Oyster Pond Restoration Project

Public Meeting

July 16, 2025

APCC Association to Preserve Cape Cod

USDA NRCS United States Department of Agriculture Natural Resources Conservation Service

Cape Cod Conservation District

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

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AGENDA

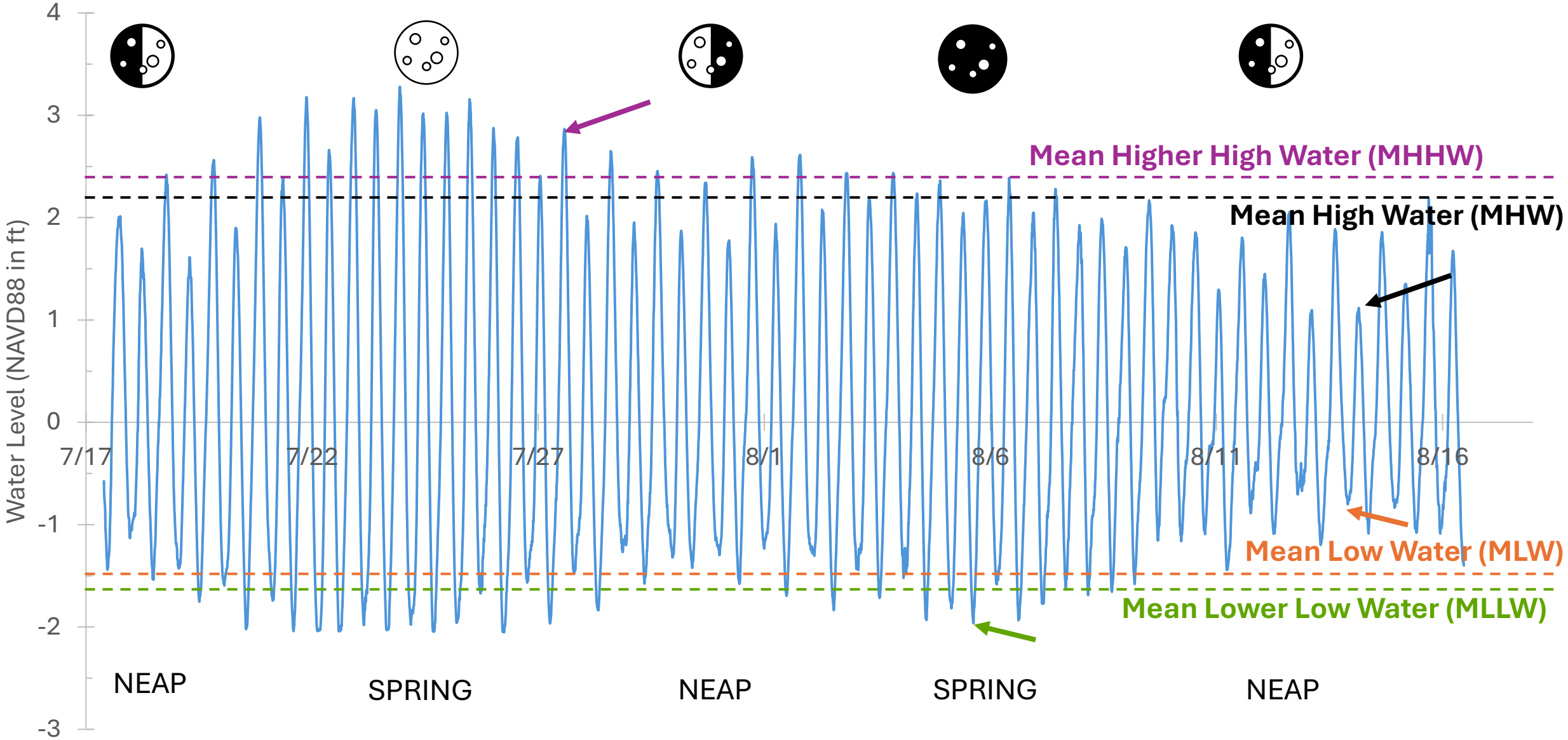
1. Welcome (5 min)
2. Project Introduction (10 min)
   - Josh Wrigley, Town of Falmouth DPW
   - Patrick Temple, Cape Cod Conservation District
3. Hydrodynamic Model (15 min)
   - Mitch Buck, Woods Hole Group
4. Culvert Design (15 min)
   - Nils Wiberg, Fuss & O'Neill
5. Habitat Monitoring & Next Steps (15 min)
   - Jordan Mora, APCC
6. Questions & Discussion (30 min)
   - Panel: Falmouth DPW, CCCD, WHG, F&O, and APCC

Josh Wrigley, Town of Falmouth DPW

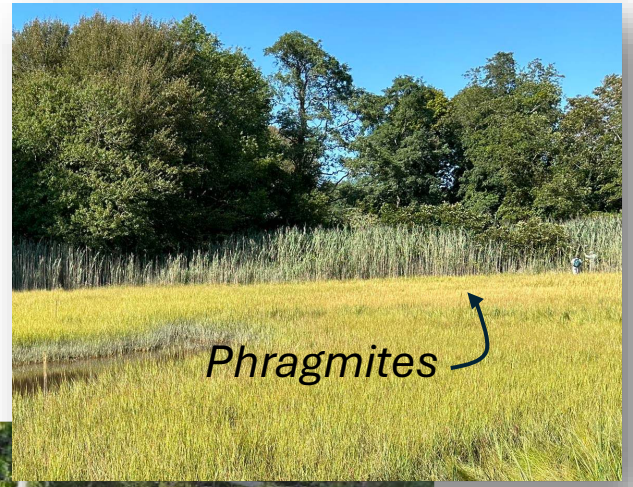
Project Area Overview

Patrick Temple, Cape Cod Conservation District

Project Area Overview


4
3
2
1
0
-1
-2
-3
Water Level (NAVD88 in ft)
7/17
7/22
7/27
8/1
8/6
8/11
8/16
Mean Higher High Water (MHHW)
Mean High Water (MHW)
Mean Low Water (MLW)
Mean Lower Low Water (MLLW)
NEAP
SPRING
NEAP
SPRING
NEAP

Salt Marsh – General Structure



Upland transition zone

Spartina alterniflora (smooth cordgrass)

Spartina patens (salt hay)

Low marsh zone

High marsh zone

Flooded 1-2x per month

Flooded 2x daily

Flooded 1x daily

Mean higher high water

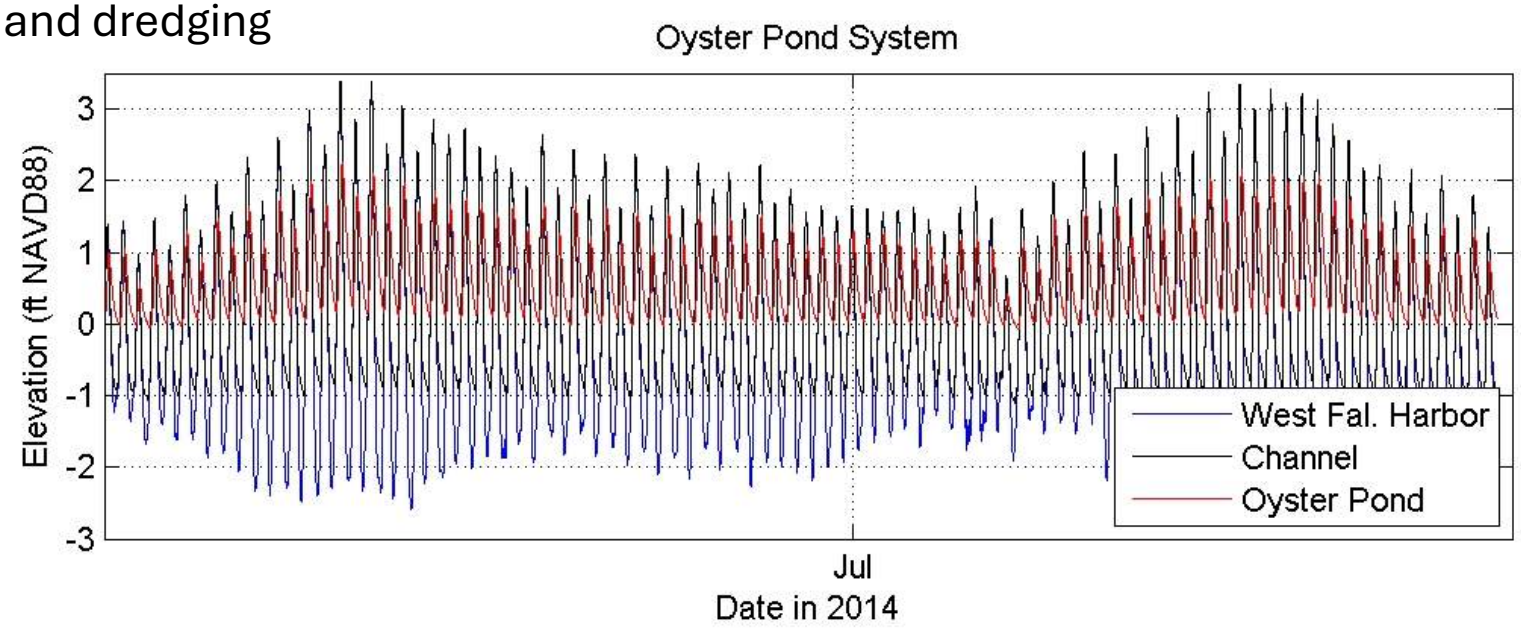
Mean high water

Mitch Buck, Woods Hole Group

Hydraulic/Hydrodynamic (H&H) Modeling of Oyster Pond

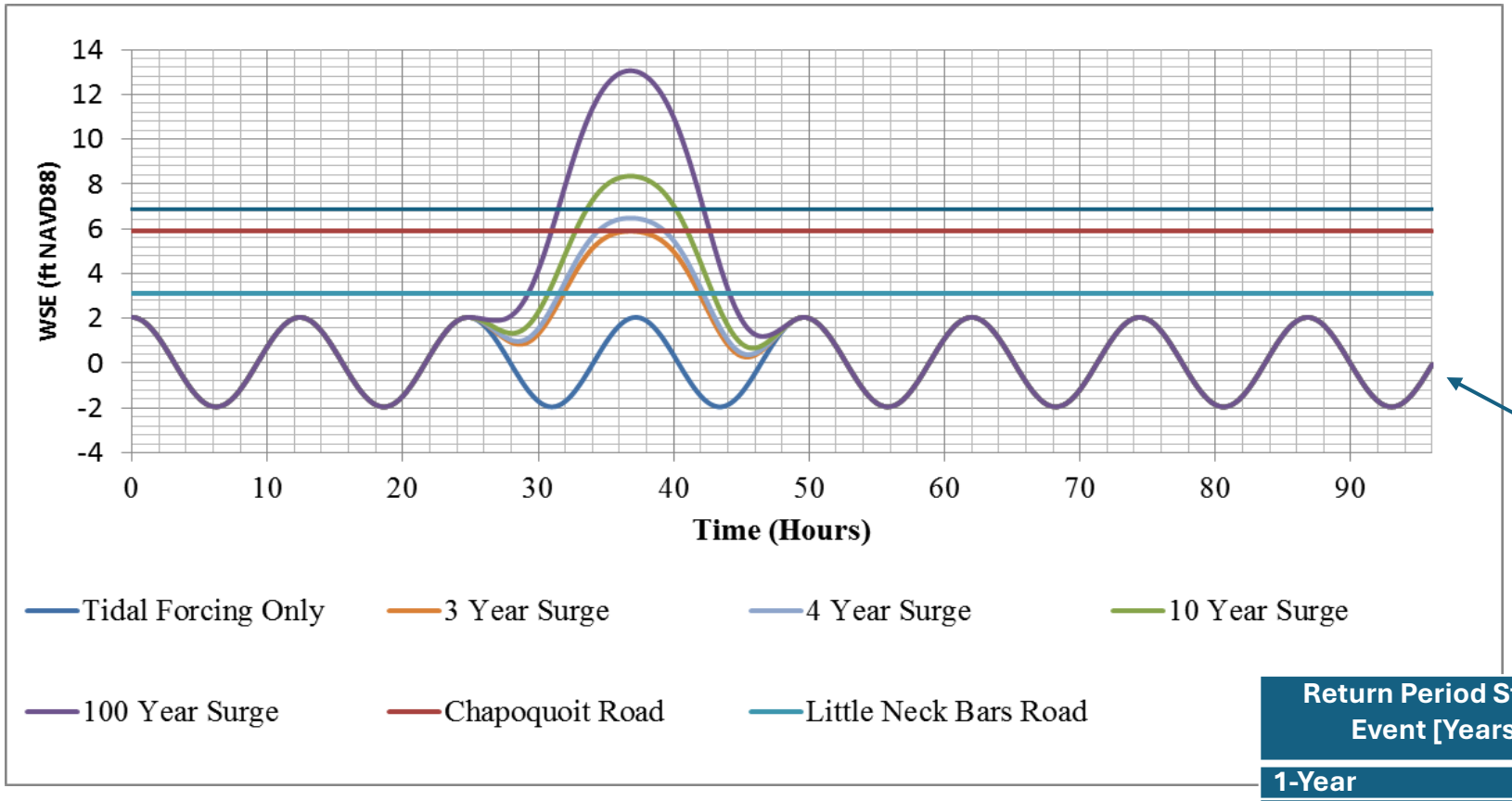
- **Goal:** Develop a computer model to simulate the existing dynamics within the oyster pond system and then evaluate potential culvert restoration alternatives.
- Developed using collected water level and elevation data.
- Simulated for normal tides, coastal storms, and future conditions
- Evaluated different culvert sizes and dredging

Tidal Metrics	West Falmouth Harbor (ft, NAVD88)	Oyster Pond System	
		Tidal Creek (ft, NAVD88)	Oyster Pond (ft, NAVD88)
Mean Higher-High Water	2.17	2.35	1.60
Mean High Water	1.93	2.09	1.42
Mean Tide Level	0.00	0.57	0.74
Mean Low Water	-1.92	-0.94	0.06
Mean Lower-Low Water	-2.03	-0.98	0.04
Tidal Maximum	3.33	3.39	2.27
Tidal Minimum	-2.75	-1.10	-0.07
Mean Range	3.85	3.03	1.36



Storm Simulations for Modeling

Time series of synthetic storm surge intervals: 3-year, 4-year, 10-year, and 100-year



Storm surge is superimposed over the tide signal to understand the culvert's ability to drain after inundation

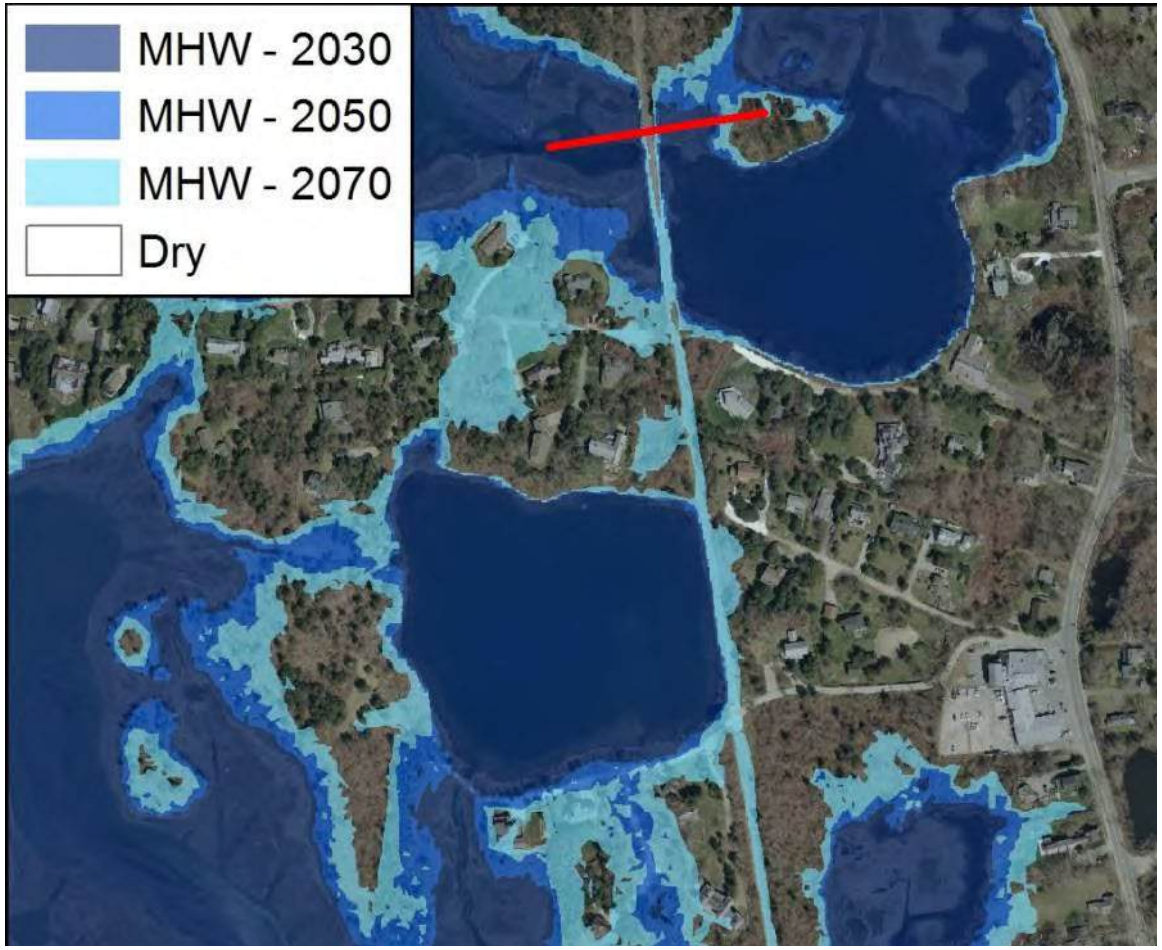
Return Period Storm Event [Years]	Water Surface Elevation in West Falmouth Harbor [NAVD88 ft]
1-Year	3.6
3-Year	5.9
4-Year	6.5
10-Year	8.4
100-Year	13.1

Future Water Levels

- *Falmouth Climate Change Vulnerability Assessment and Adaptation Planning* report (WHG, January 2020)
  - SLR projections were based on the Representative Concentration Pathways (RCP) greenhouse gas concentration trajectories developed by IPCC
  - Assumes that no changes are made to human-based emissions, was developed specifically for the Commonwealth of Massachusetts

Storm Event		Present Day		2030		2070	
Annual Probability (%)	Return Period (years)	Sea Level Rise (ft)	Flood Elevation (NAVD ft)	Sea Level Rise (ft)	Flood Elevation (NAVD ft)	Sea Level Rise (ft)	Flood Elevation (NAVD ft)
0.1	1000	0	14.7	1.3	16.0	5.7	21.7
0.2	500	0	13.7	1.3	15.0	5.4	20.4
0.5	200	0	12.9	1.2	14.1	5.2	19.3
1	100	0	11.8	1.2	13.0	4.9	17.9
2	50	0	10.9	1.2	12.1	4.7	16.8
5	20	0	10.0	1.2	11.2	4.4	15.6
10	10	0	8.8	1.2	10.0	4.1	14.1
20	5	0	7.9	1.2	9.1	3.8	12.9
25	4	0	6.9	1.2	8.1	3.5	11.6
30	3	0	6.5	1.2	7.7	3.5	11.2
50	2	0	6.2	1.2	7.4	3.4	10.8
100	1	0	5.1	1.2	6.3	3.1	9.4

Probability of Exceedance Summary Table for Old Dock Road in West Falmouth Harbor

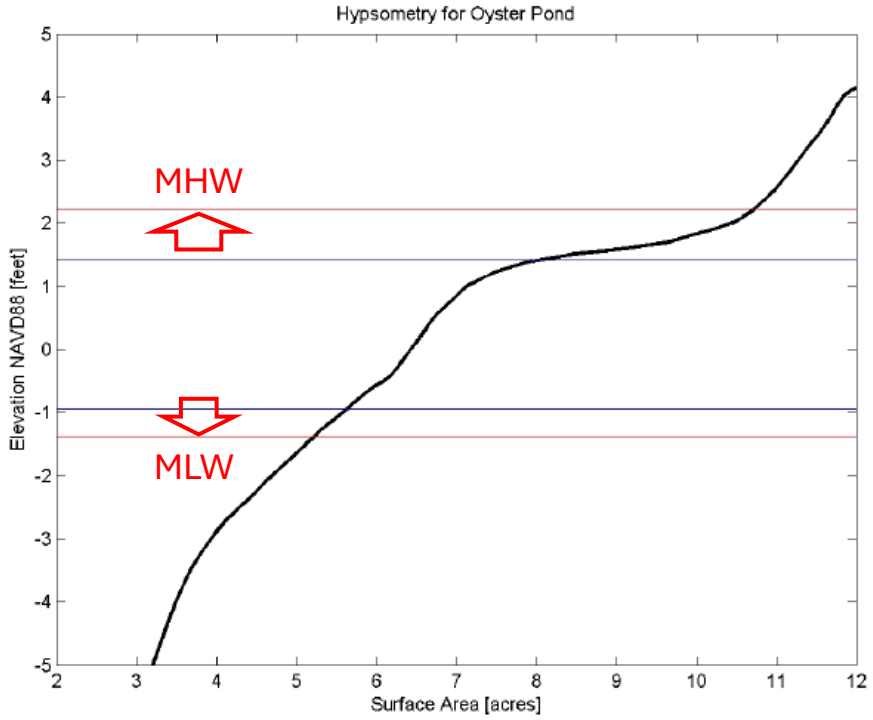


West Falmouth Bikeway in the vicinity of Oyster Pond is at risk of daily tidal inundation in the future. Culvert shown approximately in Red.

Flood elevations shown where purple shading represents overtopping of the Shining Sea Bikeway (7.1 ft NAVD).

Comparison of Tidal Metrics & Flushing Characteristics

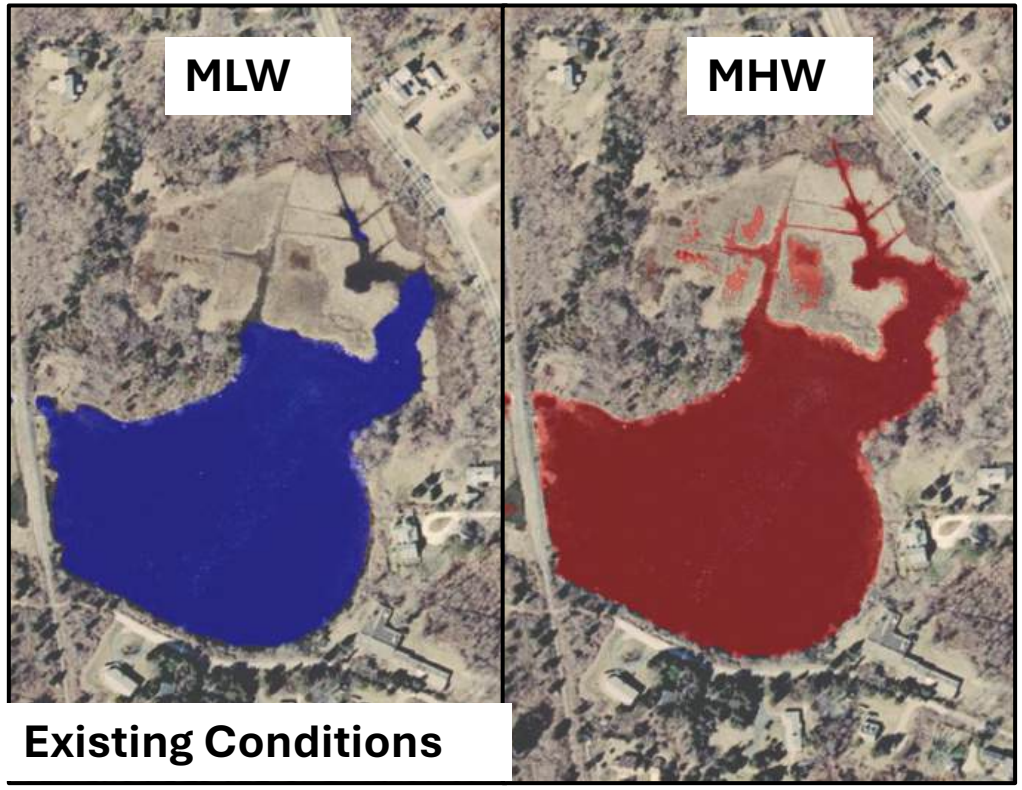
Existing and proposed tidal datums (MLW & MHW) relative to the Oyster Pond Hypsometry

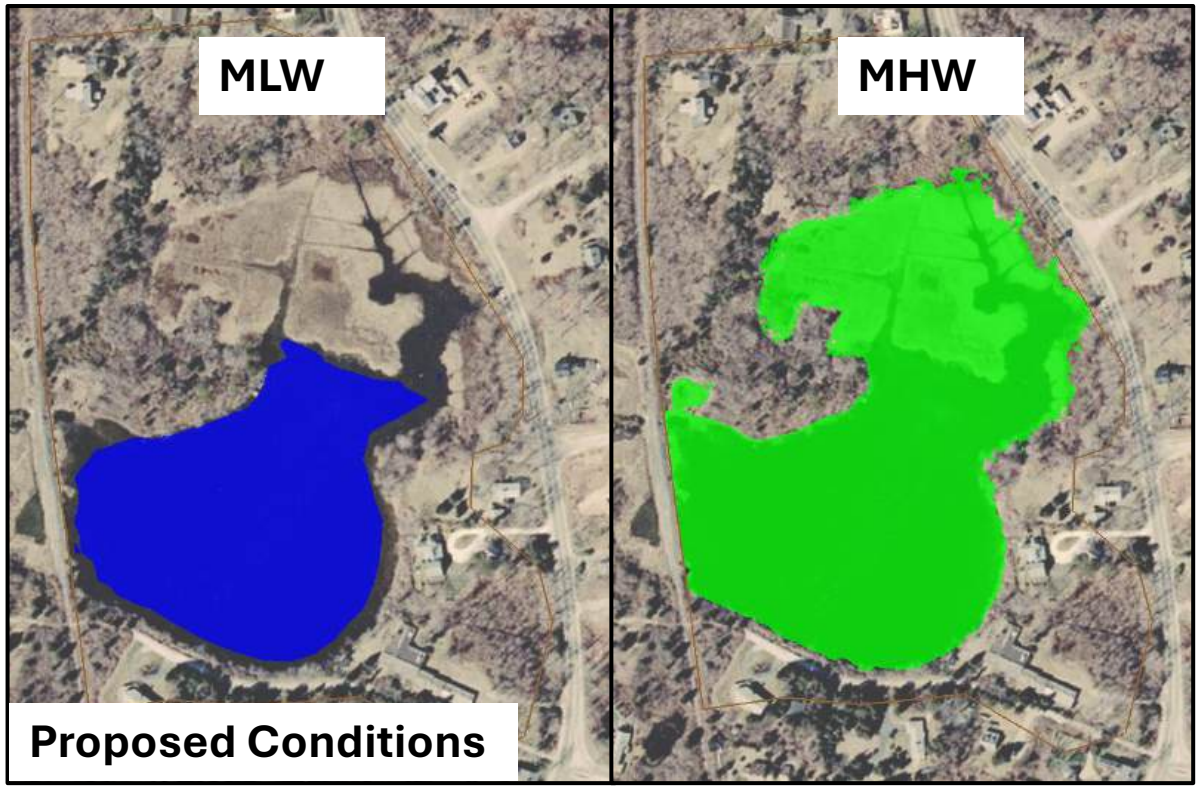


Comparison of tidal metrics and flushing characteristics for existing and proposed conditions at Oyster Pond

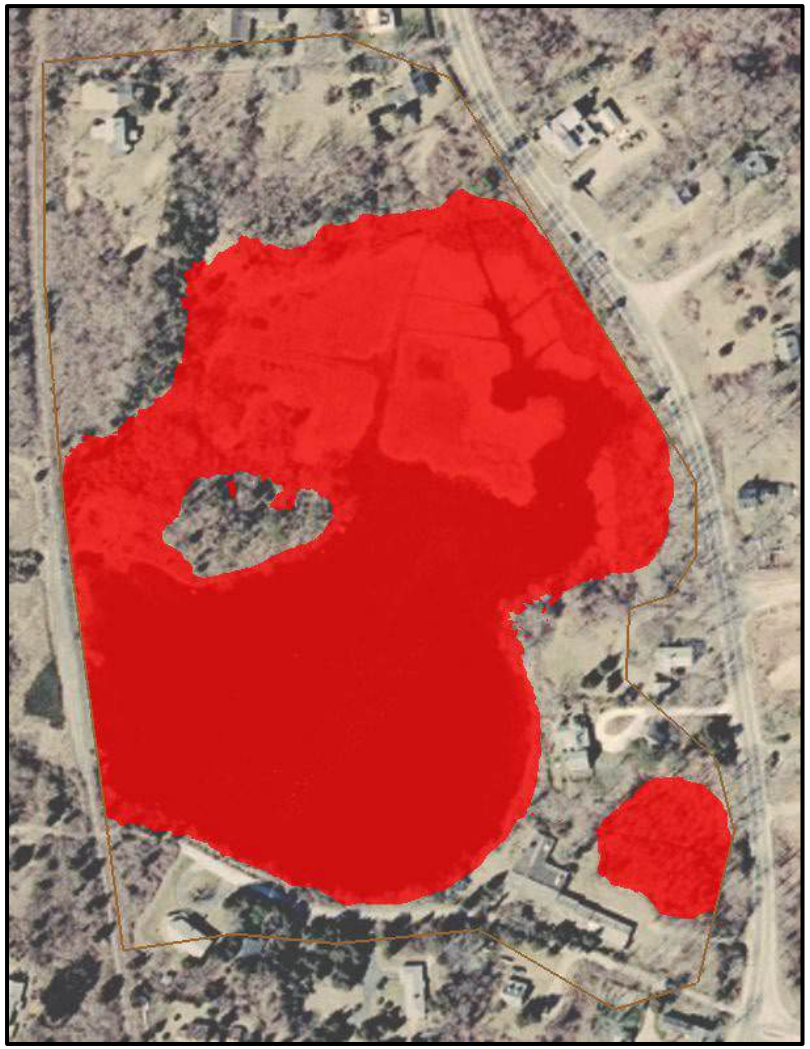
Tidal Metrics and Elevation (ft-NAVD88)						
Tidal Metric	Unit	Existing Culvert	4x4 box Culvert	4x4 Box Dredged	4x6 box Culvert	4x8 box Culvert
MHW	ft	1.31	1.98	1.98	1.99	1.99
MLW	ft	0.03	0.004	-1.38	-0.005	-0.01
MTL	ft	0.67	0.99	0.3	0.99	0.99
MHHW	ft	1.45	2.21	2.21	2.22	2.22
MLLW	ft	0.01	0	-1.39	-0.01	-0.02
Mean Range	ft	1.28	1.98	3.36	2	2
Intertidal Area	ft^2	54,553	172,825	225,530	174,100	174,225
Tidal Prism	ft^3	387,620	668,470	1,025,000	675,870	677,270
Residence Time	days	3.1	1.9	1.1	1.9	1.9
Mean Velocity (Flood)	ft/s	4.1	6.6	8	4.8	3.8
Mean Velocity (Ebb)	ft/s	2.2	2.3	7	1.8	1.5
Post Storm Recovery Time	days	1	≈ 0	≈ 0	≈ 0	≈ 0

Comparison of Low and High Water Inundation



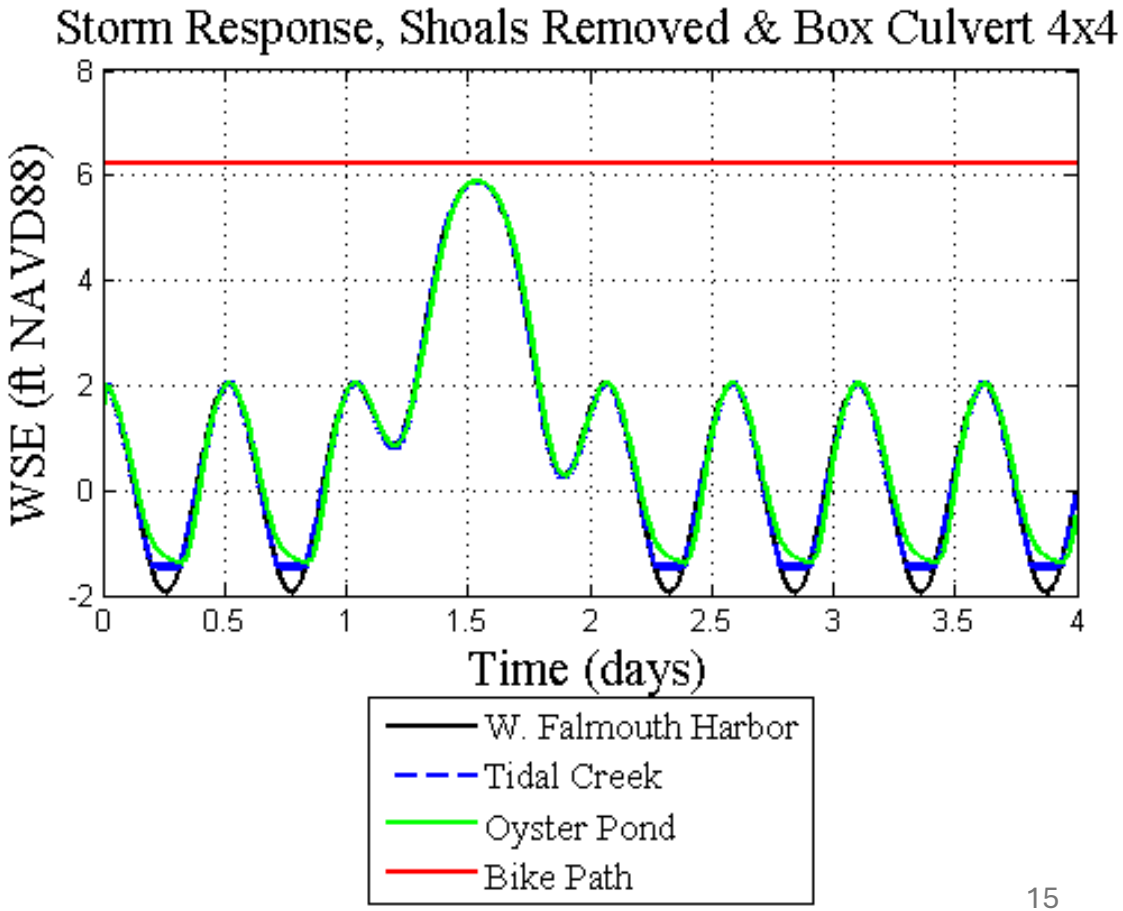


Storm Inundation for Proposed Conditions



Extent of inundation for 3-year storm at Oyster Pond for the existing culvert with the shoals removed

Modeled surge response to the 3-year storm for proposed conditions



Questions?

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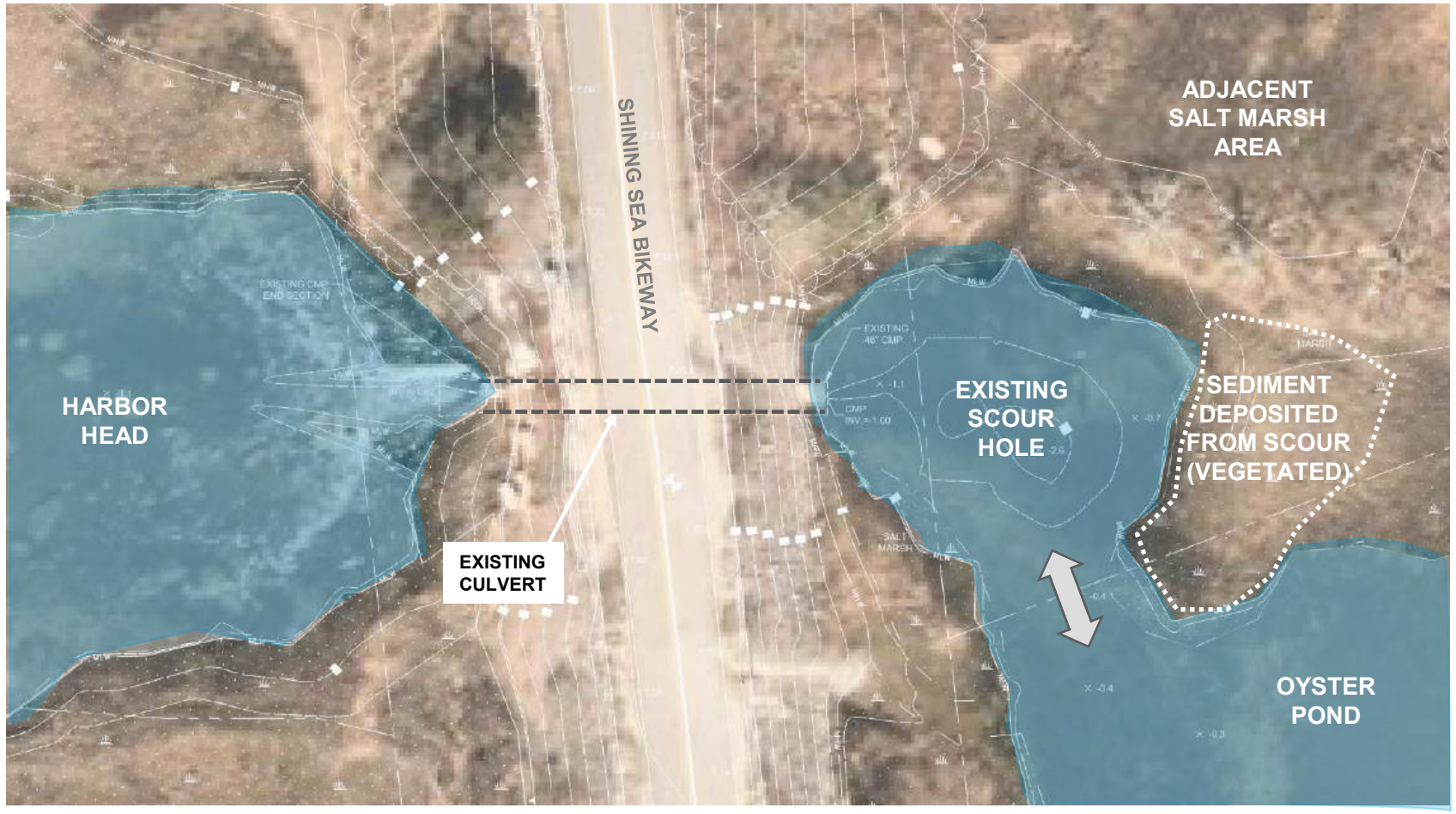
Nils Wiberg, Fuss & O’Neill

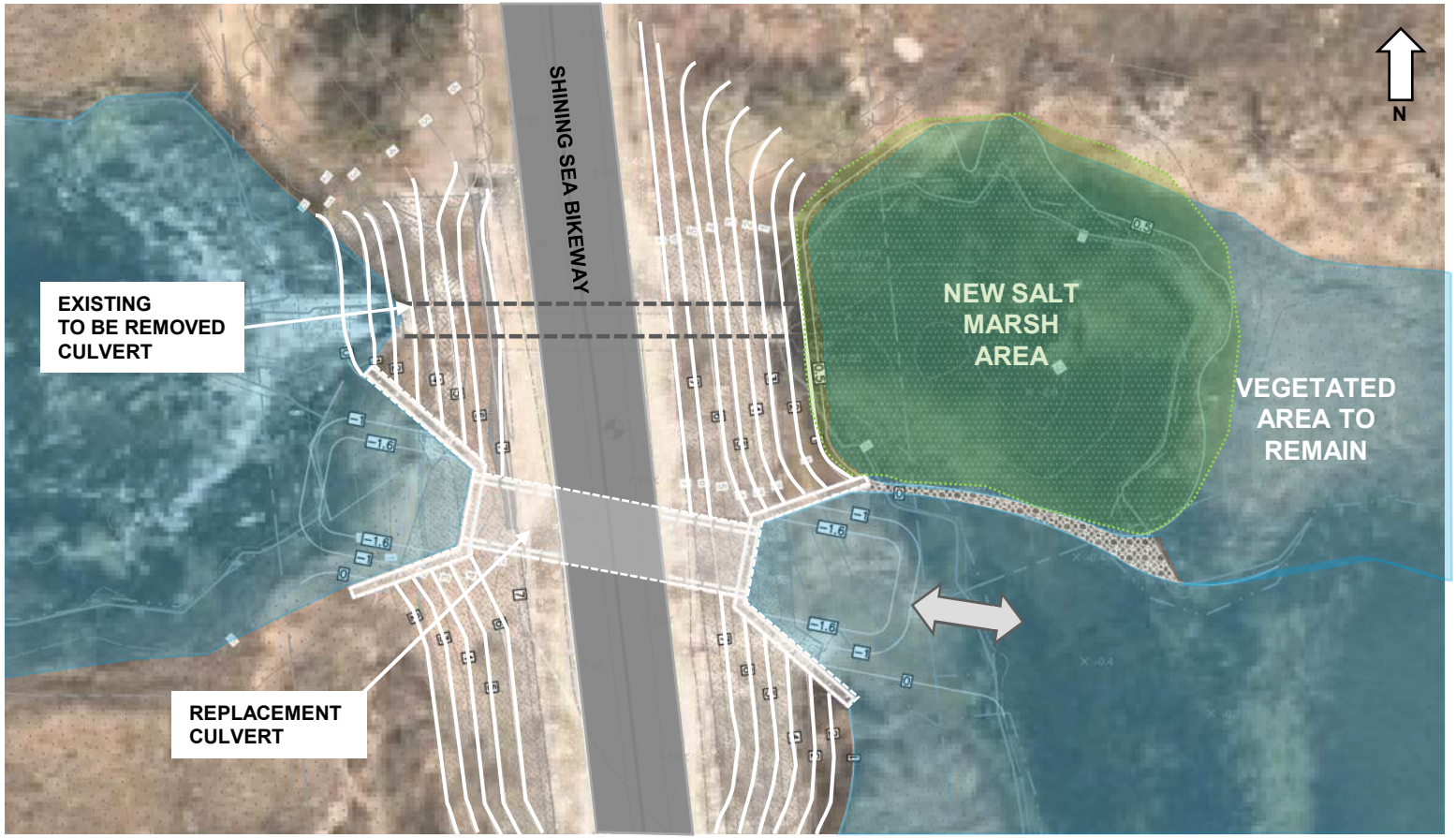
Project Area Overview

Existing Culvert Configuration



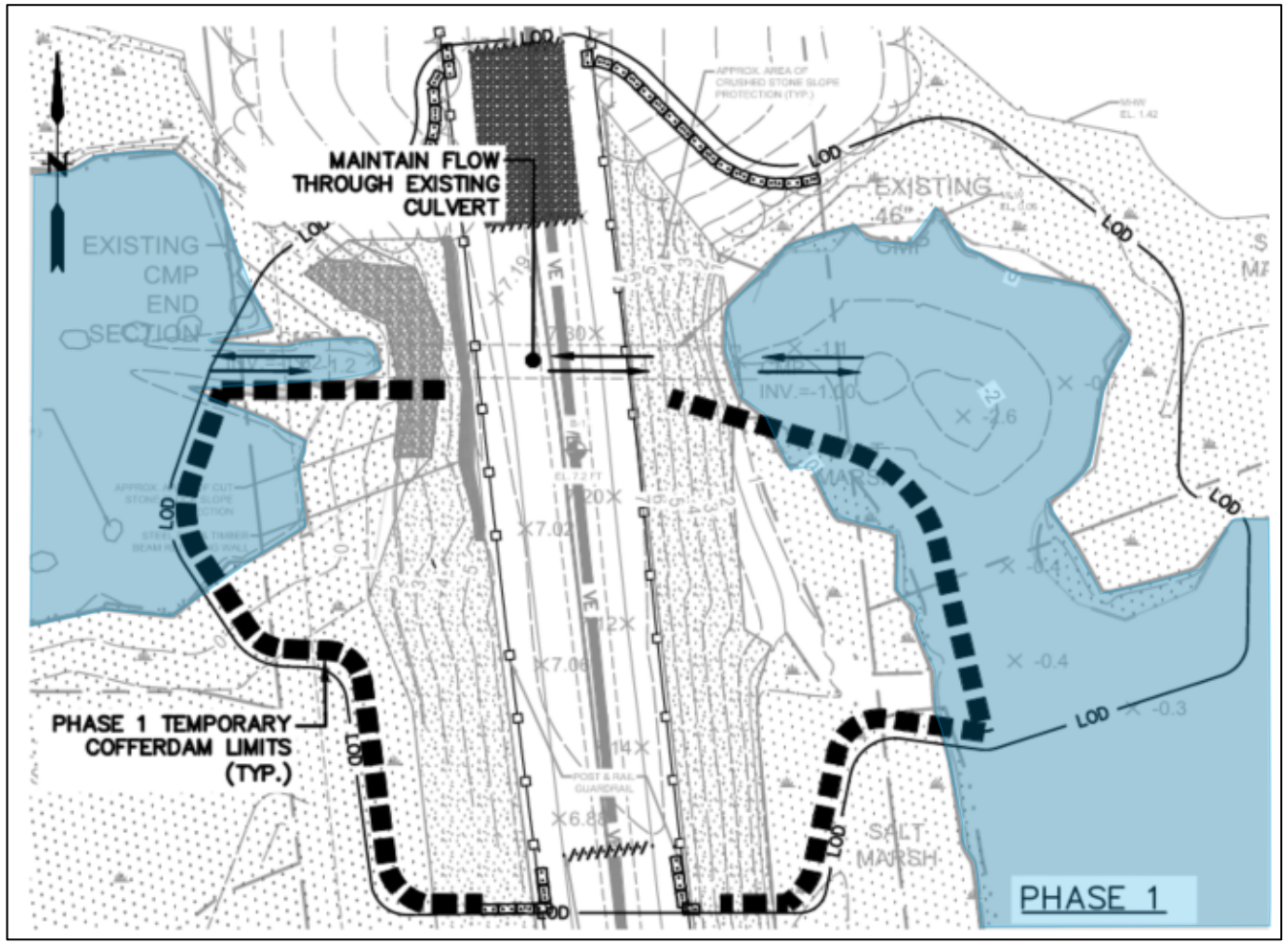
- 46” Dia. Existing Culvert
- Scour Hole and Sediment Deposition Ring Restrict Flows to/from Oyster Pond

Proposed Culvert Configuration



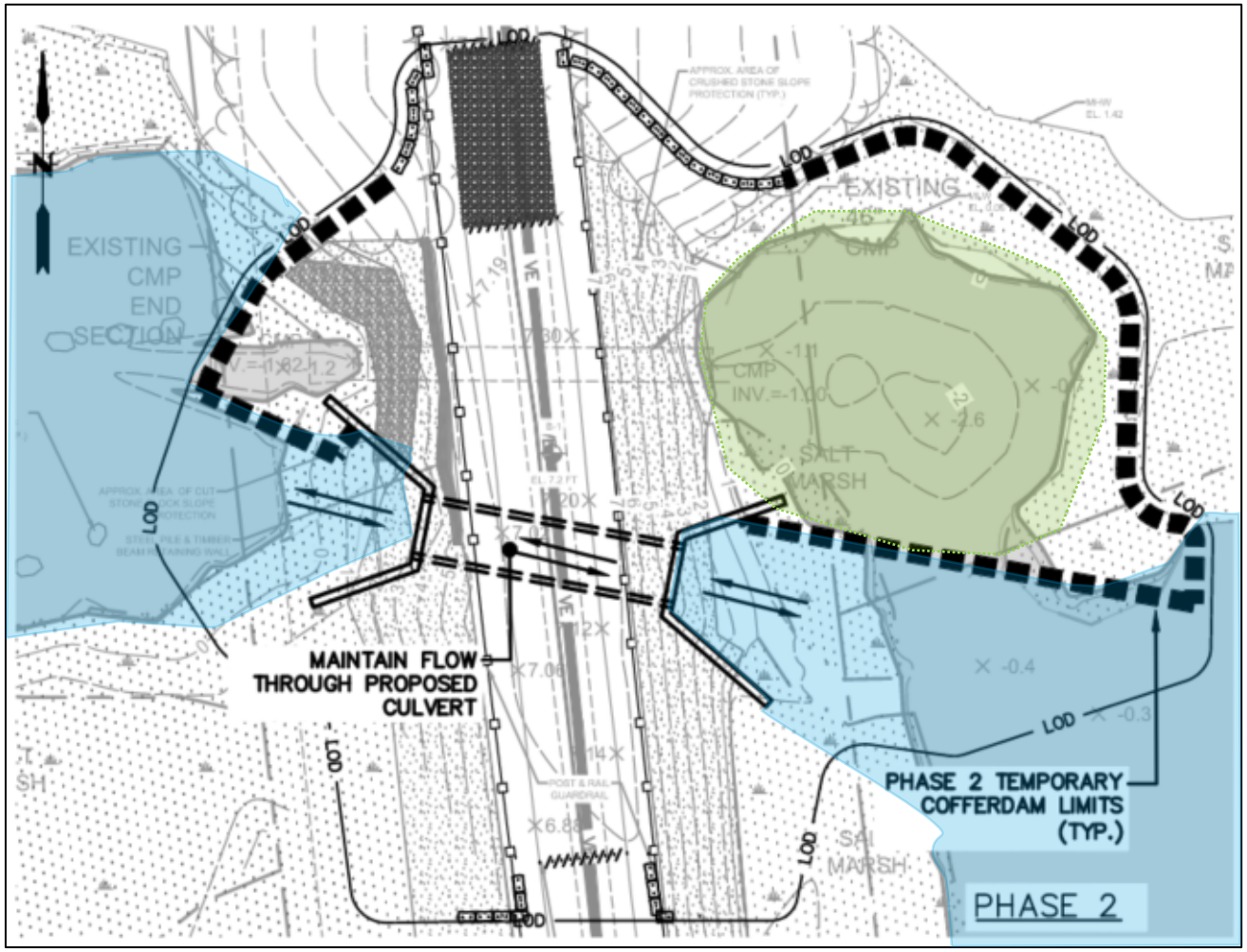
- 30’L x 5’H x 6’W Precast 3-sided Culvert
- Armored Natural Channel Bottom
- Multiple Alternative Culvert Positions & Alignments Evaluated to Maintain Flow During Construction and Maximize Hydraulic Connectivity to the Pond

Phase I - Culvert Construction



- Bikeway Temporarily Closed for Construction Equipment Access
- Temporary Cofferdam to be Installed Around Proposed Culvert Location
- Flow to be Maintained Through Existing Culvert
- Estimated Duration: 4 - 5 Months

Phase II – Existing Culvert Removal and Site Restoration



- Bikeway Remains Closed for Construction Equipment Access
- Temporary Cofferdam to be Relocated Around Existing Culvert and Scour Hole
- Flow to be Diverted Through New Culvert, Existing Culvert to be Removed
- Estimated Duration: 3 - 4 Months

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Jordan Mora, Association to Preserve Cape Cod

2024 Pre-Restoration Monitoring Results

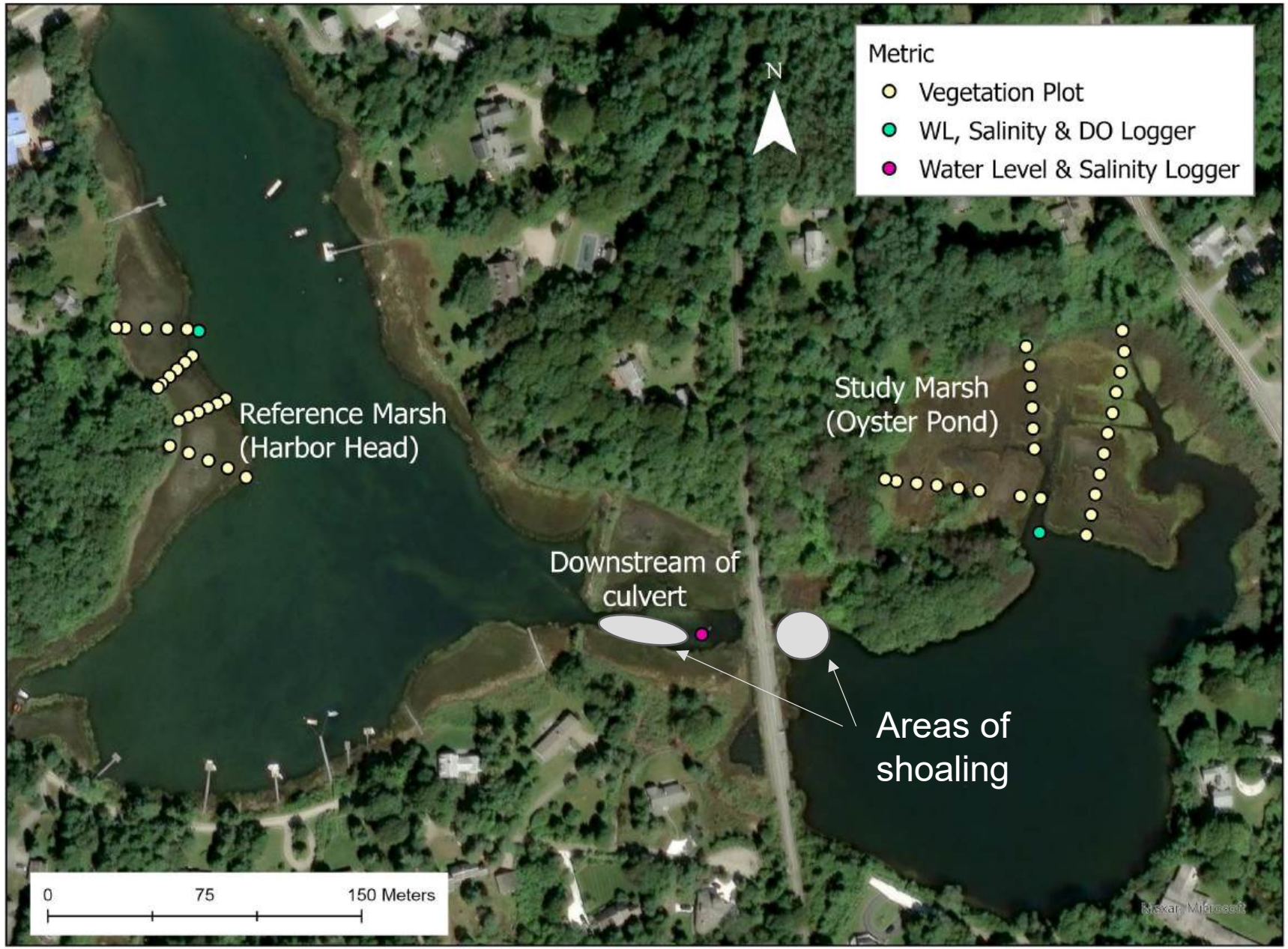
Funded by the Cape Cod Conservation District under the NRCS Cape Cod Water Resources Restoration Project

Parameters Measured & Methods

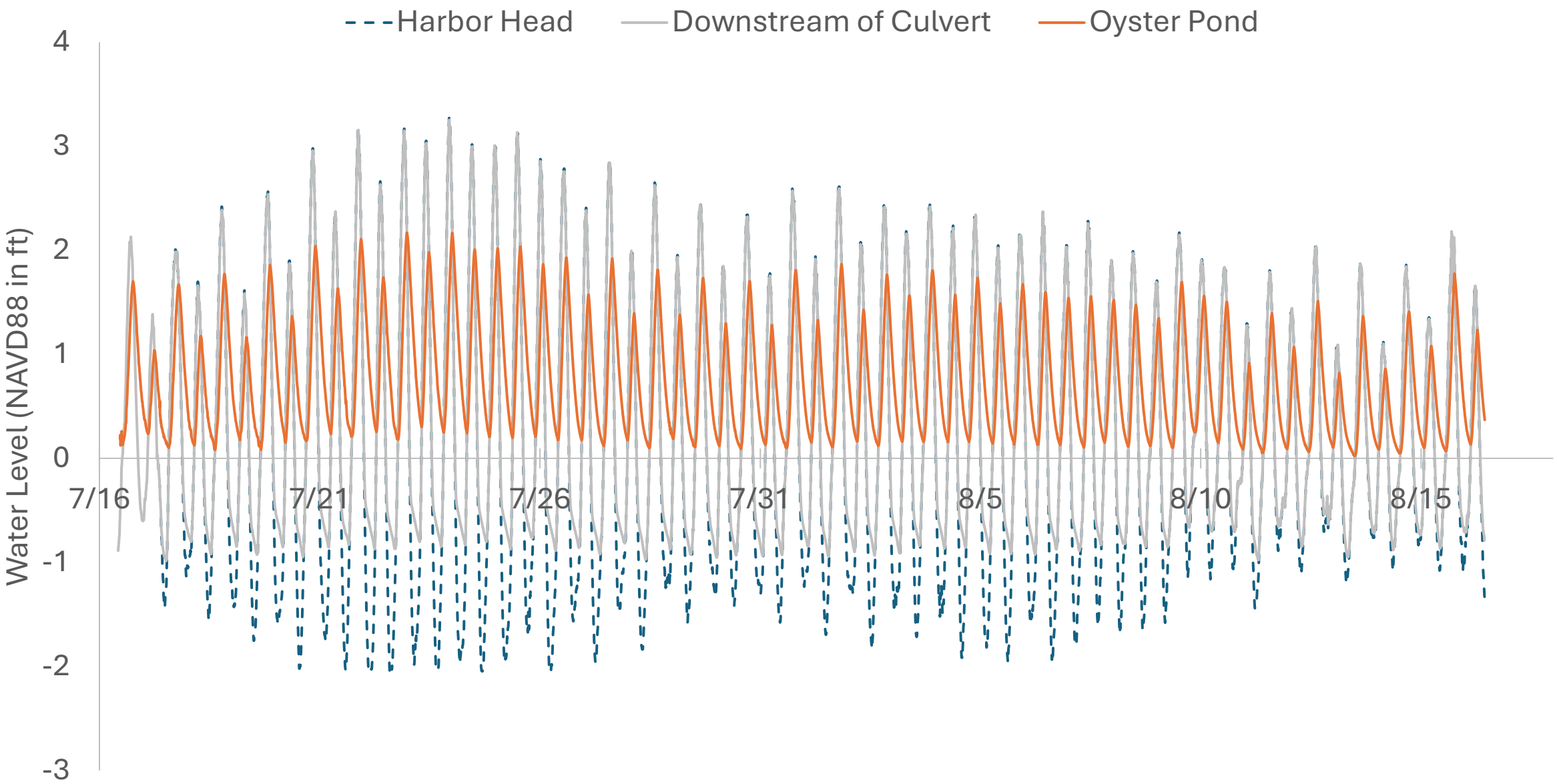
Vegetation

Water Levels & Elevation

Water Quality

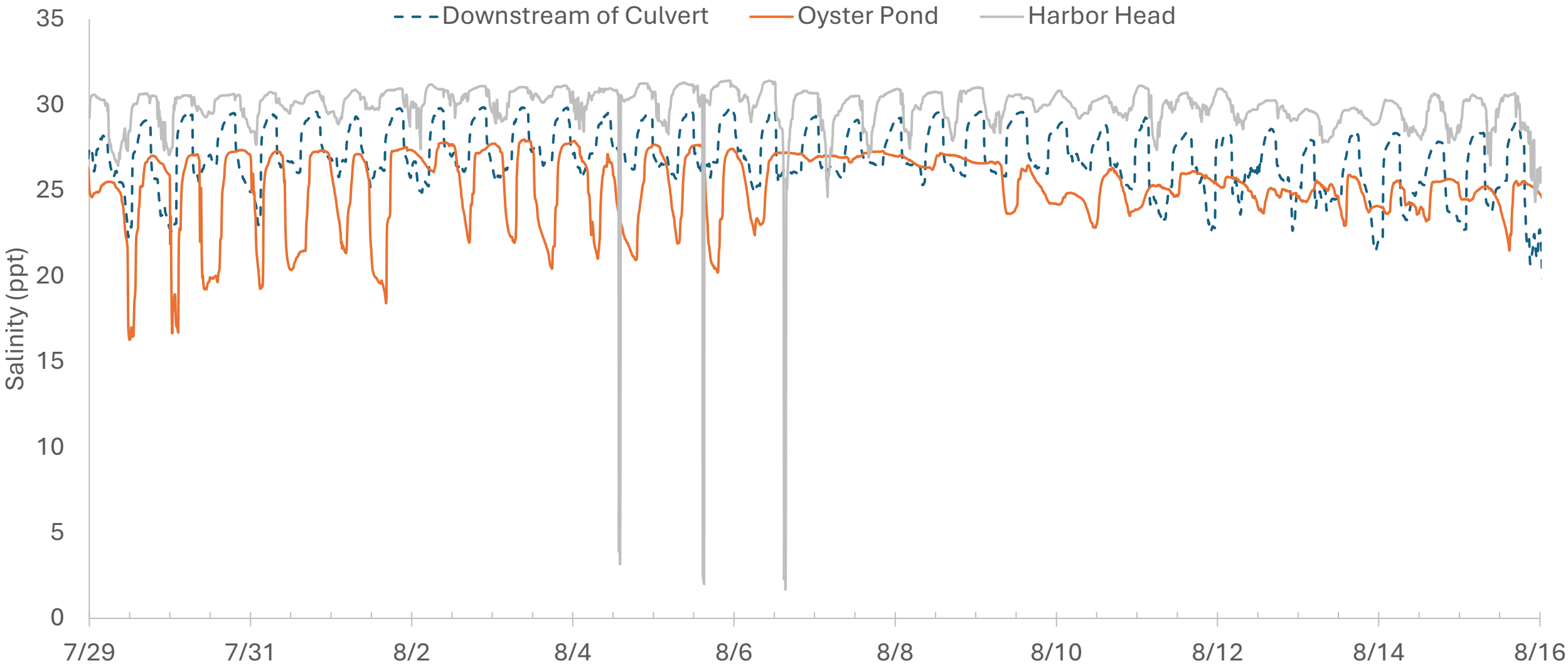

Metric
Vegetation Plot
WL, Salinity & DO Logger
Water Level & Salinity Logger
N
Reference Marsh
(Harbor Head)
Study Marsh
(Oyster Pond)
Downstream of
culvert
Areas of
shoaling
0
75
150 Meters

Culvert limits tidal flow in Oyster Pond



Why is limited tidal flow a problem?

1. Alters salinity gradient upstream

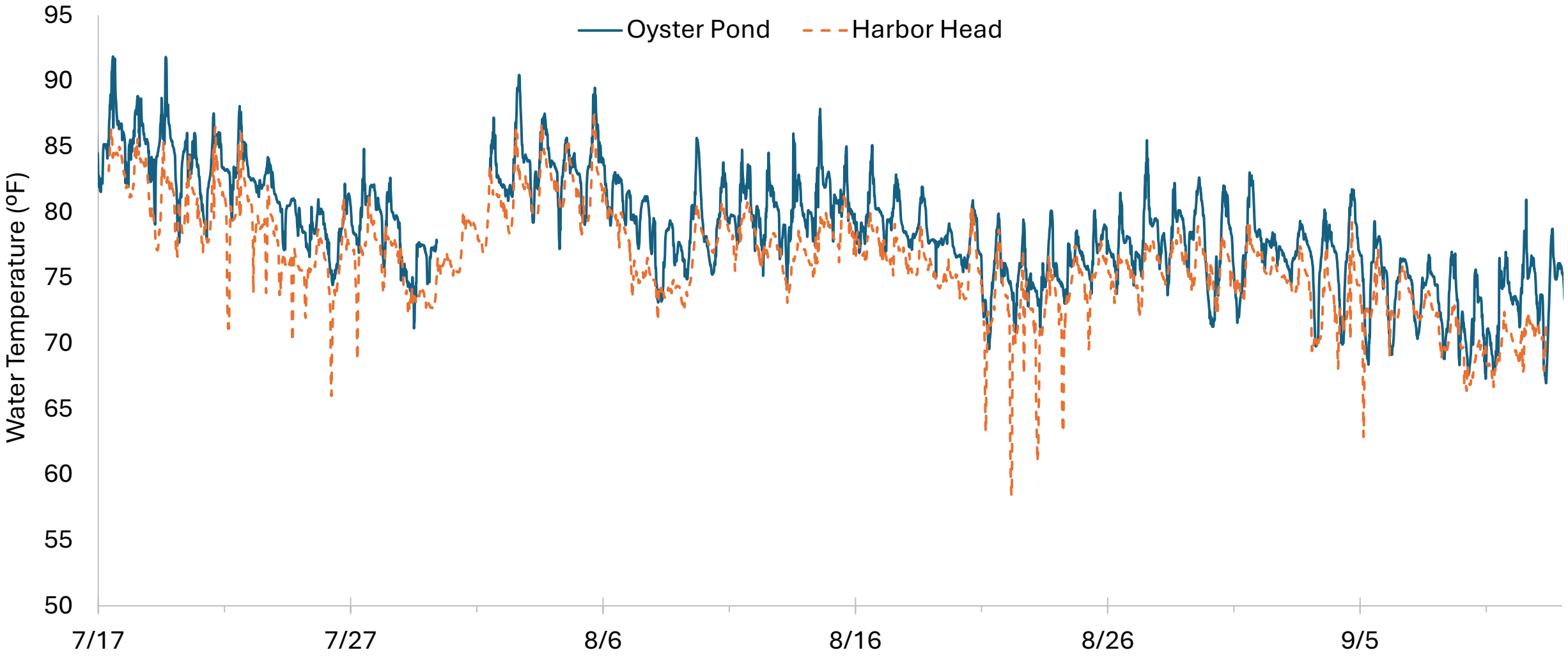


Why is an <u>altered salinity gradient</u> a problem?

- Invasive *Phragmites* can spread throughout the upstream system, reducing biodiversity

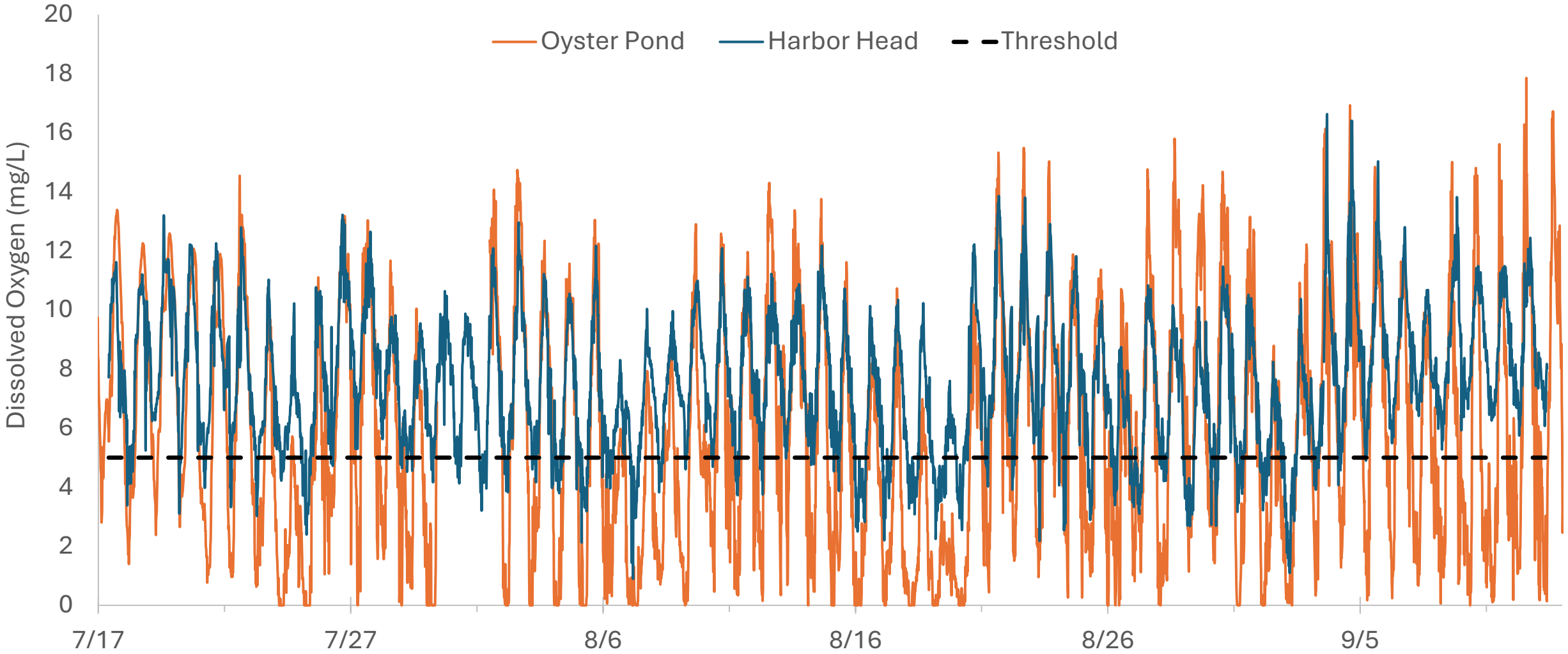
Why is limited tidal flow a problem?

2. Reduces water quality upstream; increases temperature

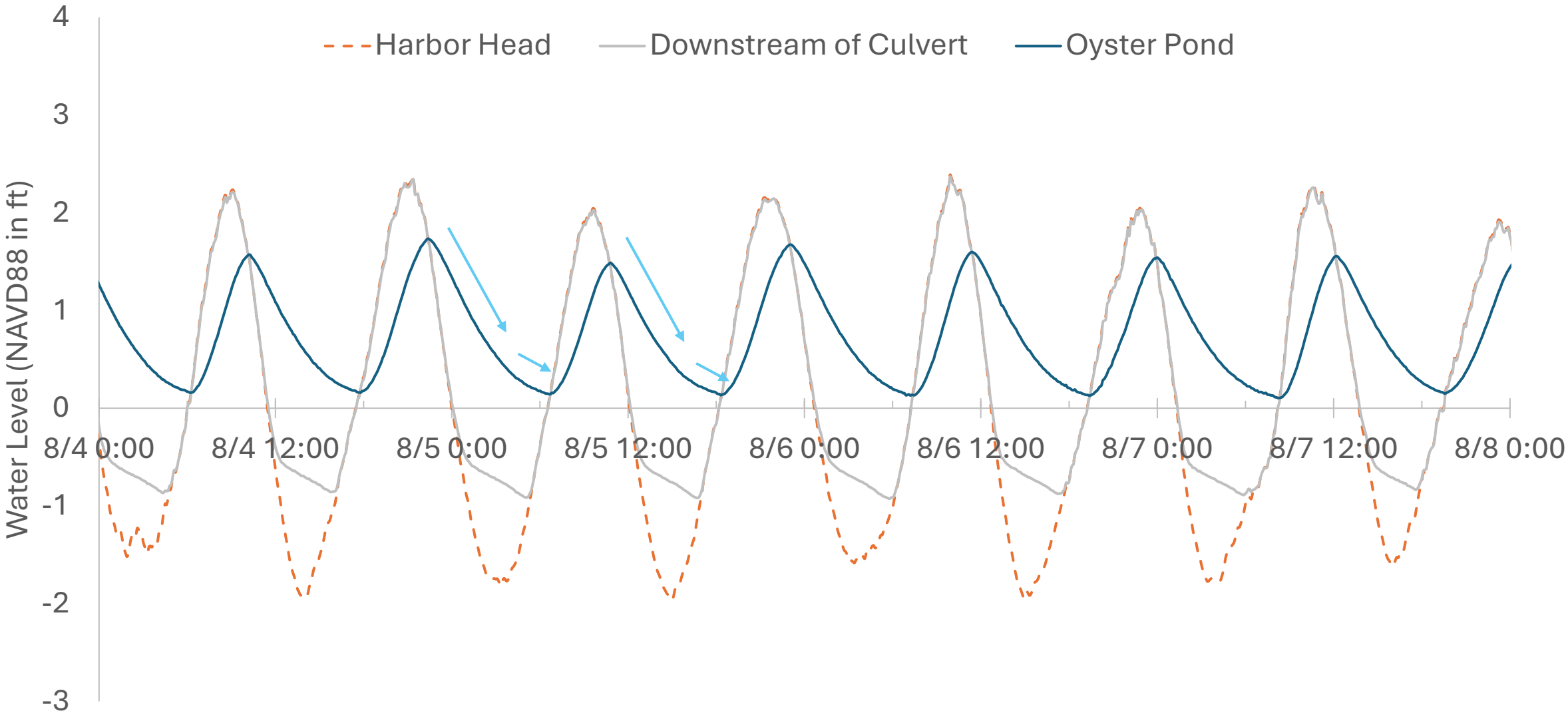


Why is warmer water a problem?

- Decreases dissolved oxygen in water column; reduces fish and shellfish habitat

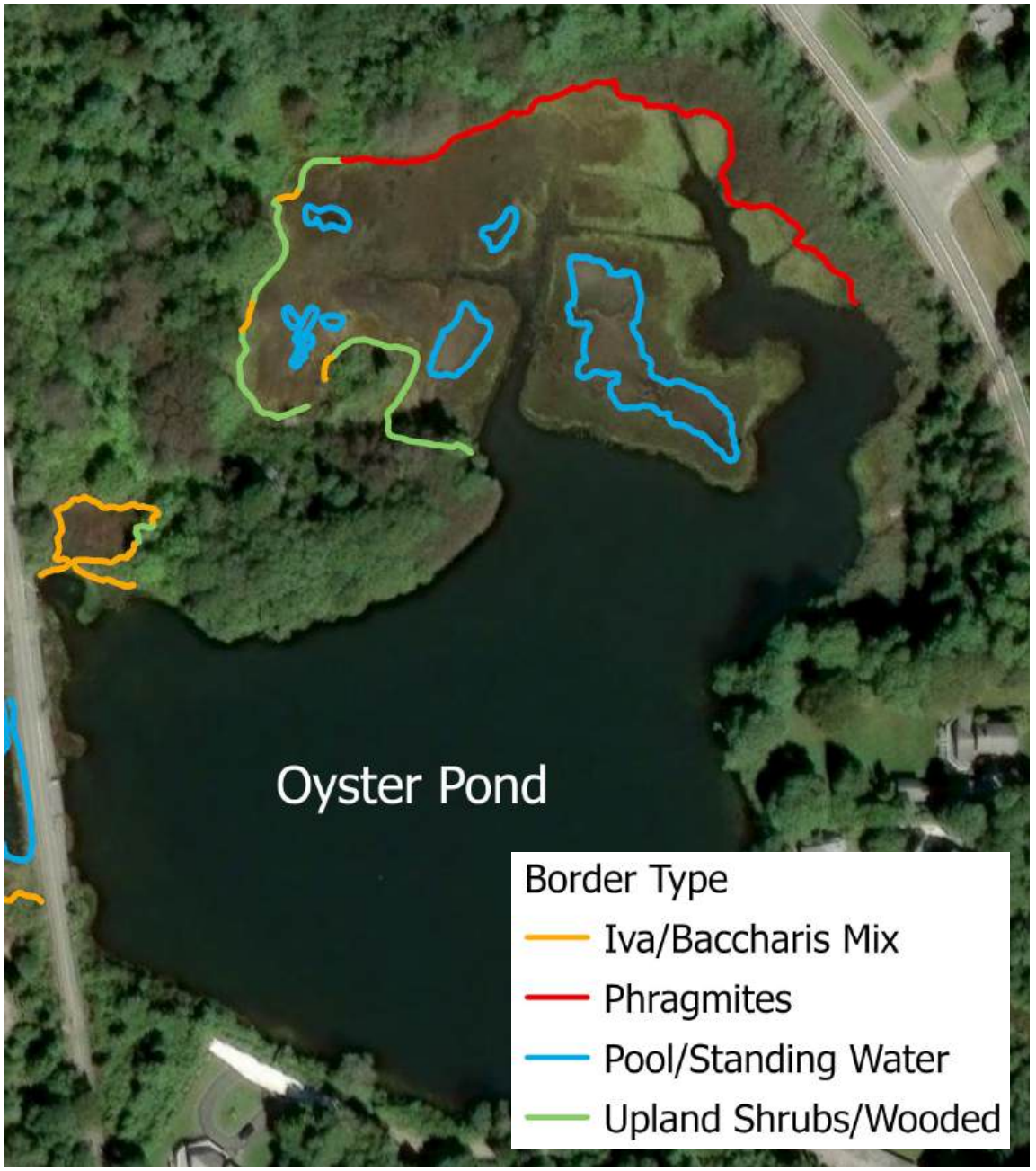


Culvert & Shoal Create Bottleneck, Slowing Drainage



Why is <u>slow drainage</u> a problem?

- Causes subsidence of the upstream salt marsh surface



Why is subsidence a problem?

- Causes increased inundation and leads to dieback of plants and expansion of bare areas

What improvements do we expect from the restoration?

- Improved water quality
- Reestablished natural salinity gradient
- Reduced cover of invasive *Phragmites australis*
- Increased native vegetation production in the upstream salt marsh
- Improved safety and less scouring related to slower velocities

Other Potential Management Actions

- Mow and Remove Stands of Phragmites Vegetation Before Construction
- Hand-Dig Small Channels (Runnels) to Allow Certain Ponded Areas to Drain
- Some Ponded Areas Providing Valuable Habitat Will Remain
- Continued Monitoring to Implement Additional Measures to Maximize Restoration Benefits

Next steps

BLUE = funding secured through NOAA Transformation Habitat Grant; RED = seeking funds

- Additional Data Collection (June – August 2025)
  - Investigate groundwater depth in target habitat and dieback areas (APCC)
  - Monitor crab activity (APCC)
  - Wetland delineation & topographic surveys (consultants)
- Finalize Restoration Designs & Construction Plans (September – November 2025)
  - Permit level designs for runnels (consultants)
  - Construction plans (consultants)
- Permitting (December 2025 – 2027) (partially funded)
  - Submit applications to regulating agencies (consultants)
  - Public hearings (consultants)
- Public Engagement (August 2025 – Summer 2027)
  - Coordinate with landowners regarding timeline and designs (project team)
  - Coordinate with surrounding community on bike trail detour options (project team)
- Construction (2027-2028)
  - Seek additional federal and/or state funding for implementation (APCC & project team)
  - Earliest start date: winter 2027-2028

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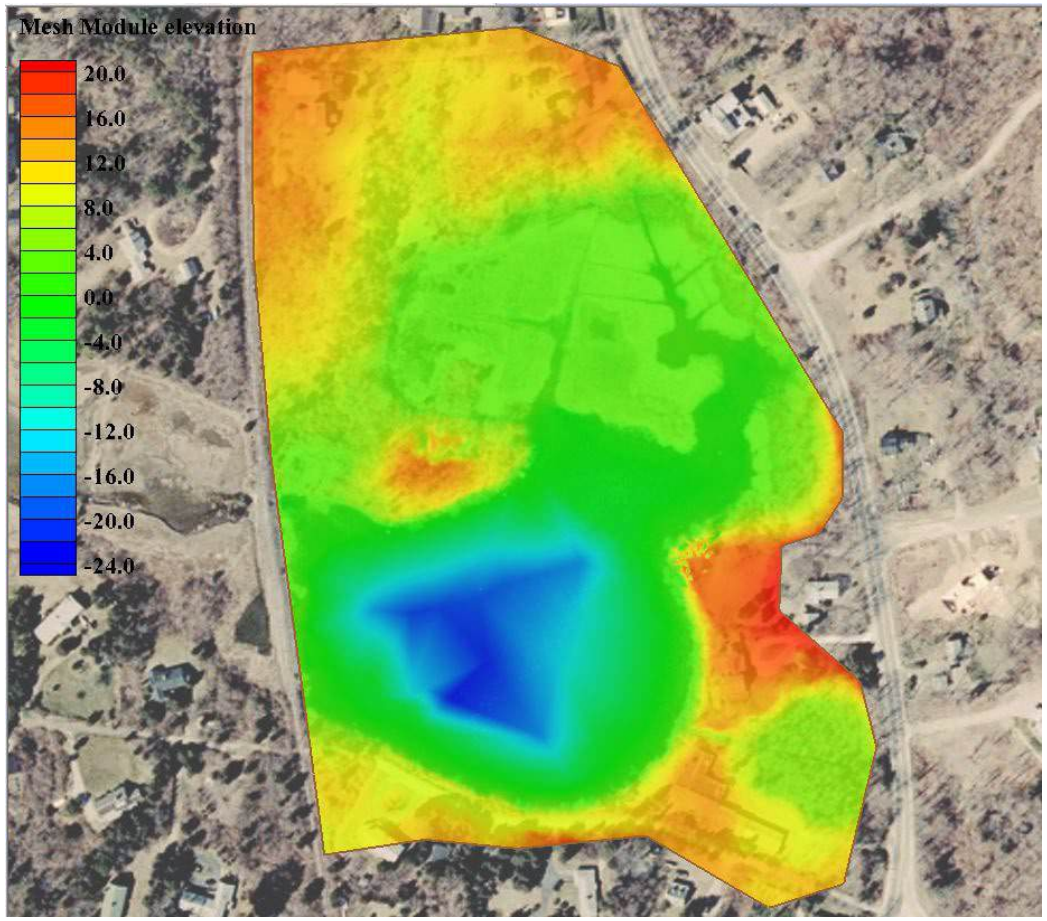
Question & Answer Panel

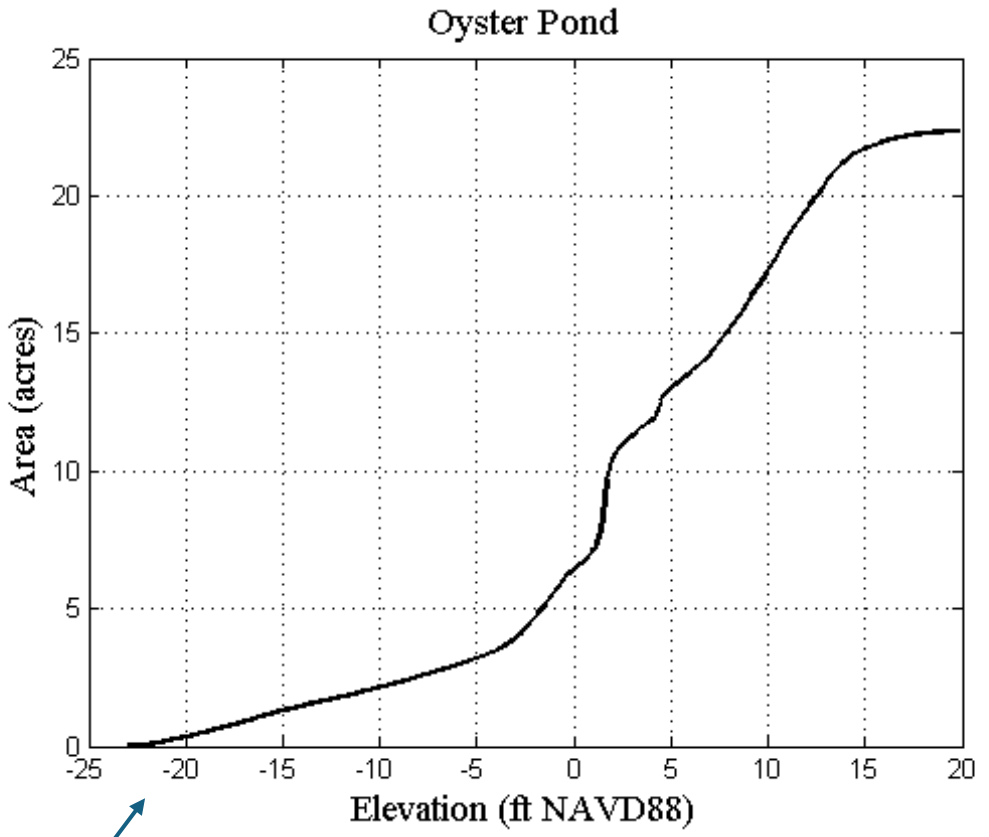
Visit our website – updates coming soon!

www.apcc.org/oyster-pond

If you have questions or concerns, please contact:
Jordan Mora, APCC Lead Ecologist & Science Advisor
jmora@apcc.org; 508-619-3185 x 310

Model Elevation & Bathymetry Data





A **hypsometric curve** shows the proportion of land within the study area that exists at various elevations and is used in the model

Scour Estimates and Countermeasure Design

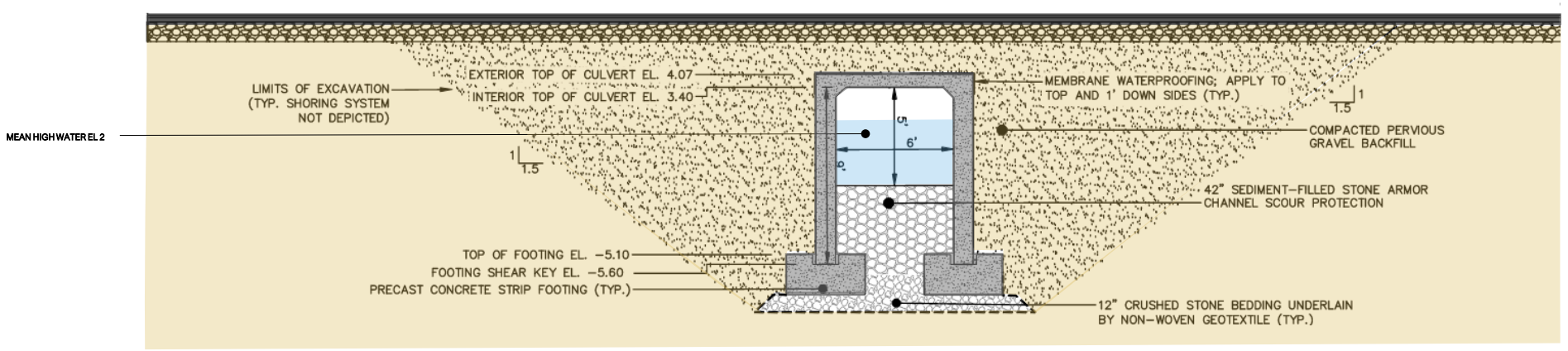
Scenario	Max Scour Depth H_s (ft)	Max Scour Width W_s (ft)	Max Scour Length L_s (ft)	Max Scour Volume V_s (ft^3)
Existing	3.1	11.6	24.4	543.9
Existing with shoals removed	3.6	14.1	29.0	862.2
Proposed 6hx4v Culvert	2.5	8.8	19.2	288.7
Proposed 8hx4v Culvert	2.3	7.8	17.2	216.1

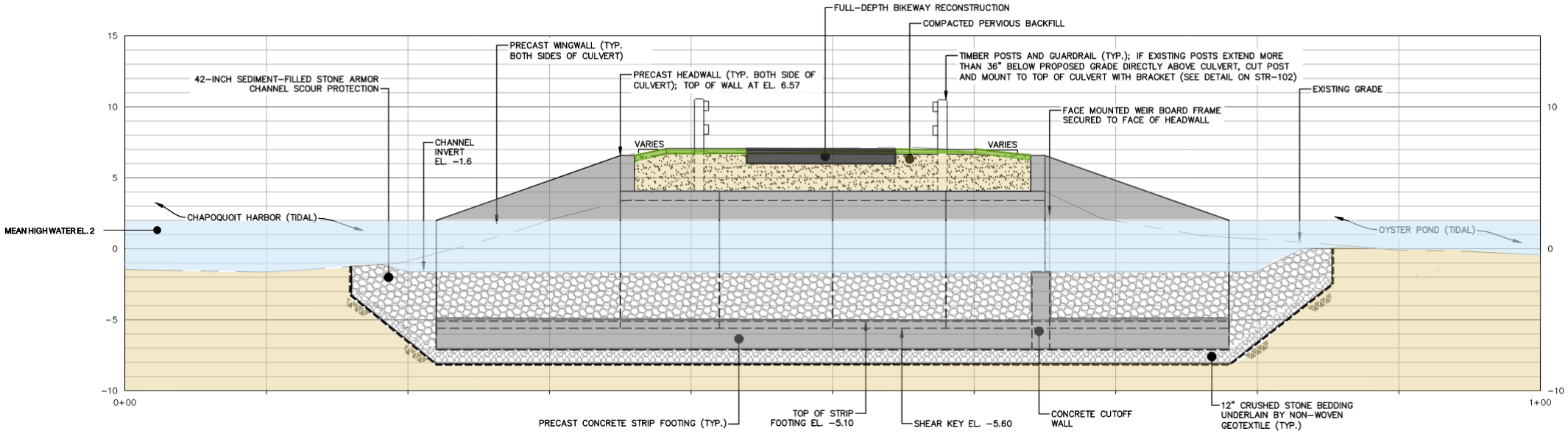
Calculated scour hole geometry without countermeasures for existing and proposed scenarios.

Minimum Stone Sizing D_{50} (ft)	Maximum Apron Length (ft)	Maximum Apron Width (ft)	Minimum Apron Depth (ft)
1	15	10	2

Scour apron (countermeasures) specifications

Replacement Culvert Section and Profiles





Potential Bikeway Detour Routes

- Construction and Detour Anticipated to Occur Between Late September and Late May
- Detour Routes Will be Developed with Additional Community Input