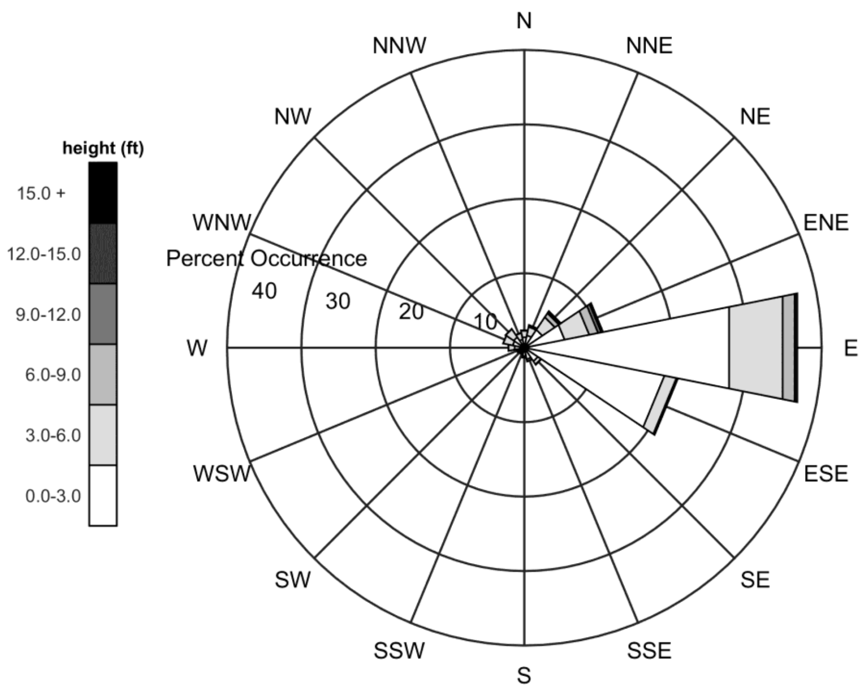
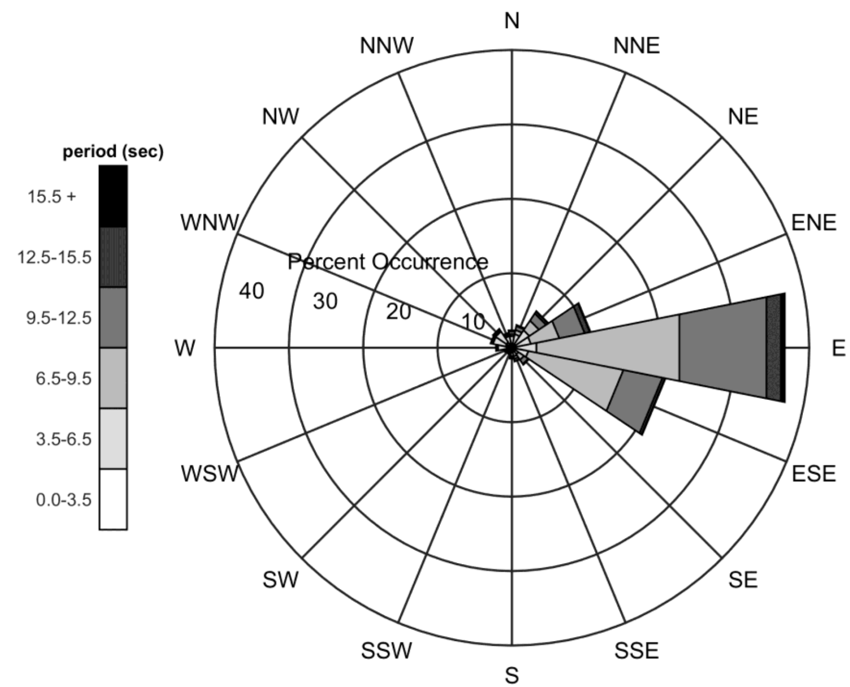

Crescent Beach
Hull, MA
April 13, 2015

Wave Conditions (1980-2012)

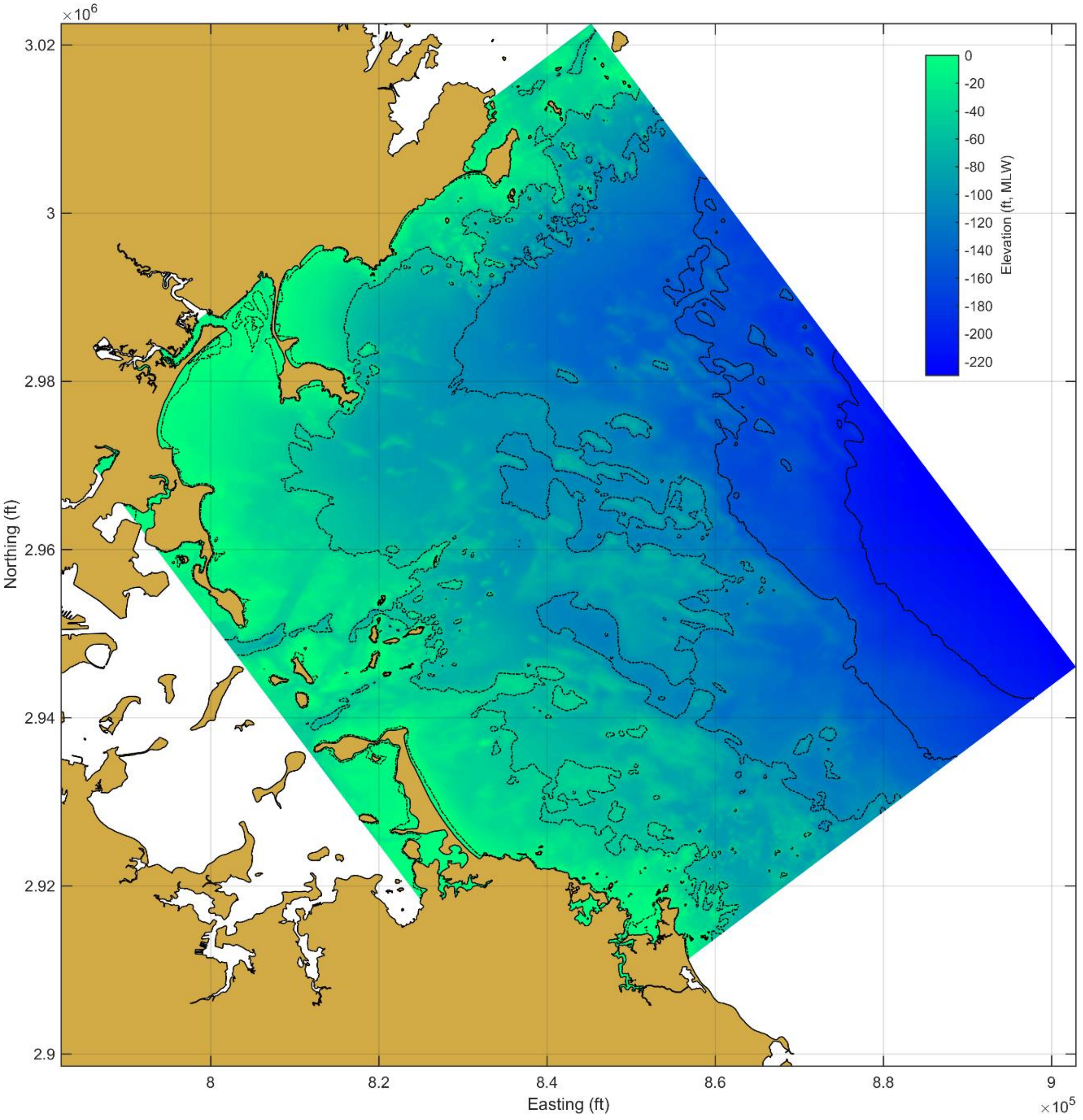
- Hindcast data from WIS station 63053
- Station located 13.7 miles north-east of Crescent Beach





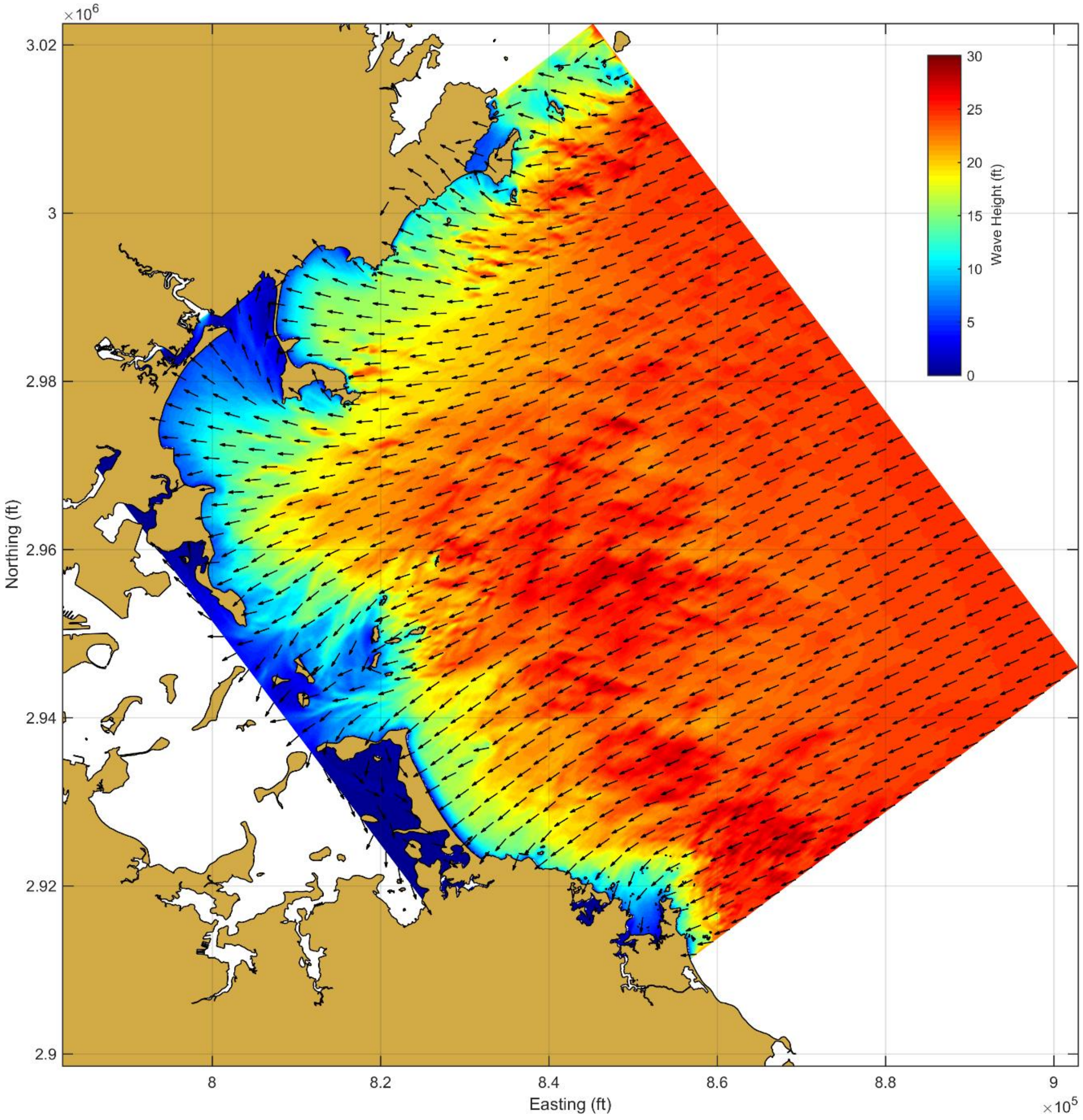
SWAN Model Grid Bathymetry

- 164 ft (50 m) grid spacing
- Bathymetry from 2010 USACE LIDAR survey



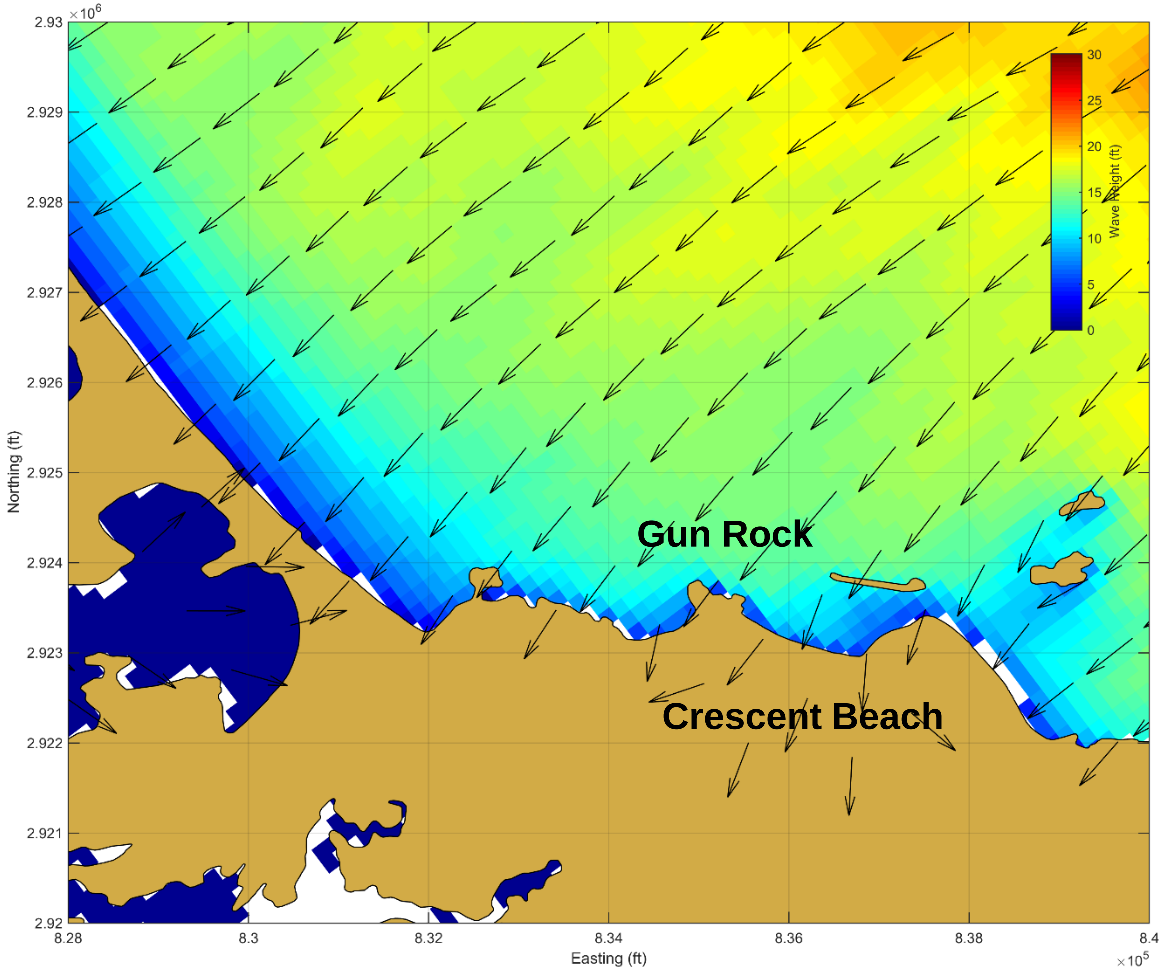
SWAN Model Results

- 100-year return period wave condition
- 26.3 ft wave height
- 15 s wave period
- Waves from east
- 14.9 ft MLW water level



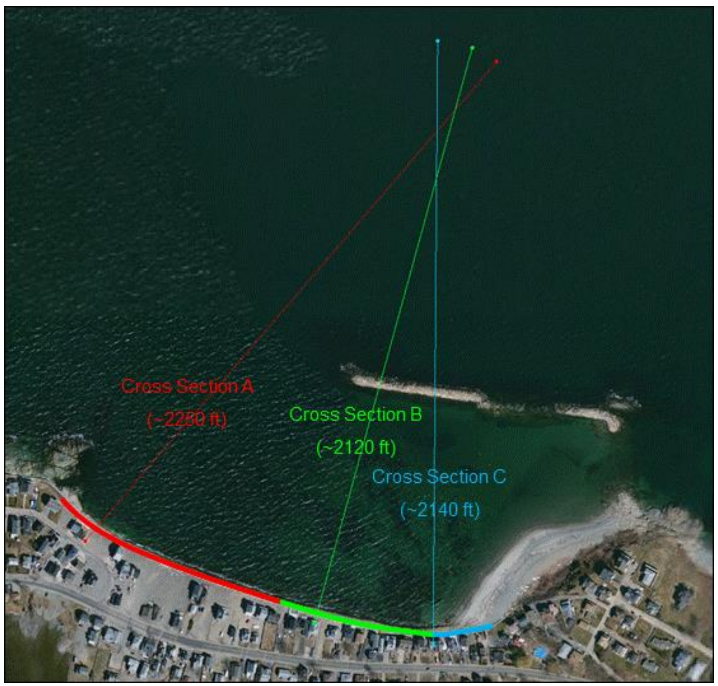
SWAN Model Results

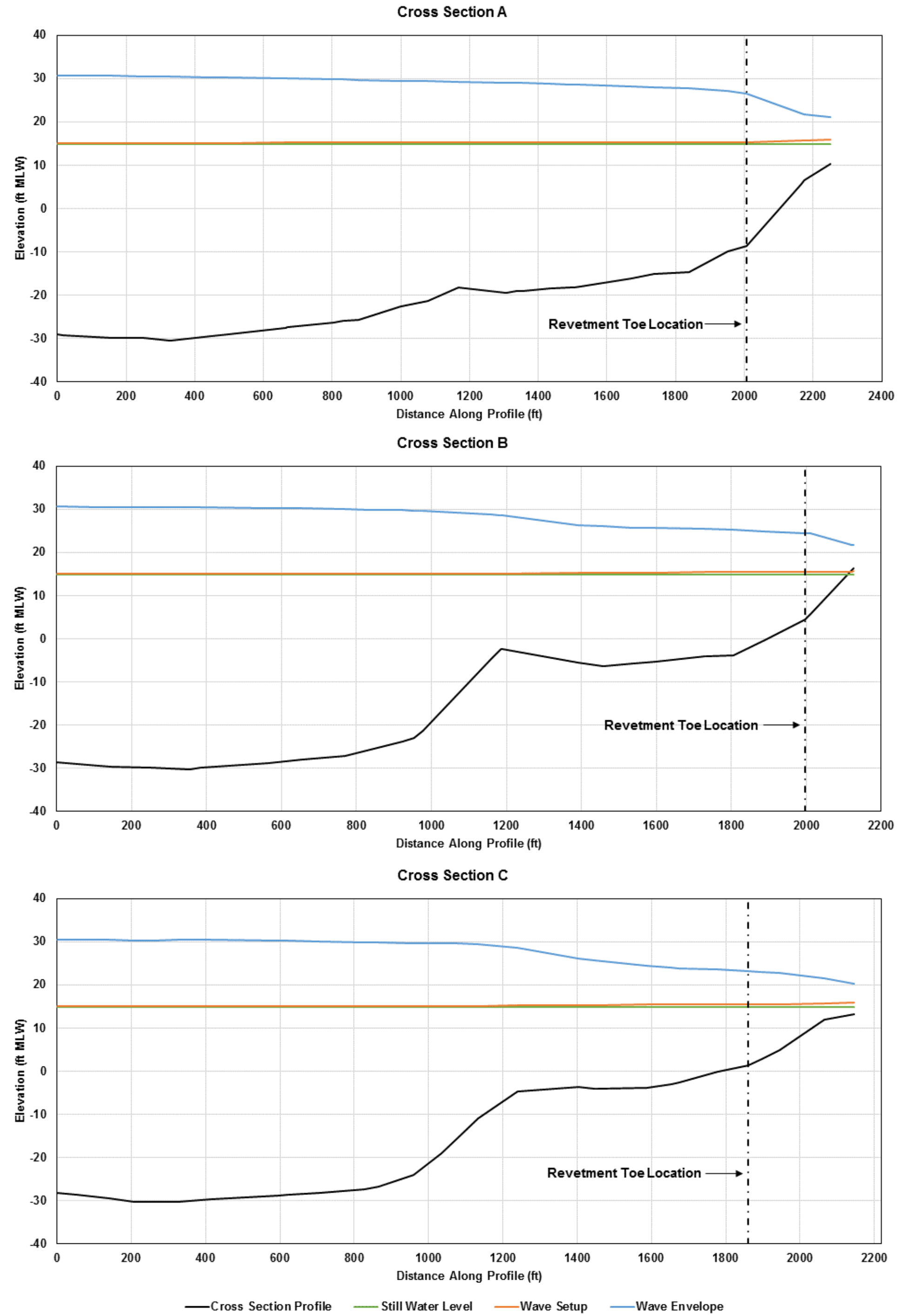
- Waves reaching Crescent Beach are <9 ft in height



Existing Conditions

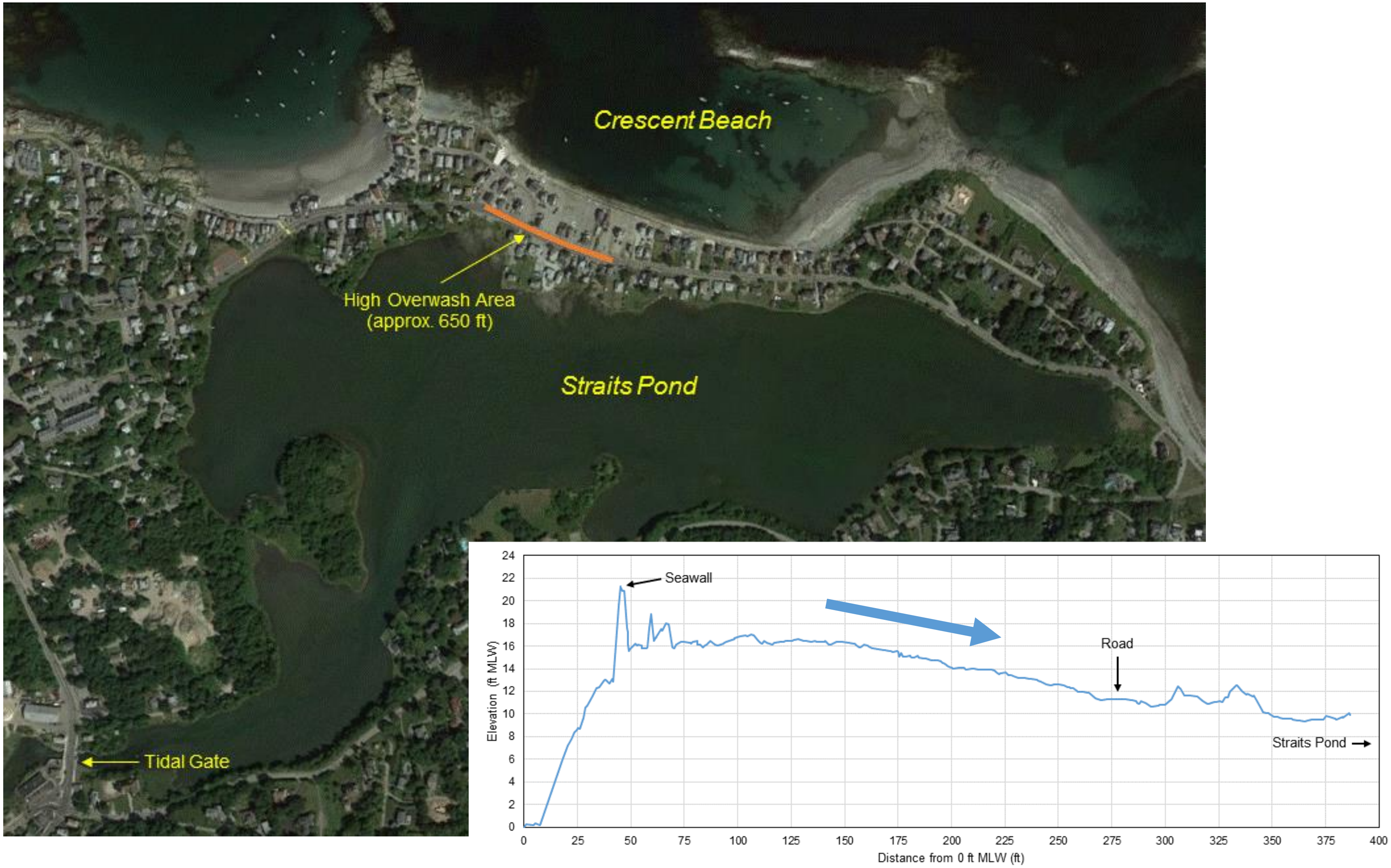
- Breakwater is under-resolved with 164 ft grid spacing (Cross Section B and C)





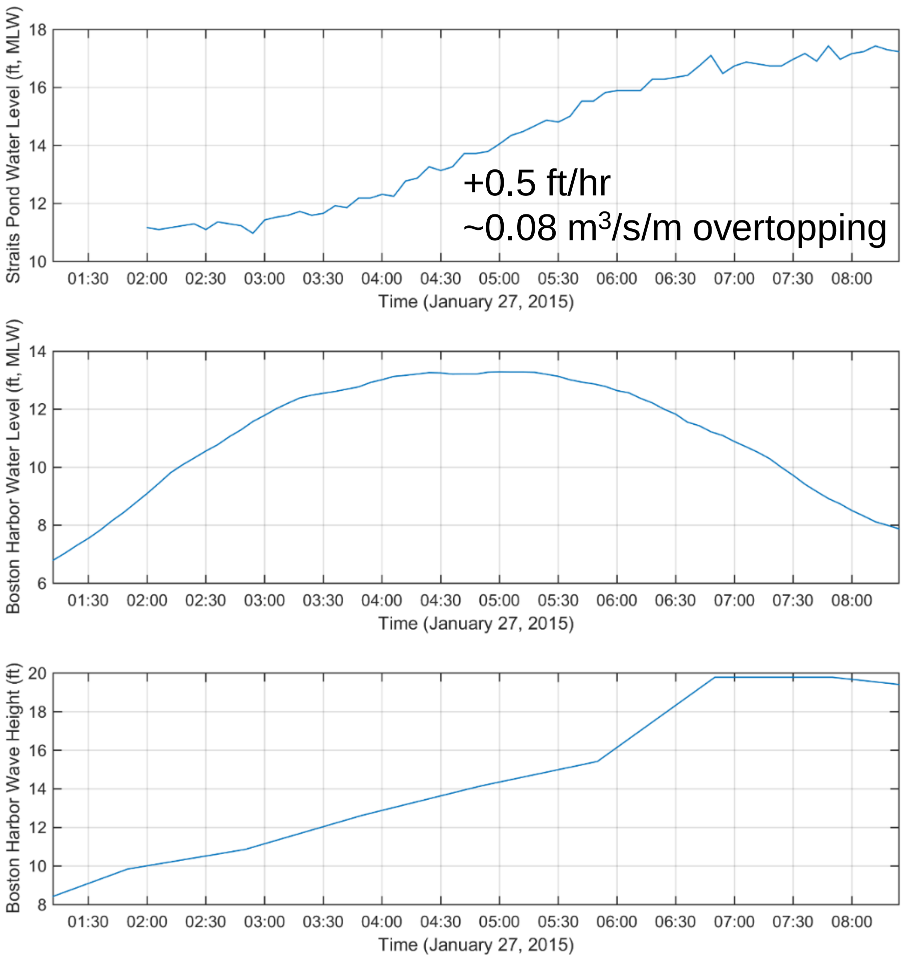
Existing Conditions - Straits Pond

- Overtopped water and overwash from Crescent Beach flows into Straits Pond

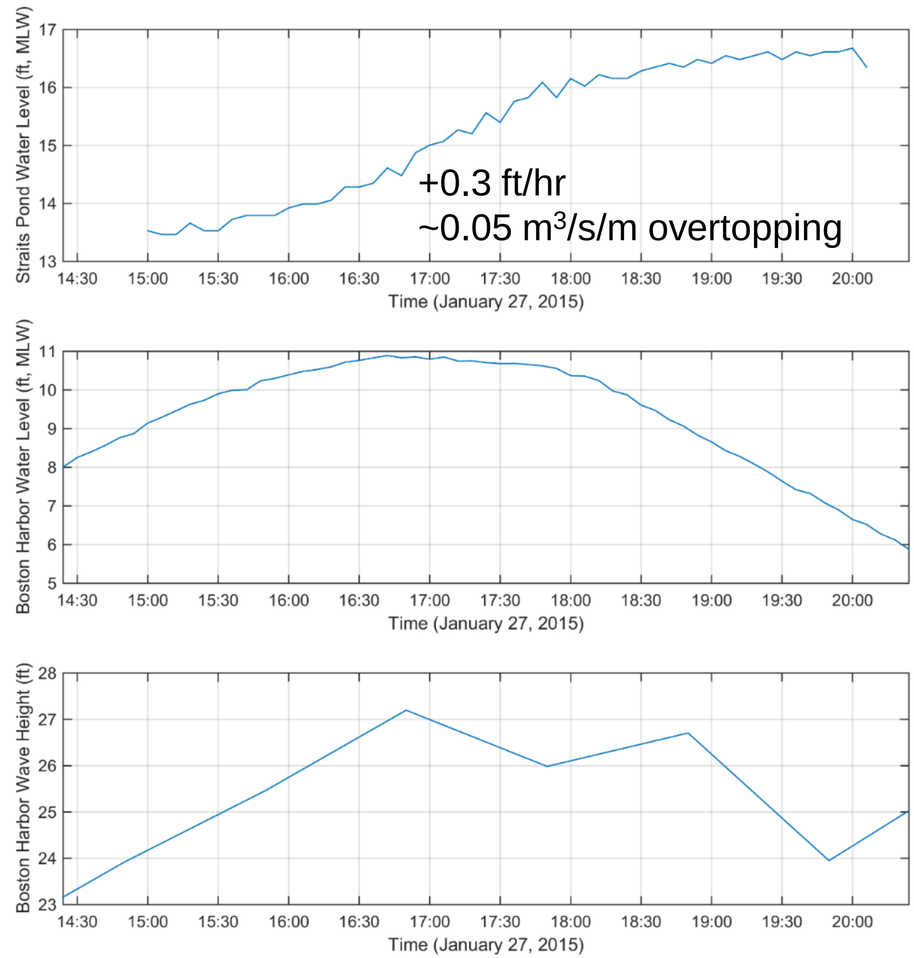


Existing Conditions - Straits Pond

- During the January 27, 2015 blizzard, the Straits Pond tidal gate was closed before the AM and PM high tide
- Overtopping estimated based on area of pond (92 acres) and width of high overwash area (650 ft)

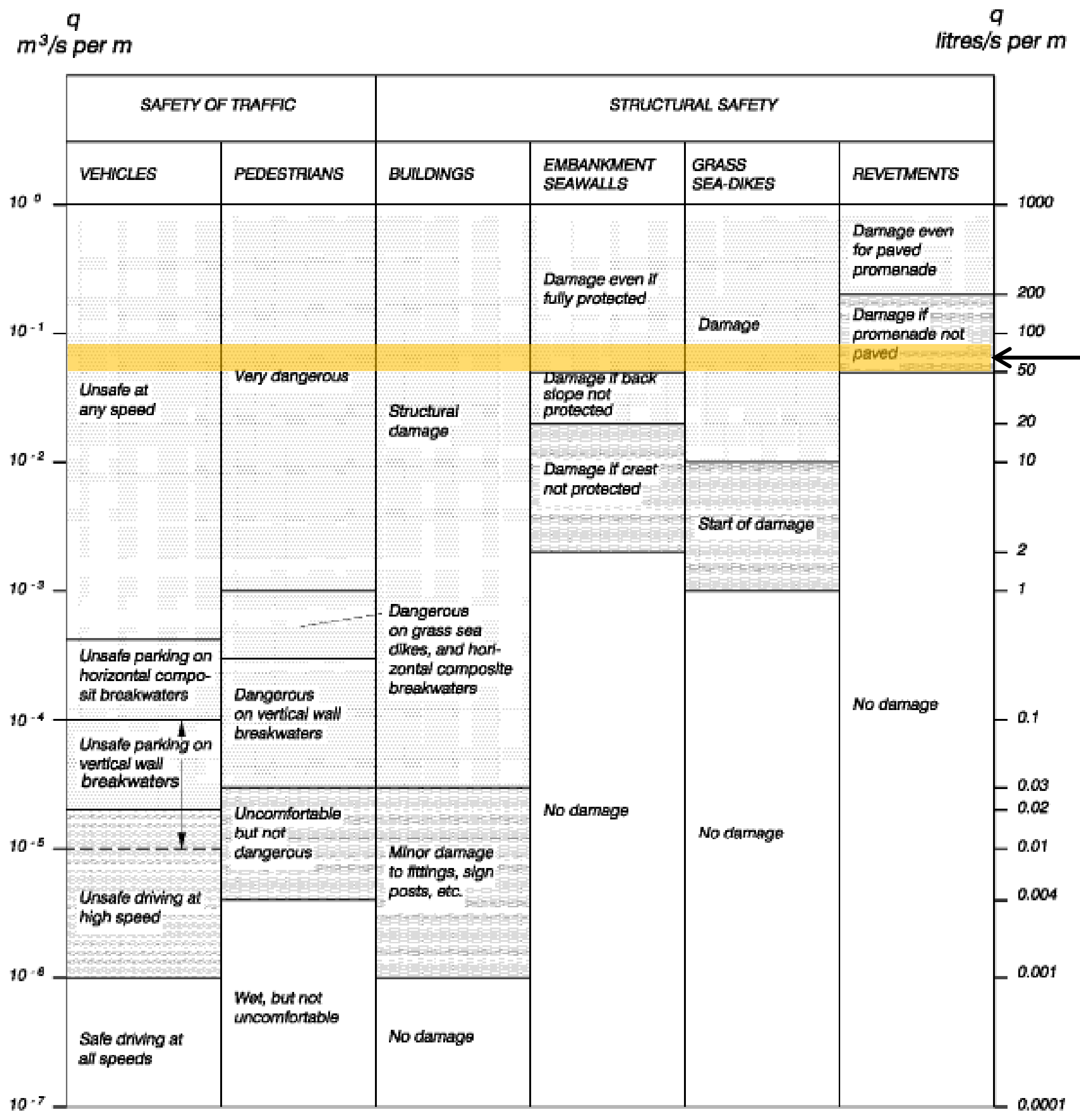


AM High Tide



PM High Tide

Critical Average Overtopping Values



Estimated overtopping during January 27, 2015 blizzard

Shore Protection Alternatives

1. No Action

Benefits	Disadvantages
• None	• Continued overtopping and storm damage to homes and public infrastructure • Further decay and failure of existing revetment and seawall structures • Increased future costs to repair or rehabilitate the structure

Shore Protection Alternatives

2. Beach Nourishment

Benefits	Disadvantages
• Restoration of the lost aerial and sub-tidal beach • Nourishment will provide wave dissipation and storm protection • Creation of a recreational resource	• Severe impacts and/or destruction of inter-tidal and sub-tidal habitats, benthic communities, and nearshore resources areas • Regular and episodic maintenance and re-nourishment required • Does not address or repair the failing coastal infrastructure • Impacts to the community during construction due to the large number of trucks trips required to deliver the nourishment material to the project site

Shore Protection Alternatives

3. Nearshore Submerged Wave Break

Benefits	Disadvantages
• The structure will provide wave dissipation and storm protection especially for lower period wave events • Reduce wave overtopping and storm damage along the shoreline • Potential increase in habitat depending on the wave break approach selected (WADS or Reef Balls)	• Potential not effective at dissipating waves • Impacts and/or destruction of sub-tidal habitats and benthic communities beneath the template of the wave break structure • The structure will not be submerged for all stages of the tide if design appropriately • Navigation hazard for mariners entering or exiting the mooring field • Does not address or repair the failing coastal infrastructure • Impacts to the community during construction due to the large number of trucks trips required to deliver the nourishment material to the project site

Shore Protection Alternatives

4. Rehabilitation of the Existing Revetment and Seawall

Benefits	Disadvantages
• The reconstructed structures will increase wave dissipation, reduce wave over topping, and provide a greater level of storm protection • Restore the shore protection along the Atlantic Avenue • Minimal impacts to nearshore and offshore benthic and aquatic resources	• Will not restore the beach • Wave overtopping during severe events could still result in potential damage • Minor impacts to the benthic resources immediately in front of the structure during construction

Proposed Revetment and Seawall Designs

- Raise the existing seawall elevation
- Replace with existing grouted revetment sections with larger armor stones (6 to 7 tons) to increase wave energy dissipation
- The revetment slope may range from 1:1.5 to 1:3

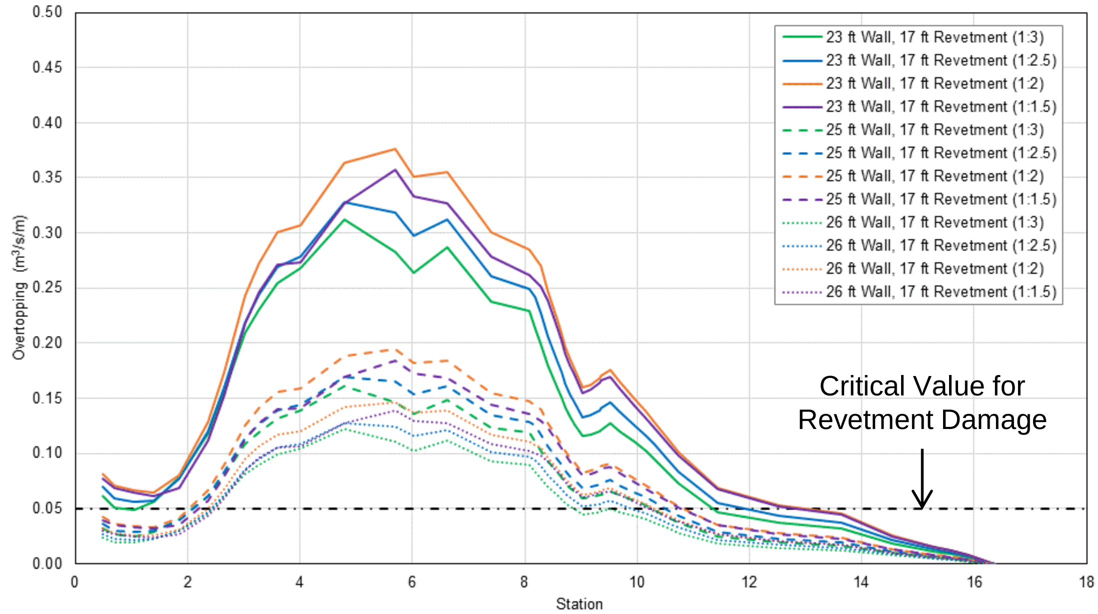
Seven design options:

1. Increase the elevation of the seawall to 23 ft MLW and revetment crest to 17 ft MLW
2. Increase the elevation of the seawall to 25 ft MLW and revetment crest to 17 ft MLW
3. Increase the elevation of the seawall to 26 ft MLW and revetment crest to 17 ft MLW
4. Increase the elevation of the seawall and revetment crest to 23 ft MLW
5. Increase the elevation of the seawall to 25 ft MLW and revetment crest to 23 ft MLW
6. Increase the elevation of the seawall to 26 ft MLW and revetment crest to 23 ft MLW
7. Increase the elevation of the seawall and revetment crest to 25 ft MLW

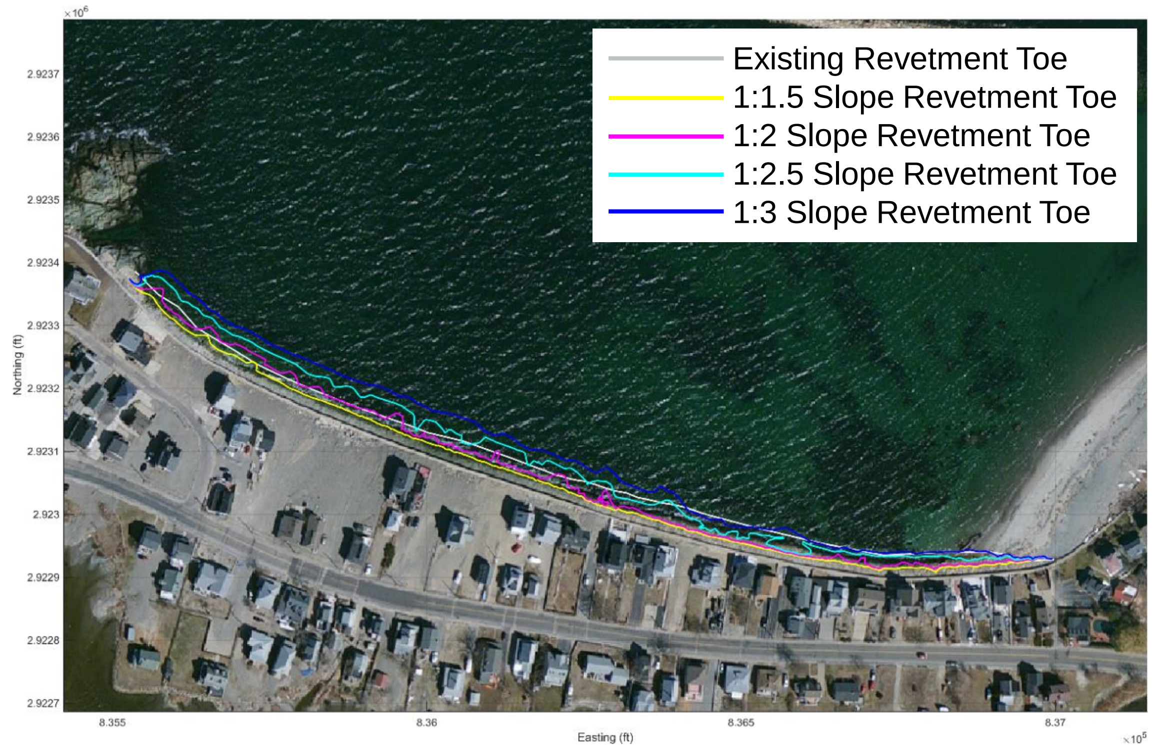
Option 1, 2 & 3

17 ft MLW Revetment

- Overtopping estimated by Pedersen (1996)

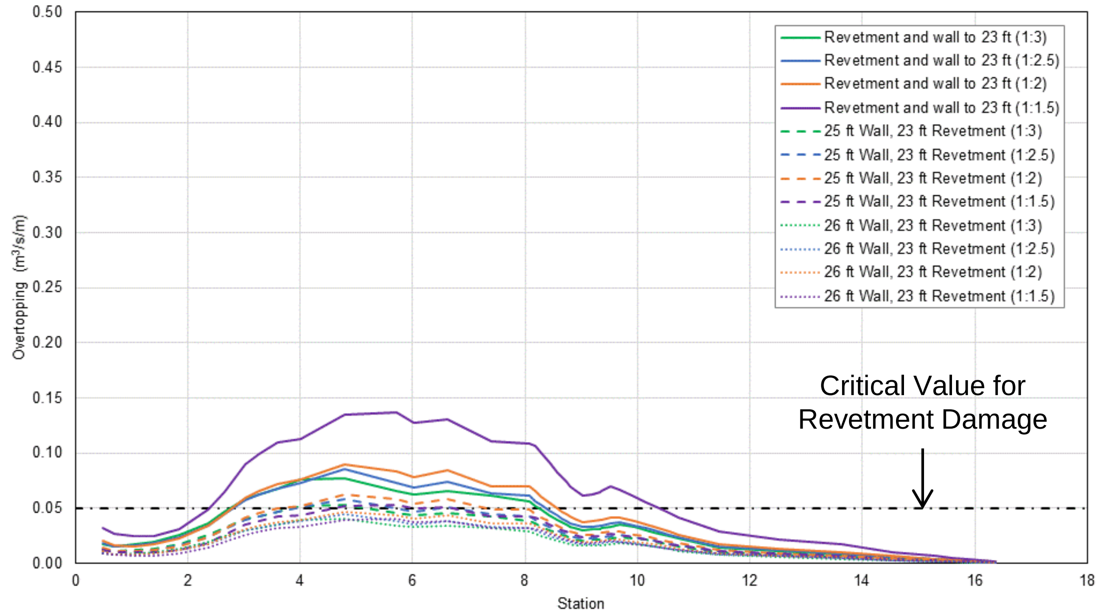


Average distance from proposed revetment toe to existing revetment toe.		
Revetment Slope	Station 0+50 to 10+00 17 ft MLW	Station 10+25 to 16+25 17 ft MLW
1:1.5	-10 ft	-26 ft
1:2	0 ft	-20 ft
1:2.5	23 ft	-10 ft
1:3	39 ft	0 ft



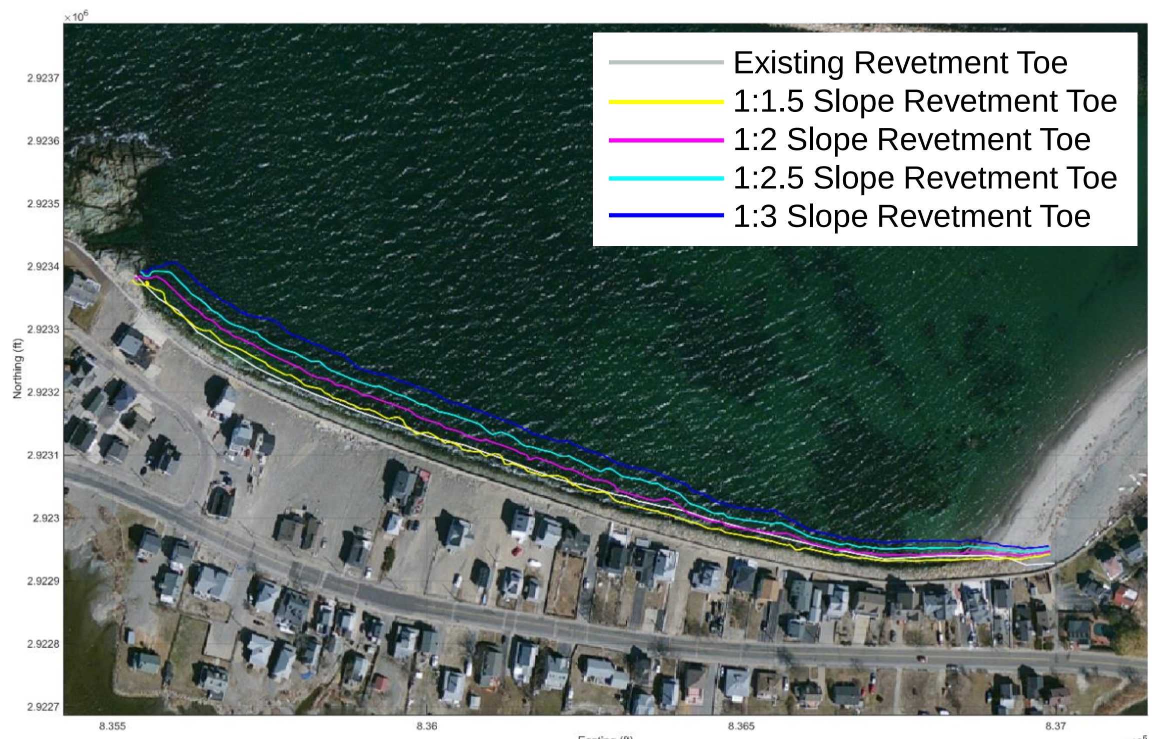
Option 4, 5 & 6
23 ft MLW Revetment

- Overtopping estimated by Pedersen (1996)



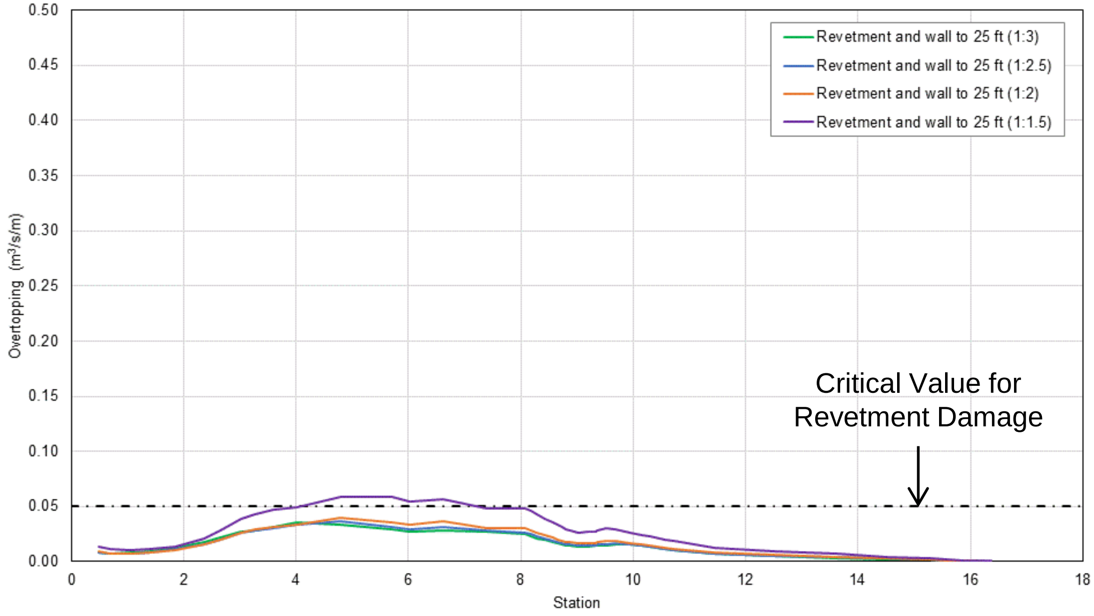
Average distance from proposed revetment toe to existing revetment toe.

Revetment Slope	Station 0+50 to 10+00 23 ft MLW	Station 10+25 to 16+25 23 ft MLW
1:1.5	12 ft	-11 ft
1:2	30 ft	0 ft
1:2.5	46 ft	13 ft
1:3	72 ft	23 ft



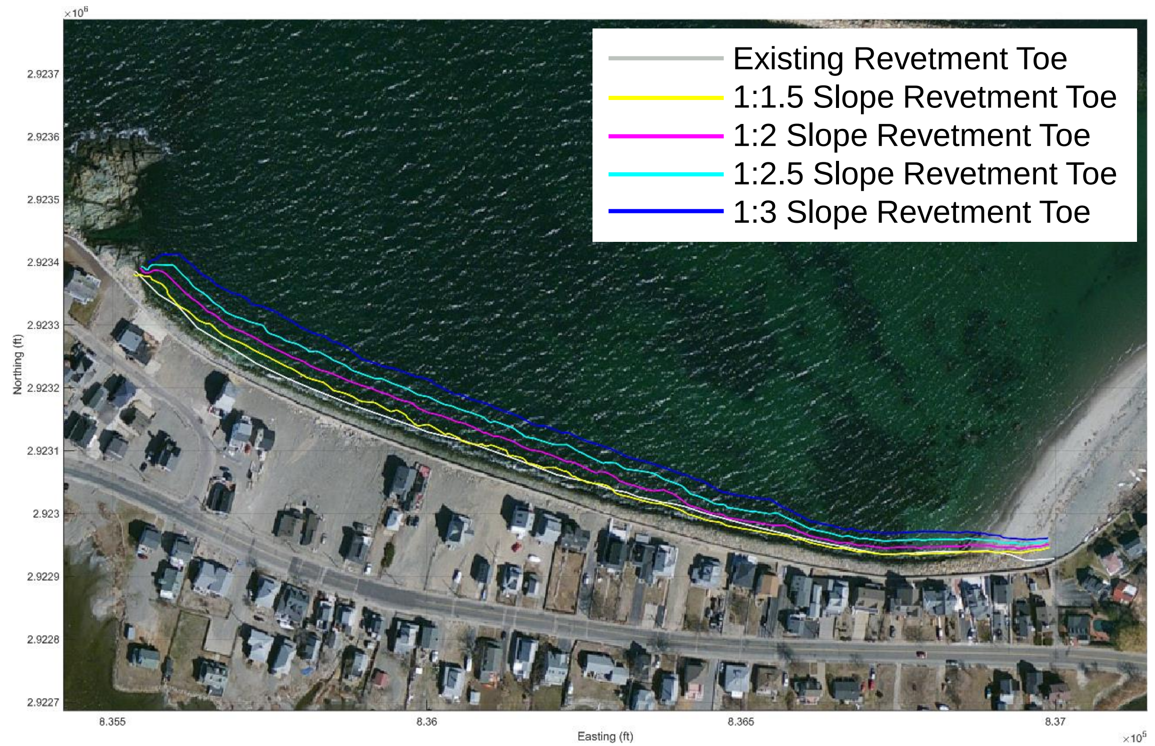
Option 7
25 ft MLW Revetment

- Overtopping estimated by Pedersen (1996)

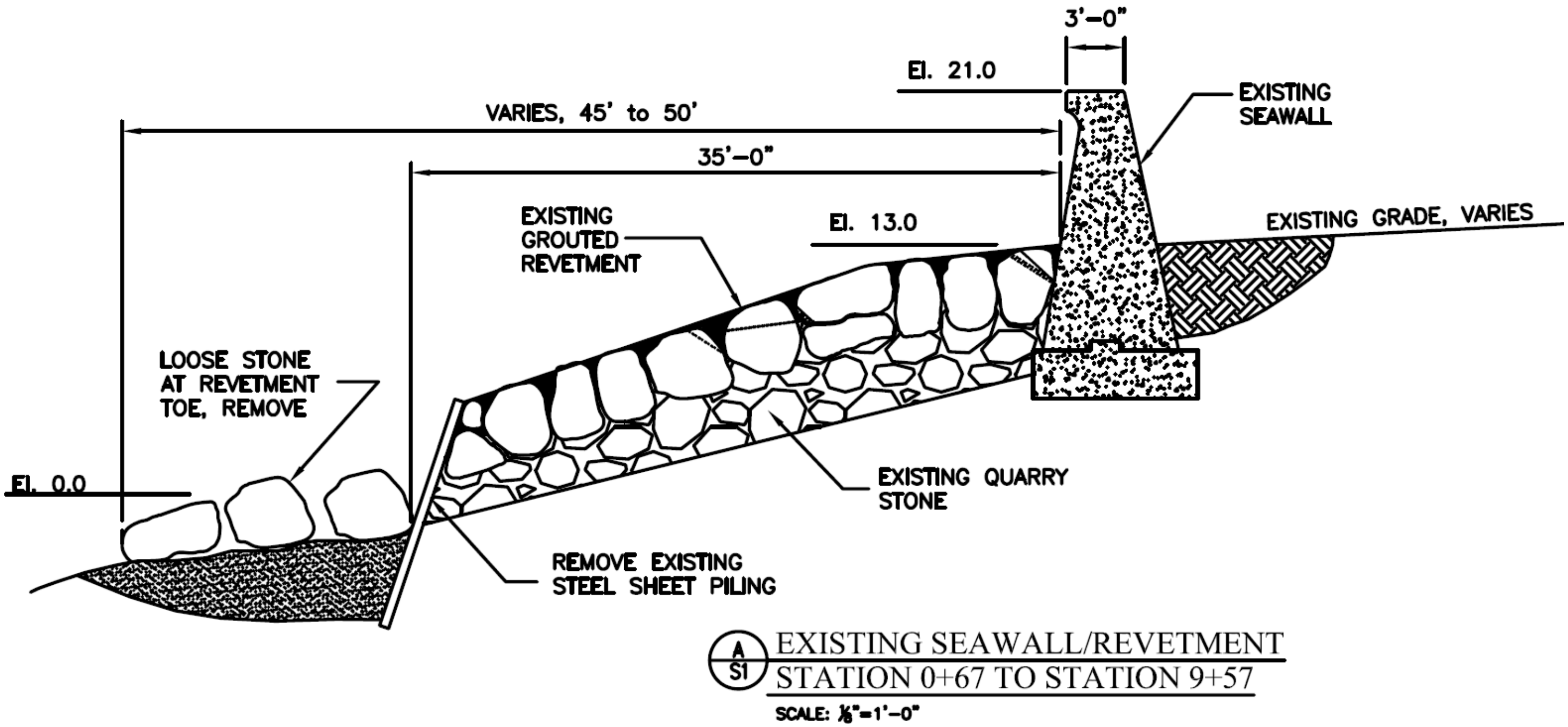


Average distance from proposed revetment toe to existing revetment toe.

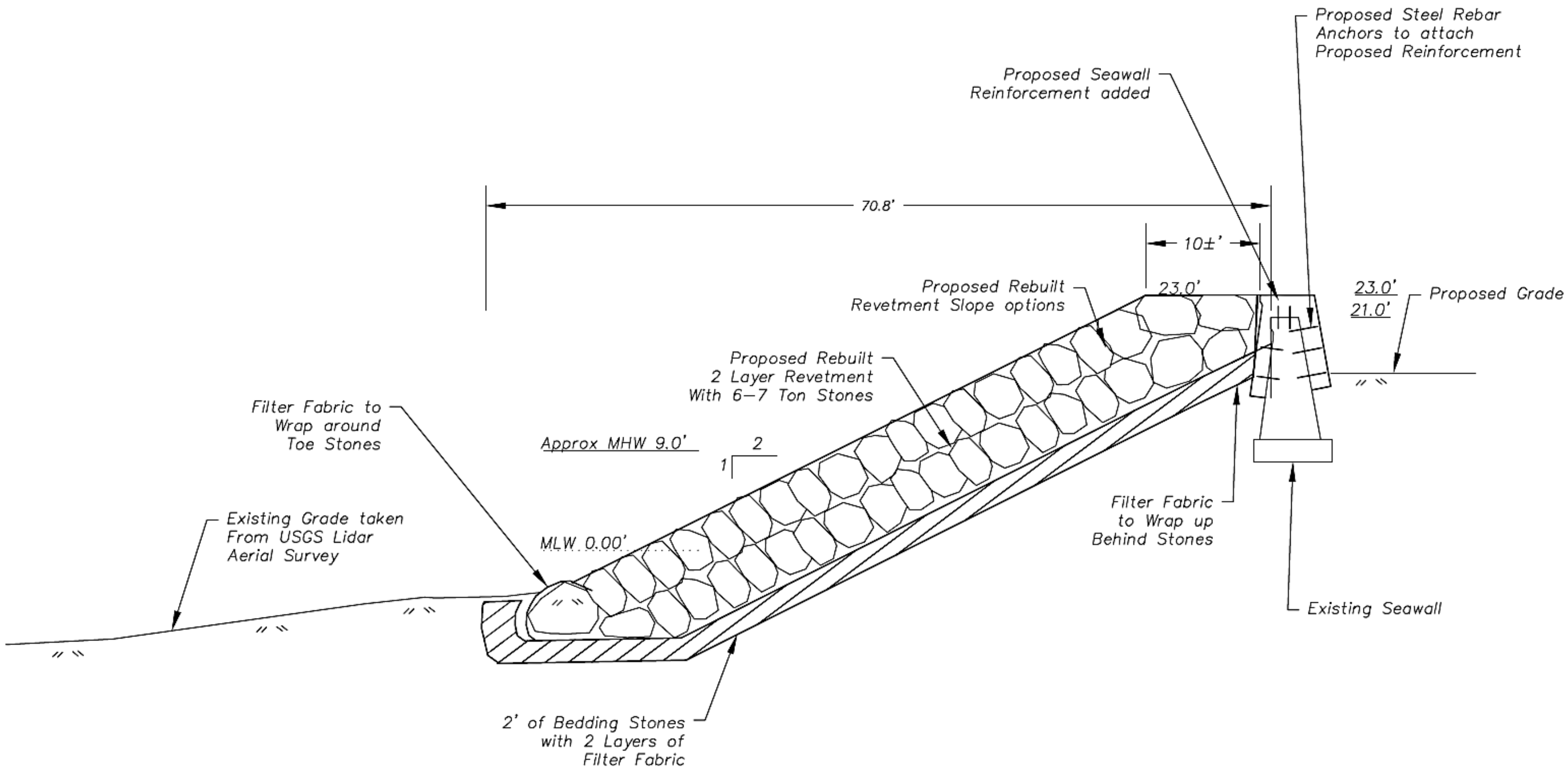
Revetment Slope	Station 0+50 to 10+00 25 ft MLW	Station 10+25 to 16+25 25 ft MLW
1:1.5	16 ft	0 ft
1:2	33 ft	10 ft
1:2.5	52 ft	16 ft
1:3	82 ft	30 ft



Existing Typical Cross Section



Proposed Design for Station 0+00 to 10+00



Proposed Design for Station 10+25 to 16+50