

**Geoff Wilson, Northeast Wetland Restoration**  
**Presentation for York River Stewardship Committee meeting**  
**September 24, 2024**

# **York River - Smelt Brook Salt Marsh Restoration Project**

- 2024 Preliminary Design Area +/-132 Acres

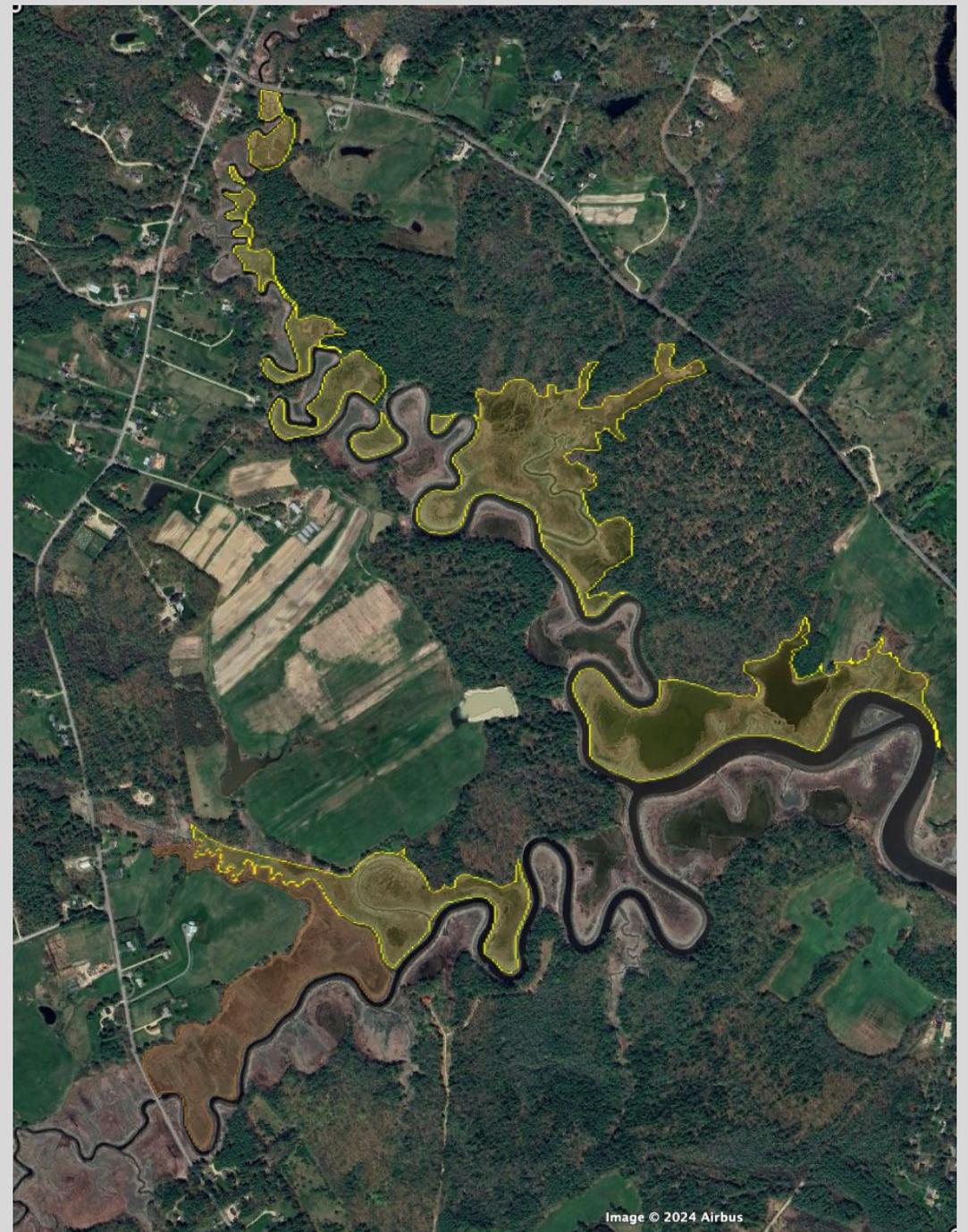
*Funding provided by the York River Stewardship  
Committee through the National Park Service under  
CFDA: 15.962 – National Wild and Scenic Rivers  
System*



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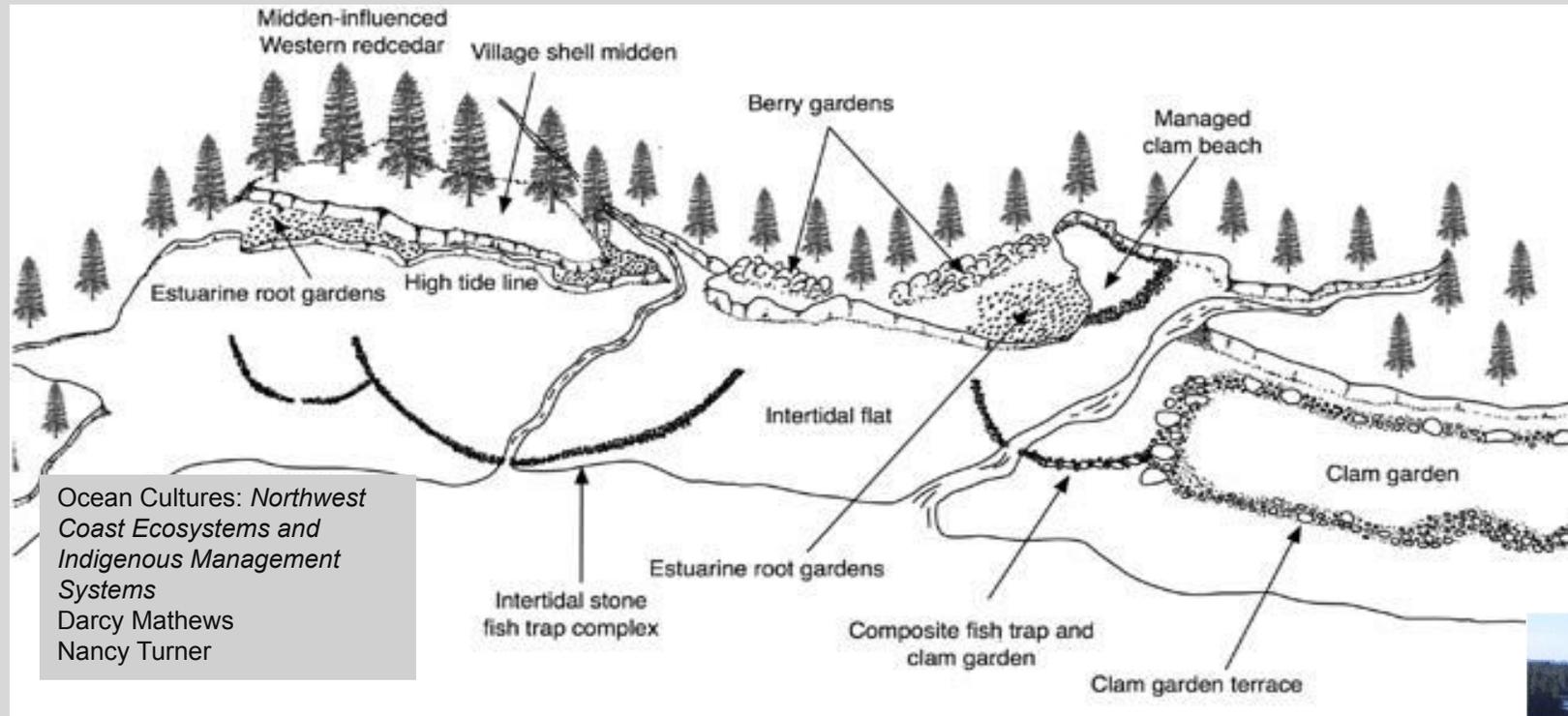


**What is a Restored Salt Marsh?**

# Salt Marshes for 10,000 Years After Glaciation

## What We Do Know

- Marshes were stable for thousands of years
- Marsh soils accumulated 4-10 feet of organic matter
- Indigenous Communities Valued the Marshes
  - Fishing and Hunting
  - Farmed and Harvested Edible Plants
  - Farmed and Harvested Medicinal and Ceremonial Plants



Ocean Cultures: Northwest Coast Ecosystems and Indigenous Management Systems  
Darcy Mathews  
Nancy Turner



Kind of a Mystery to Modern Cultures  
But is  
Well Known in Indigenous Knowledge



Salt Marshes for the Four Hundred Years After Colonial Settlement

# Salt Marshes in the Last 25 Years





## 10th Street Marsh Salisbury MA 1965 Air Photo

- Pre-colonial Tidesheds  
Based on Existing Creek  
Hydrology

Pre-colonial Tideshed



# 10th Street Marsh Salisbury MA 1965 Air Photo

- Pre-colonial Tidesheds  
Based on Existing Creek  
Hydrology (Blue)

Pre-colonial Tideshed





# 10th Street Marsh Salisbury MA 1965 Air Photo

- Pre-colonial Tidesheds Based on Existing Creek Hydrology (Blue)
- Early Colonial Farmers Fractured Tidesheds With Farmer's Ditch Network (Orange)

Early Salt Marsh  
Agricultural Tideshed



## Late Salt Marsh Agricultural Tideshed

### 10th Street Marsh Salisbury MA 1965 Air Photo

- Pre-colonial Tidesheds Based on Existing Creek Hydrology (**Blue**)
- Early Colonial Farmers Fractured Tidesheds With Farmer's Ditch Network (**Orange**)
- Later Eras of Salt Marsh Farming Further Isolated Areas With Agricultural Embankments (**Red**)



# Early Period Salt Marsh Agricultural Embankment Systems

- **Low Earthen Embankments**
  - Widely used in the 1700s
  - Reduced tidal inundation frequency to improve salt hay production
  - Incorporated crude sluice valves with **leather hinges** in the ditches
  - Salt Hay yield increases of 200 to 300%



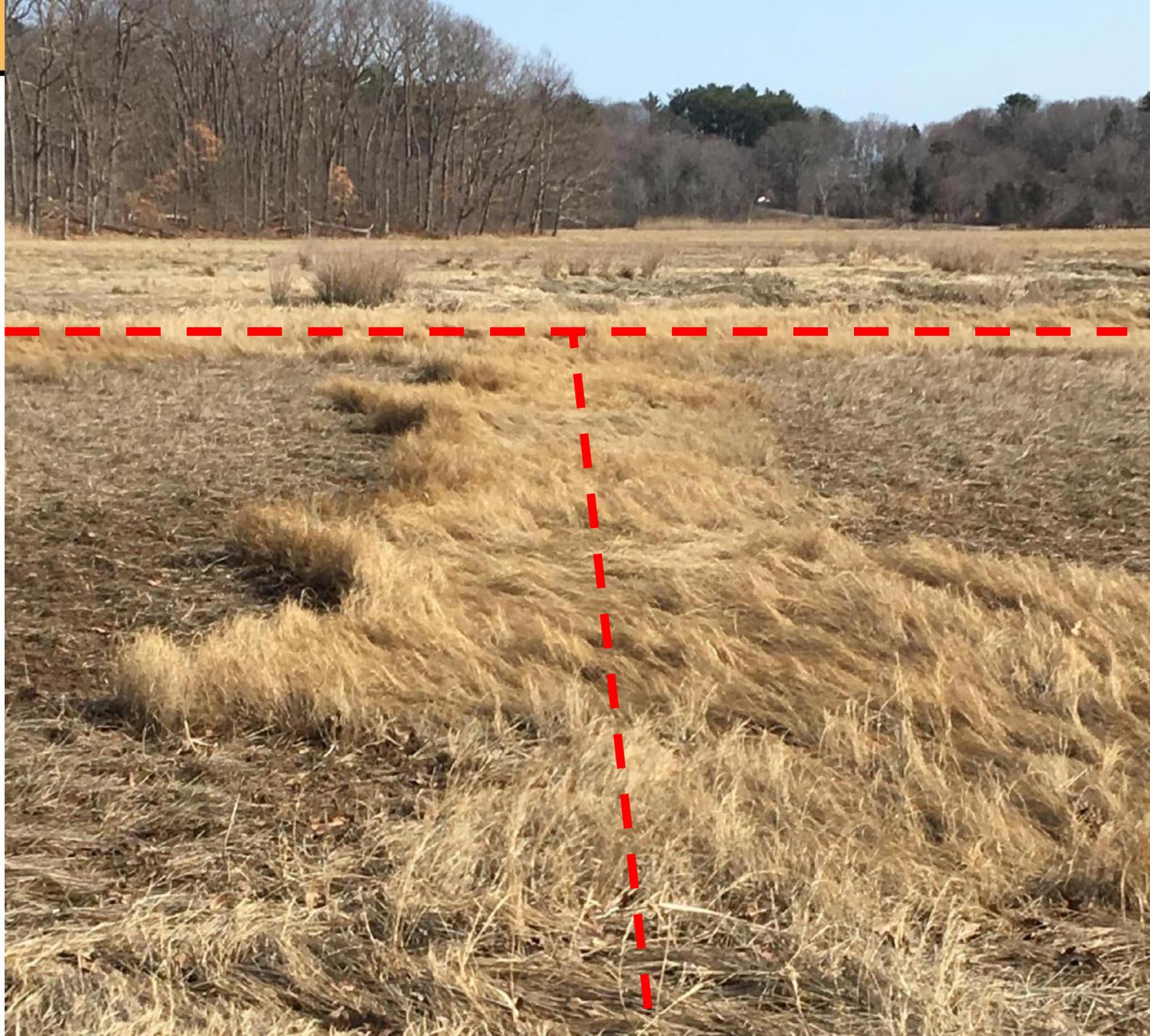
# What Early Period Salt Marsh Embankments look like today





# What Early Period Salt Marsh Embankments look like today

- Red lines depict the centerline of the embankments that surround two adjacent salt hay fields.
- Embankments surround enclosure causing extended waterlogging and either open water areas or vegetation communities most tolerant of the wet growing conditions.





# Salt Marsh Reclamation Embankment Systems

**Late Period** reclamation embankment systems 'reclaimed' large areas of salt marshes into lands that could produce freshwater crops.

- Widely used in the 1800s
- In the High Meadow tides were blocked from entering the marsh
- In the Inner and Outer Marshes tides were reduced increase salt hay yields
- Utilized a 'Marginal Ditch' between the upland and the marsh
- Contained an internal drainage system that lowered the groundwater in the marsh and the adjacent uplands
- Produced various agricultural products
  - 4 tons/acre Herd Grass (English Hay)
  - 1600 bushels/acre Mangel-wurzel
  - 2-3 tons/acre Salt Hay
  - Sweet Corn, Potatoes, and other produce



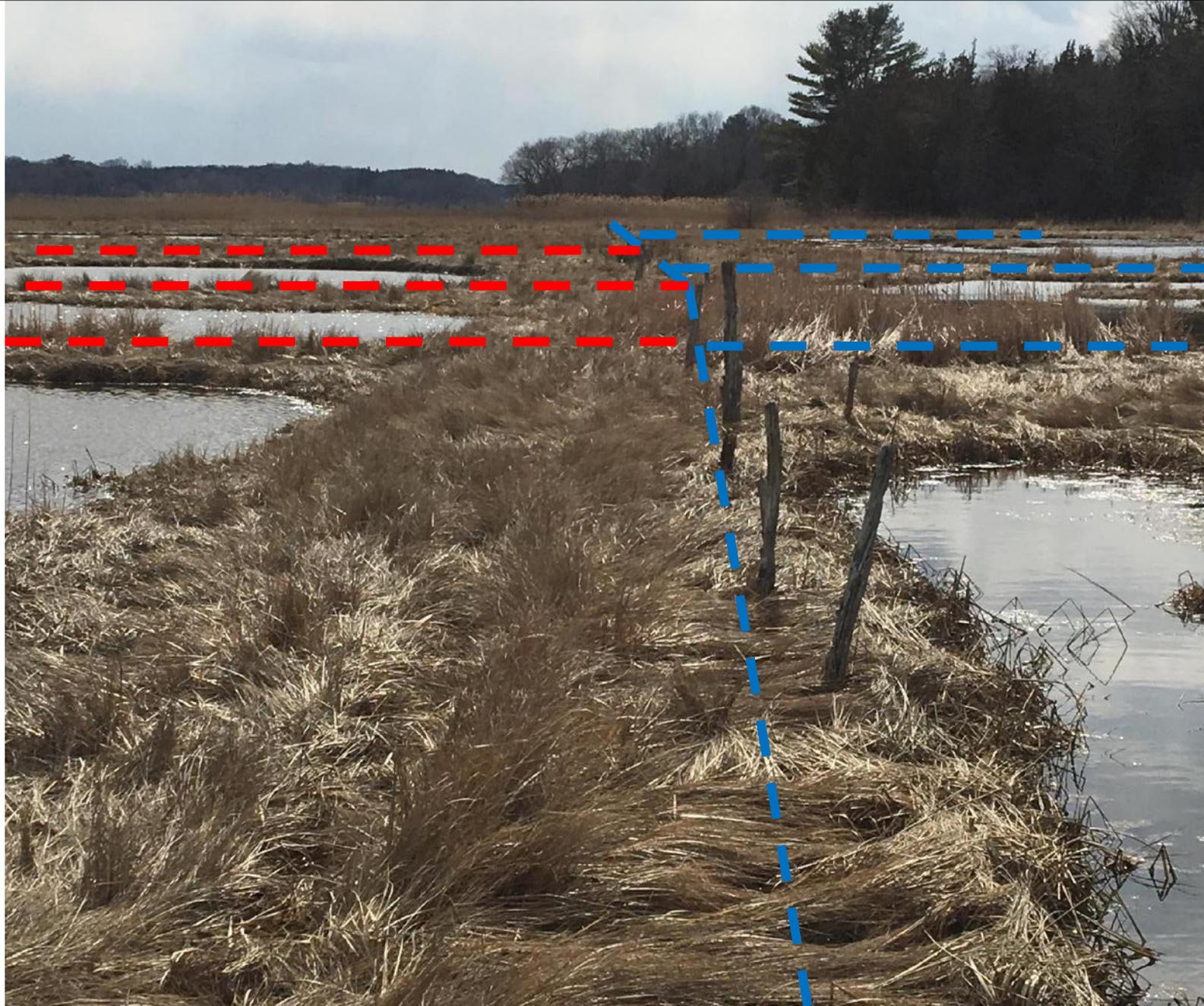
# What Reclamation Embankments look like today





# What Reclamation Embankments look like today

- Blue Lines Depict Reclamation embankments
- Red Lines Depict Salt Marsh embankments
- A form of terraced agriculture, the fields outlined in blue are higher in elevation than the fields outlined in red.
- Both forms of agricultural embankments lead to waterlogging and degradation of the salt marsh area.





# Why are Marshes Suddenly Changing?

**Understanding  
the Legacy of  
Agricultural  
Impairments in  
New England  
Salt Marshes**





# Leetes Island, Guilford Connecticut 1917 and 2006



Photo credits  
to  
Ron Rozsa



# Leetes Island, Agricultural Infrastructure

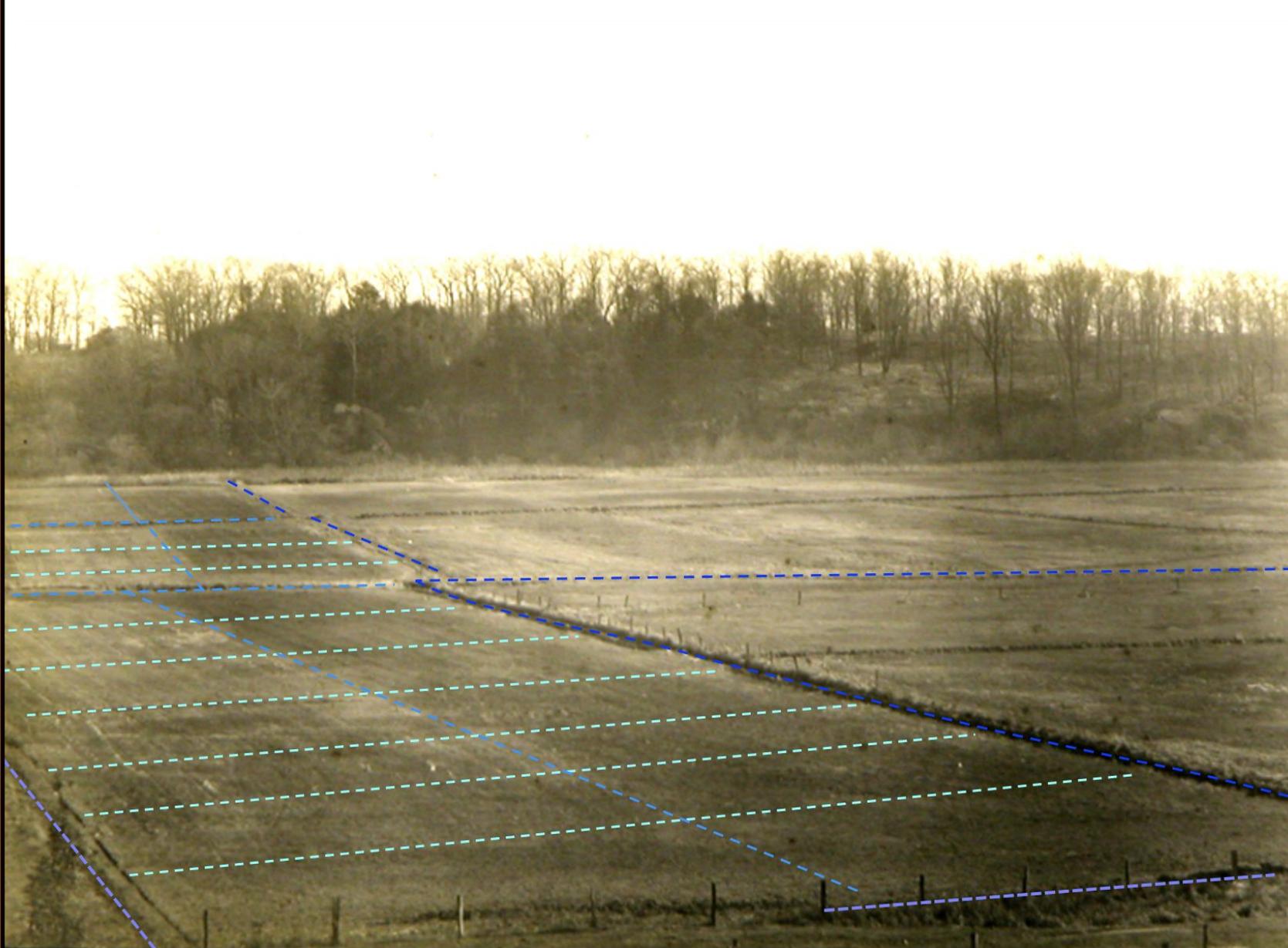
- 200-year-old agricultural infrastructure is still visible
- Notice the dramatic slope visible in every section of the marsh



# Leetes Island, Agricultural Infrastructure

- Inner Embankments —
- Outer Embankments —



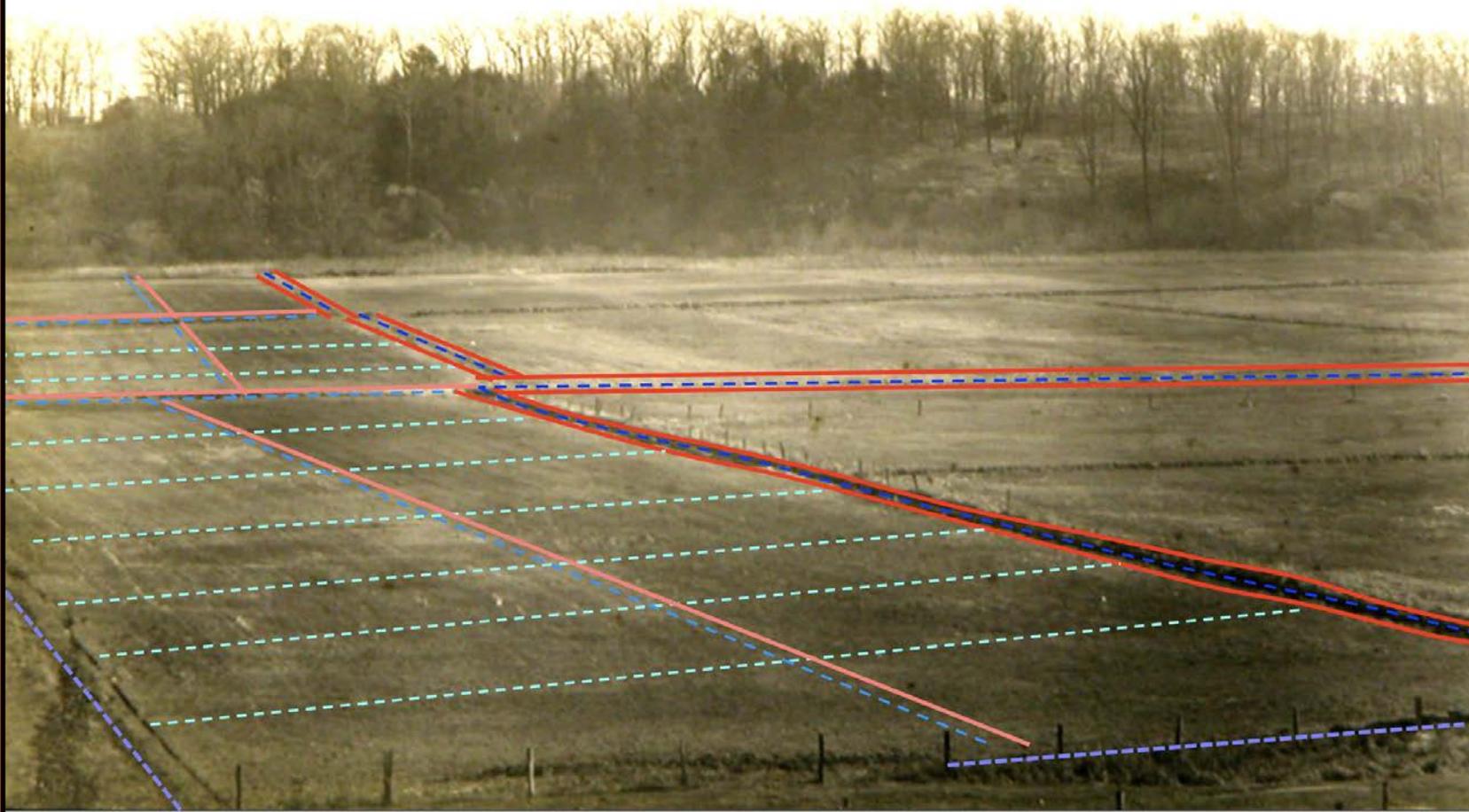


# Leetes Island, Agricultural Infrastructure

- Marginal Ditch - - - -
- Drainage Ditch - - - -
- Cross Ditch - - - -
- Trunk Ditch - - - -



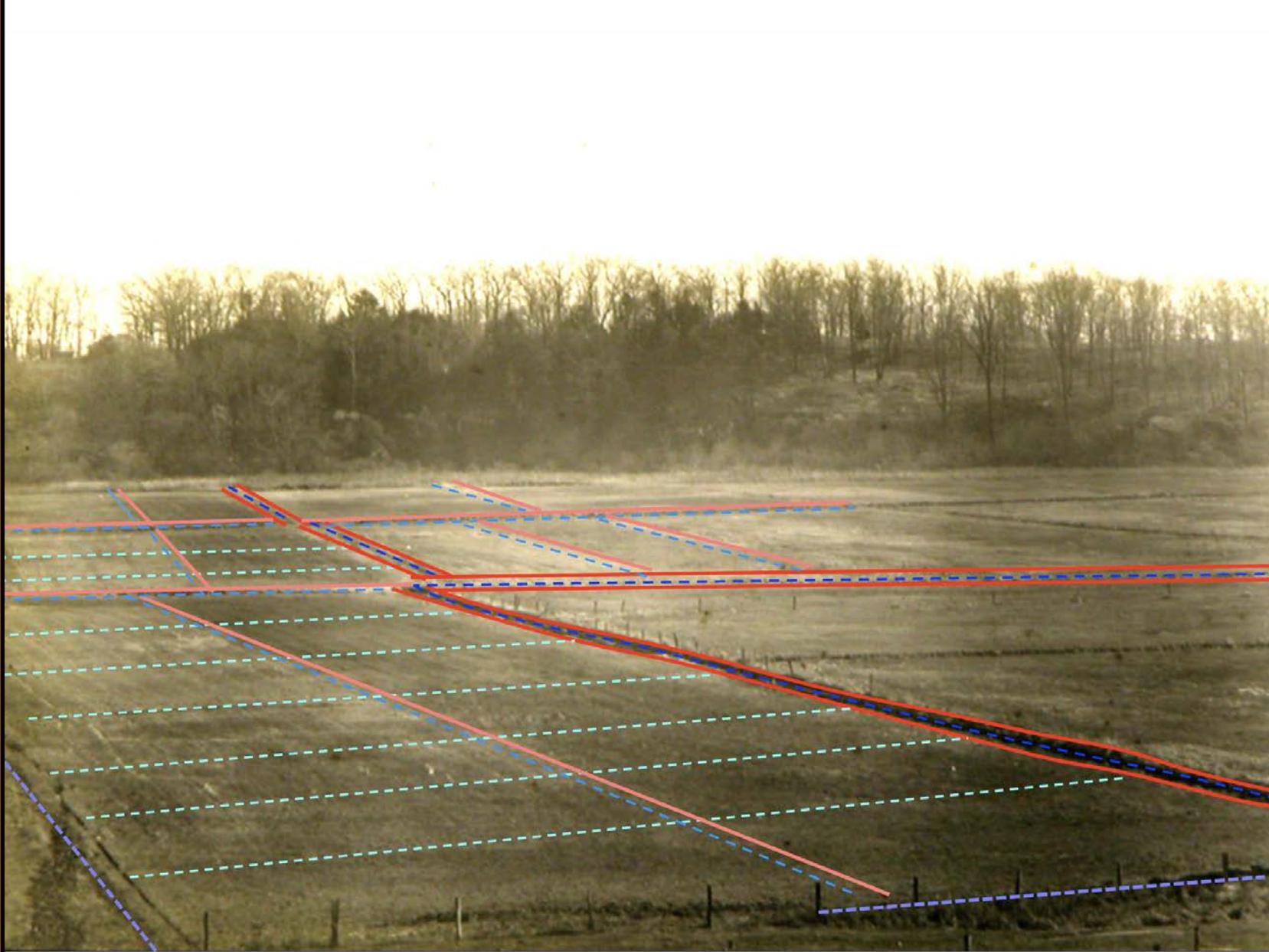
# Leetes Island, Agricultural Infrastructure



- Put it all together
- Salt marsh agriculture yielding between 2-3 tons per acre of salt marsh hay
- Do you see more infrastructure in the adjacent fields?



# Leetes Island, Agricultural Infrastructure

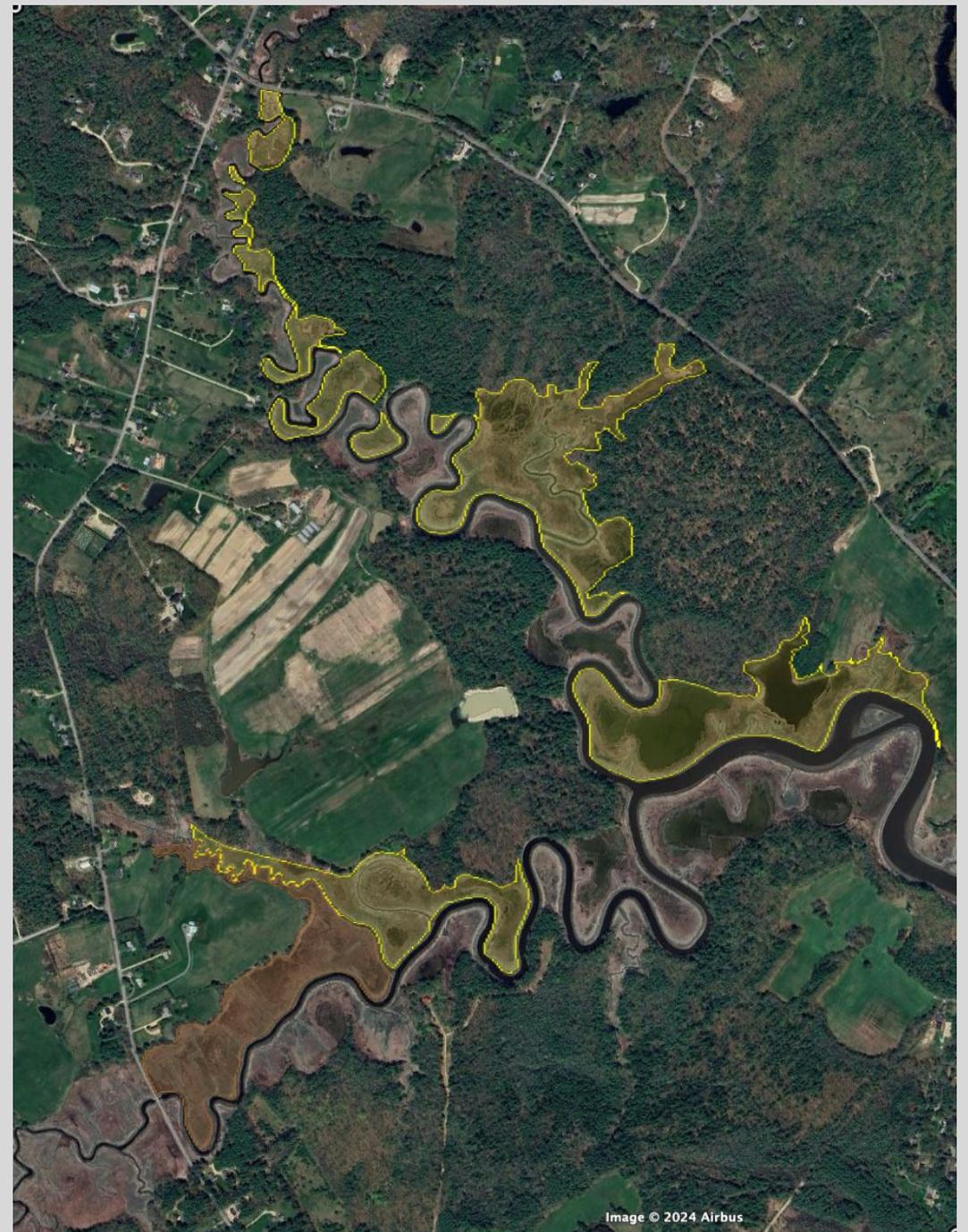


- Inner Embankments ———
- Outer Embankments ———
- Marginal Ditch - - - -
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# Smelt Brook Agricultural Infrastructure Signatures

- Unconsolidated Coble in Tidal Course
- Typical Water of Control Structure
- Repeated Many Times in Smelt Brook





# Smelt Brook Agricultural Infrastructure Signatures

- Red - Late Period Embankment Signatures





# Smelt Brook Agricultural Infrastructure Signatures

- Red - Late Period Embankment Signatures





# York River Agricultural Infrastructure Signatures

- Unusual Secondary Creek Formation





# York River Agricultural Infrastructure Signatures

- Orange - Early Period Embankment Signatures





# York River Agricultural Infrastructure Signatures

- Red - Late Period Embankment Signatures





# 4-Tiered Restoration Model

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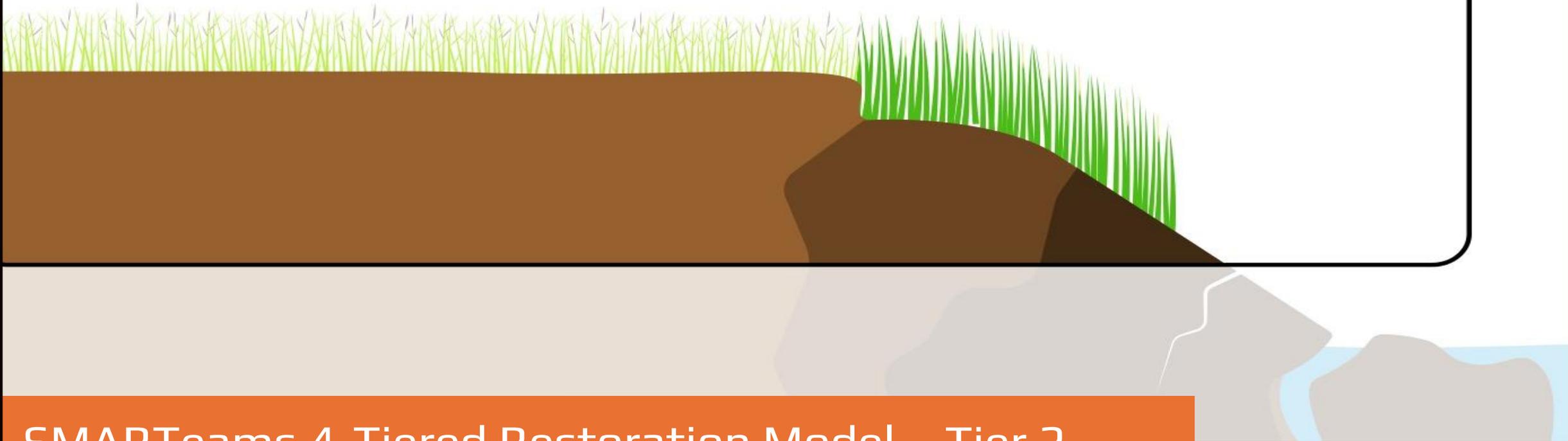


## SMARTeams 4-Tiered Restoration Model – Tier 1

### Platform Hydrology

- Halt subsidence trajectories
- Stabilize marsh platform
- Preserve 1,500 to 4,000-year-old blue carbon stores
- Provide base for vertical accretion

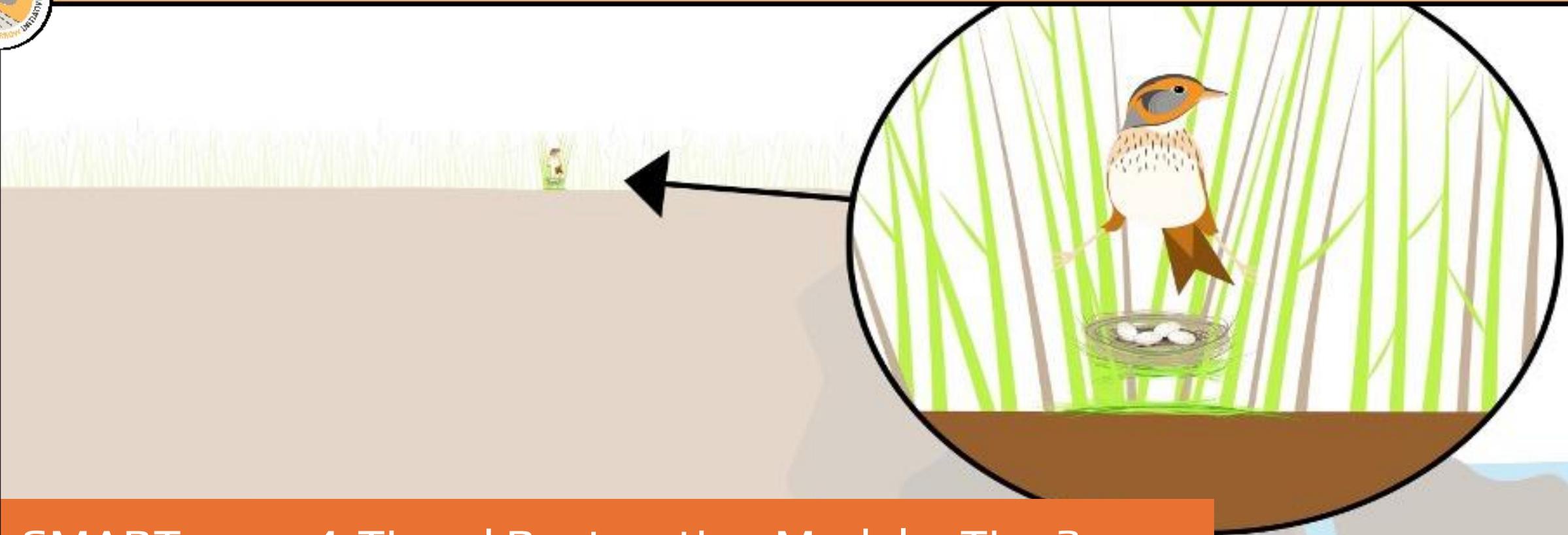




## SMARTeams 4-Tiered Restoration Model – Tier 2

### Surface Hydrology

- Increase primary production
- Increase below ground biomass
- Increase accretion rates
- Increase carbon sequestration rates
- Increase marsh resiliency



## SMARTeams 4-Tiered Restoration Model – Tier 3

### **Wildlife Management Considerations**

- Structured micro-topography for saltmarsh sparrows
- Keep saltmarsh sparrows in the landscape for 60-80 years
- Provide time for vertical accretion to restore elevation across marsh platform



## SMARTeams 4-Tiered Restoration Model – Tier 4

### Long-Term Management Considerations

- Monitoring to ensure success
- Adaptive management strategies
- Vertical accretion to restore elevation across marsh platform
- Managed marsh migration

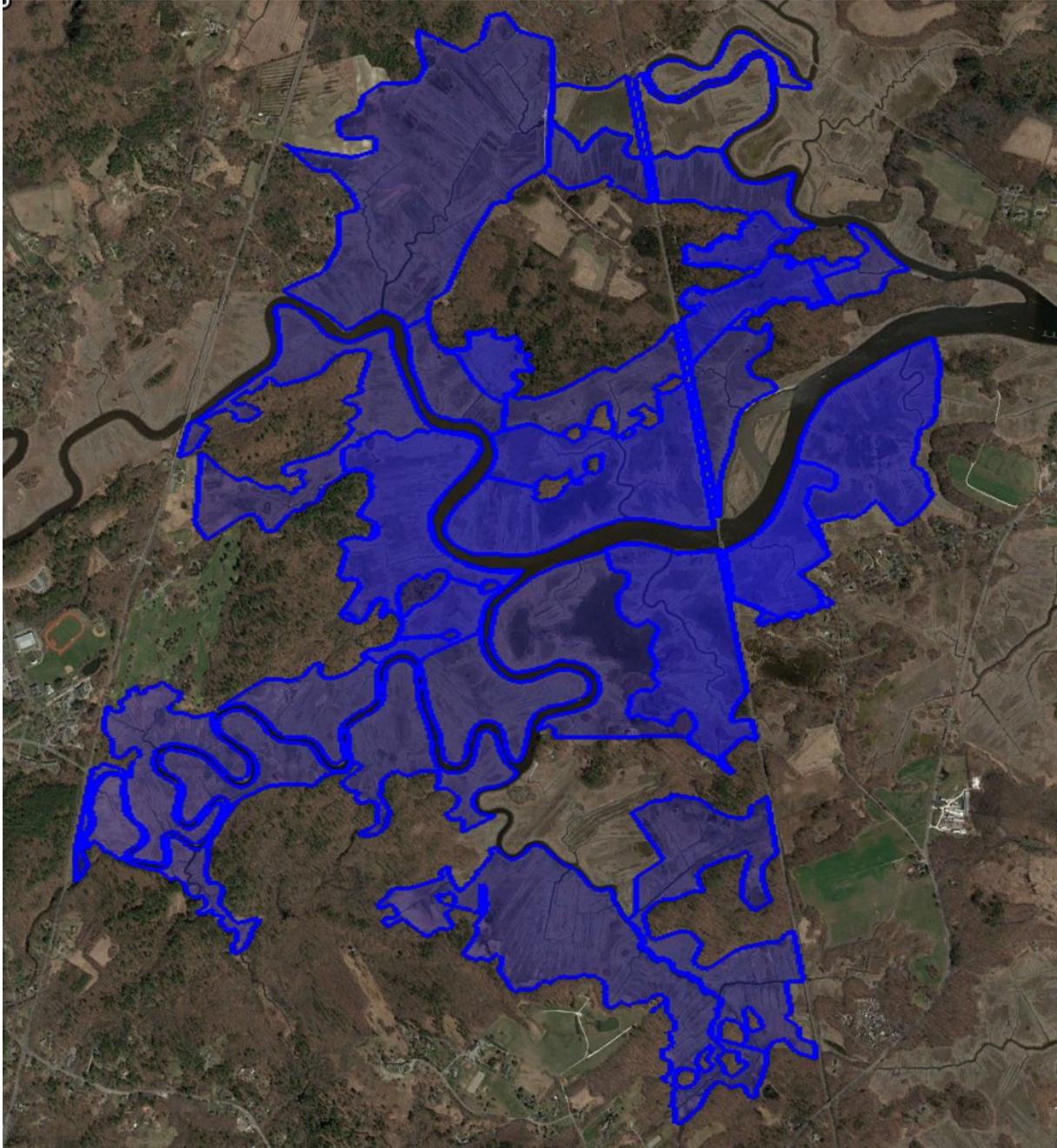


# William Forward Wildlife Management Area

Salt Marsh Restoration at  
the Landscape Scale



MASSWILDLIFE



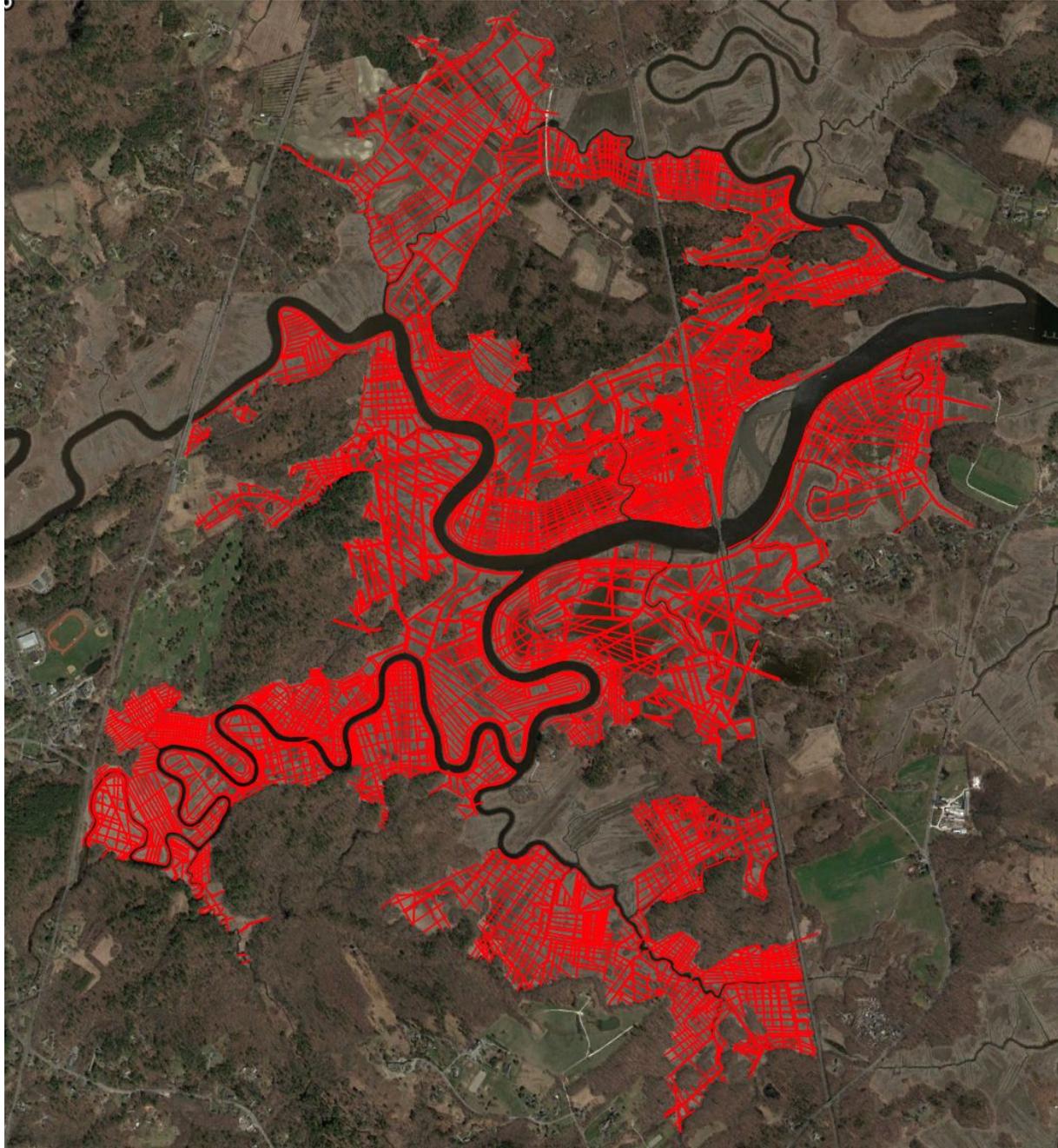
# MassWildlife

## William Forward Wildlife Management Area

- 1,172-Acres
- 10 Marsh Management Units



MASSWILDLIFE



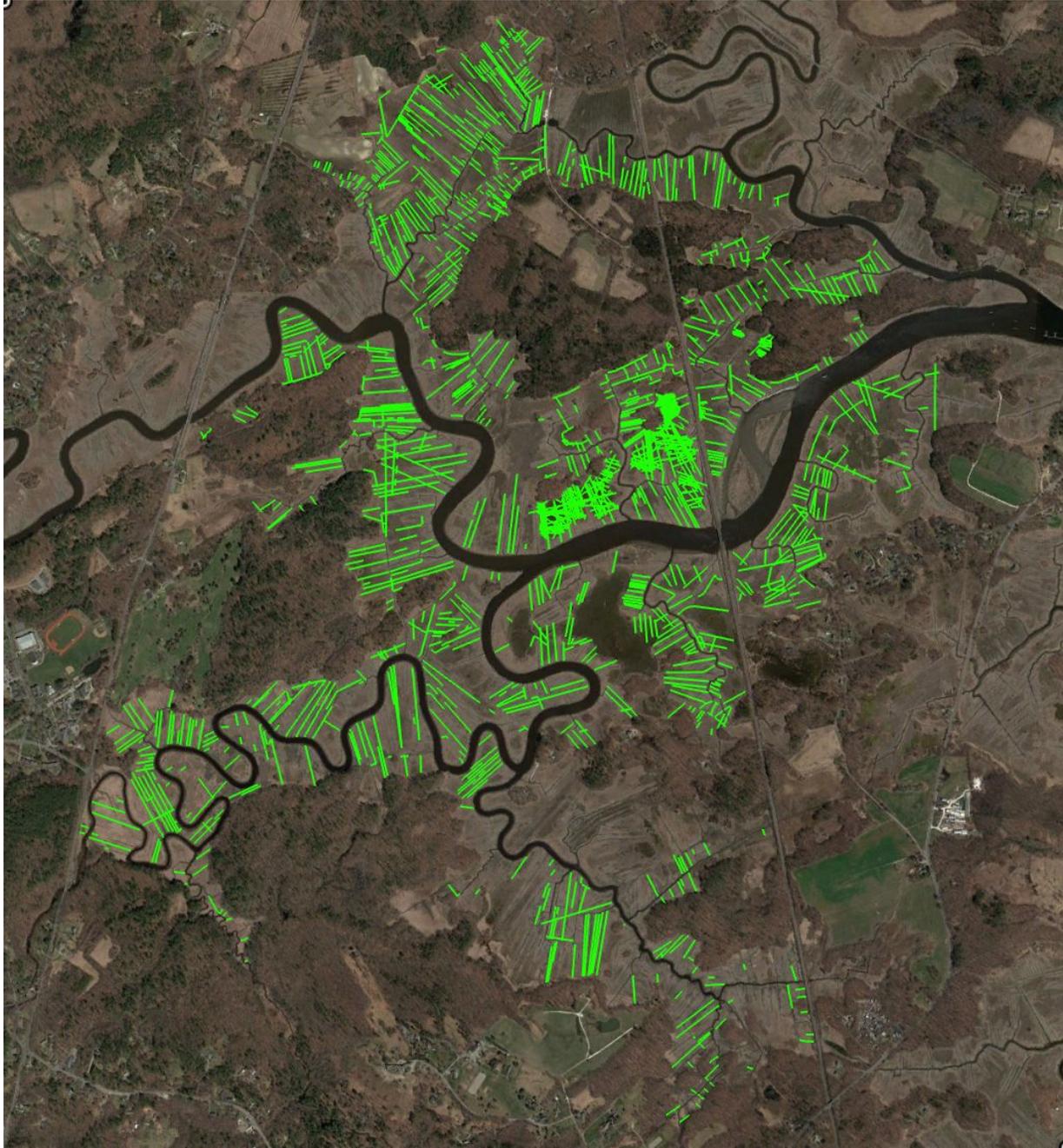
# MassWildlife

William Forward  
Wildlife Management  
Area

- 1,172-Acres
- 10 Marsh Management Units
- **2,314** Late Period Agricultural Embankments



MASSWILDLIFE



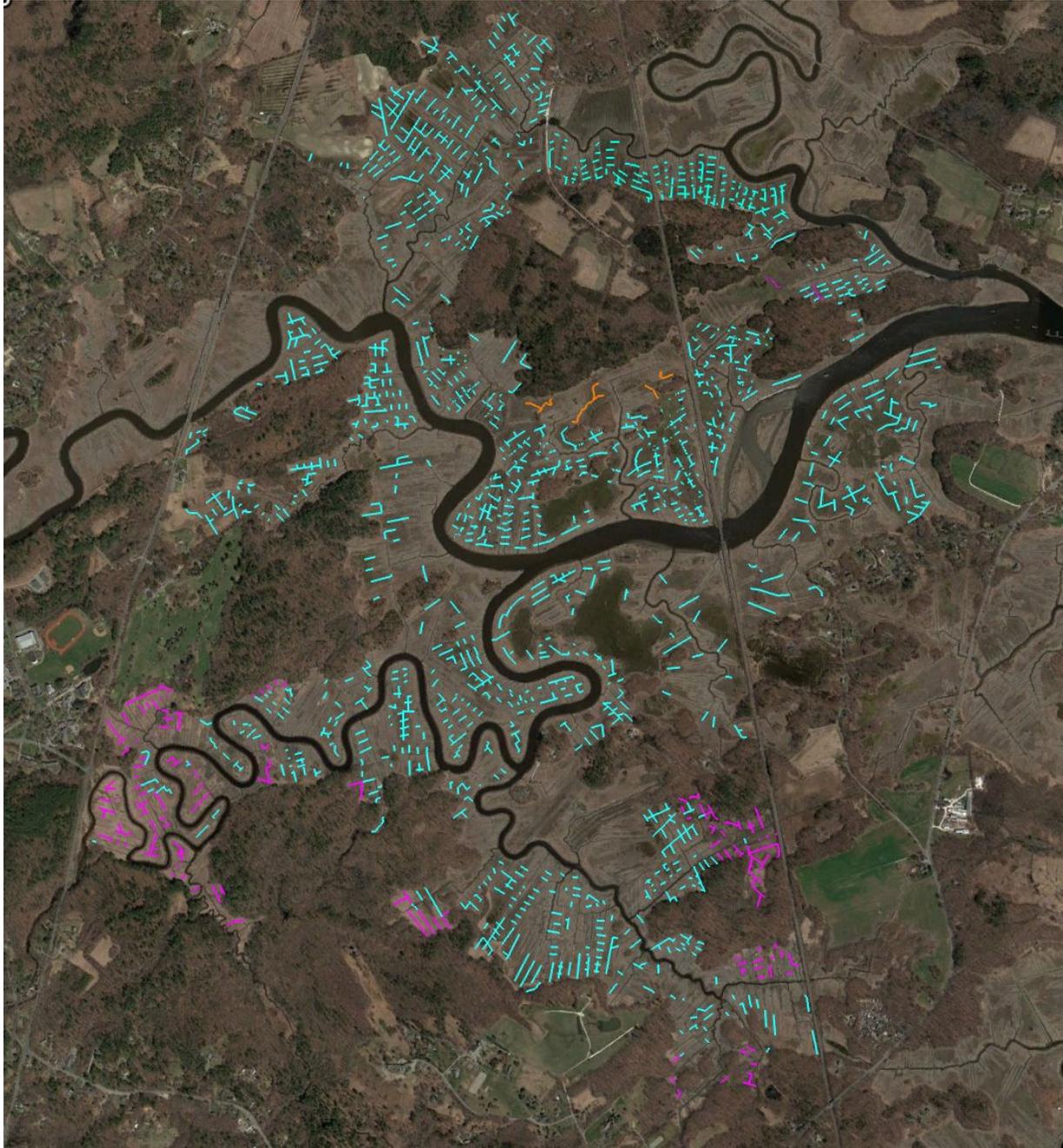
# MassWildlife

## William Forward Wildlife Management Area

- 1,172-Acres
- 10 Marsh Management Units
- **1,298** Ditch Remediation Treatment Ditches



MASSWILDLIFE



# MassWildlife

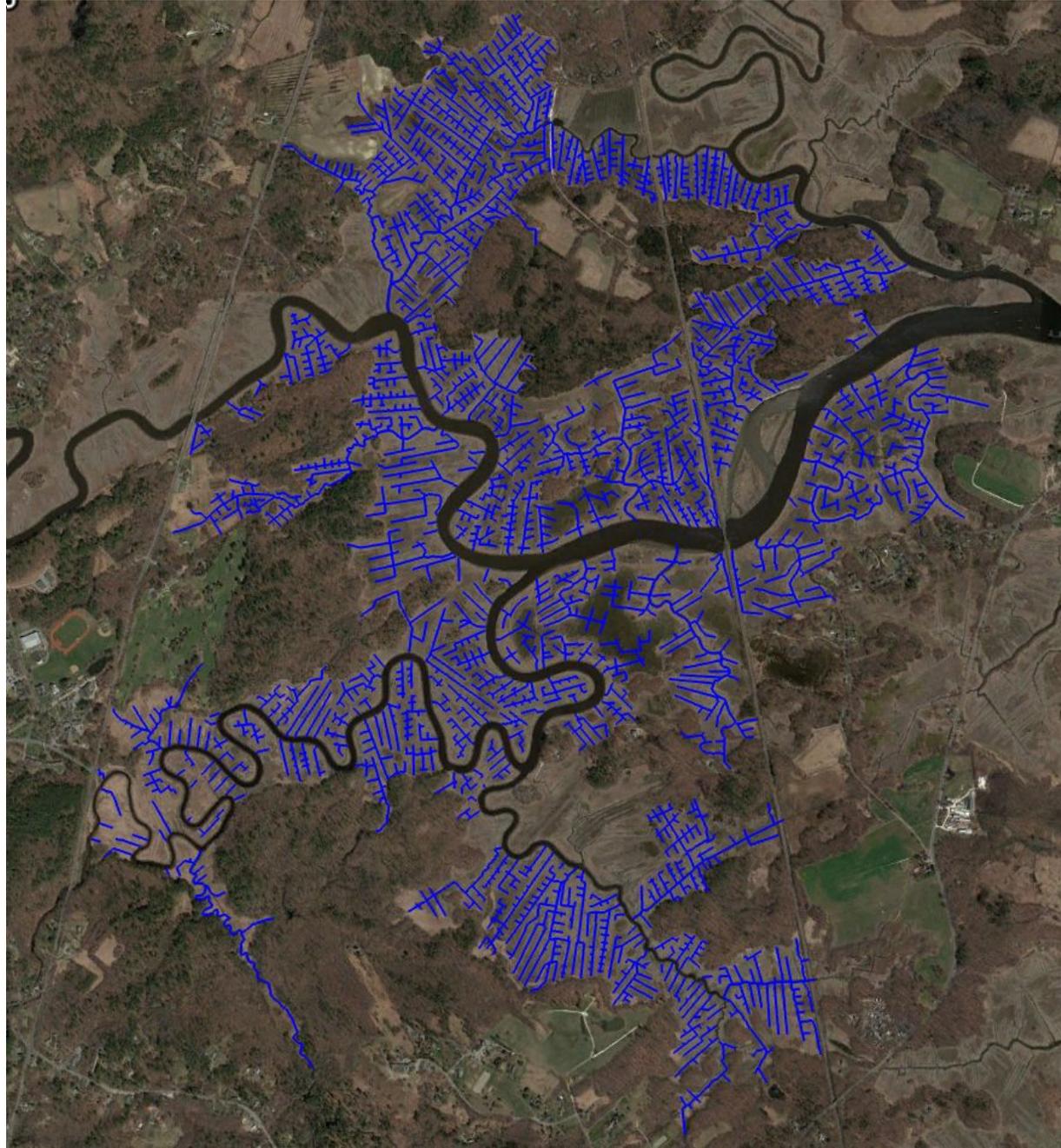
## William Forward Wildlife Management Area

- 1,172-Acres
- 10 Marsh Management Units
- **1,682** Micro-Runnels



MASSWILDLIFE





# MassWildlife

## William Forward Wildlife Management Area

- 1,172-Acres
- 10 Marsh Management Units
- **3,030** Single Channel Hydrology Pathways Restored Within the Existing Agricultural Infrastructure Footprint



MASSWILDLIFE



**Thank You**

**Next Steps**

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