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The Future of Duxbury Beach

Planning in the Face of Climate Change

February 12, 2020

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Coastal Scientist
Woods Hole Group

DUXBURY BEACH RESERVATION, INC.

Massachusetts Office of Coastal Zone Management

Presentation Overview

1. Background & Existing Conditions

2. Current CZM Coastal Resiliency Grant
   - Potential Project Areas
   - Permitting

3. Overall Timeline & Process

Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

The 2016 report looked at:

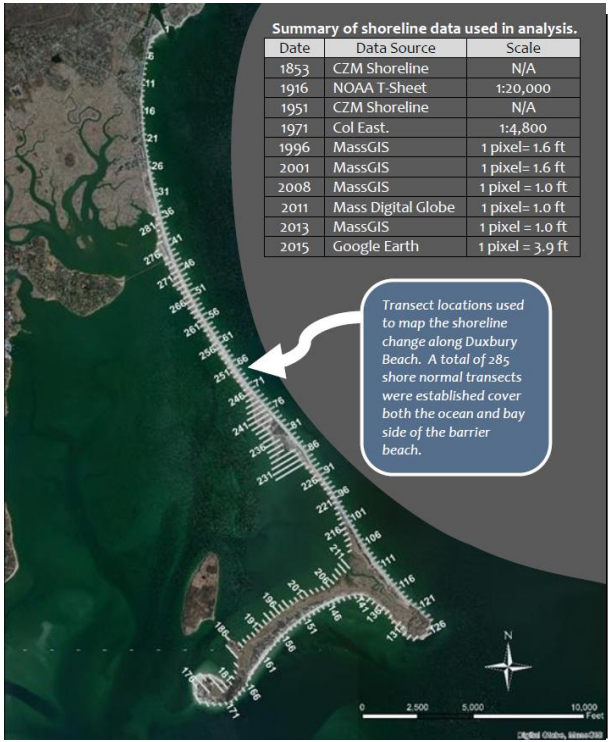
- Historical Shoreline Change
- Field Data Collection
- Hydrodynamics
- Waves & Sediment Transport
- Conceptual Resiliency Adaptations

Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Historical Shoreline Change

- Aerial photos and historical maps and charts from 1853 to 2015
- Entire 15 mile coastline of Duxbury Beach (285 transects)

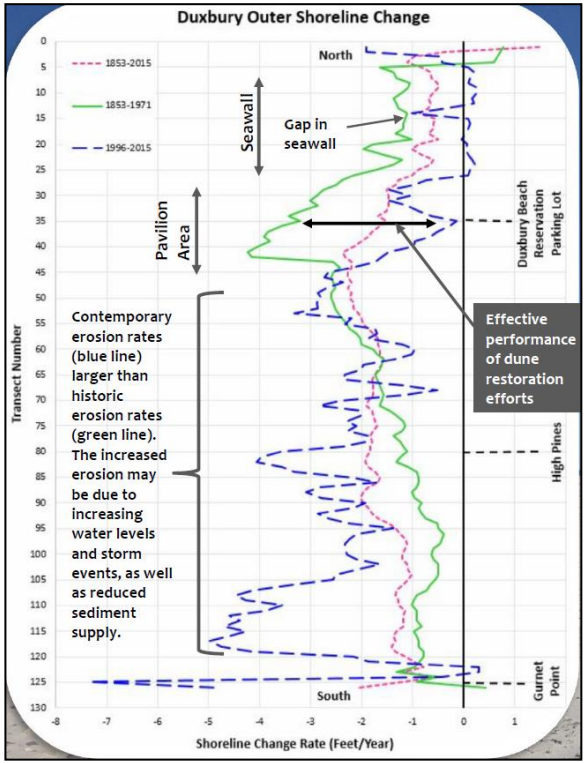


Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Historical Shoreline Change - Results

- Ocean beach

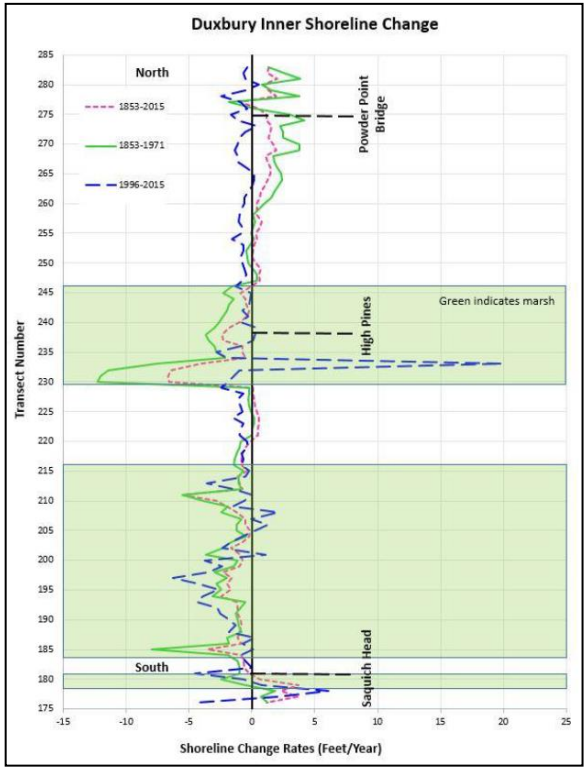


Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Historical Shoreline Change - Results

- Bay-side beach

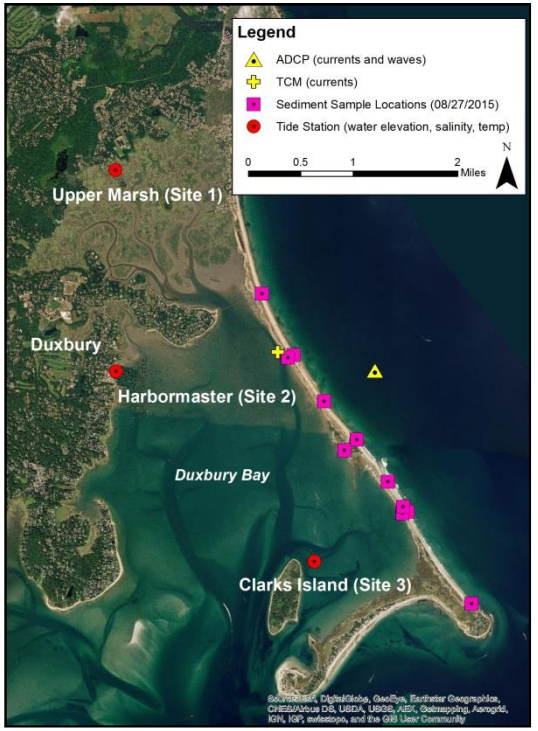


Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Field Data Collection:

- **ADCP –** wave observations
- **Tidal Current Measurements (TCM)** – velocities at erosional area (cobble berm)
- **Sediment Samples** – input to sediment transport models; grain size compatibility for nourishment
- **Tide Stations** – used to calibrate hydrodynamic model of Duxbury Bay

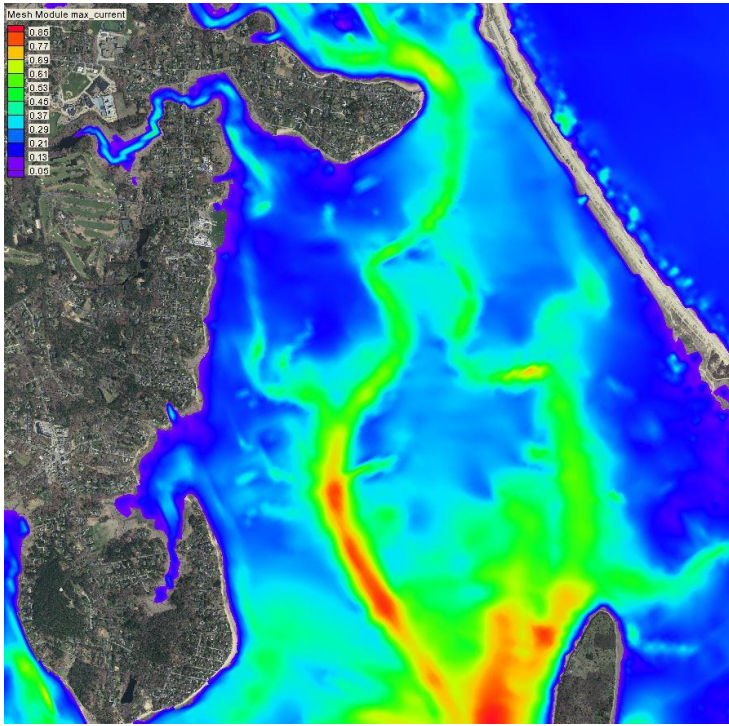


Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Hydrodynamic Modeling:

- Bayside area erosion

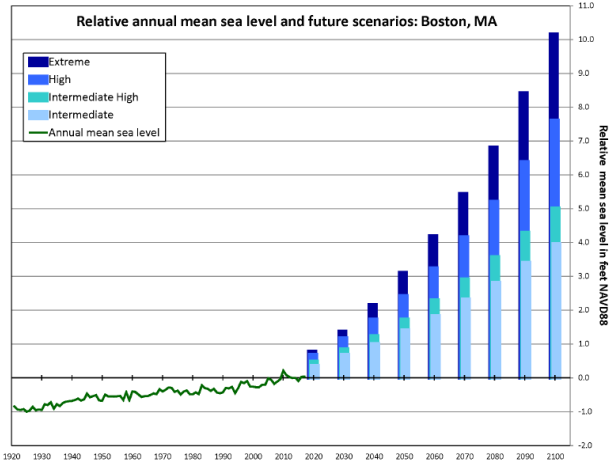


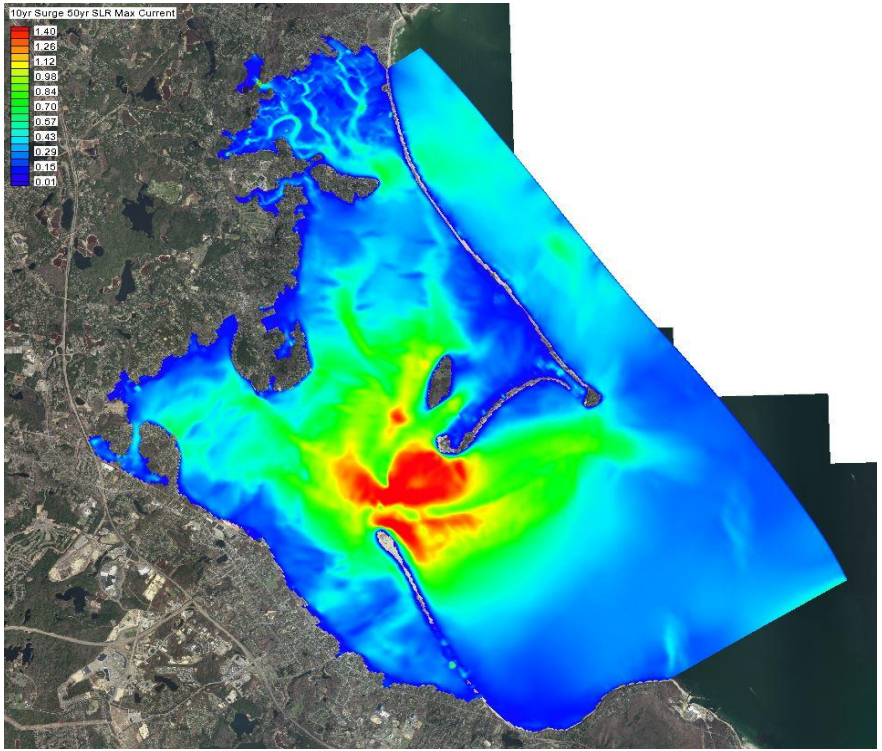
Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Hydrodynamic Modeling:

- Normal tide vs. storm conditions
- Present vs. future sea-level rise conditions



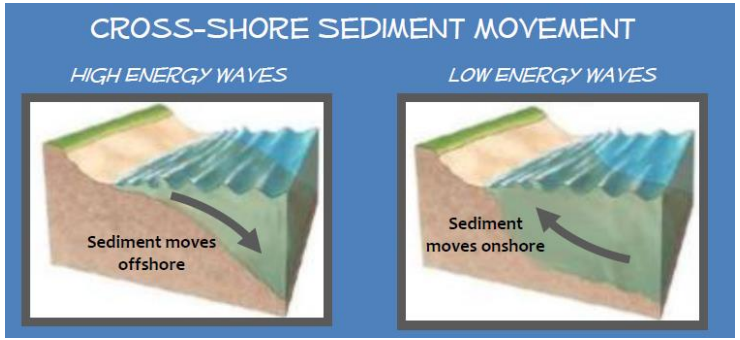


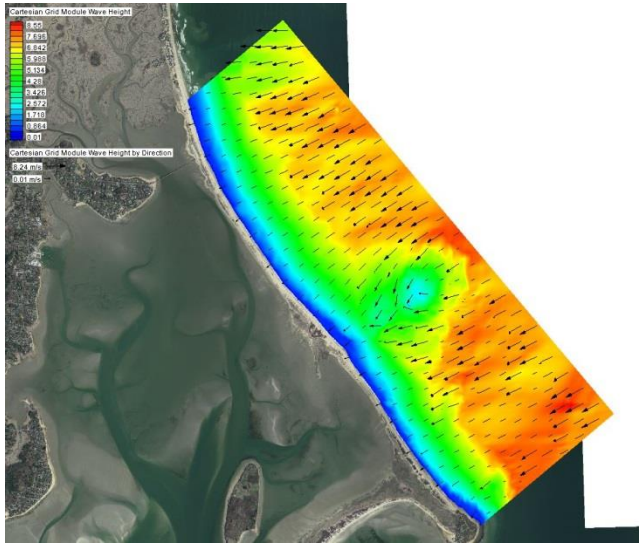
Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

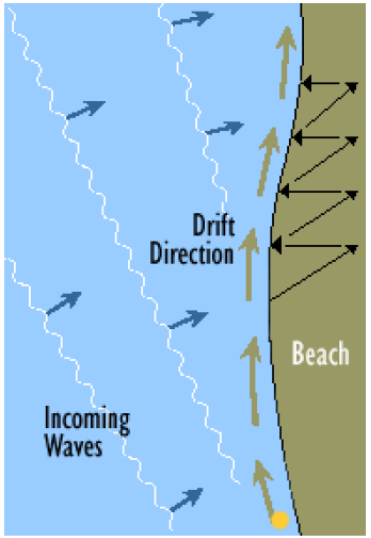
Waves & Sediment Transport:

- Normal tide conditions vs. storm conditions





LONG-SHORE SEDIMENT MOVEMENT

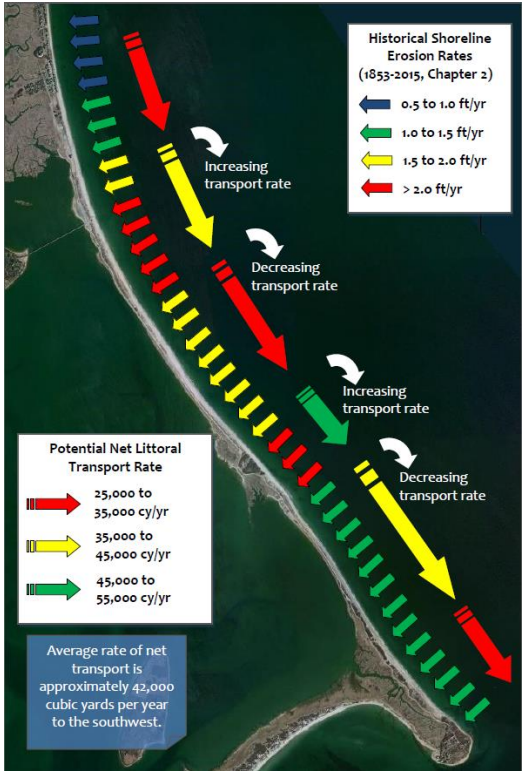


Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Sediment Transport:

- Net sediment transport is from north to south



Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

Conceptual Resiliency Actions

1. Regional Adaptation: Dune and Beach Nourishment
2. Site 1: Duxbury Beach Park Pavilion
3. Site 2: Powder Point Bridge
4. Site 3: Bay Side Channel
5. Site 4: 1st and 2nd Crossover
6. Site 5: High Pines
7. Site 6: High Pines Salt Marsh
8. Site 7: 3rd Crossover
9. Site 8: Bayside New Road
10. Site 9: Plum Hills

Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

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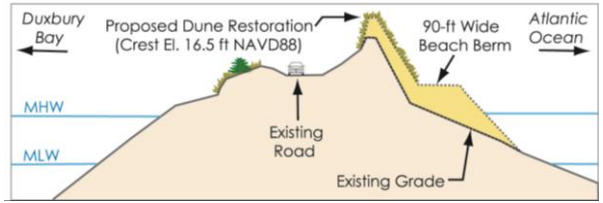

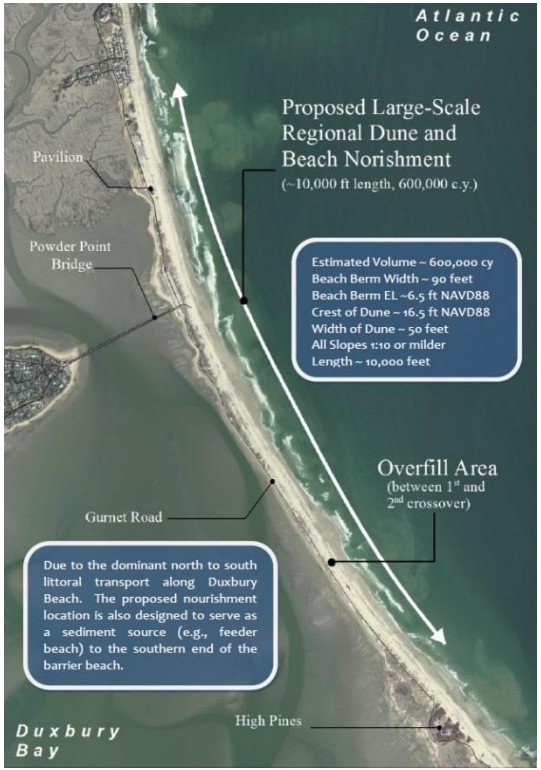

Background & Existing Conditions

November 2016 Coastal Processes Study & Resiliency Recommendations

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Project Specs

- ⇒ 1,000 linear feet
- ⇒ Add 50,000-60,000 tons of compatible material
- ⇒ Elevate crest of dune to 16.5ft NAVD88
- ⇒ Widen dune width to 50ft
- ⇒ Elevate beach berm to 6.5ft NAVD88
- ⇒ Create slopes 1:10 or milder
- ⇒ Plant 22,000 culms American Beach Grass 36in on center

Awarded NAWCA Grant

Background & Existing Conditions

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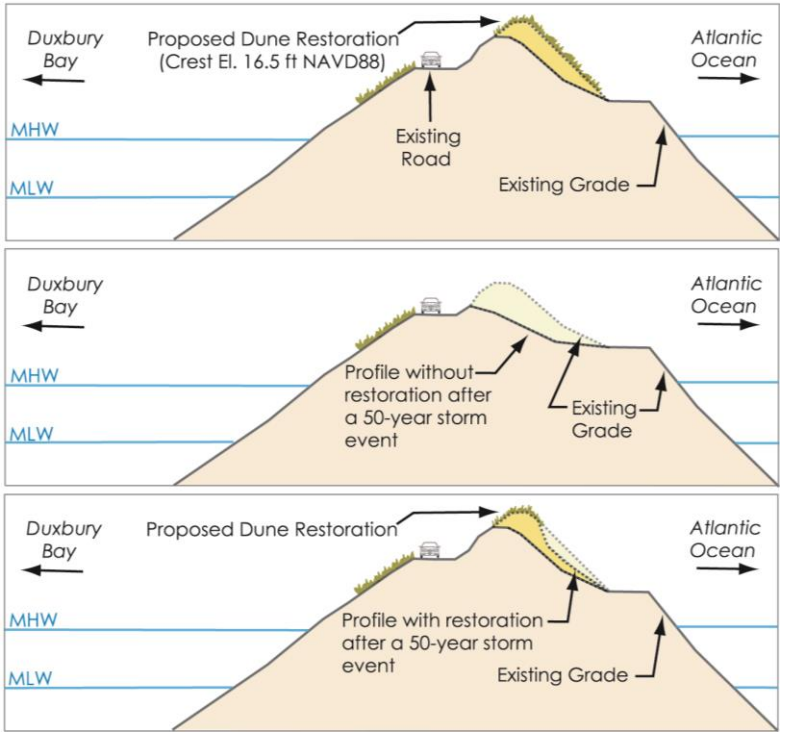

Background & Existing Conditions

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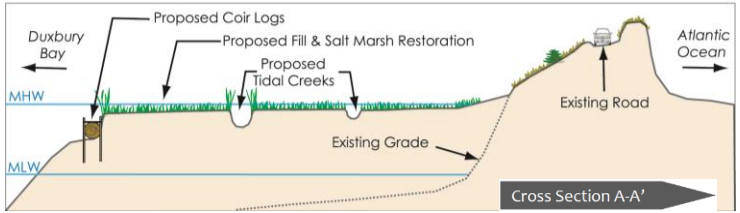


Background & Existing Conditions

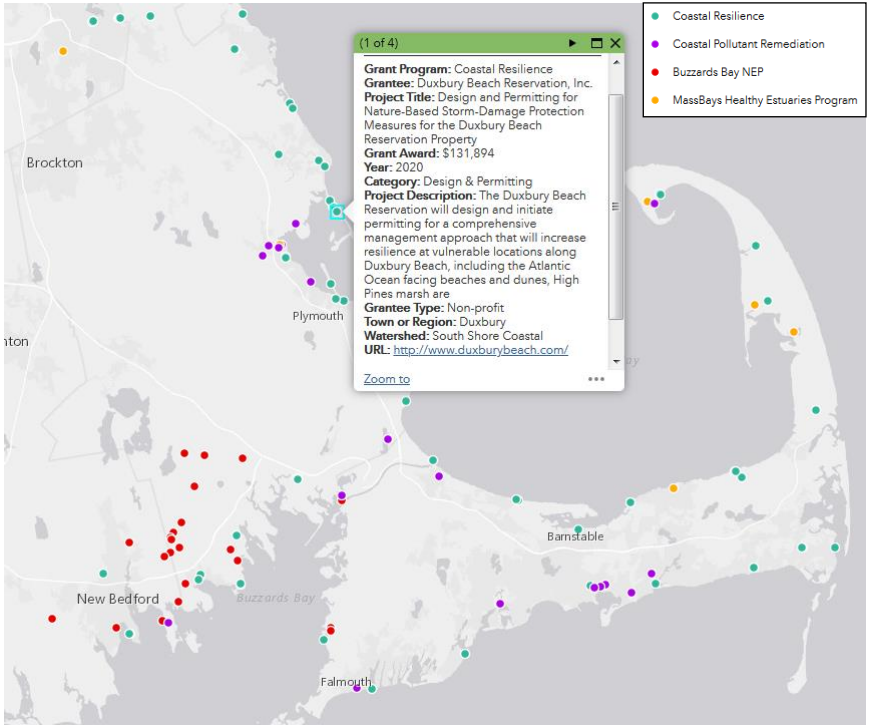
November 2016 Coastal Processes Study & Resiliency Recommendations

Outcomes of 2016 Study:

- Detailed understanding of local coastal processes (present & future)
- A suite of coastal resiliency recommendations
  - Some of these projects, such as the dune restoration between the 1st and 2nd crossover, have already been implemented
- Additional permitting necessary to move remaining recommendations forward

Current CZM Coastal Resiliency Grant

Goals & Scope of Work



Design and Permitting for Nature-Based Storm-Damage Protection Measures

Goals:

- Build on 2016 report recommendations
- Develop a comprehensive management approach
- Flexibility to implement projects on an as needed basis
  - Response to storms and future SLR
  - Availability of funding and/or sand sources

Scope of work:

- Additional field data collection
- Alternatives analysis
- Develop engineering designs
- Begin permitting process (EENF)

Current CZM Coastal Resiliency Grant

Goals & Scope of Work

Design and Permitting for Nature-Based Storm-Damage Protection Measures

Four Key Areas:

1. Ocean-facing beaches & dunes
2. High Pines salt marsh
3. Erosional area of bayside roadway
4. Low areas of roadway vulnerable to flooding

Current CZM Coastal Resiliency Grant

Five Key Areas – Ocean Facing Beaches and Dunes

Design and Permitting for Nature-Based Storm-Damage Protection Measures

Four Key Areas:

1. **Ocean-facing beaches & dunes**
2. High Pines salt marsh
3. Erosional area of bayside roadway
4. Low areas of roadway vulnerable to flooding

Current CZM Coastal Resiliency Grant

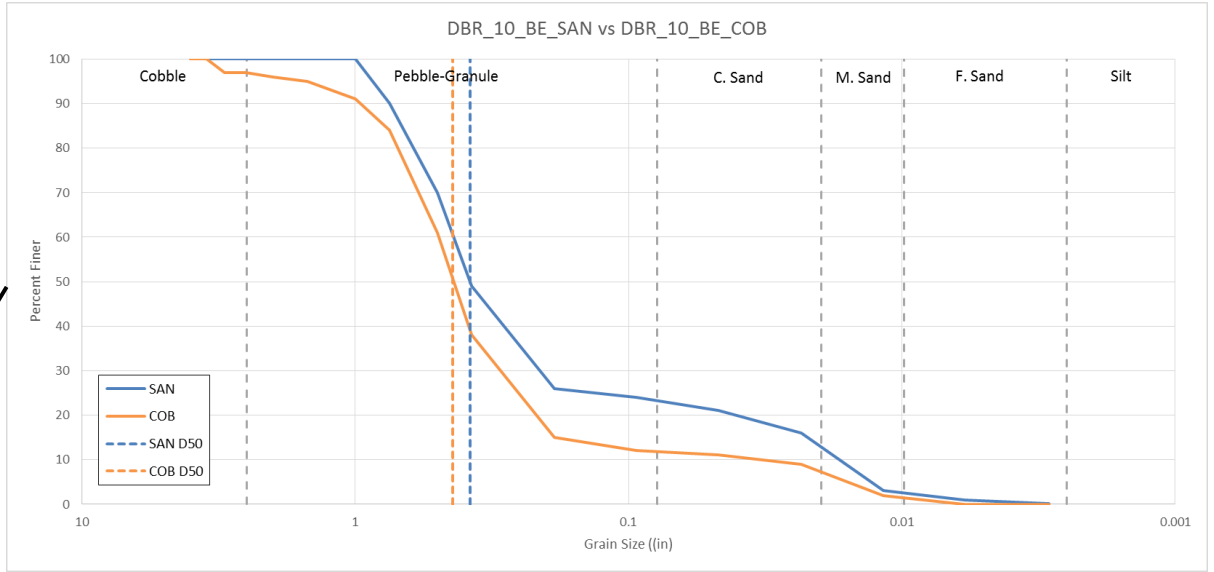
Five Key Areas – Ocean Facing Beaches and Dunes

Resource area delineations – rocky intertidal shore

Current CZM Coastal Resiliency Grant

Five Key Areas – Ocean Facing Beaches and Dunes

Grain size sampling and characterization



Current CZM Coastal Resiliency Grant

Five Key Areas – Ocean Facing Beaches and Dunes

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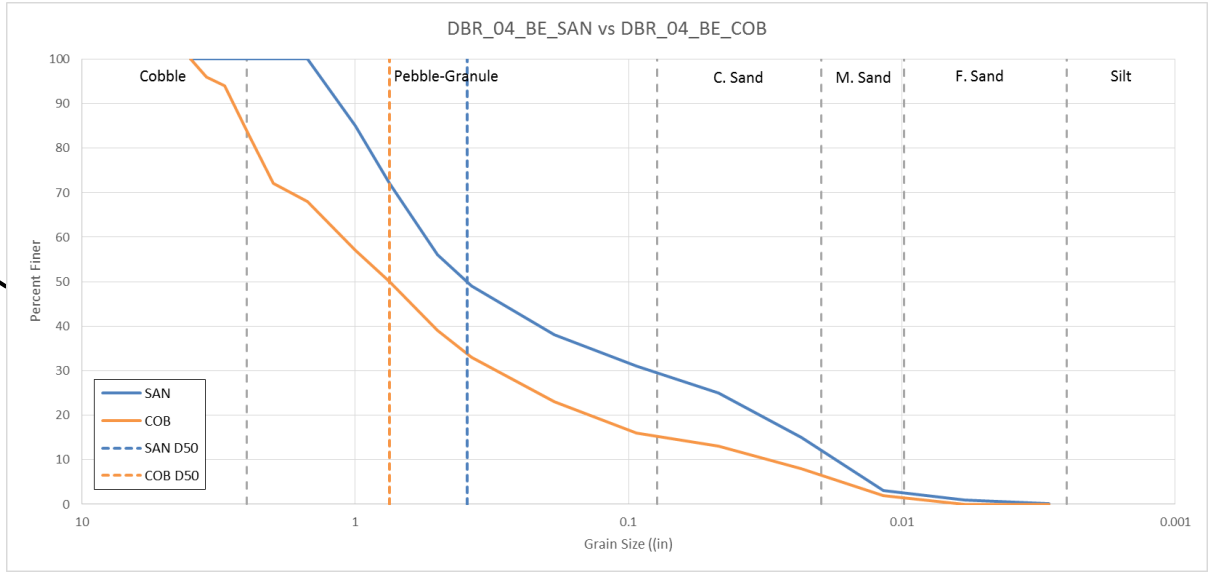
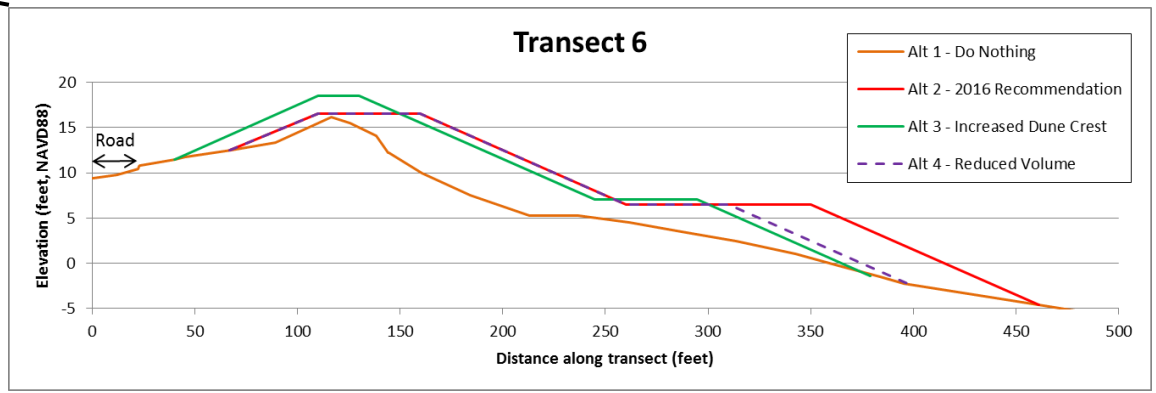


Current CZM Coastal Resiliency Grant

Five Key Areas – Ocean Facing Beaches and Dunes

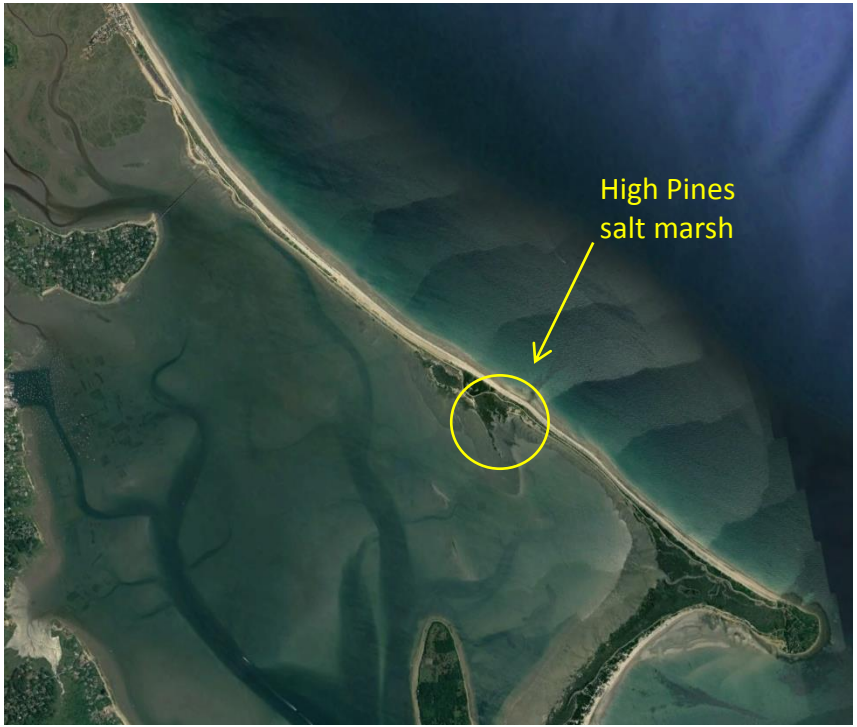
Topographic survey and alternative nourishment designs

	Crest Height (ft, NAVD88)	Crest Width (ft)	Berm Height (ft, NAVD88)	Berm Width (ft)
Alt 2	16.5	50	6.5	90
Alt 3	18.5	20	7.0	50
Alt 4	16.5	50	6.5	50



Current CZM Coastal Resiliency Grant

Five Key Areas – High Pines Salt Marsh



Design and Permitting for Nature-Based Storm-Damage Protection Measures

Four Key Areas:

1. Ocean-facing beaches & dunes
2. **High Pines salt marsh**
3. Erosional area of bayside roadway
4. Low areas of roadway vulnerable to flooding

Current CZM Coastal Resiliency Grant

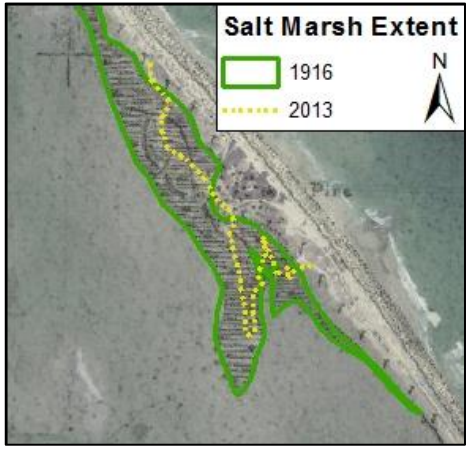
Five Key Areas – High Pines Salt Marsh

Salt marsh habitat delineation &

topographic survey of the High Pines salt marsh area

Current CZM Coastal Resiliency Grant

Five Key Areas – High Pines Salt Marsh



Salt marsh restoration alternatives

Current CZM Coastal Resiliency Grant

Five Key Areas – Erosional Area on Bayside of Roadway

Design and Permitting for Nature-Based Storm-Damage Protection Measures

Four Key Areas:

1. Ocean-facing beaches & dunes
2. High Pines salt marsh
3. **Erosional area of bayside roadway**
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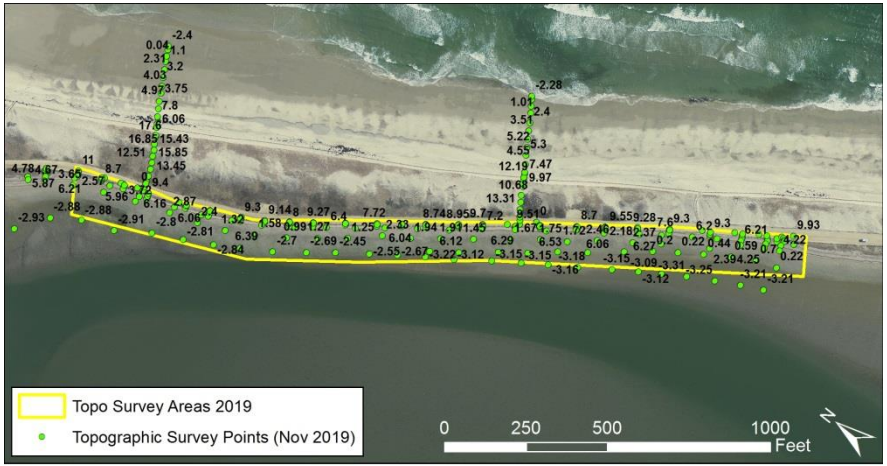
Current CZM Coastal Resiliency Grant

Five Key Areas – Erosional Area on Bayside of Roadway

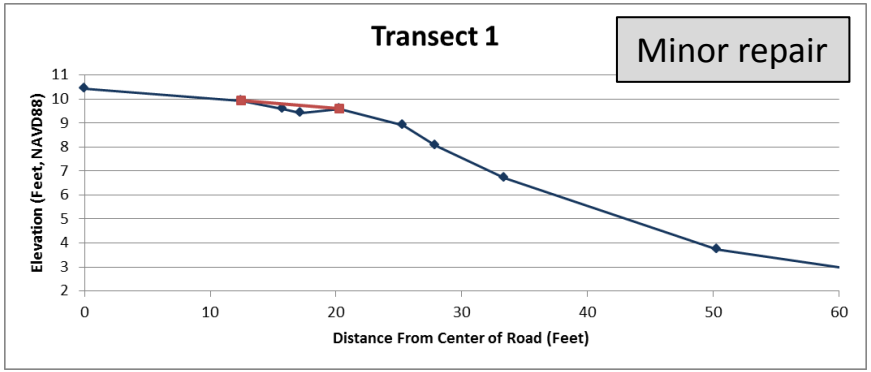
Existing conditions

- Resource Area Delineations
- Topographic Survey

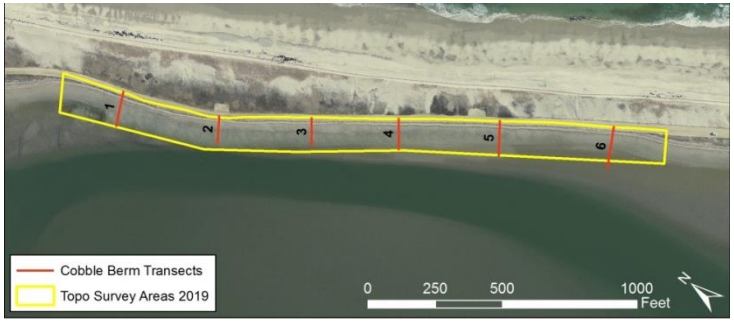


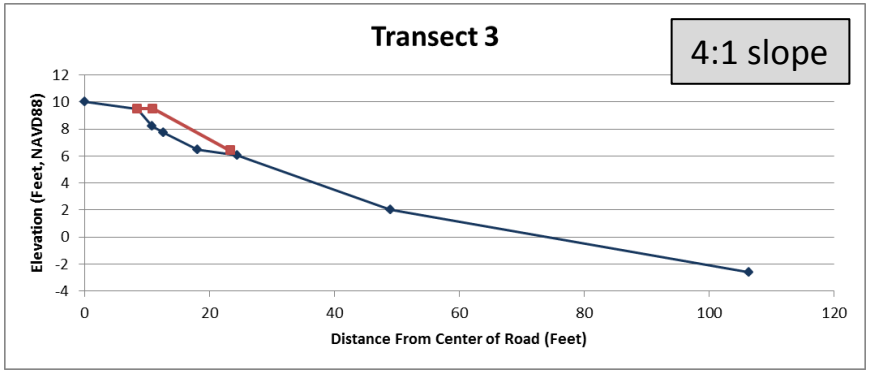
Current CZM Coastal Resiliency Grant

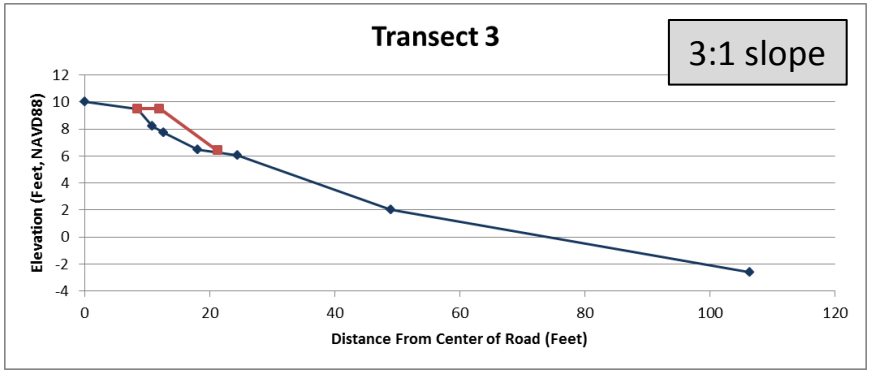
Five Key Areas – Erosional Area on Bayside of Roadway



Alternative designs for cobble berm







Current CZM Coastal Resiliency Grant

Five Key Areas – Low Areas of Roadway Vulnerable to Flooding

Design and Permitting for Nature-Based Storm-Damage Protection Measures

Four Key Areas:

1. Ocean-facing beaches & dunes
2. High Pines salt marsh
3. Erosional area of bayside roadway
4. **Low areas of roadway vulnerable to flooding**

Current CZM Coastal Resiliency Grant

Five Key Areas – Low Areas of Roadway Vulnerable to Flooding

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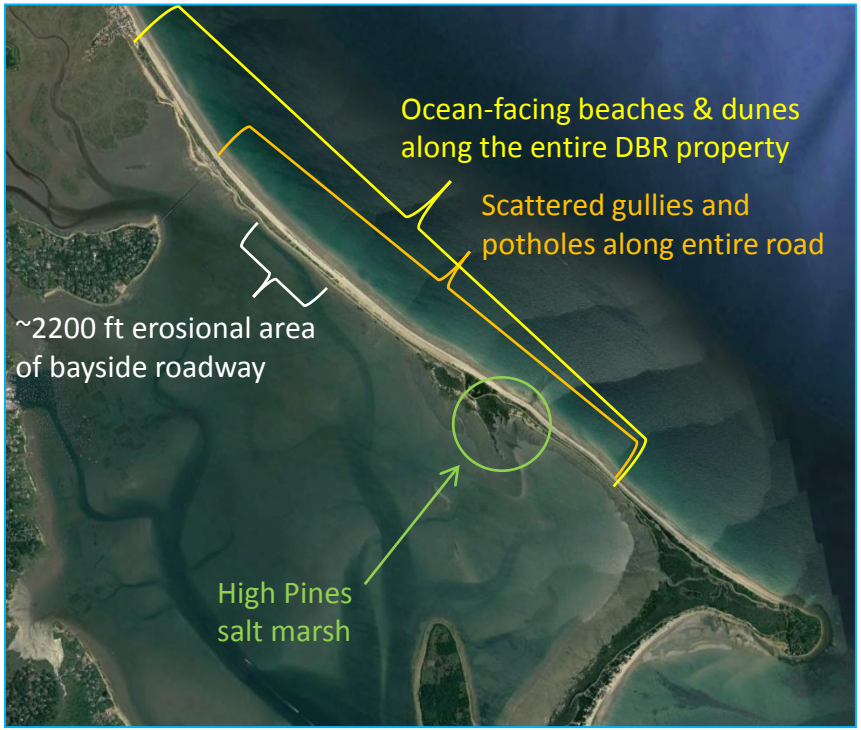

Design and Permitting for Nature-Based Storm-Damage Protection Measures

Five Key Areas:

1. Ocean-facing beaches & dunes
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3. Erosional area of bayside roadway
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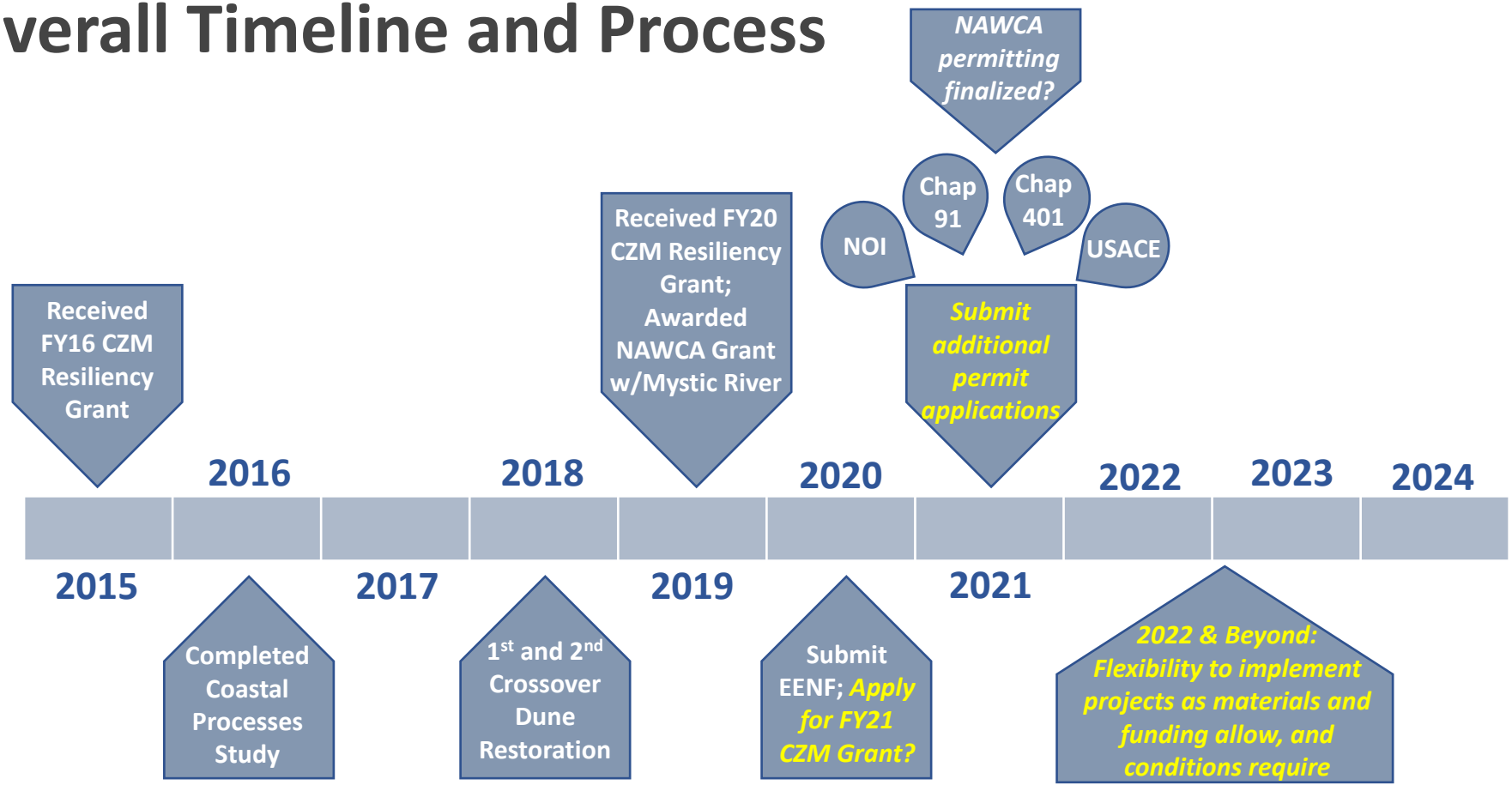
Current CZM Coastal Resiliency Grant

Permitting

Remaining Steps:

1. Finalize alternatives analyses
2. Develop engineering designs
3. Submit Expanded Environmental Notification Form (EENF) to MEPA
4. Second public outreach event (*date TBD*)
5. Deadline June 30, 2020

Overall Timeline and Process



Questions?