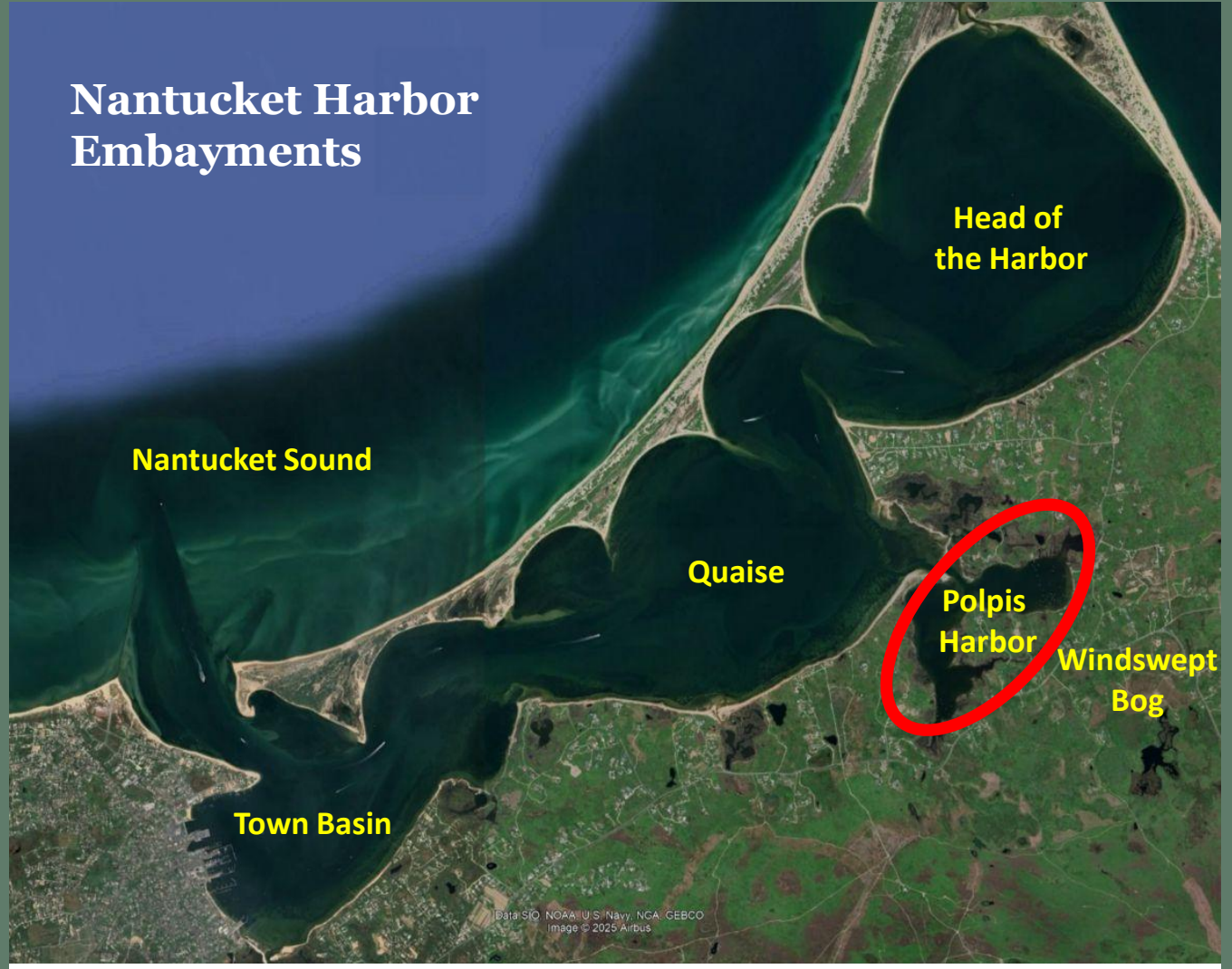
Predicted Improved Water Quality Inputs Will Benefit Estuary Habitat Health

- Polpis Harbor is currently impaired for high levels of nitrogen and bacteria
- Impaired water quality reduces the health and resilience of salt marshes
- One of the main coastal resilience challenges facing Nantucket Island is degradation and loss of estuarine habitats and their buffering capacity
- Improved water quality discharging from Windswept into Polpis Harbor will assist with estuarine resilience and overall harbor health

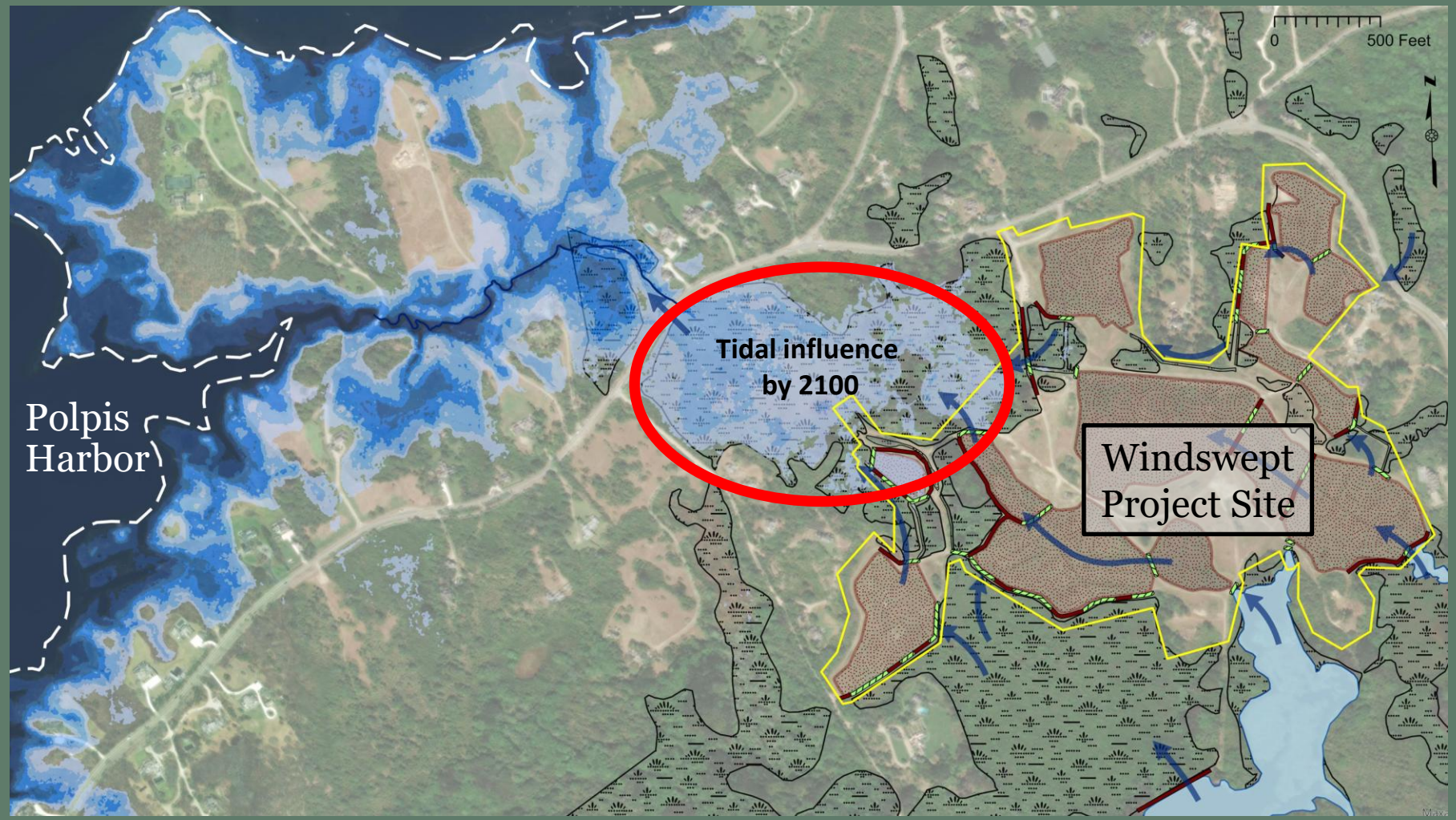


Total Nitrogen TMDLs

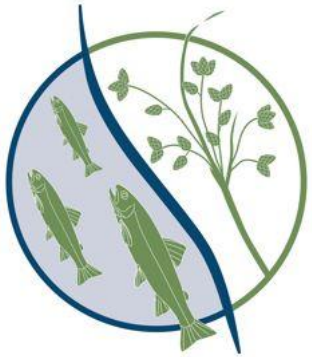
Embayment	Description	Sub-Embayment	TMDL (kg/day)
Nantucket Harbor Water Body Segment # MA97-01_2004	Determined to be impaired for nutrients, pathogens, and noxious aquatic plants by MassDEP.	Head of Harbor	23
		Quaise Basin	64
		Town Basin	25
Polpis Harbor Water Body Segment # MA97-26_2004	Determined to be impaired for nutrients, other habitat alterations, and pathogens by MassDEP.		31

Future Benefits of Wetland Restoration at Windswept

- NOAA Projections show a portion of the Windswept site under tidal influence by 2100
- Expanded acreage of low elevation wetlands adjacent to the coast will buffer flooding and increase resiliency
- Windswept will be a pathway for sea level rise and salt marsh migration



Acknowledgements



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SNEP
Southeast New England Program

RESTORE AMERICA'S ESTUARIES

FUNDERS + PARTNERS

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Questions?

Thank you!

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