WOODS HOLE GROUP
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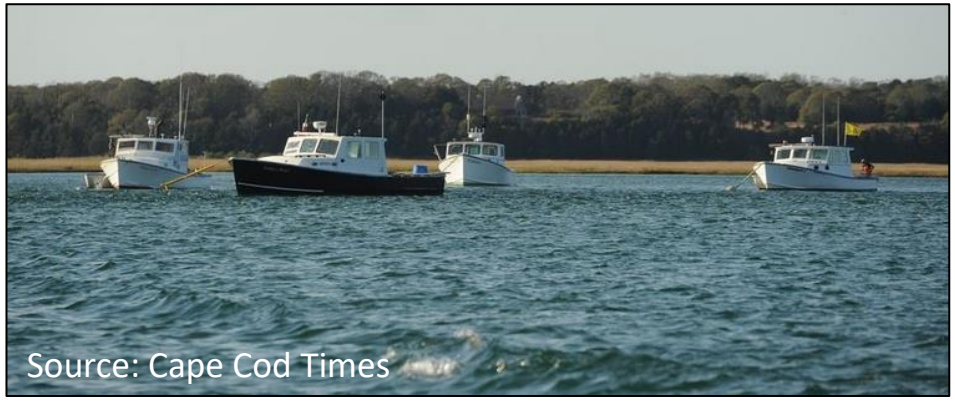
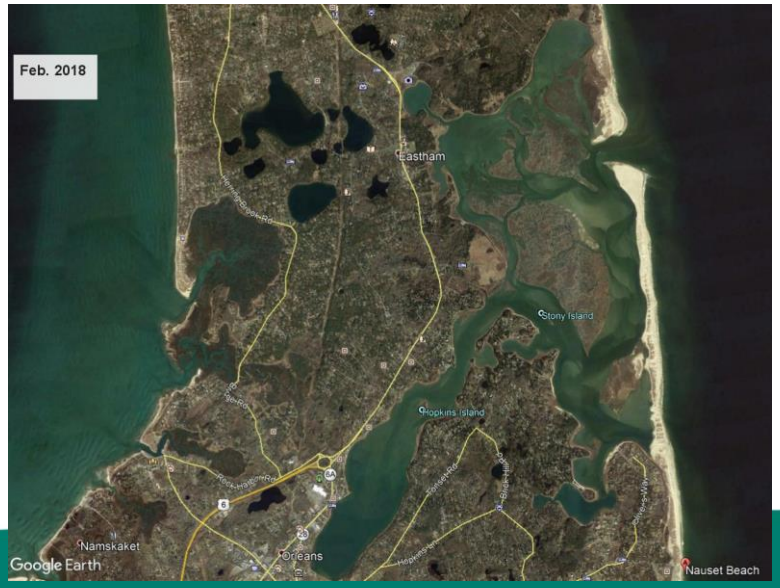
FOR EARTH, FROM SPACE

Nauset Estuary Dredging Project

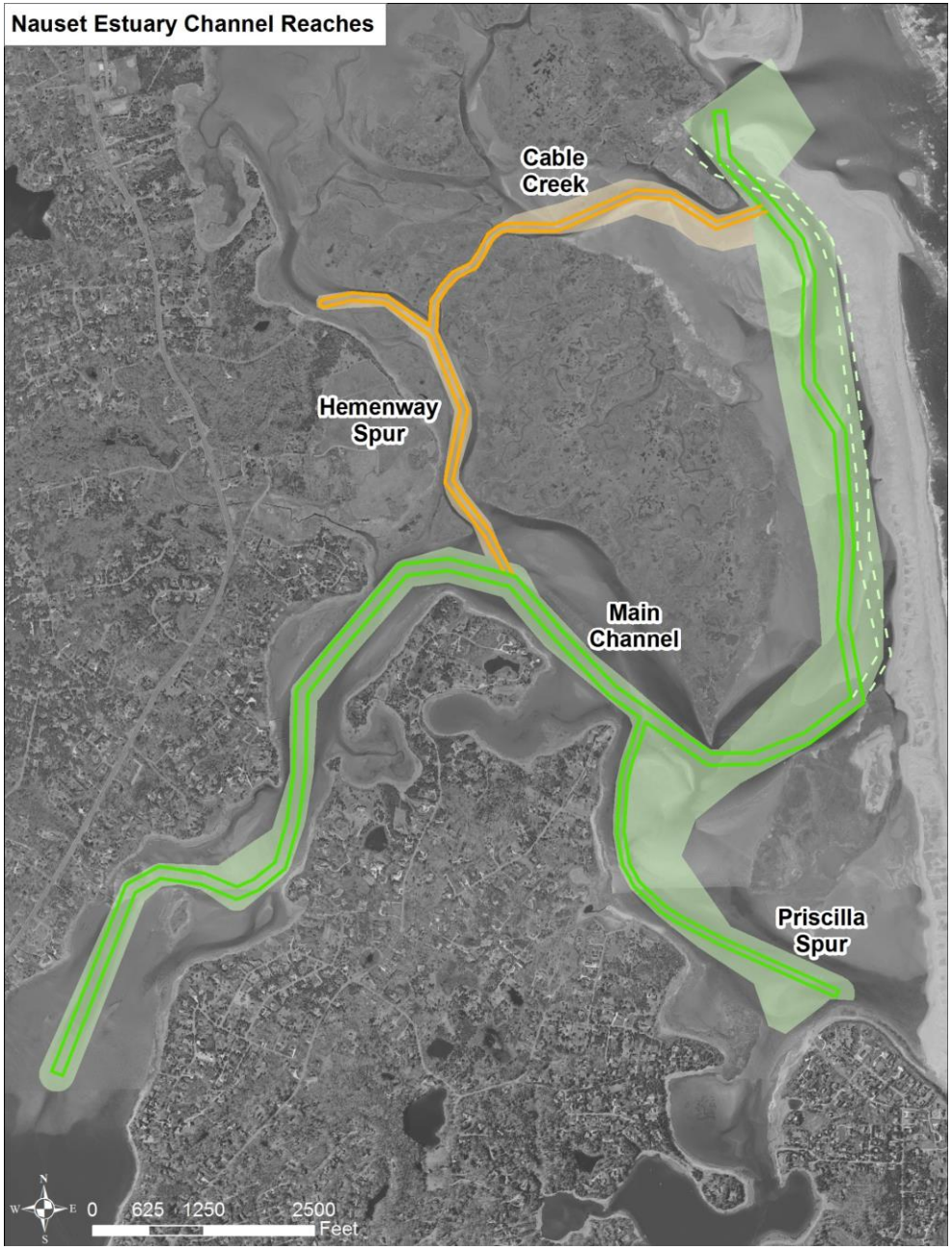




Pre-Application Meeting
January 11, 2019

Project Components

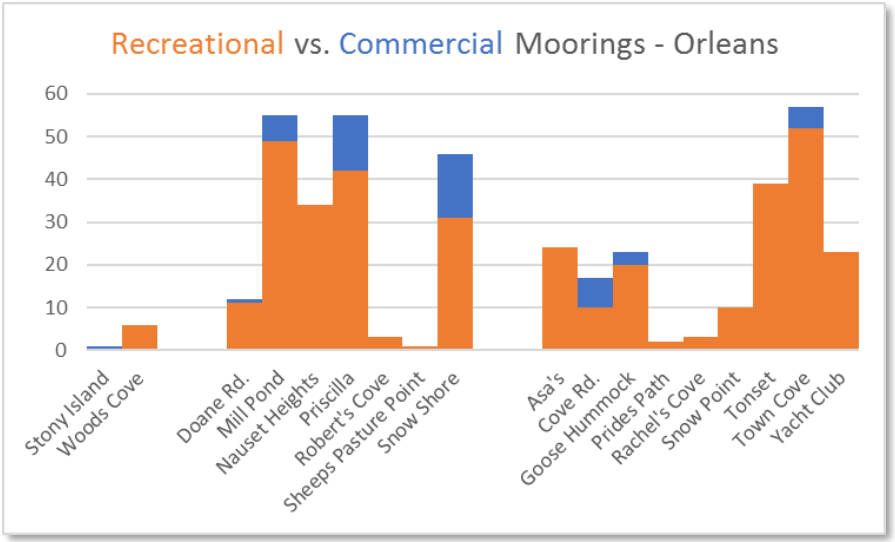
- original channel layout
- additional Eastham reaches
- 50-100 ft wide
- -5 ft at MLLW
- buffer from barrier beach
- buffer from eel grass
- dredge zone
- dewatering and disposal on Nauset Beach

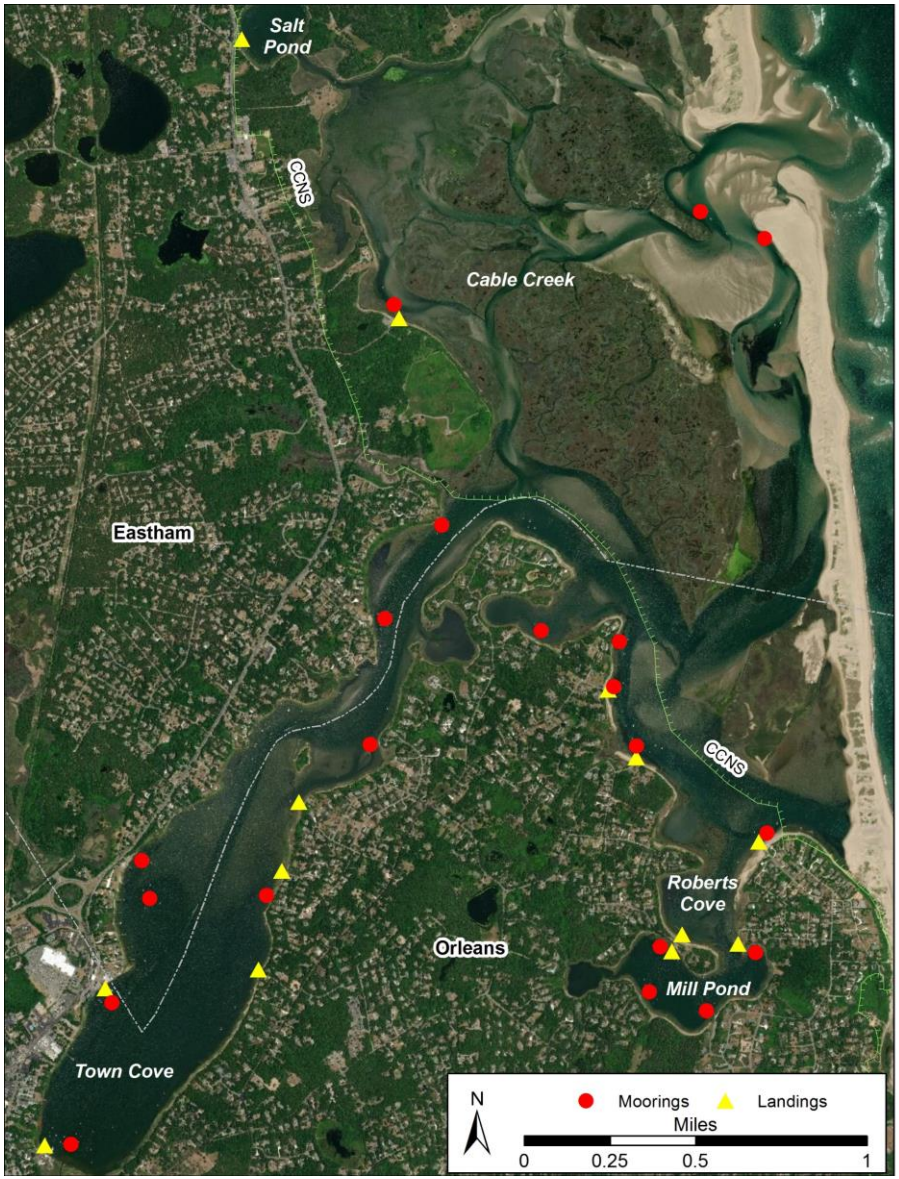


Existing Uses of Nauset Estuary

Commercial & Recreational

- Towns of Orleans, Eastham & CCNS
- 13 town landings
- 20 mooring areas
- 2 commercial marinas
- 1 yacht club
- many private & association docks
- emergency response: 1.5 to 4.3 miles

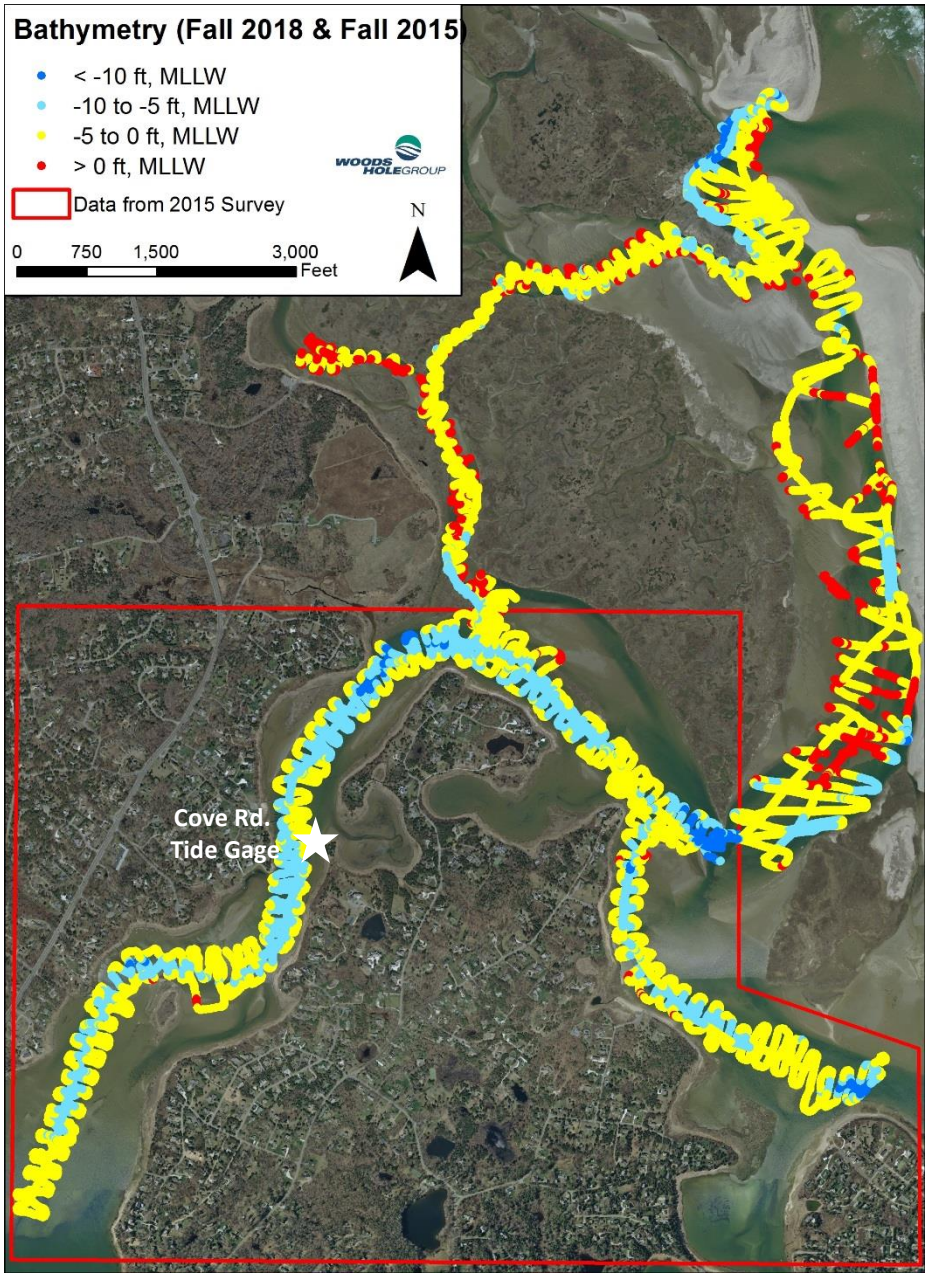




Existing Conditions

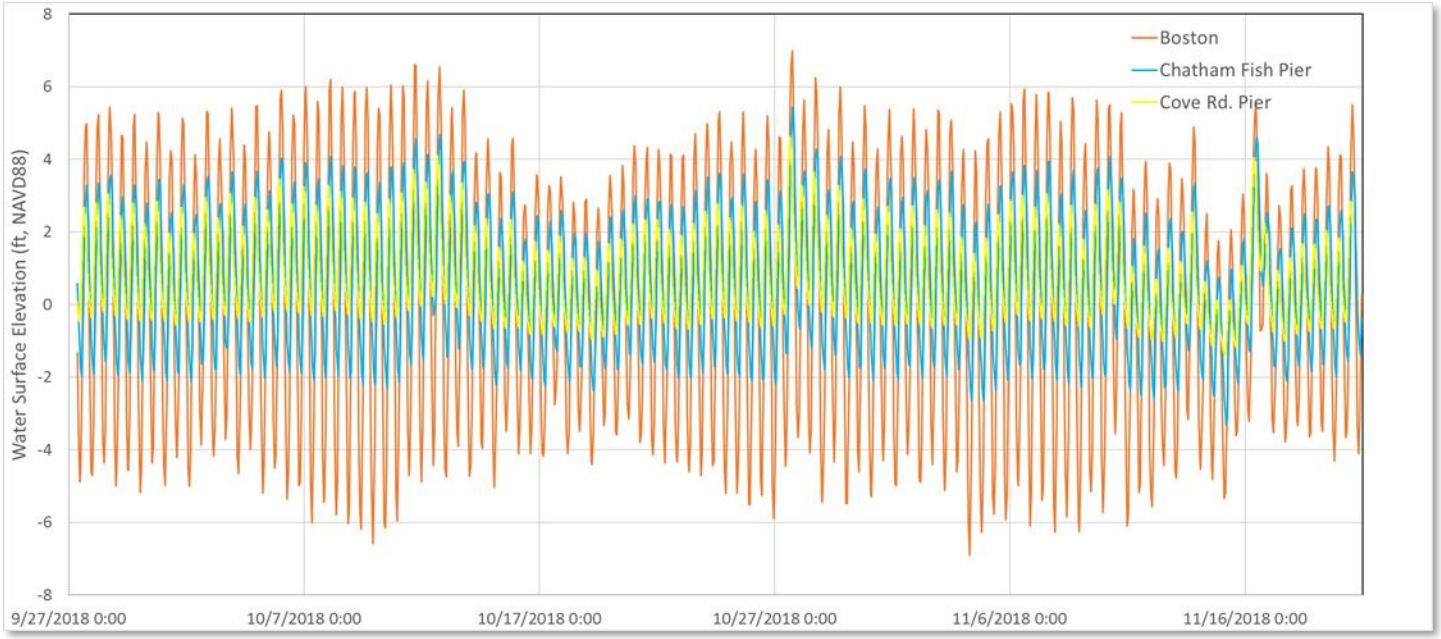
Bathymetry

- 2105 and 2018 surveys
- corrected to common vertical datum
- inner estuary: deeper
- behind barrier, northern channels: shallower
- 2018 water level survey



Existing Conditions

Tides & Hydrodynamics



DATUM	COVE RD. ELEV. (ft, NAVD88)	SALT POND ELEV. (ft, NAVD88)
MHHW	2.73	2.94
MHW	2.43	2.65
MTL	0.97	1.08
MLW	-0.49	-0.49
MLLW	-0.56	-0.55

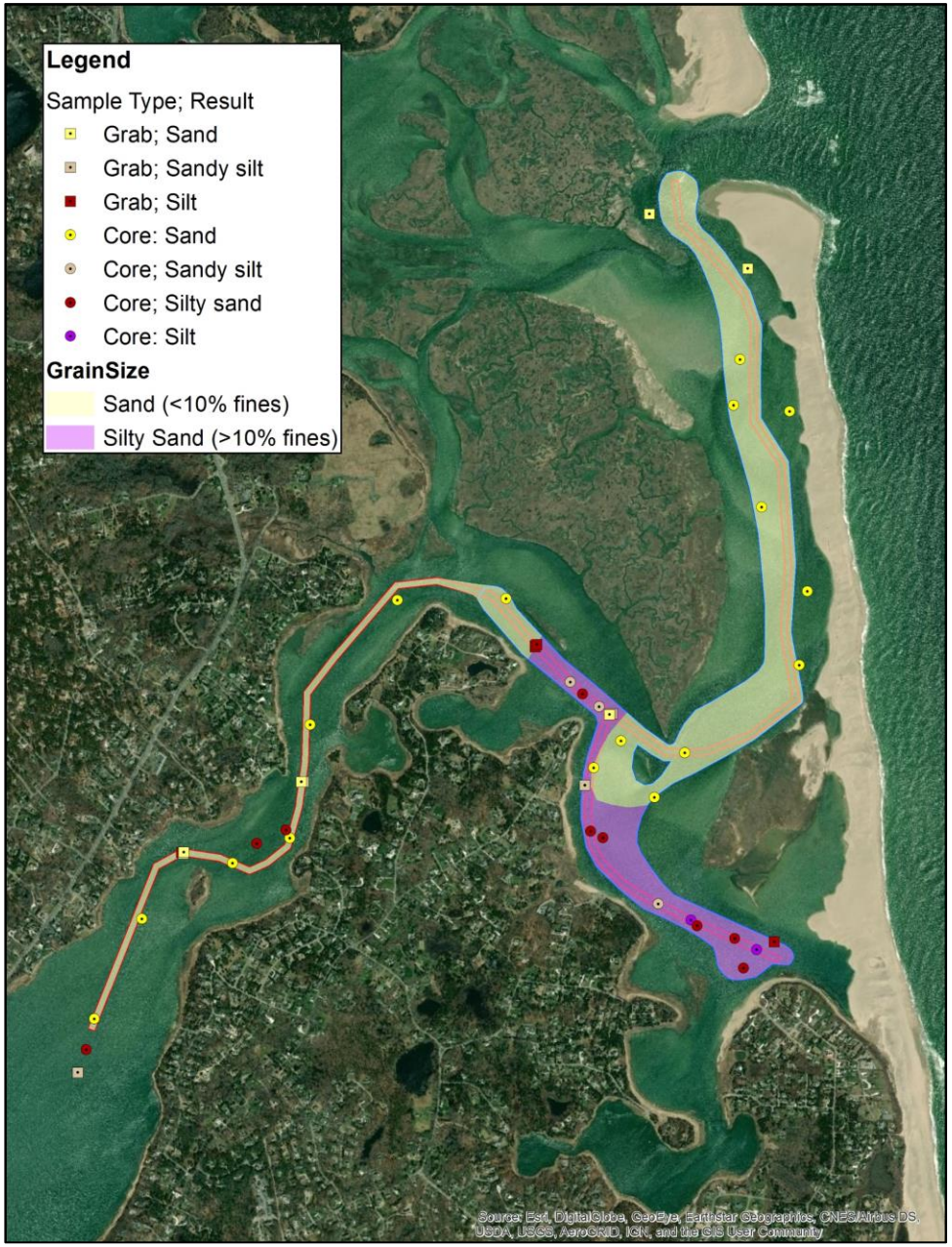
- attenuated tidal signal
- 3.3 to 3.5 ft tidal range – Nauset
- 10.3 ft tidal range – Boston
- 5.5 ft tidal range – Chatham Fish Pier
- flood dominant system

Existing Conditions

Sediments

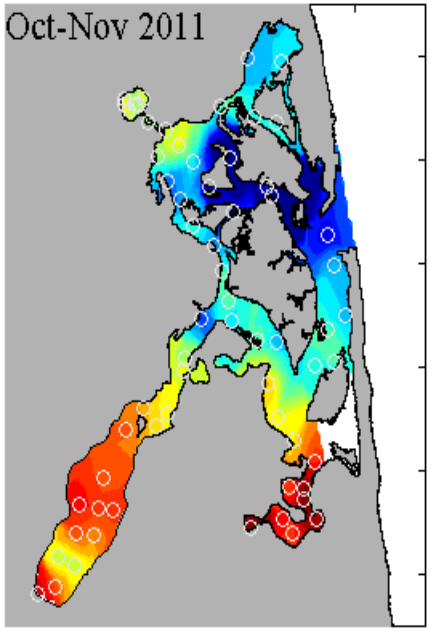
Sampling programs:

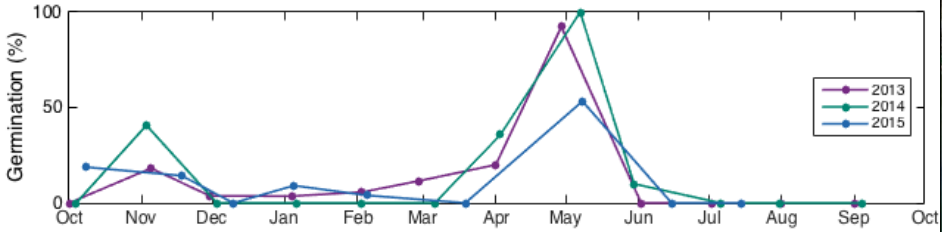
- Fall 2015 – exploratory grabs (16) and vibra cores (6)
- Fall 2017 – vibra cores (16)
- Summer 2019 – vibra cores (8)
- USACE approved SAP
- grain size & sediment chemistry
- sand and silty sand (>10% fines)
- sandy sediments suitable for beach/dune nourishment
- silty sands meet MA criteria for upland placement

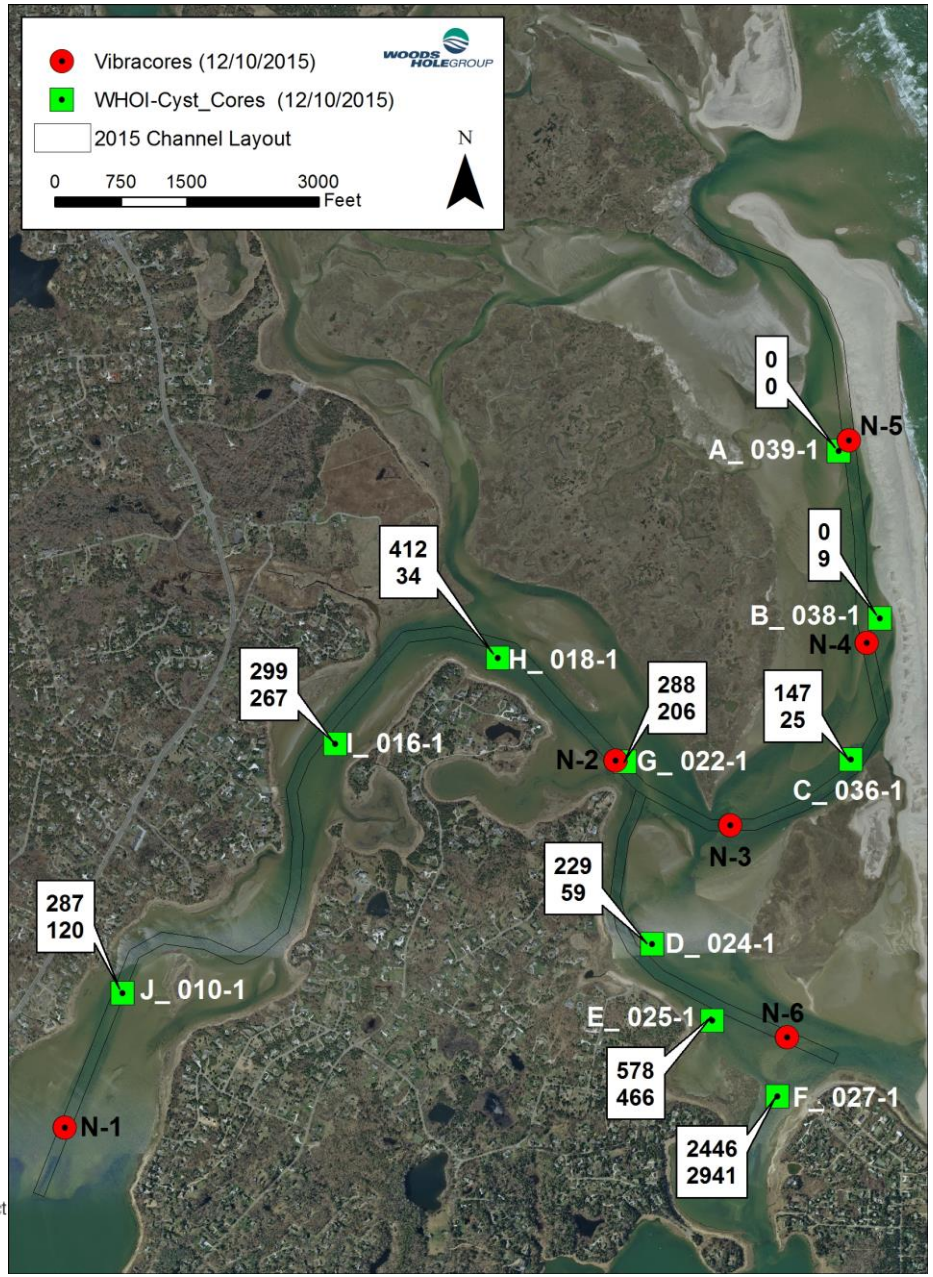


Existing Conditions

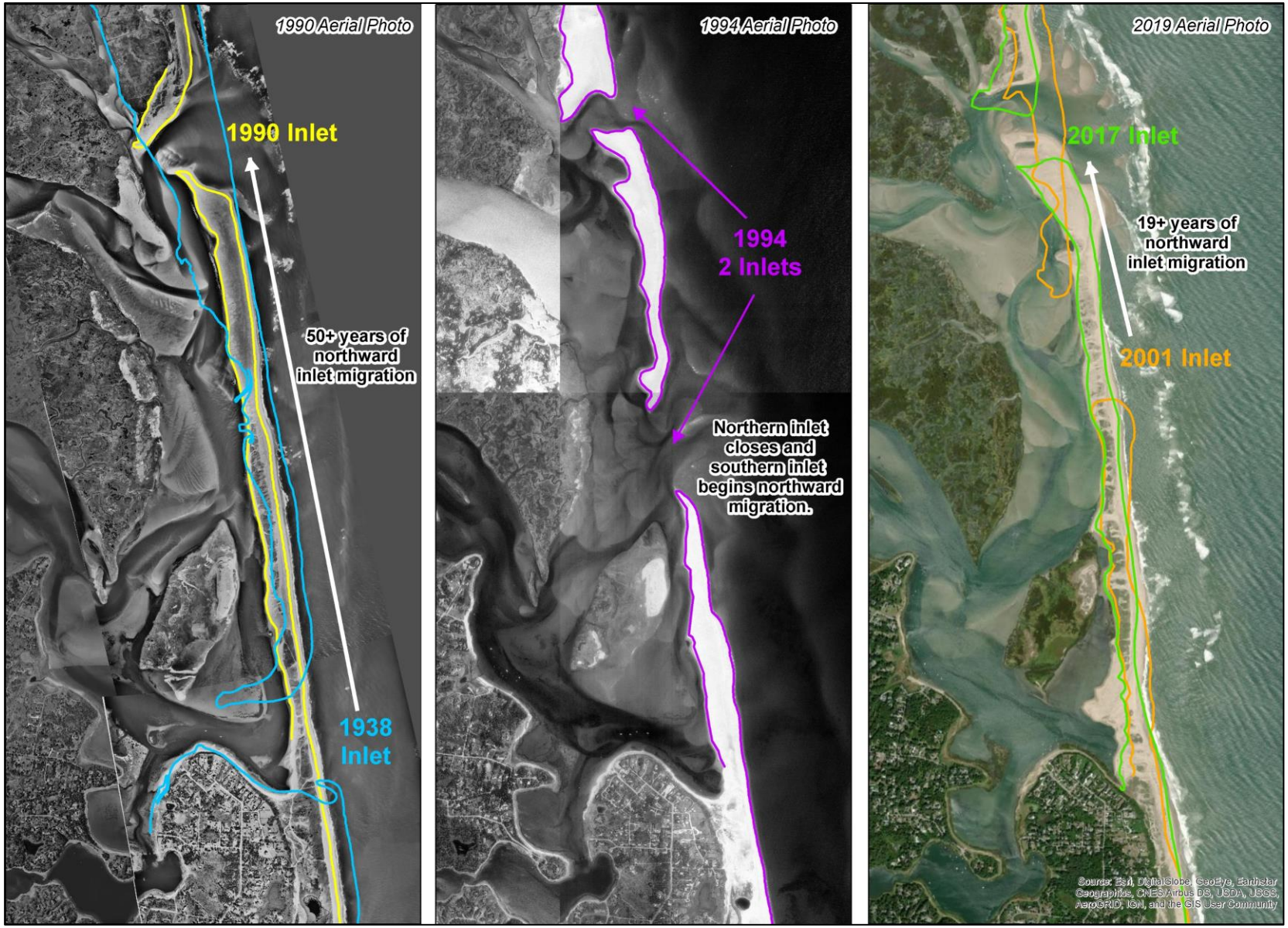
Red Tide





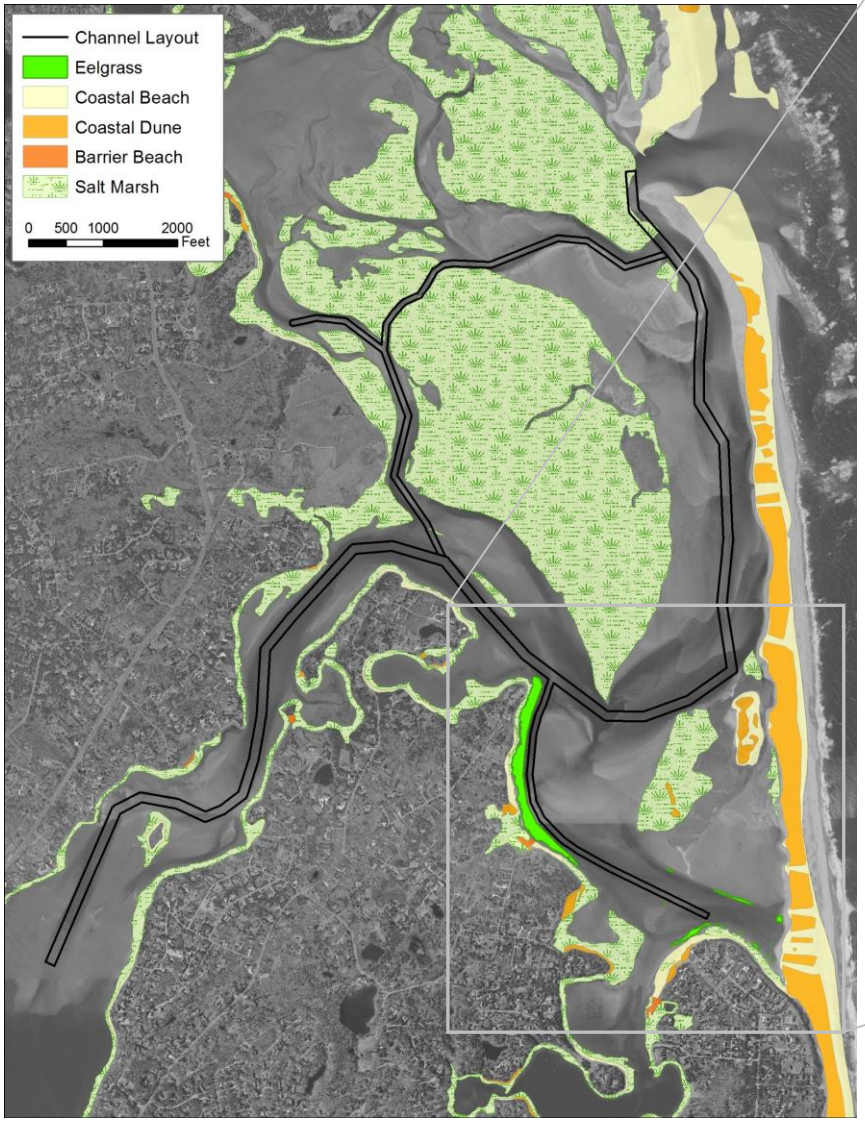


Existing Conditions – *Barrier Beach Dynamics*



Existing Conditions

Wetland Resources

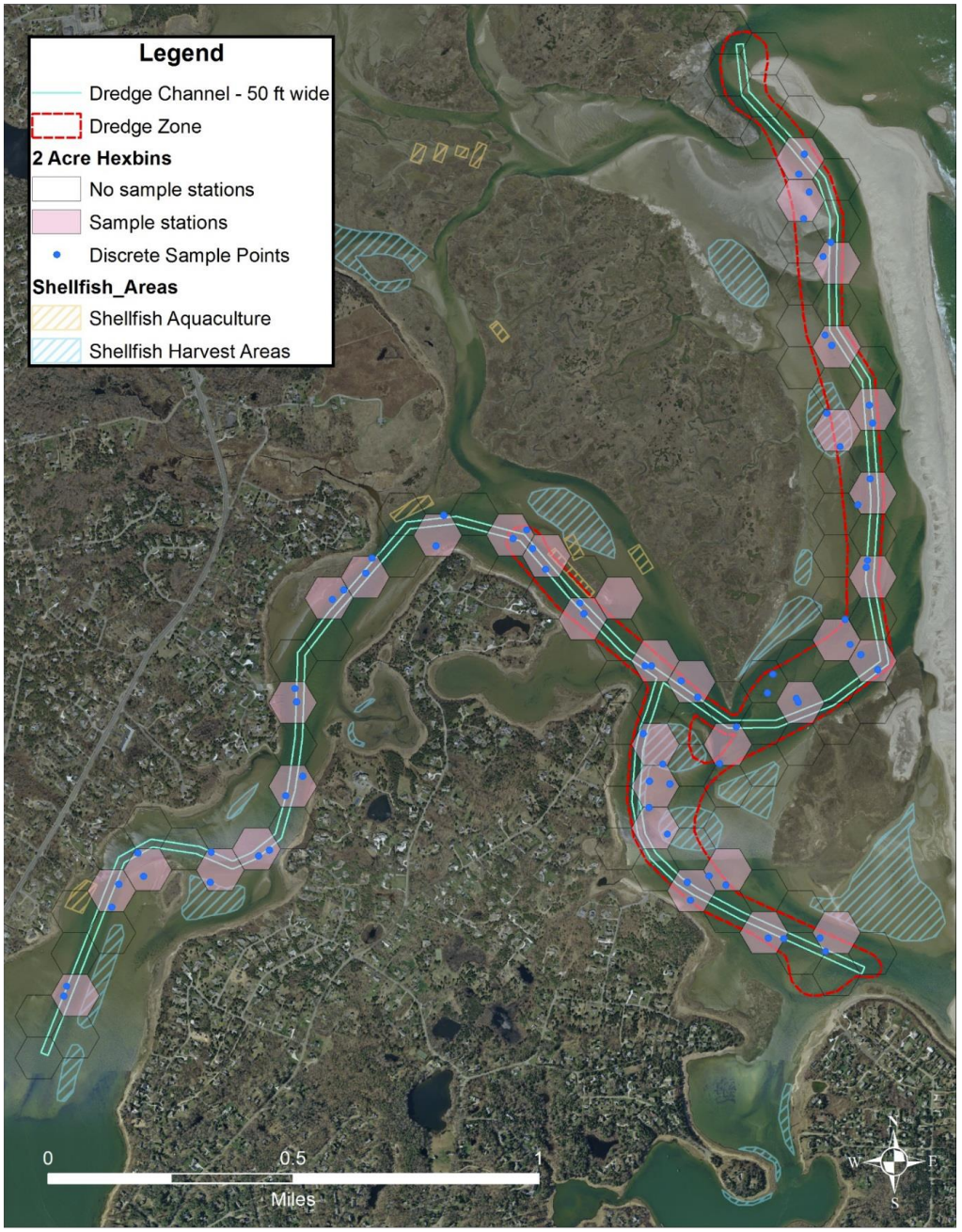


- eelgrass mapped in Priscilla spur
- extensive salt marsh resources
- barrier beach – beaches and dunes
- priority and estimated habitat

Existing Conditions

Shellfish Resources

- DMF habitat: scallop, mussel, quahog, razor clam, soft shell clam
- Aquaculture: oyster
- Town propagation: quahog
- Shellfish survey Sept. 2019



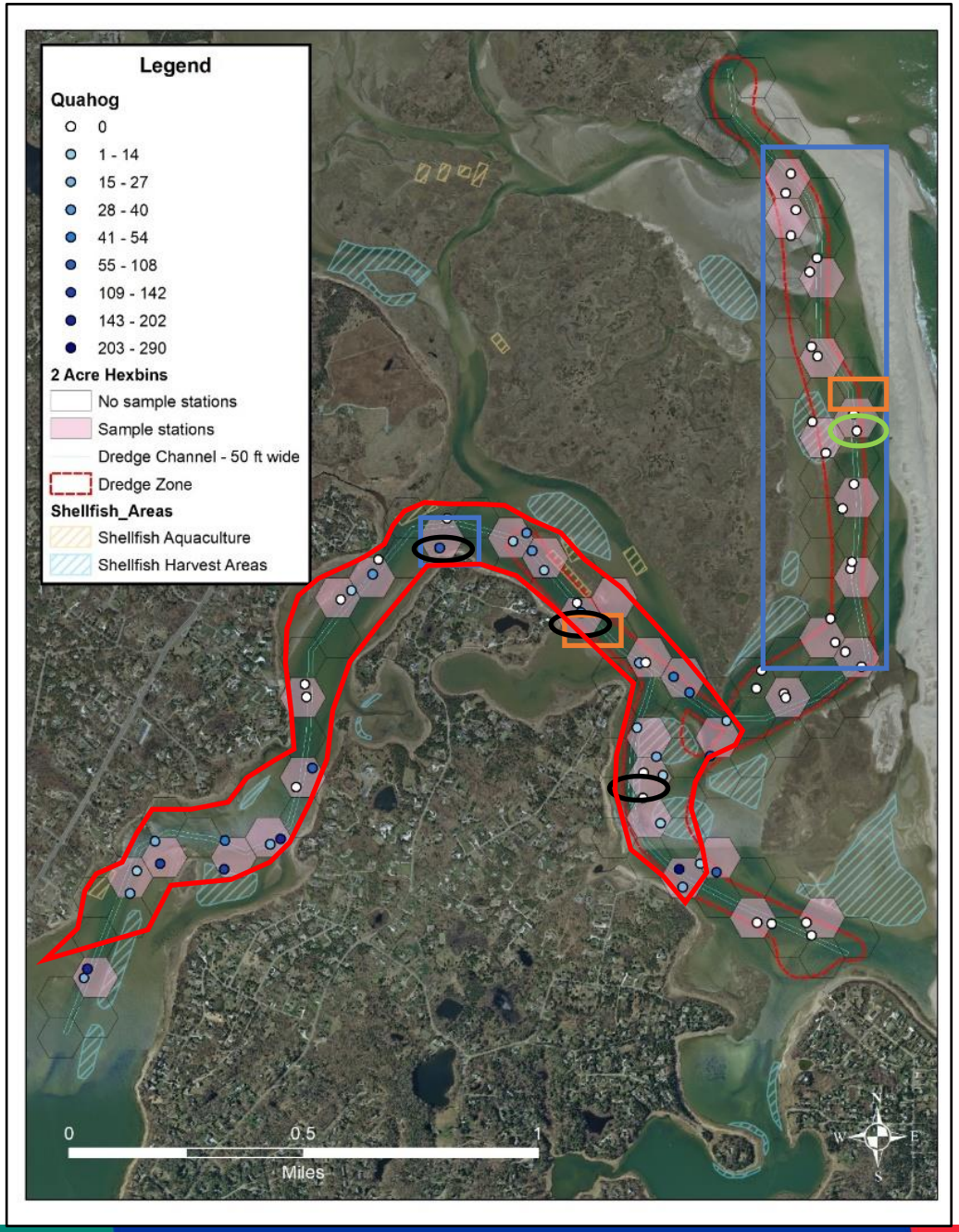
Existing Conditions

Shellfish Resources

Species	# Observed	Net Density/ cu ft
Bay Scallop	4	0.01
Blue Mussel	24	0.08
Soft-shelled Clam	2	0.01
Surf Clam	31	0.11
Quahog	269	0.96

Options for Mitigation

- relay prior to dredging
- shellfish seeding
- Other (?)



Existing Conditions

Consultations: Essential Fish Habitat and Endangered Species

NOAA NMFS Recommendations

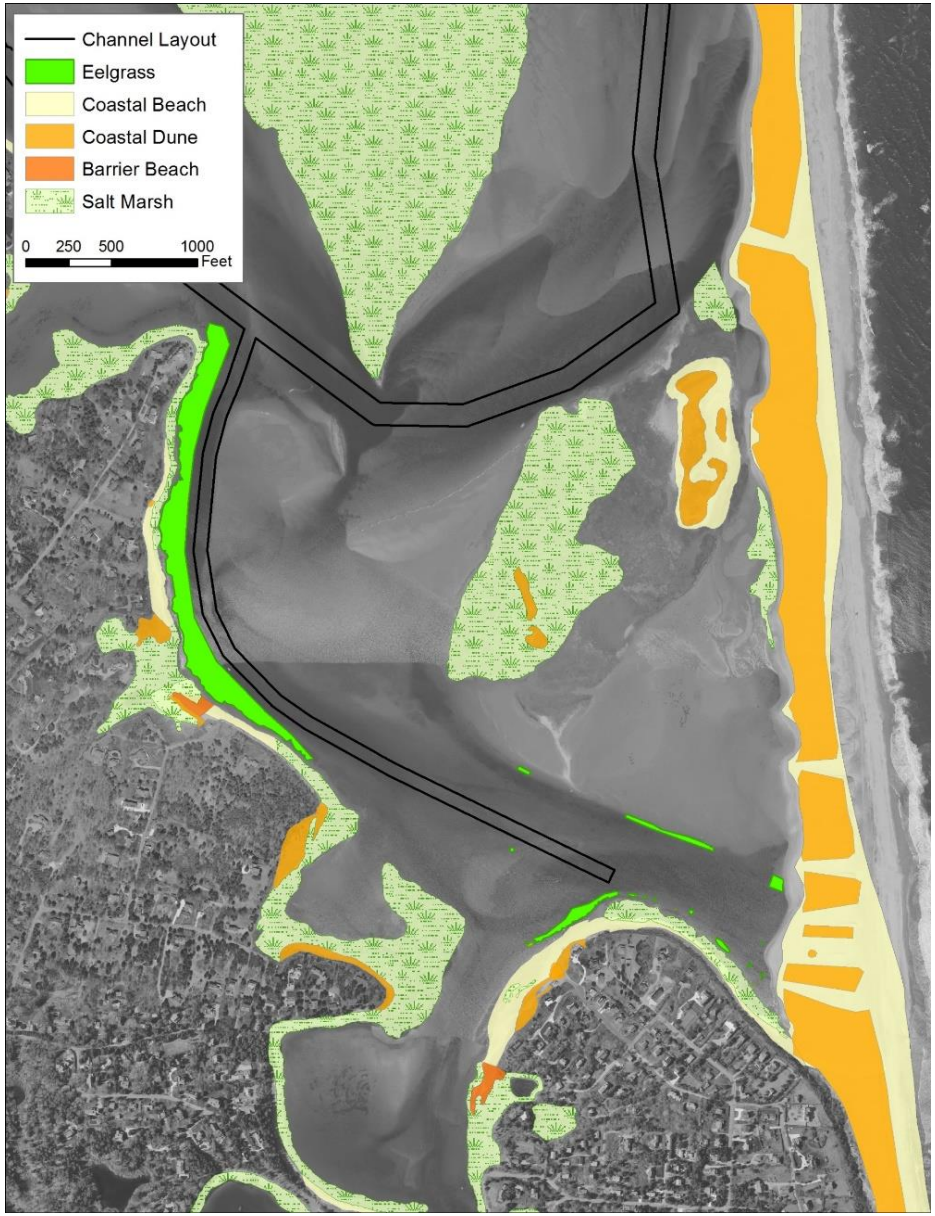
- No dredging within 100 ft of eelgrass
- Avoid dredging intertidal areas
- Follow TOY restrictions

USF&WS Recommendations

- Follow TOYs to protect North Atlantic right whale, fin whales, sea turtles, sturgeon, piping plover, & roseate tern
- Consider use of silt curtains

NHESP Comments

- Minimize side of dewatering basin
- More detail on frequency, pipeline

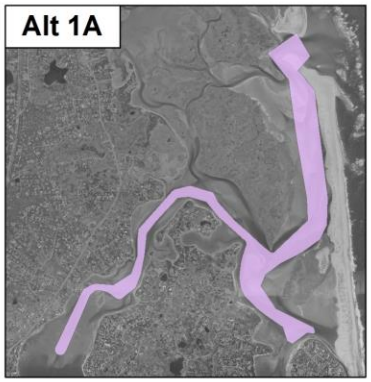


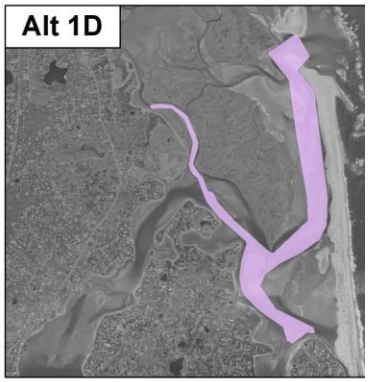
Red Tide Cyst Pilot Project

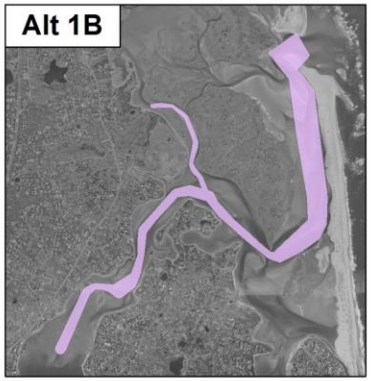
Pilot project Jan to April 2020

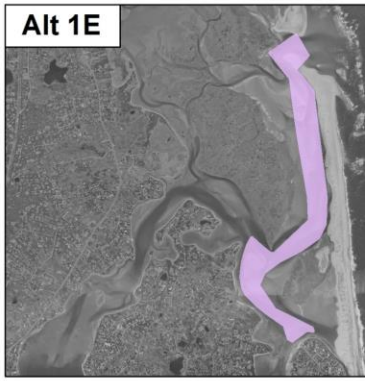
- Tested mortality caused by desiccation, freezing and salinity changes
- Dune burial replicated dewatering area
- Cysts remained viable for ~ 3 months, then showed 100% mortality by 5 months
- Mild winter so freezing not tested
- Desiccation and salinity likely not cause of mortality
- Altered cyst morphology likely lead to mortality

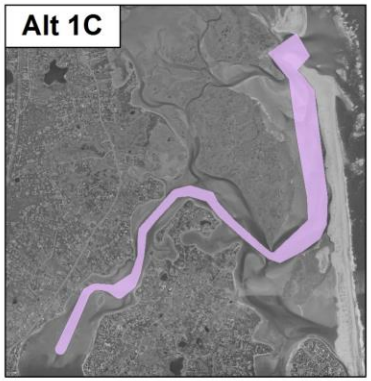
Dredging Alternatives – Alt. 1

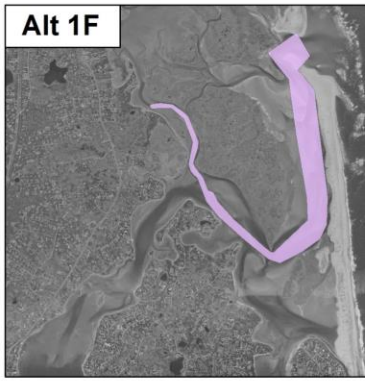




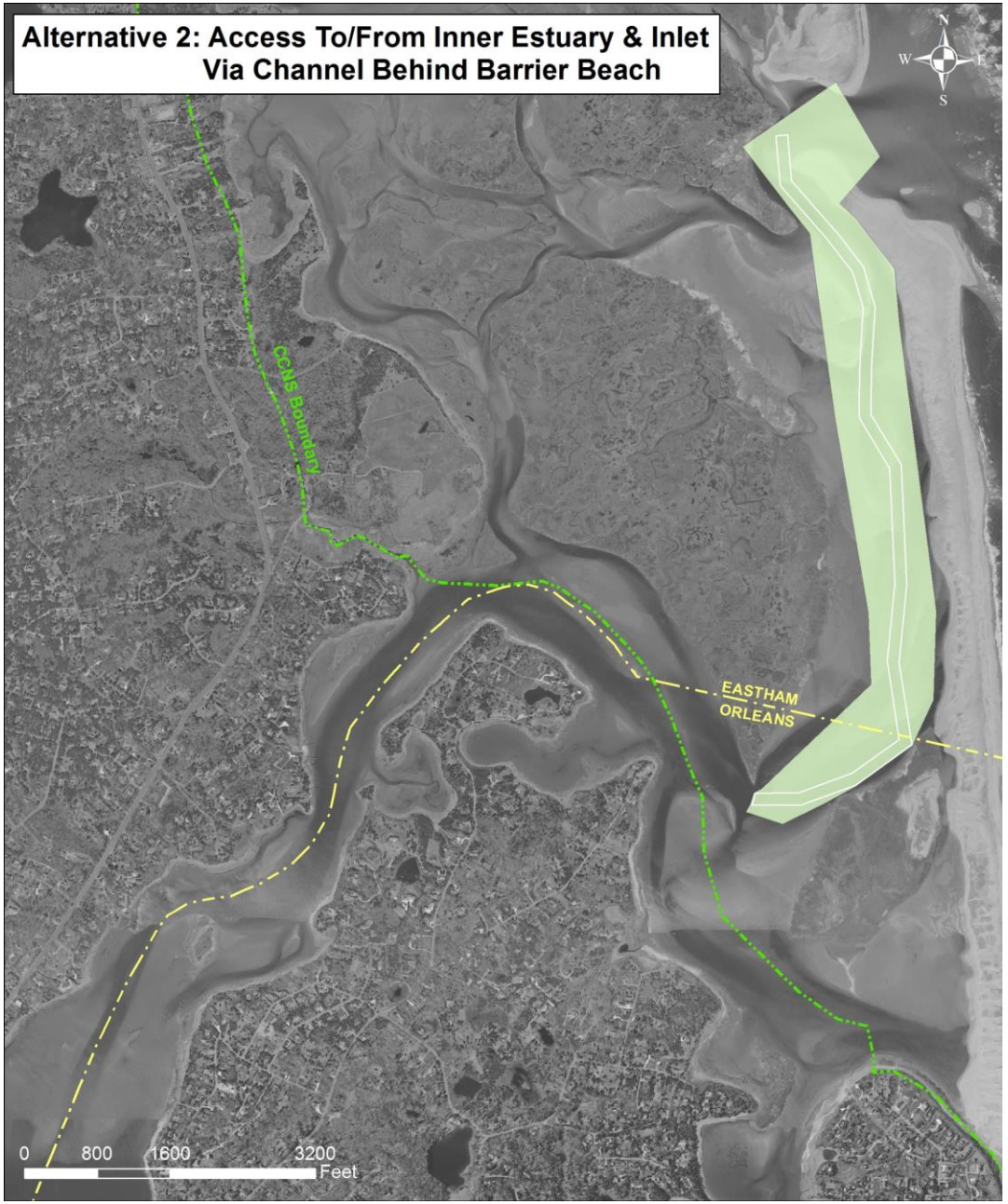






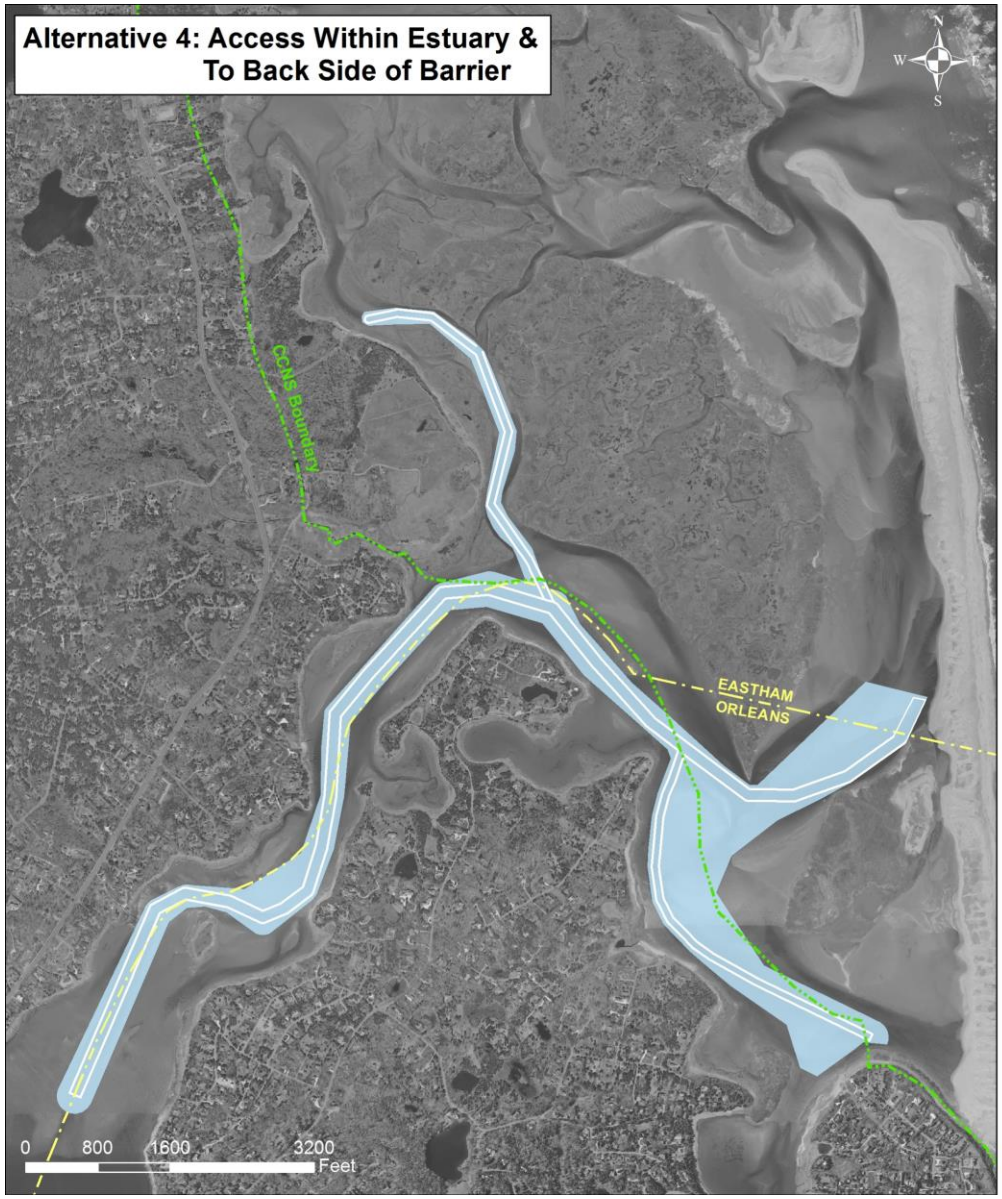


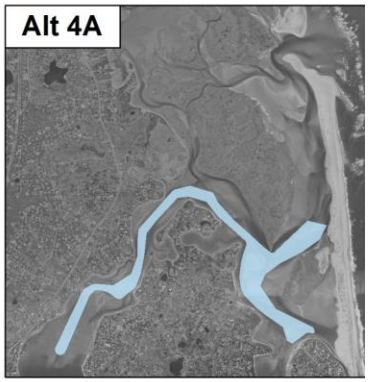
Dredging Alternatives Alt. 2

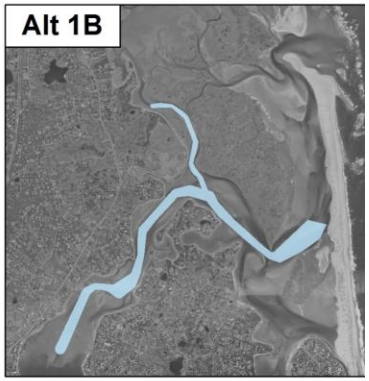


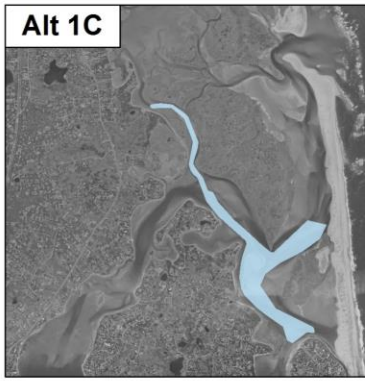
Dredging Alternatives – Alt. 3

Dredging Alternatives – Alt. 4



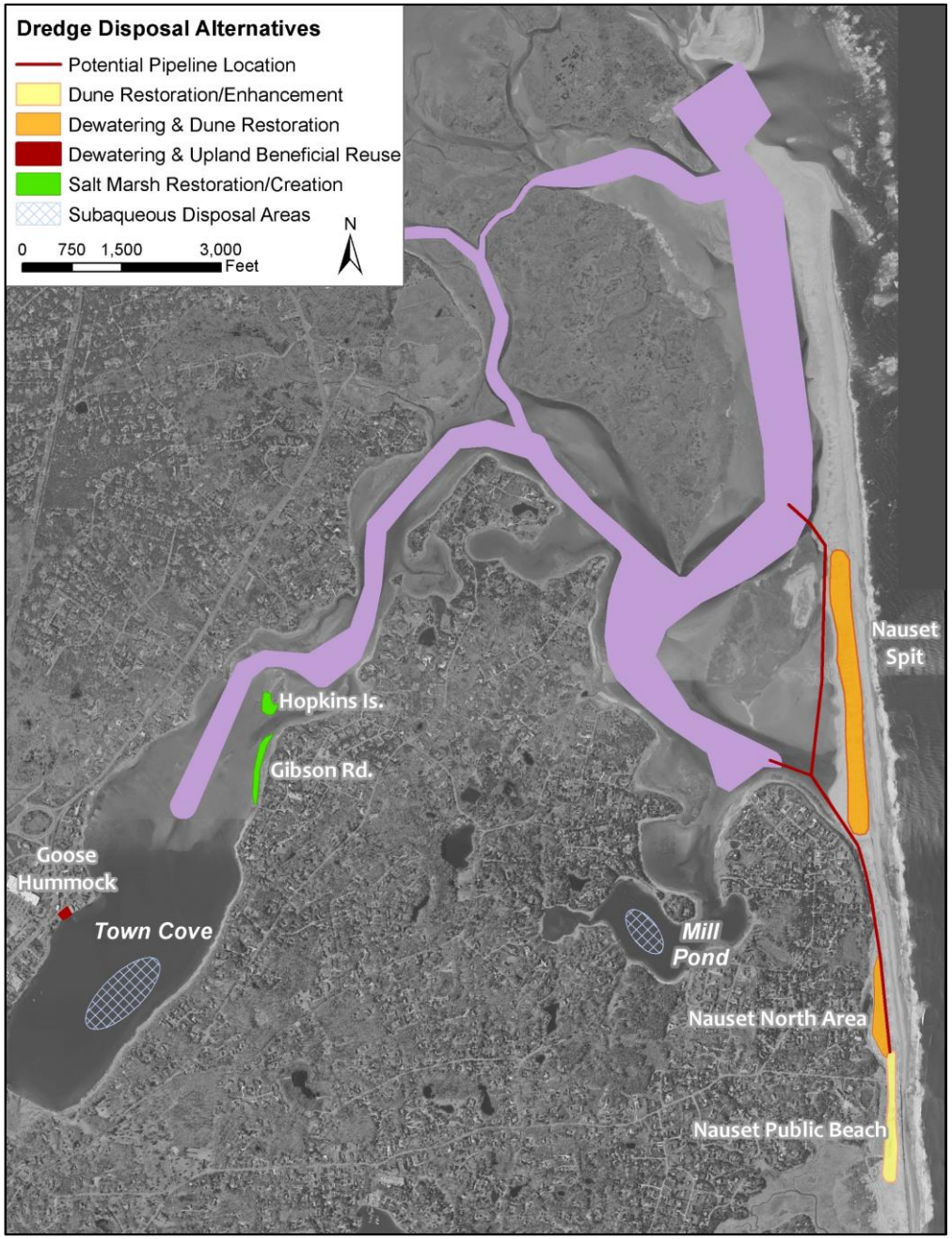






Disposal Alternatives

- Maximize beneficial reuse for
  - coastal resilience
  - habitat enhancement
  - red tide mitigation



Alternatives Analysis

Dredging & Disposal

Environmental *Factors*

- *Eelgrass*
- *Shellfish*
- *Salt marsh*
- *Barrier stability*
- *Hydrodynamics*
- *T&E species*
- *Red tide*
- *Beach/dune*

Engineering Factors

- *Maintenance dredging frequency*
- *Dredge method*
- *Distance to disposal sites*
- *Beneficial reuse*
- *Disposal site capacity*
- *Construction access*

Economic Factors

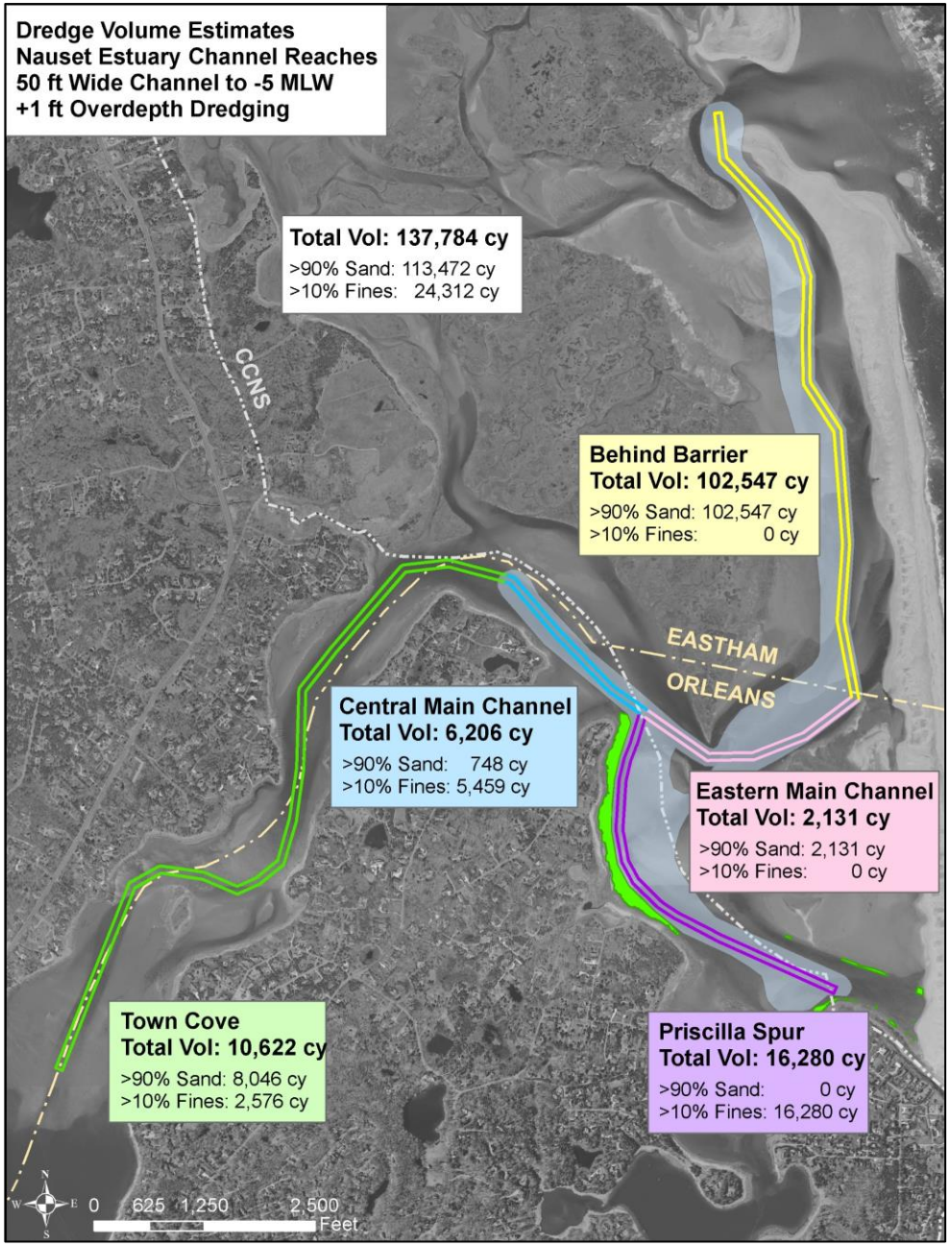
- *Construction costs*
- *Offset costs of local resiliency projects*
- *Benefits to local businesses & economies*
- *Benefits to commercial users of landings*
- *Public safety*

Preferred Channel Layout

Alternative 1A (50 ft channel)
- Total dredge volume of 137,784 cy
- 82% Sand (113,472 cy)
- 18% Fines (24,312 cy)

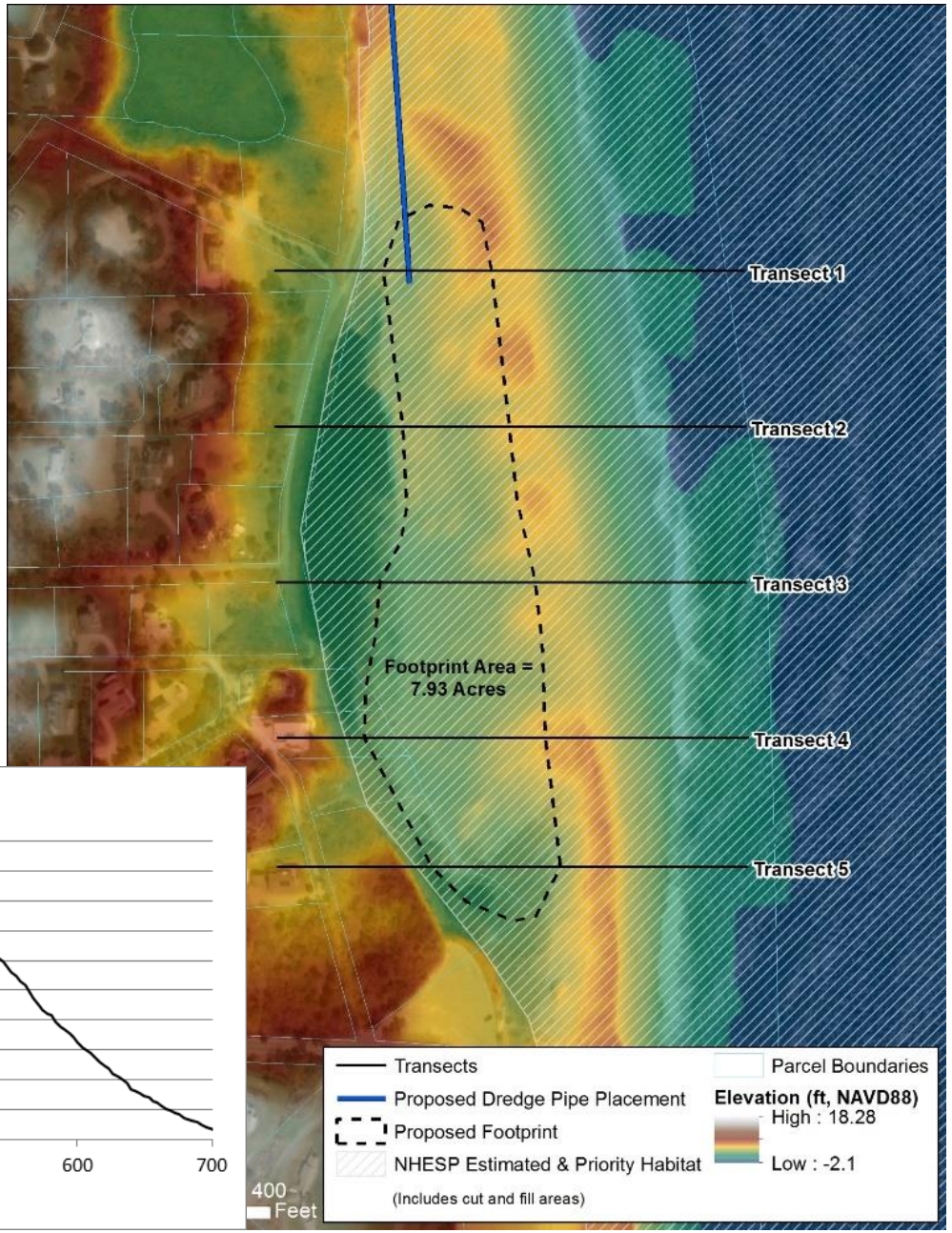
Alternative 1A (100 ft channel)
- Total dredge volume of 163,554 cy
- 84% Sand (136,731 cy)
- 16% Fines (26,822cy)

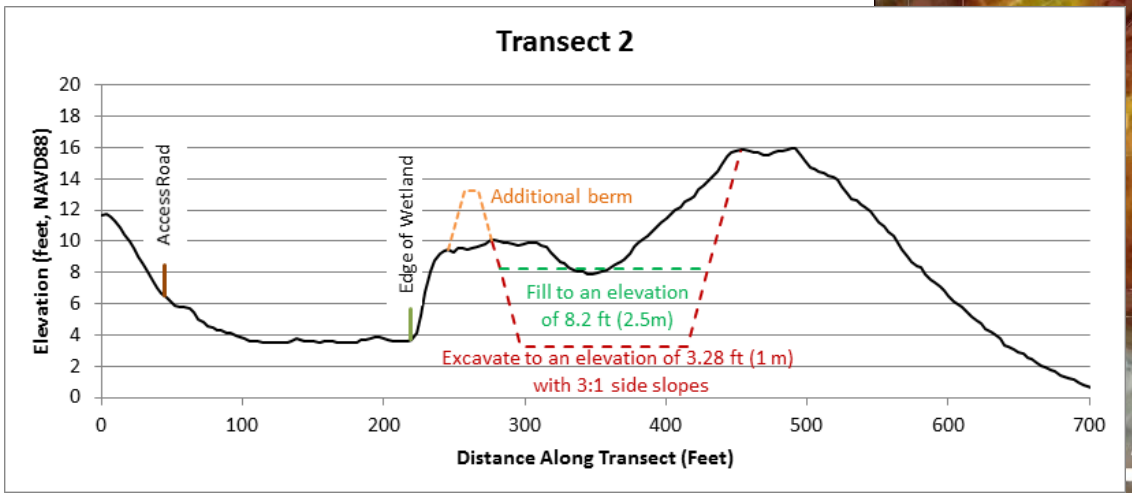
Dredge zone in most dynamic areas
Mechanical and hydraulic dredging



Preferred Disposal Locations

- Hydraulic dredge to Nauset dunes north of public beach
- Mechanical dredge to barges offloaded at Goose Hummock or at Orleans Yacht Club





Environmental Permitting

Required Permits

- MEPA – Mandatory EIR (301 CMR 11.03 (3)(a)1.b.)
- NEPA – EA or EIS
- CCC – District of Regional Impact
- Town of Orleans – Notice of Intent
- Town of Eastham – Notice of Intent
- DEP – Water Quality Certification
- DEP – Chapter 91 Permit
- MA CZM – Coastal Zone Consistency
- USACE – Individual Permit

Consultations/Coordinated Reviews

- NHESP MESA
- DMF
- NOAA NMFS (Section 7, EFH and endangered species)
- MHC & NHPA Section 106