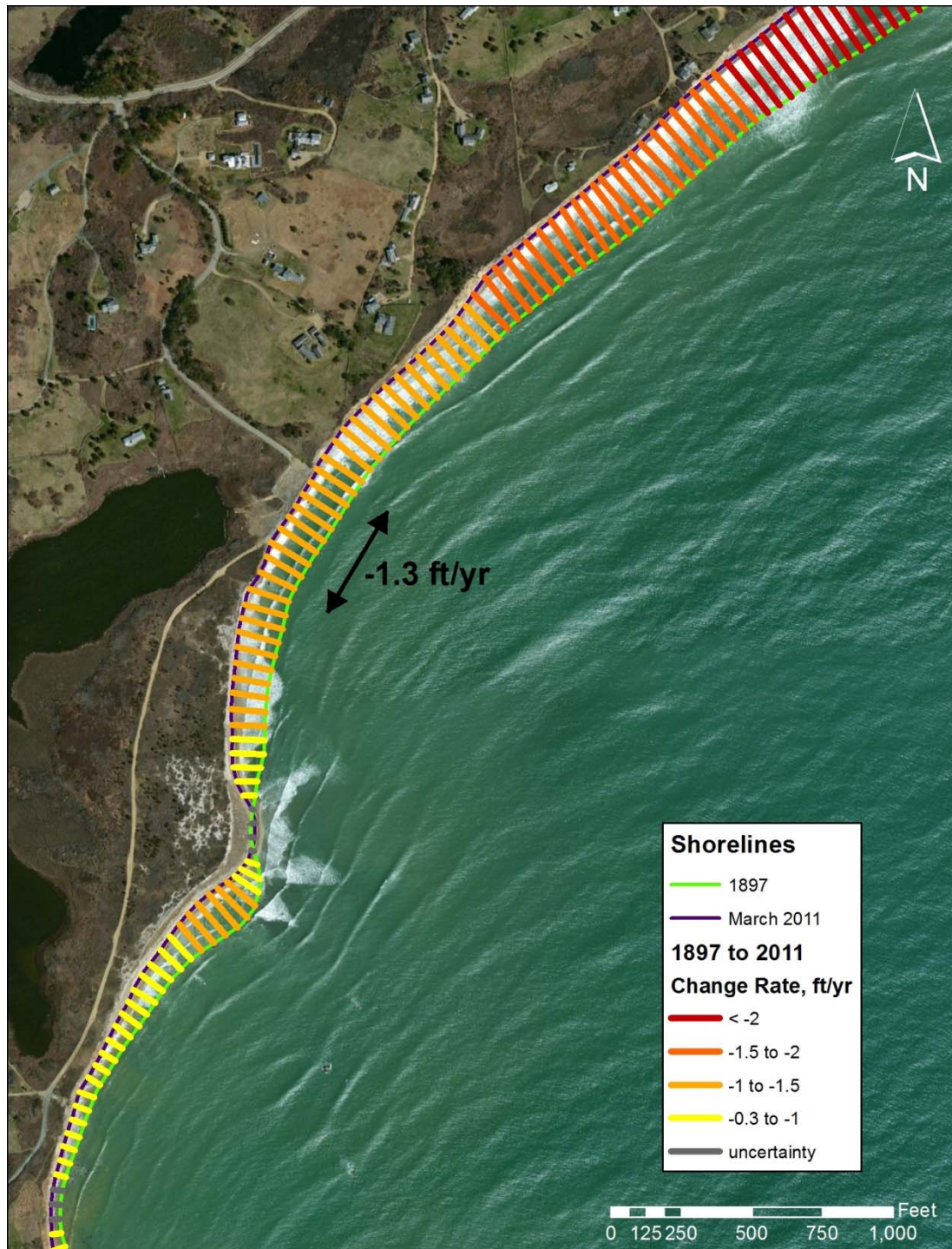


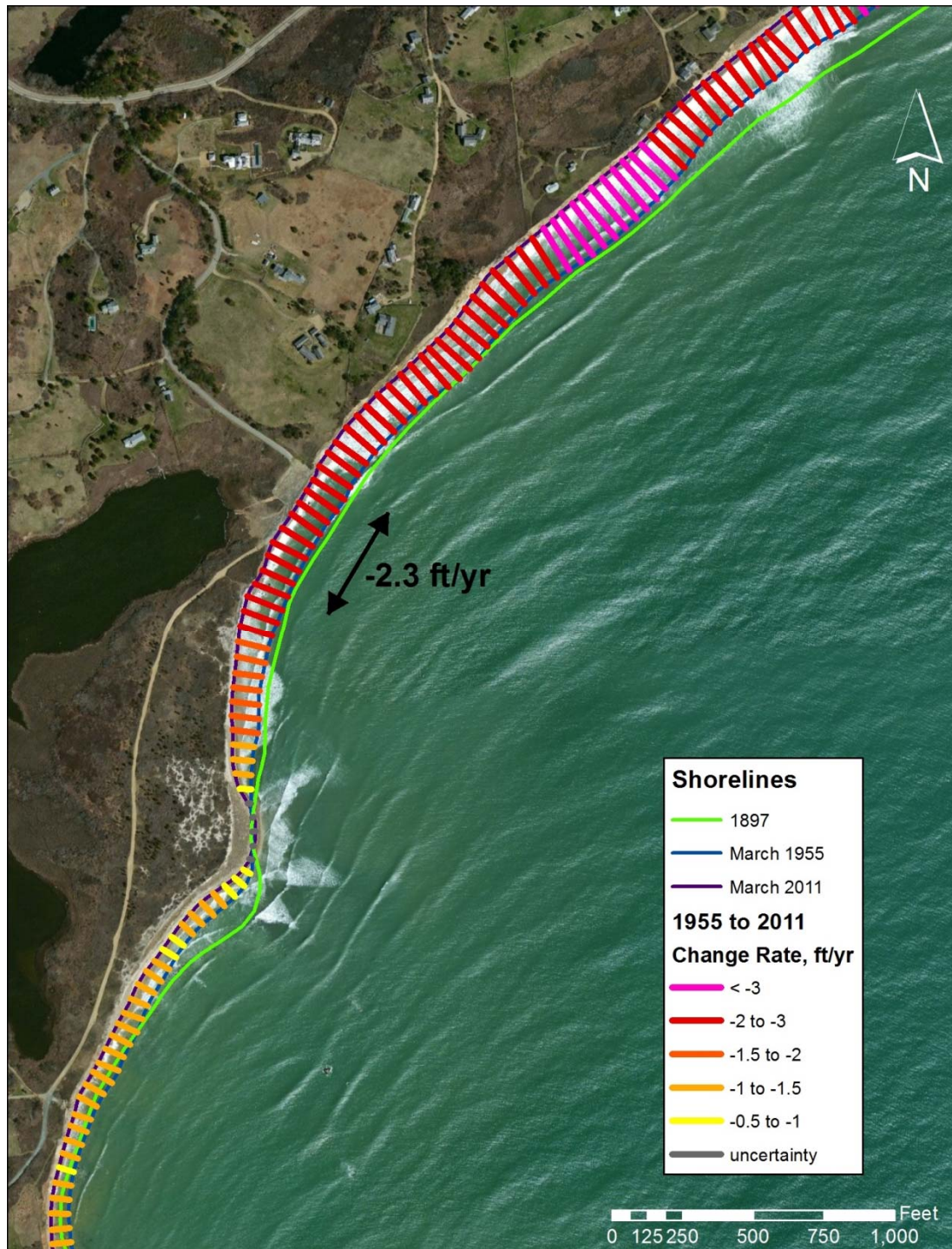




1897-2011

1.3 ft per year
erosion

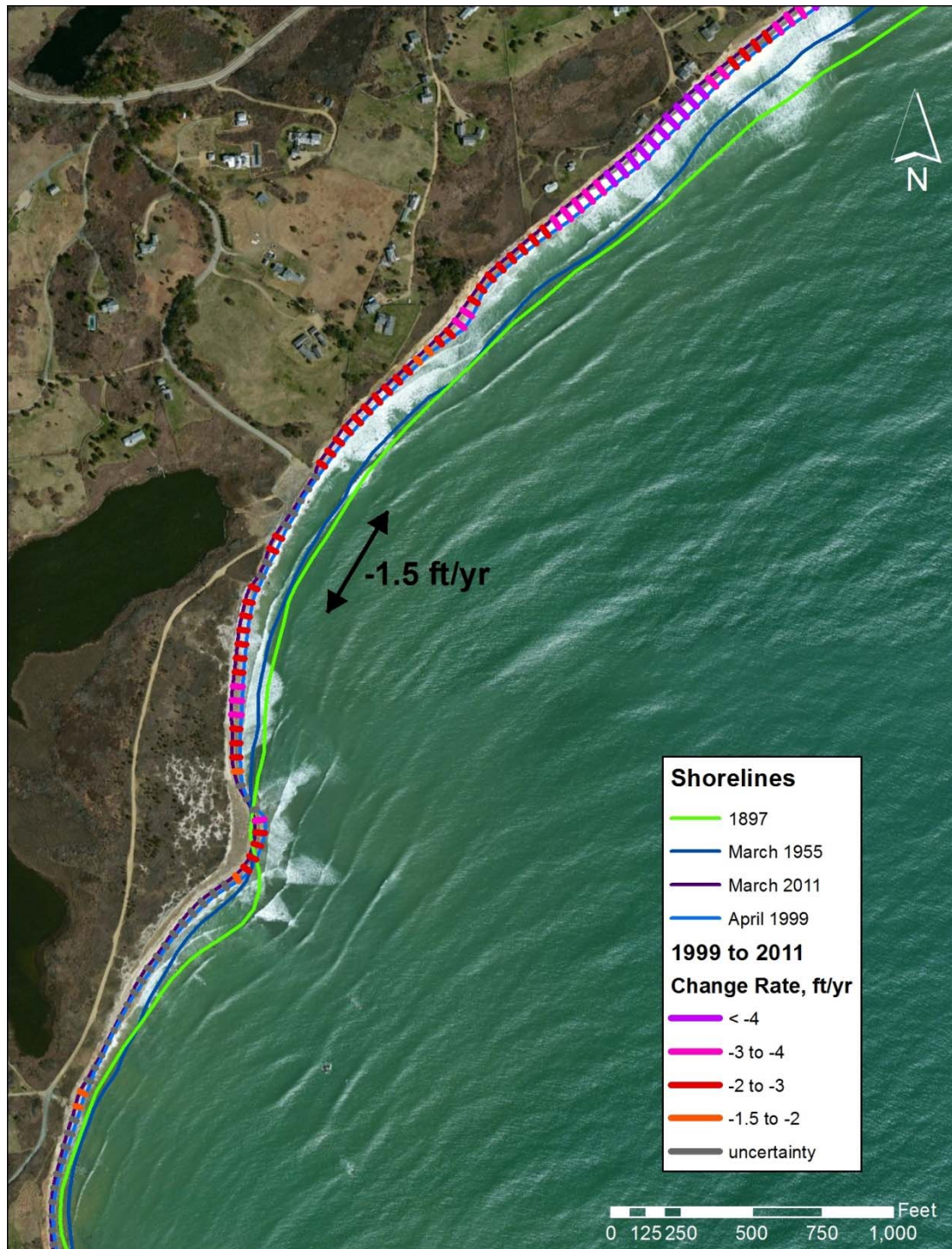
Contemporary
rate for no
structures



1955-2011

2.3 ft per year
erosion

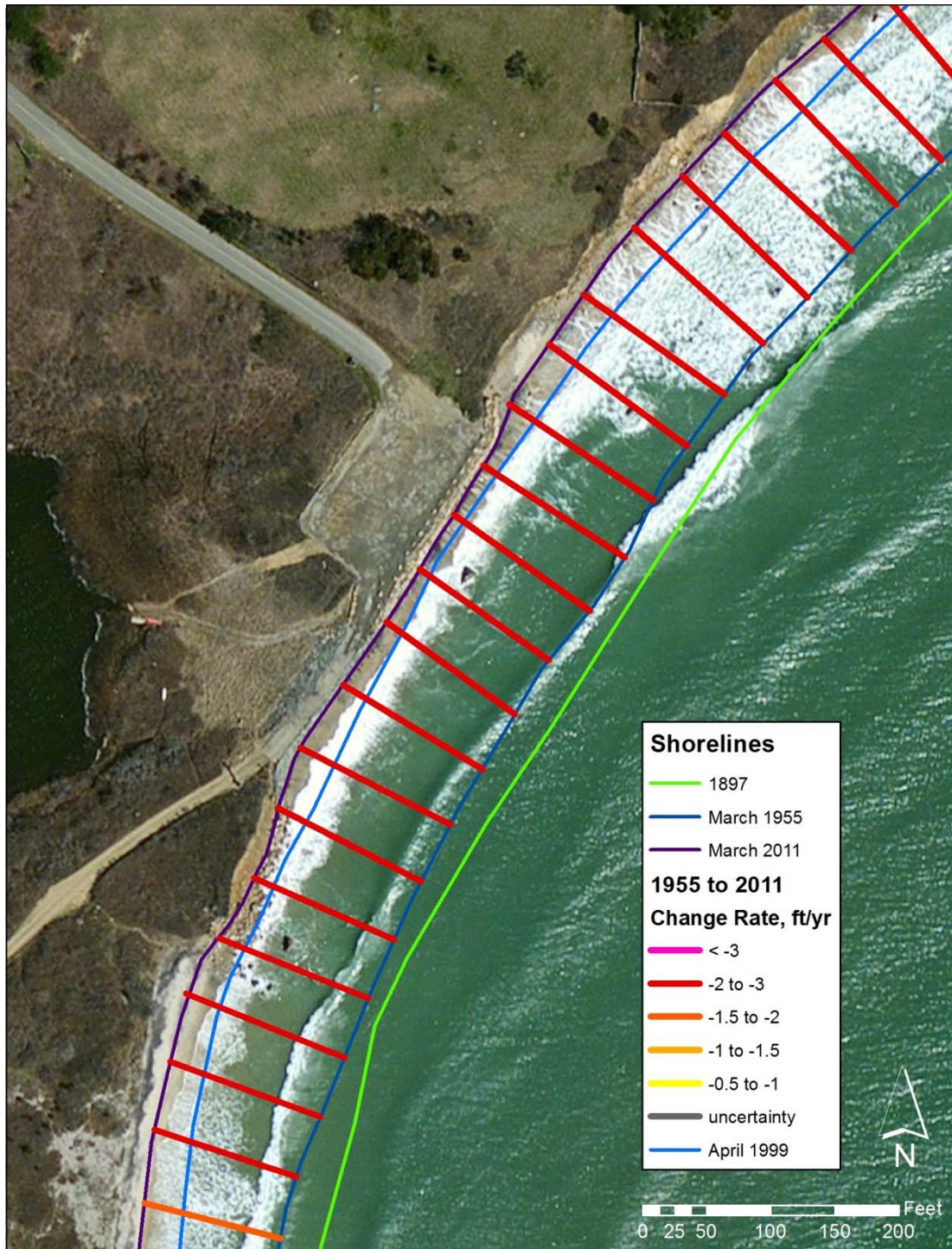
Contemporary
rate for no
structures



1999-2011

1.5 ft per year
erosion

Contemporary
rate for armored
shoreline



1955-2011
Close-up
(56 years of
erosion)

2.3 ft per year
erosion

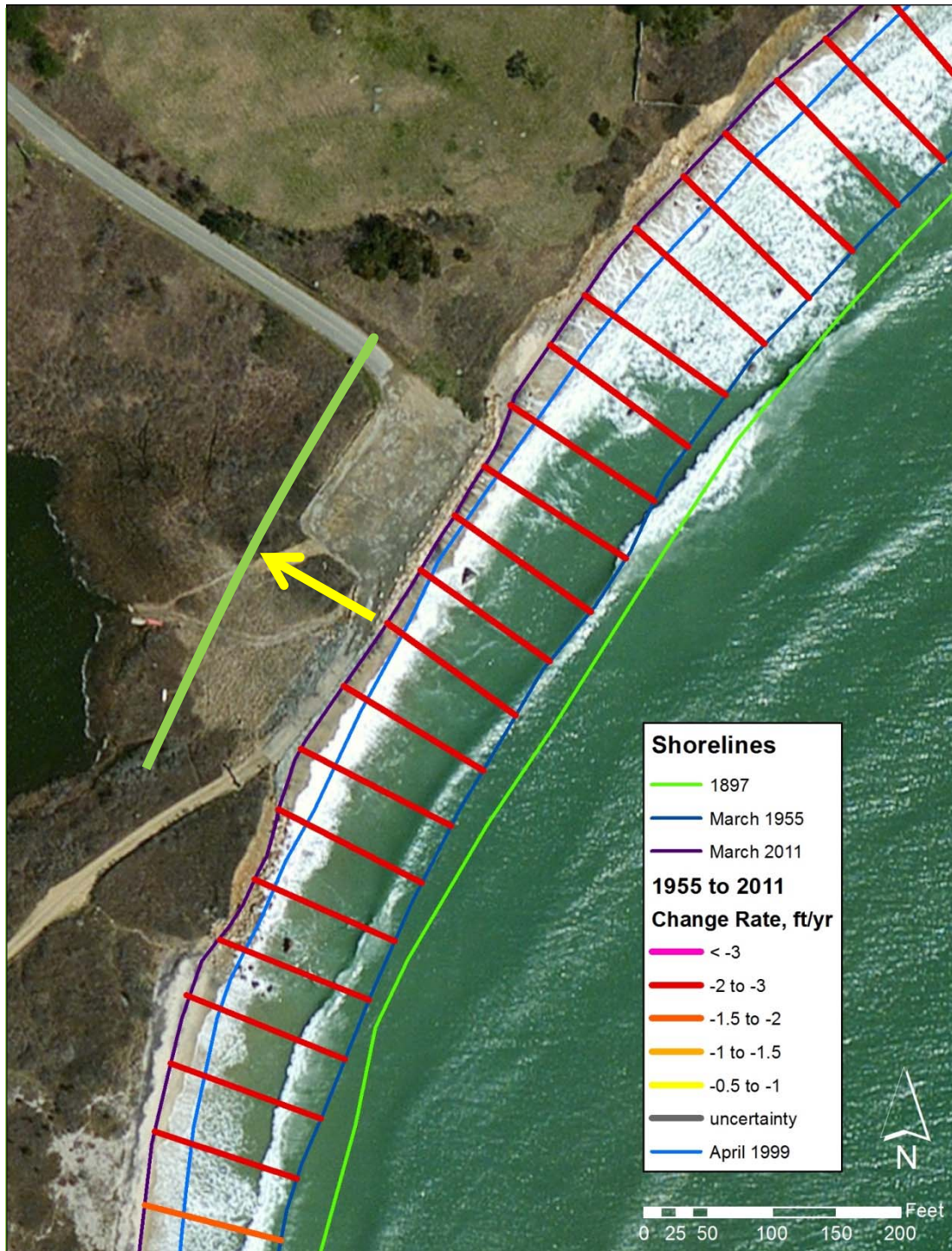
Contemporary
rate for armored
shoreline



1943 USGS Topographic Map

Same Road
Position

Before 1944 and
1954 Hurricanes



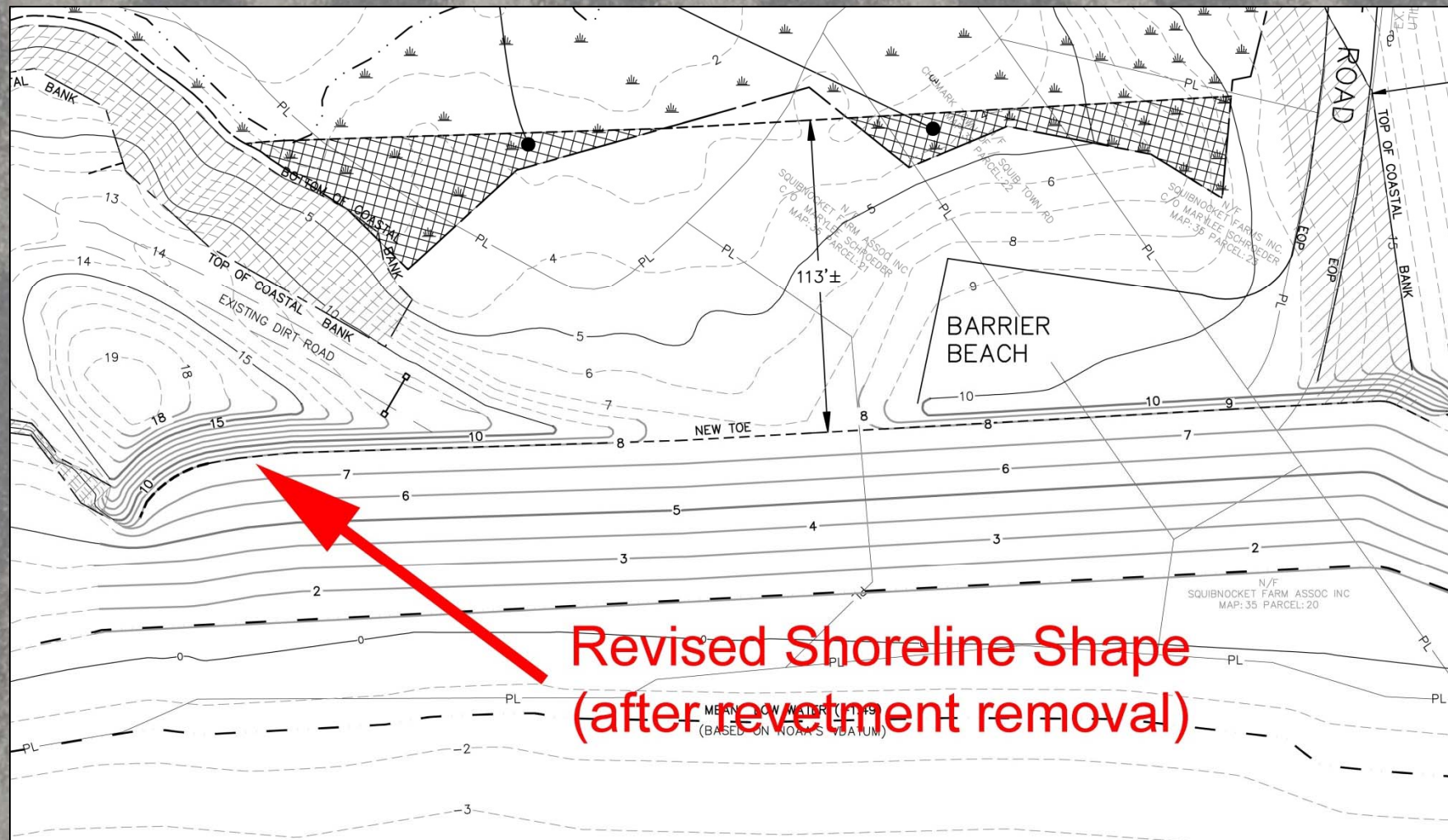
1955-2011
Close-up
(56 years of
erosion)

2.3 ft per year
erosion

Shoreline
Erosion

25 years = 58 ft
50 years = 115 ft
75 years = 173 ft

Shoreline Shape – Based on Method Developed by Gonzalez and Medina (2000)

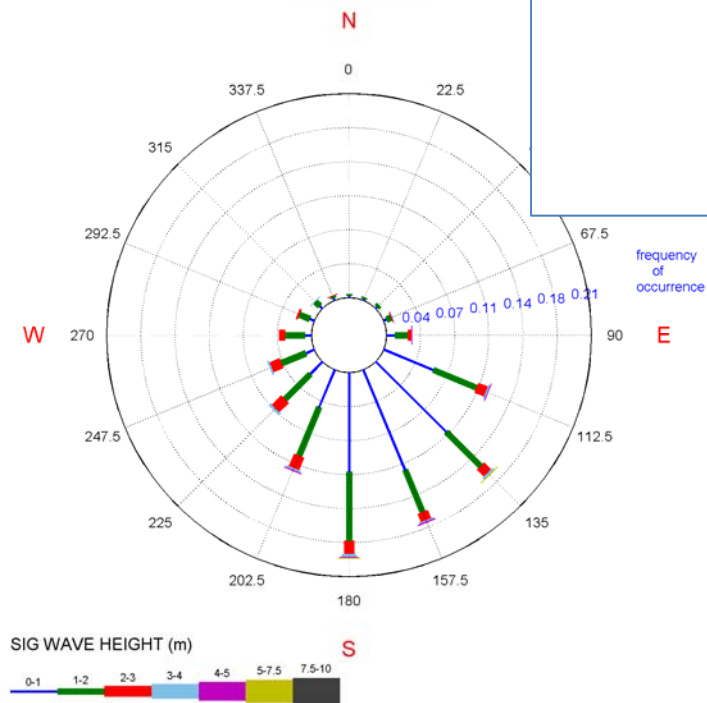


WIS Data Set



Atlantic WIS Station 63086
01-Jan-1980 thru 31-Dec-2012
Long: -70.75° Lat: 41.17° Depth: 34 m
Total Obs : 289977

WAVE ROSE

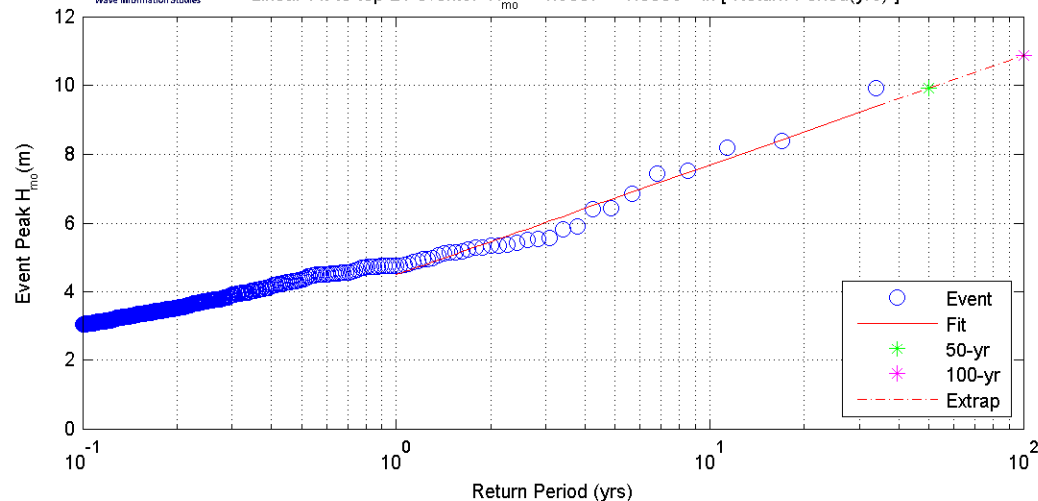


US Army Engineer Research & Development Center

ST63086_v02



Storm Event Return Period of 33-yr (1980-2012) Wave Hindcast
Atlantic Station 63086 : Lat: 41.170° Lon:-70.750° Depth: 34m
Linear Fit to top 21 events: $H_{mo} = 4.5007 + 1.3836 \cdot \ln [\text{Return Period(yrs)}]$



Top 10 events based on Peak H_{mo}

Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}	Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}
1	1991/08/19 18:00	9.92	15.84	189.0	6	2007/11/03 21:00	6.84	16.10	164.0
2	2012/10/29 22:00	8.39	15.53	151.0	7	1999/09/17 06:00	6.44	12.10	191.0
3	1985/09/27 20:00	8.20	14.31	185.0	8	2010/09/04 03:00	6.40	15.59	175.0
4	1993/03/14 18:00	7.53	16.27	193.0	9	1992/12/12 01:00	5.91	12.98	129.0
5	2011/08/28 18:00	7.45	13.95	184.0	10	1980/10/26 00:00	5.83	12.03	165.0

An event is defined as any period when $H_{mo} > 3.00m$

θ_{mean} is direction that waves are arriving from



US Army Engineer Research & Development Center

ST63086_v02

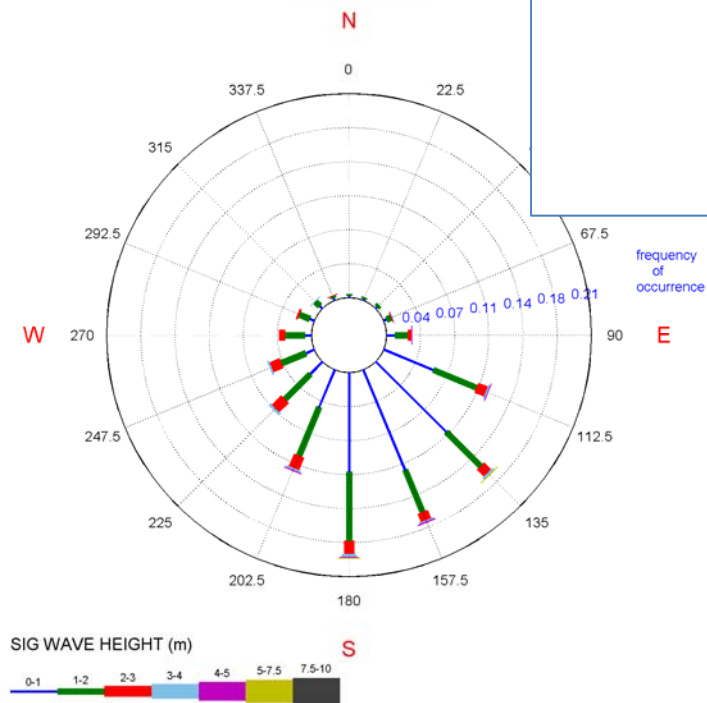
Hurricanes Bob and Sandy produced largest waves in past 33 years

WIS Data Set



Atlantic WIS Station 63086
01-Jan-1980 thru 31-Dec-2012
Long: -70.75° Lat: 41.17° Depth: 34 m
Total Obs : 289977

WAVE ROSE

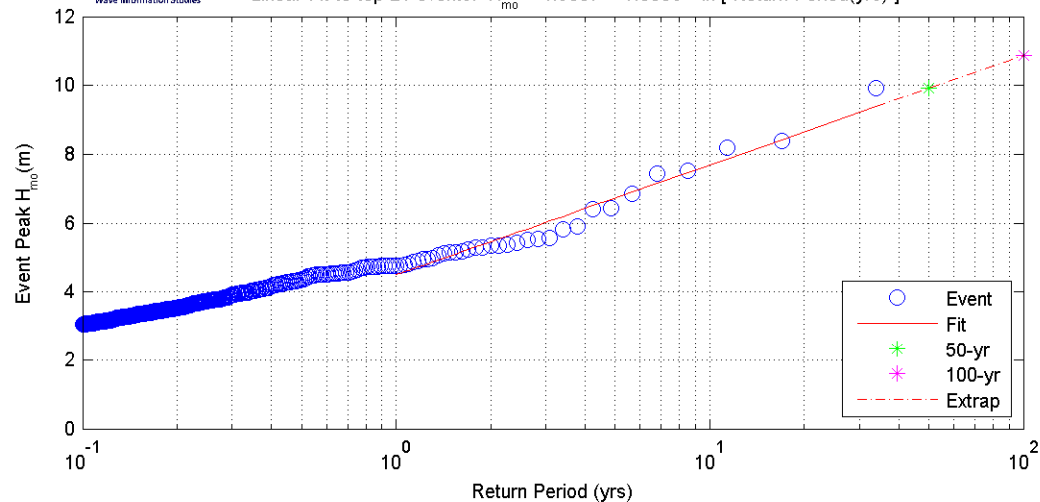


US Army Engineer Research & Development Center

ST63086_v02



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5	2011/08/28 18:00	7.45	13.95	184.0	10	1980/10/26 00:00	5.83	12.03	165.0

An event is defined as any period when $H_{mo} > 3.00m$

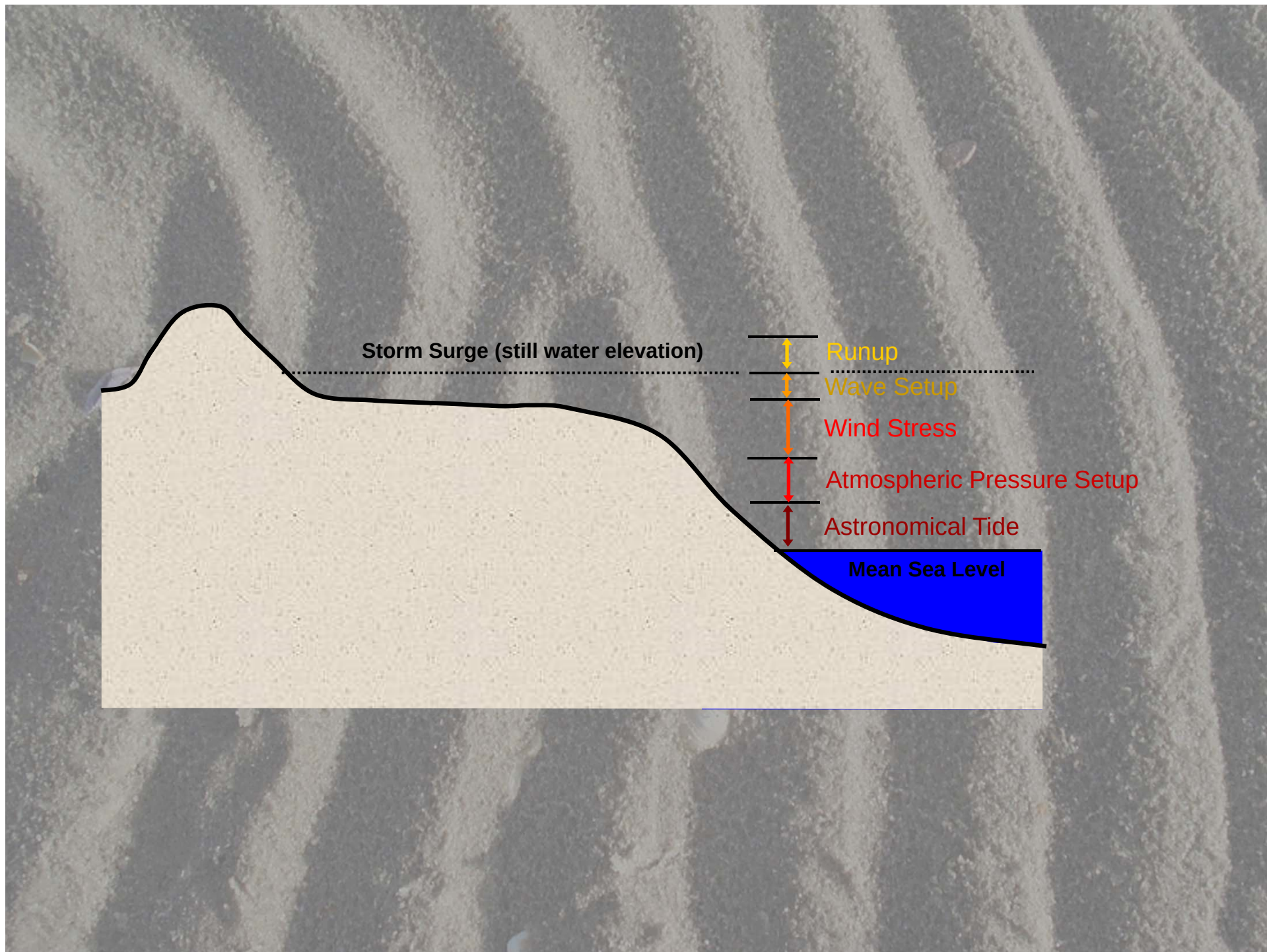
θ_{mean} is direction that waves are arriving from



US Army Engineer Research & Development Center

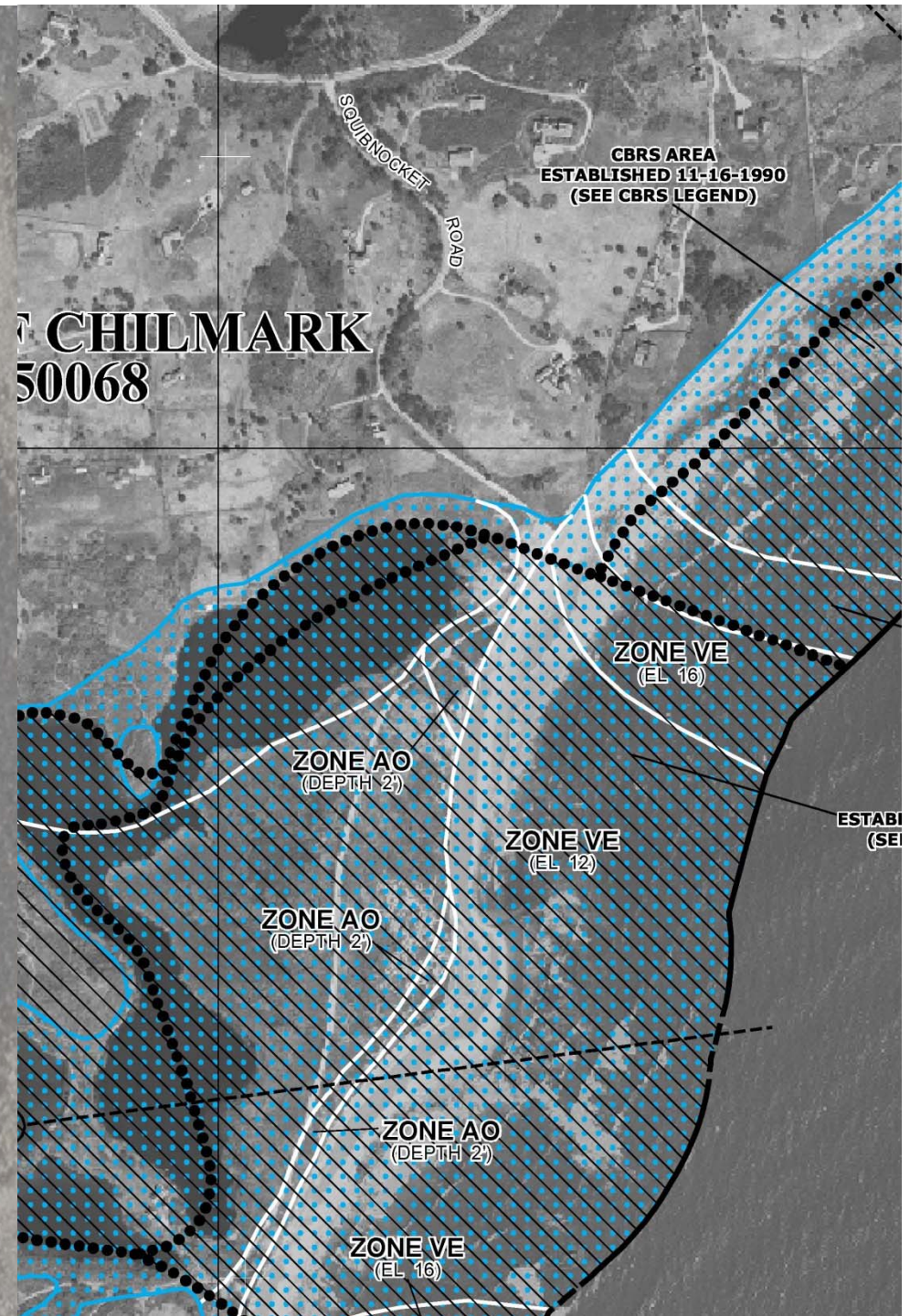
ST63086_v02

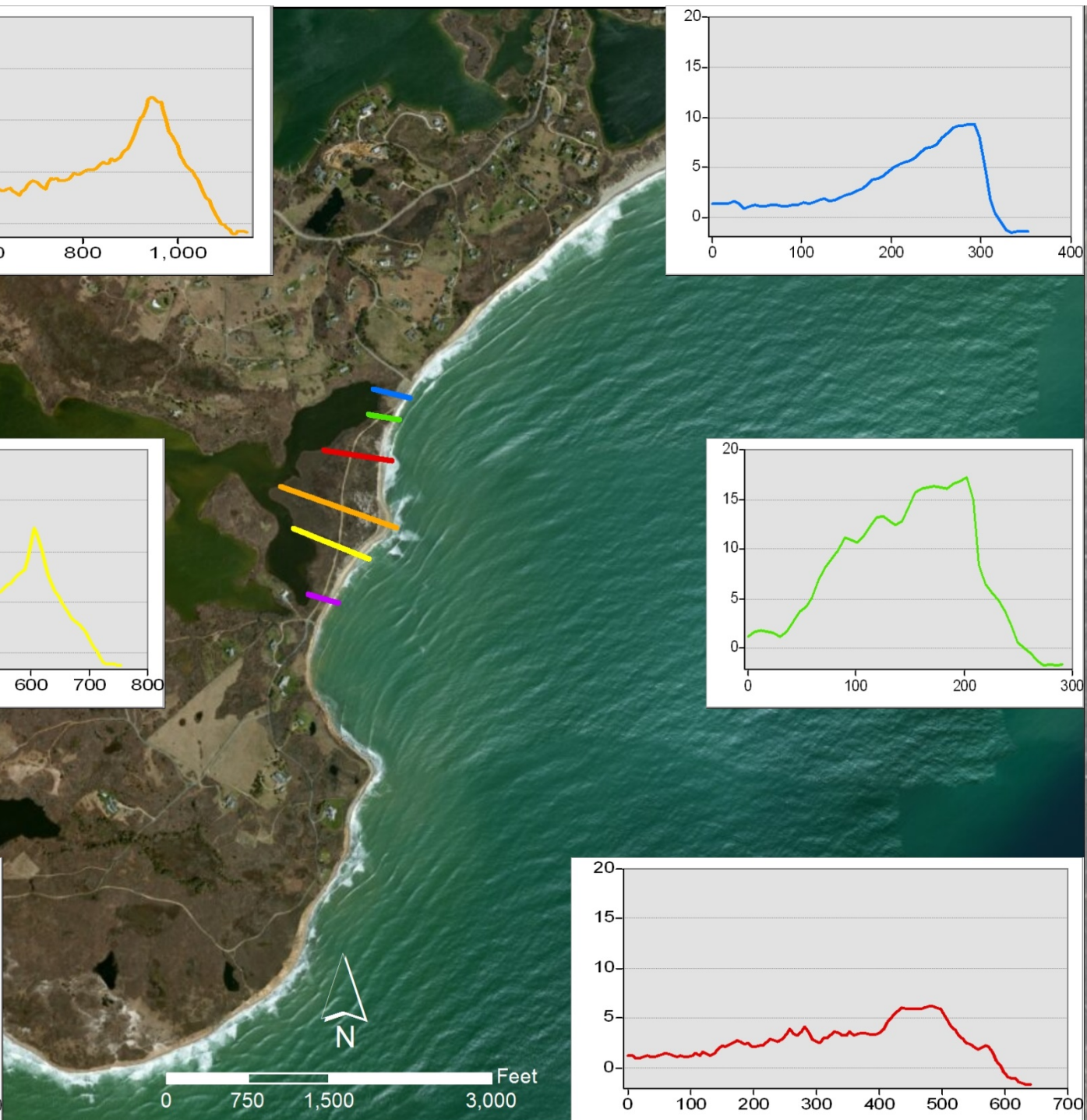
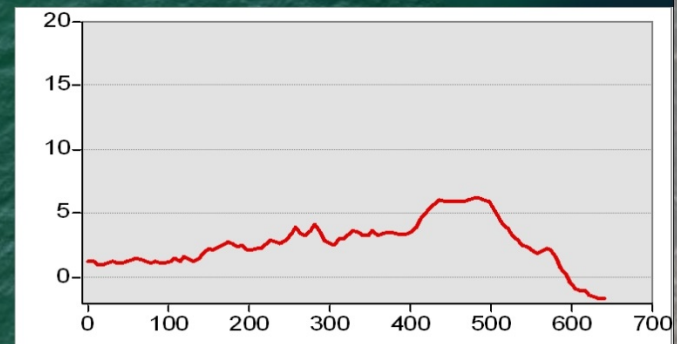
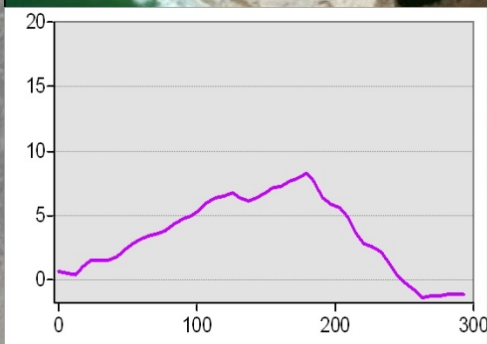
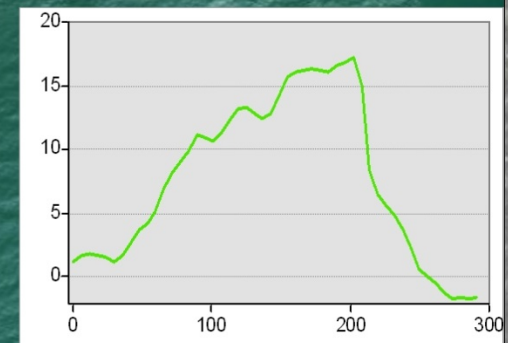
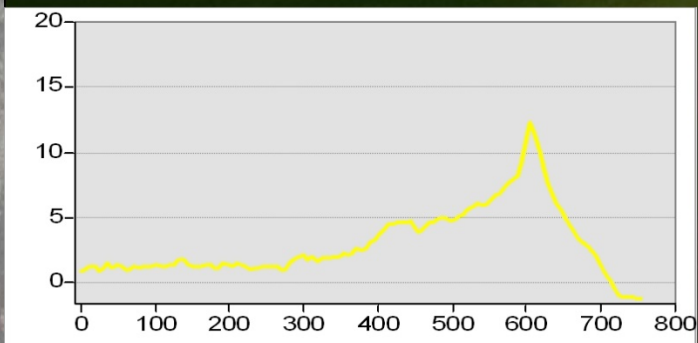
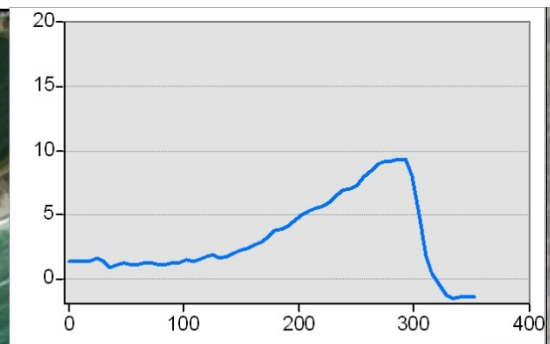
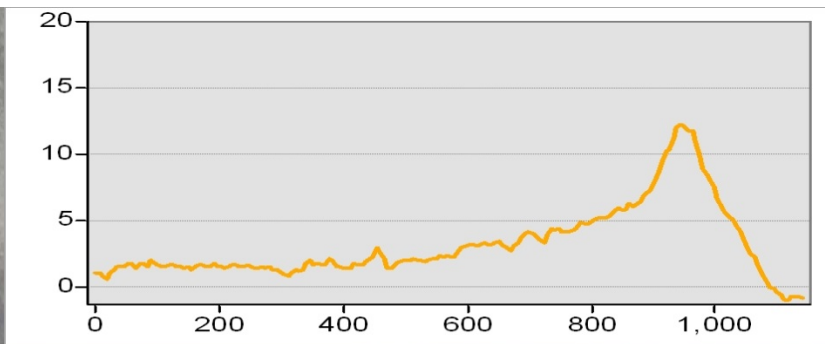
100-year Wave Height =
10.5 m (34.4 ft)



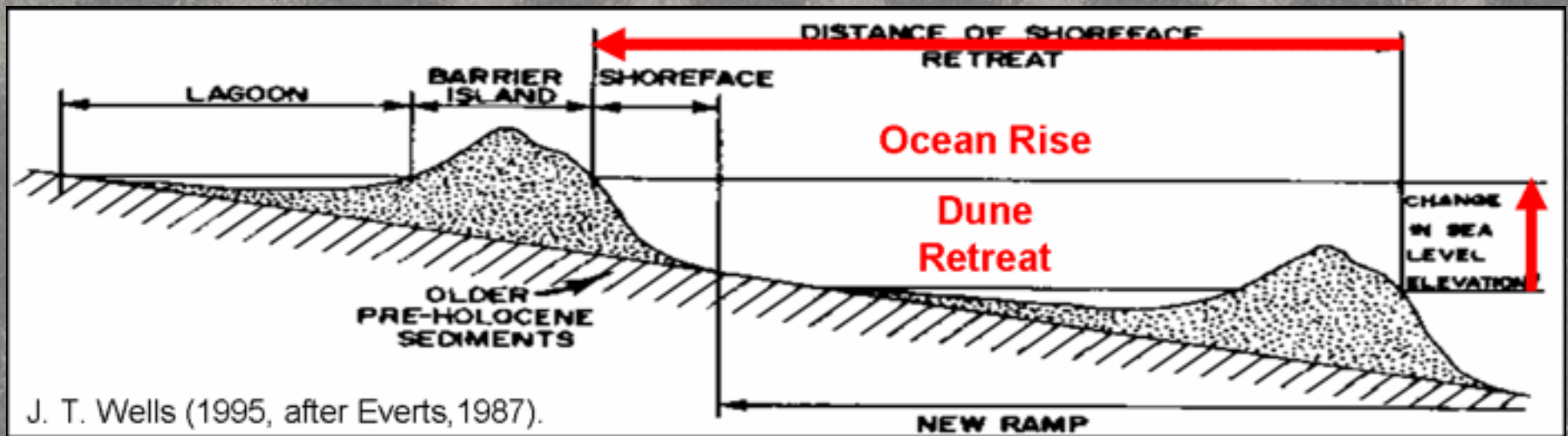
FEMA Preliminary Predicted Storm Surge FIS – June 3, 2013

10-year = 4.2 ft NAVD
50-year = 5.7 ft NAVD
100-year = 6.8 ft NAVD



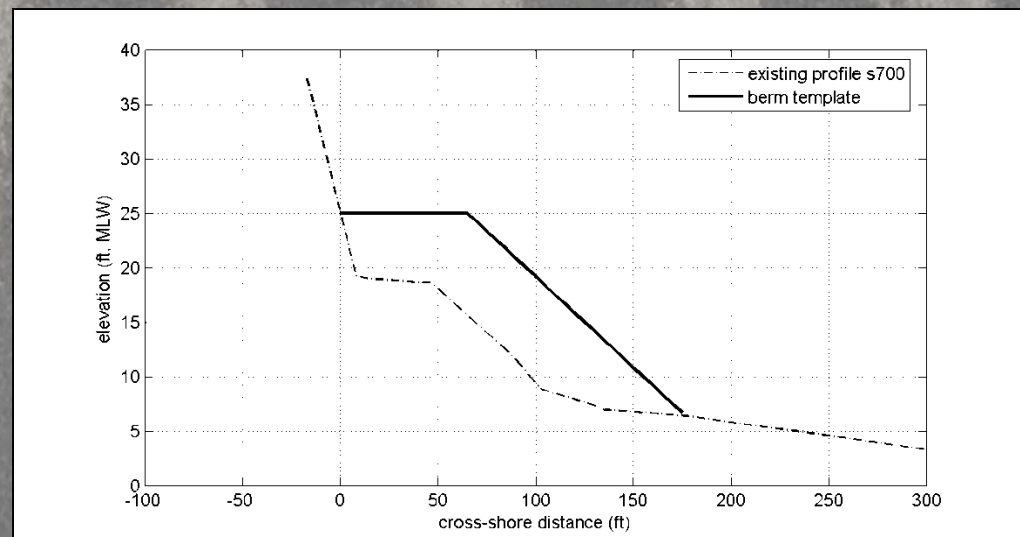
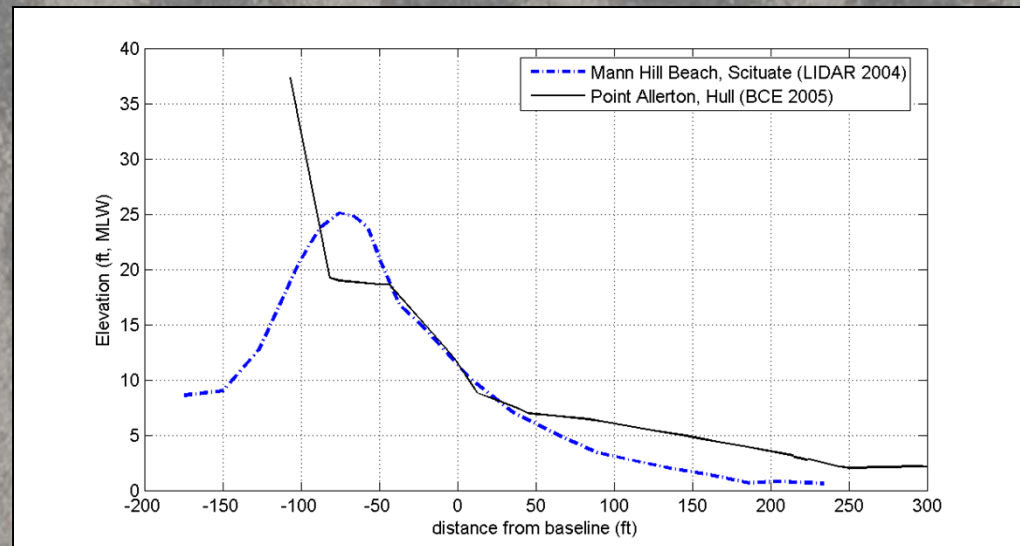
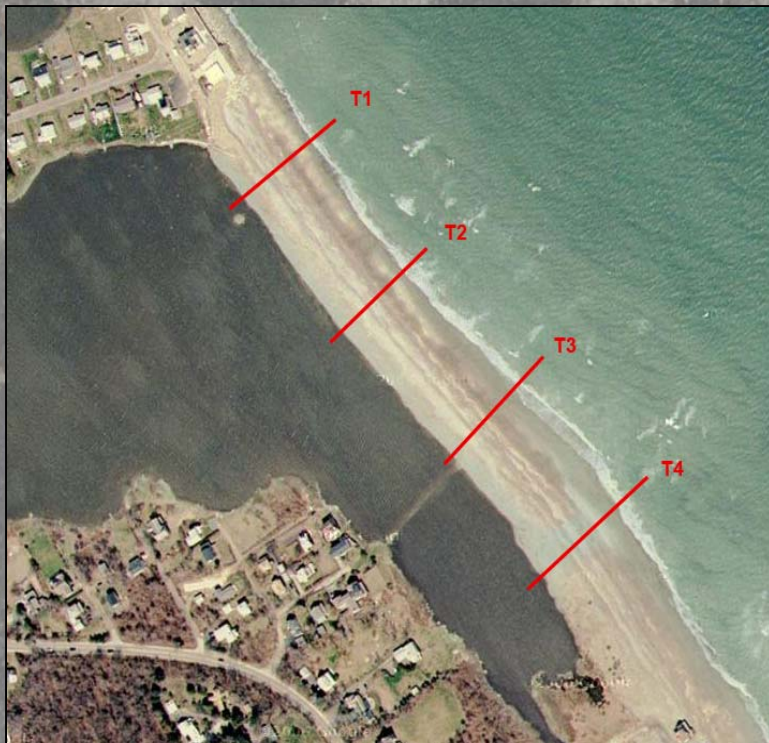


Barrier Beach Dynamics



Mimic Nature

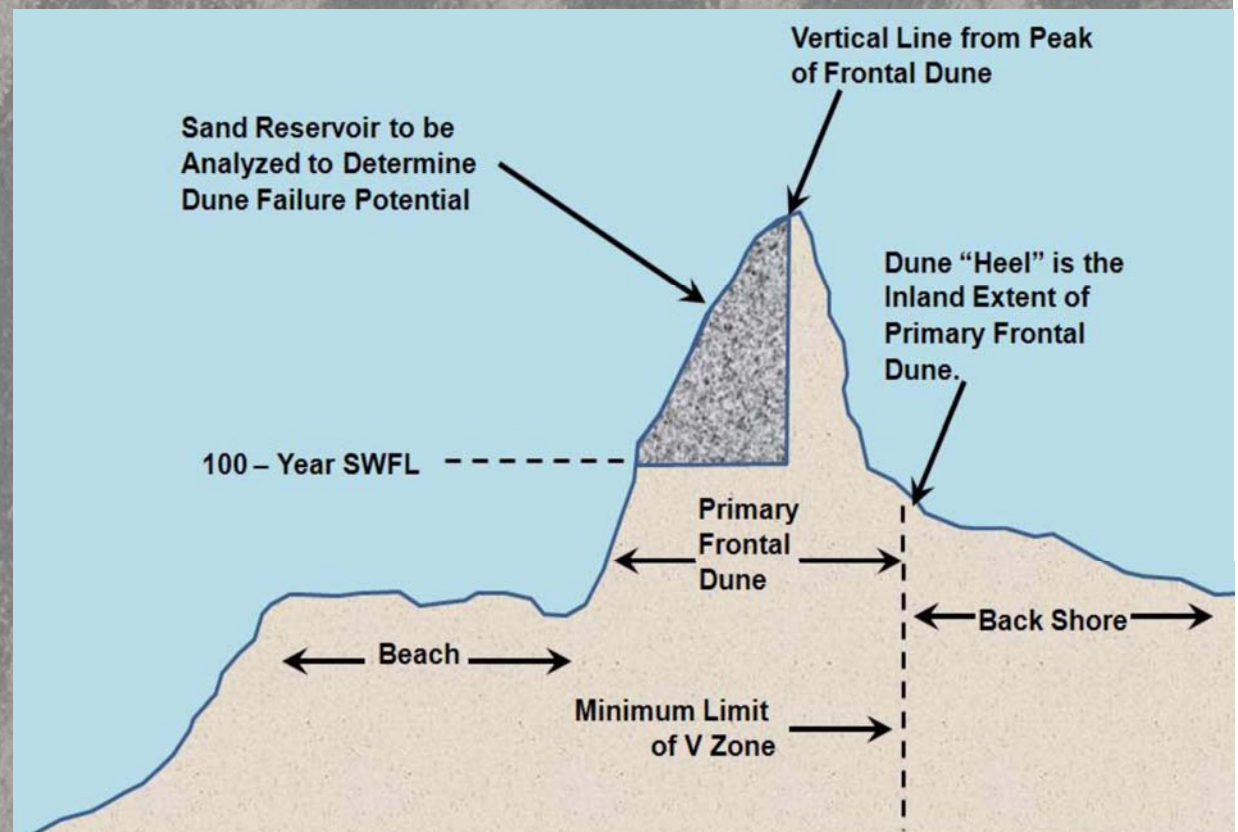
Massachusetts Design Example - Point Allerton



Design Parameters Squibnocket, MA

100-year SWFL =
6.8 ft NAVD

100-year wave
conditions
(offshore) =
34.4 feet



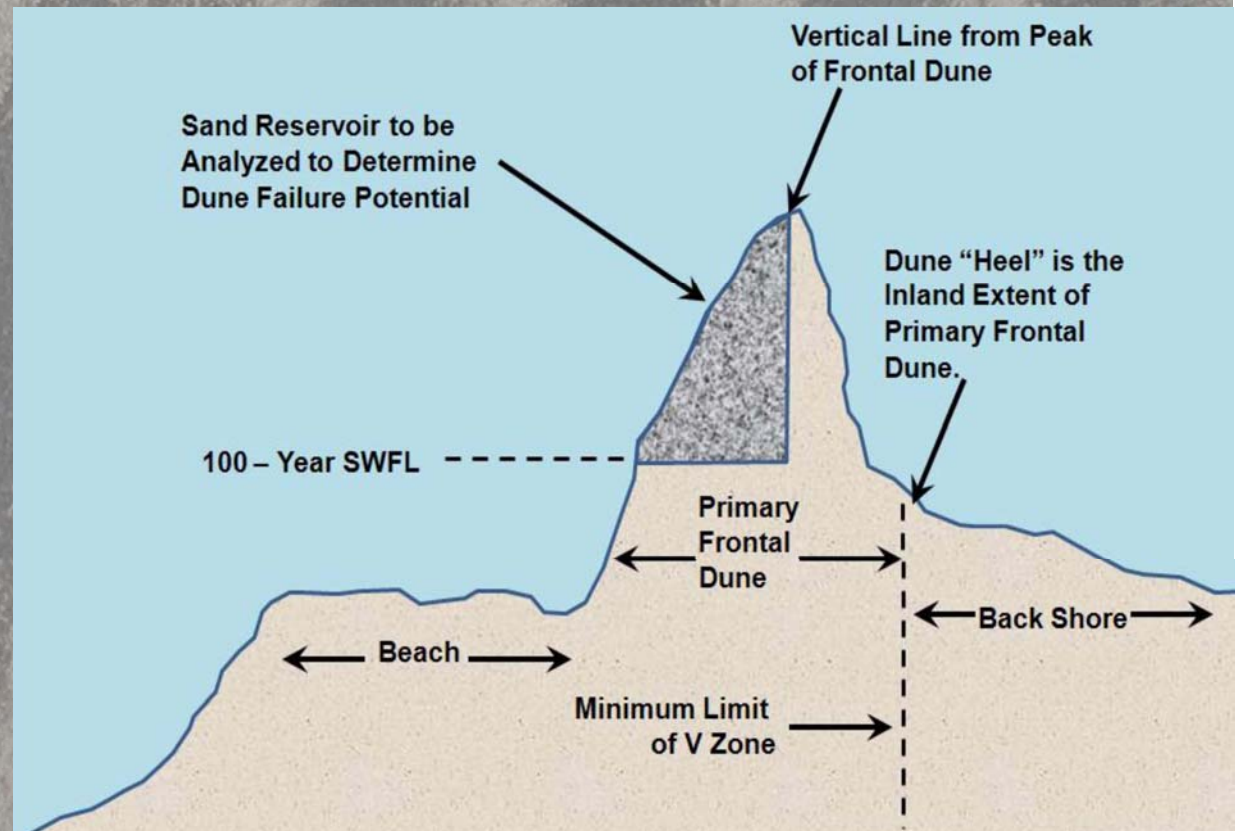
Design Parameters “540 Rule”

Dune Design

Crest Height =
16.8 ft NAVD

Crest Width =
±30 feet

Side Slopes
1:3 (v:h)



Design Parameters Stockton et al., 2006

Dune Design

Crest Height =
16.8 ft NAVD

2% Runup Above
SWFL =
9.7 feet
(16.5 ft NAVD)

$$R_2 = 1.1 \left(0.35B_f(H_0 L_0)^{1/2} + \frac{[H_0 L_0(0.563\beta_f^2 + 0.004)]^{1/2}}{2} \right)$$

Infra-Gravity waves

Wave Setup

Swash

