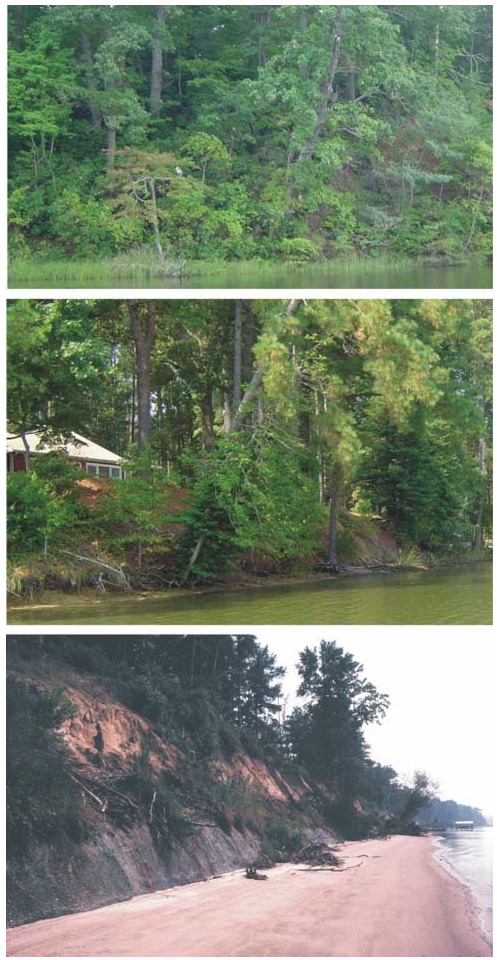
Coastal Evolution in Chesapeake Bay

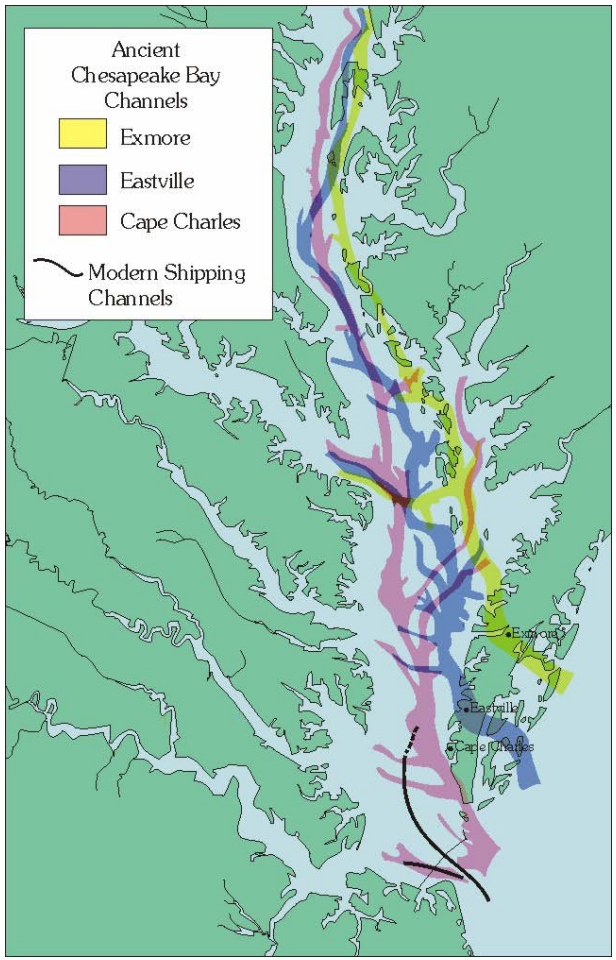
Short and Long Term Impacts to The Edge

Edge has many faces



Sheltered Coasts

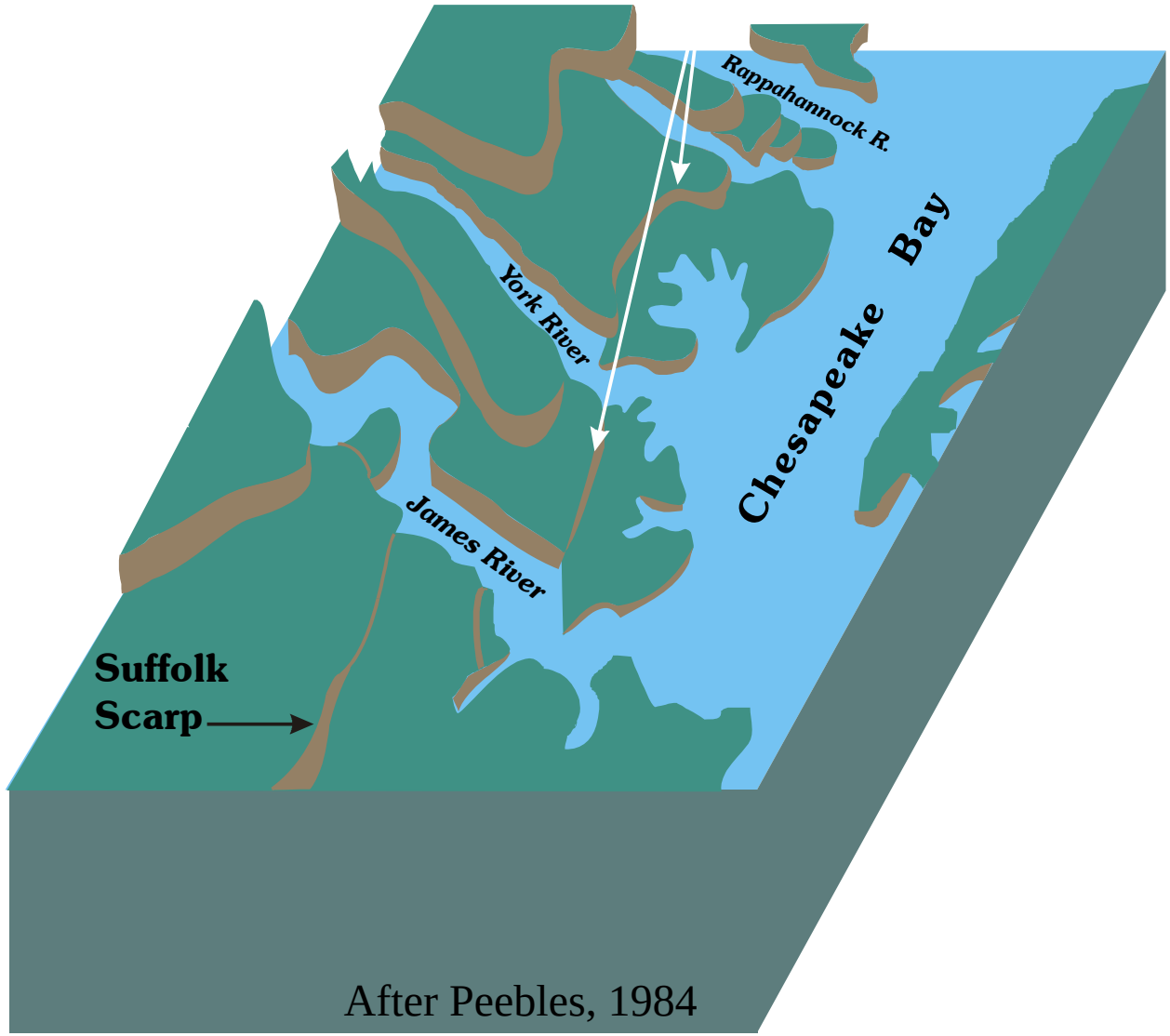
At a point in time



Va Portion of Chesapeake Bay

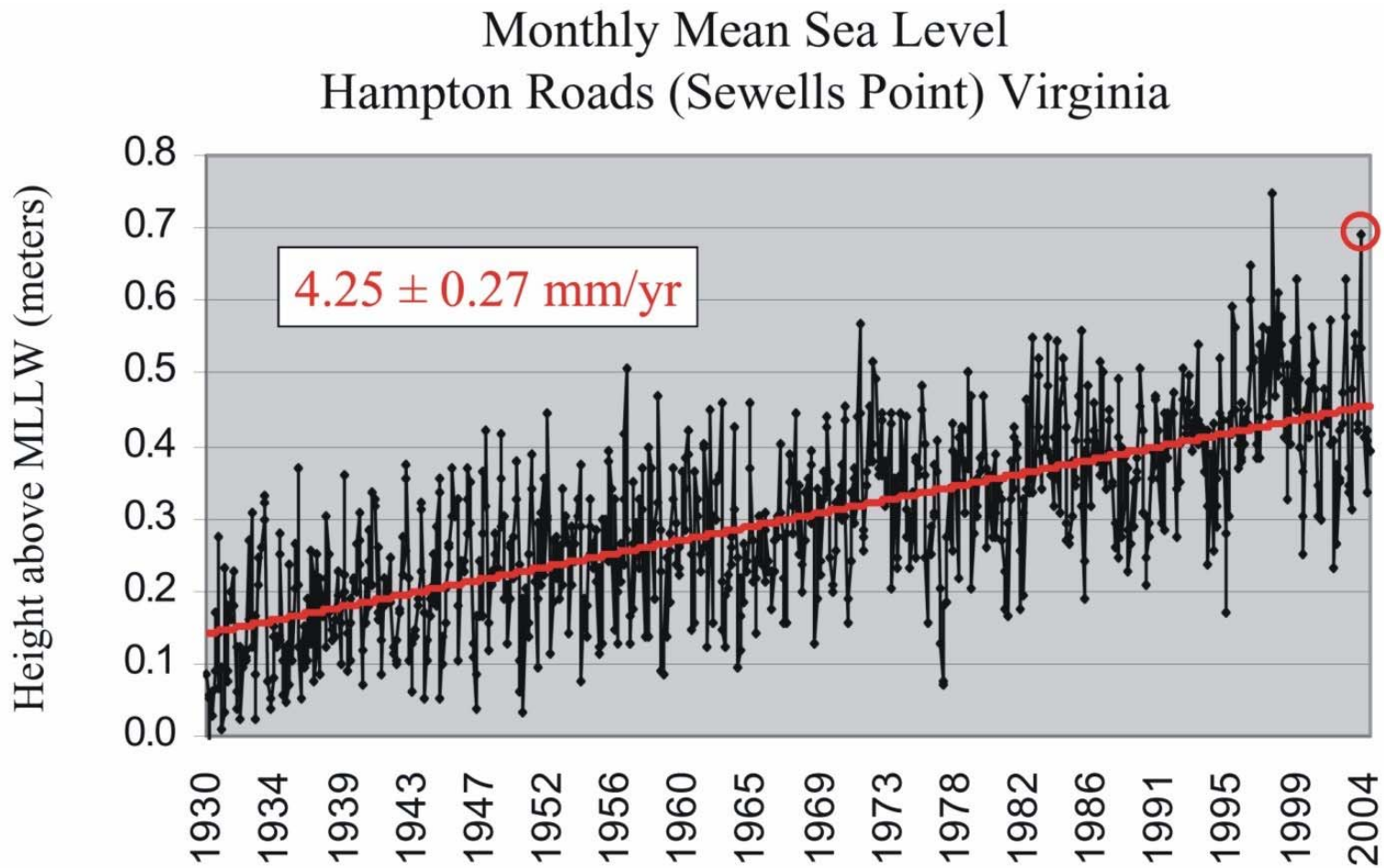
Va. Coastal Plain Geology

Shoreline Evolution



After Peebles, 1984

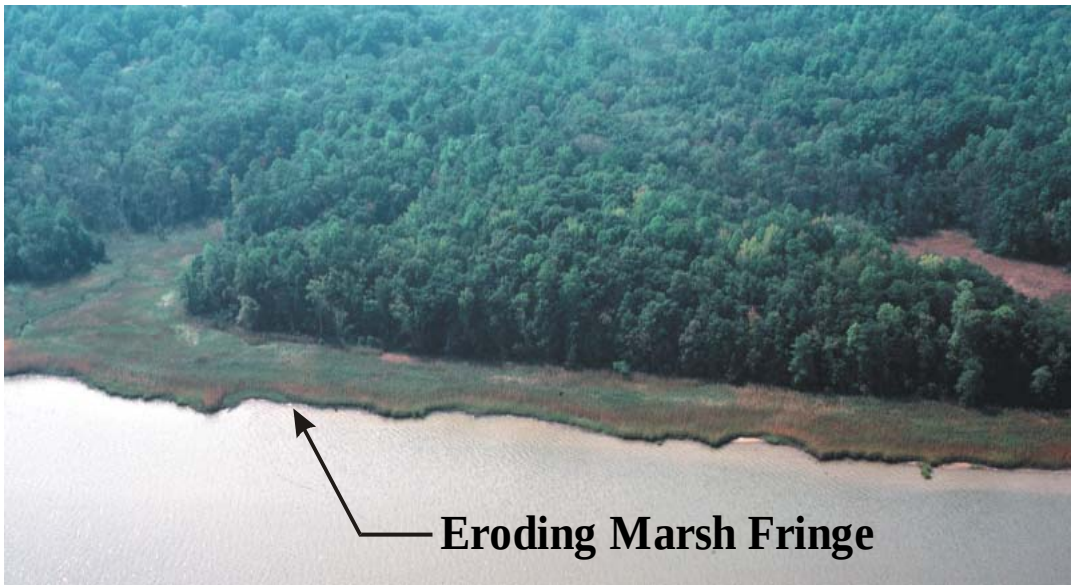
From Dr. Boon, VIMS



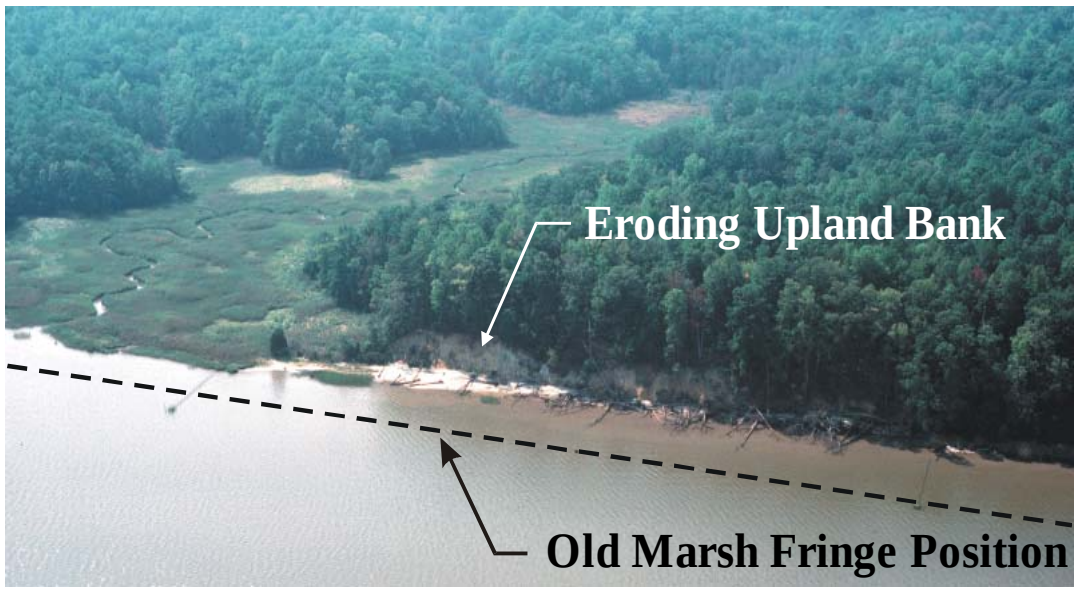
Shoreline Evolution

Broad marshes in foreground give way to fringing marshes downstream where there is greater fetch exposure. At the transition point (T), shoreline processes go from tidally dominated to wave dominated (Ware River, Virginia).

Shoreline Evolution



This marsh fringe along the York River in James City County, Virginia is eroding on the water side, but it is wide enough to protect the upland region from wave attack.



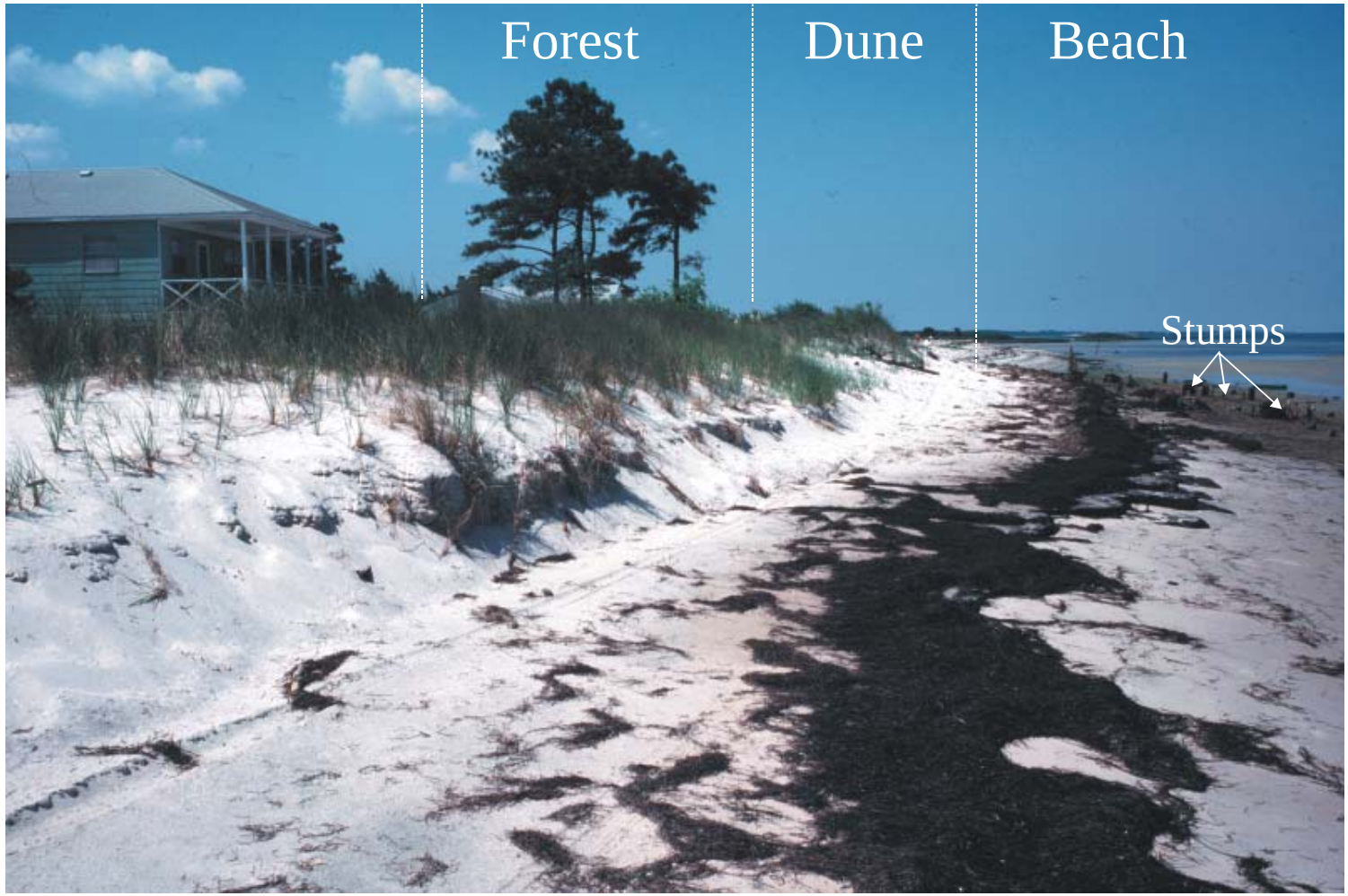
York River shoreline with fringe marsh absent due to erosion. The upland banks are directly exposed to the force of the waves. The result is eroding upland banks.

Shoreline Evolution

Exposed and eroding upland banks along the Rappahannock River, Virginia. Note: Basal clay acts as a groundwater perch causing the upper layer of sand to slump.

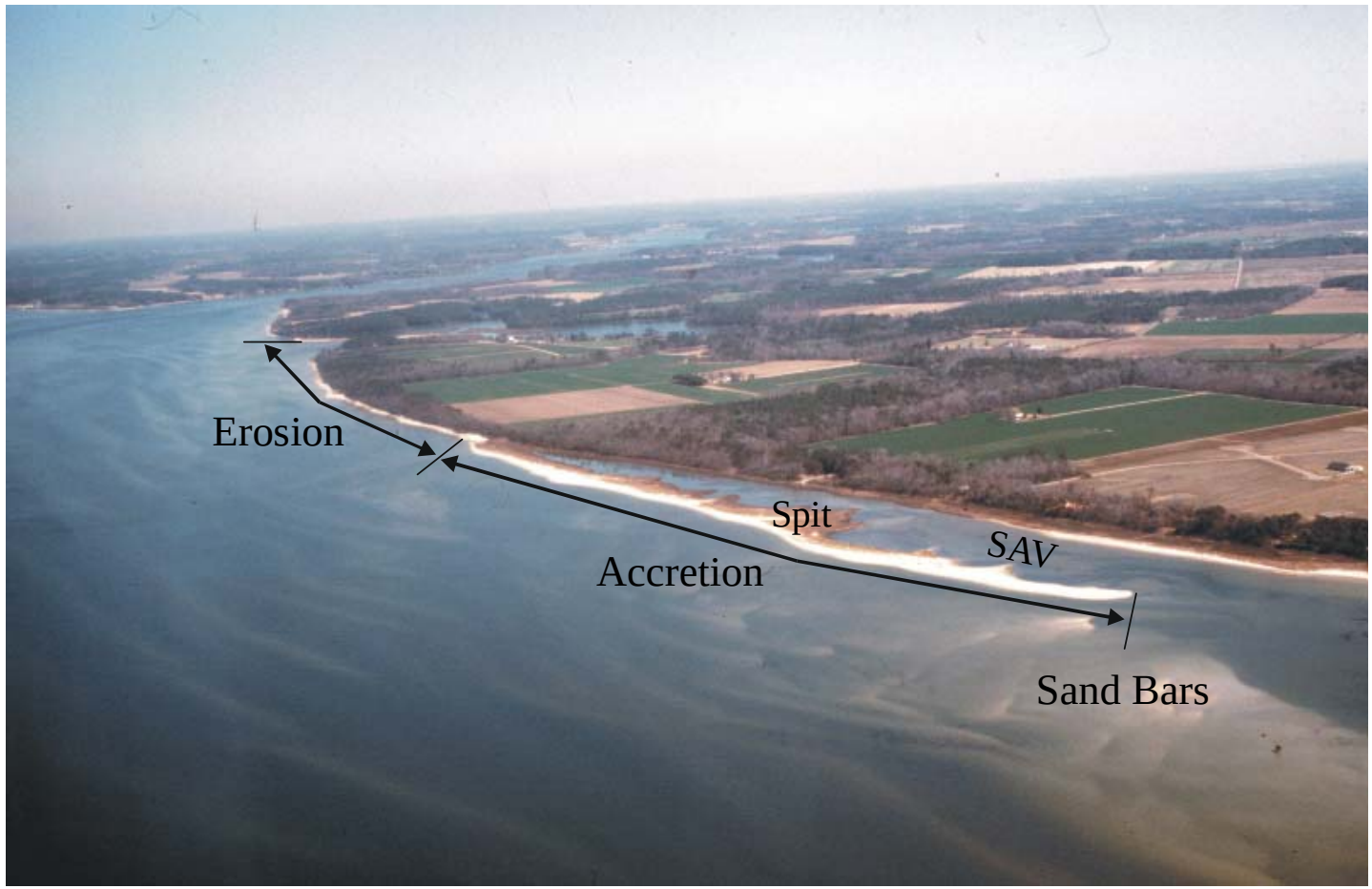
Shoreline Evolution

Dune and beach system along the Chesapeake Bay, Mathews County, Virginia. Old stumps in the nearshore area are evidence of landward migration of dune and beach systems.



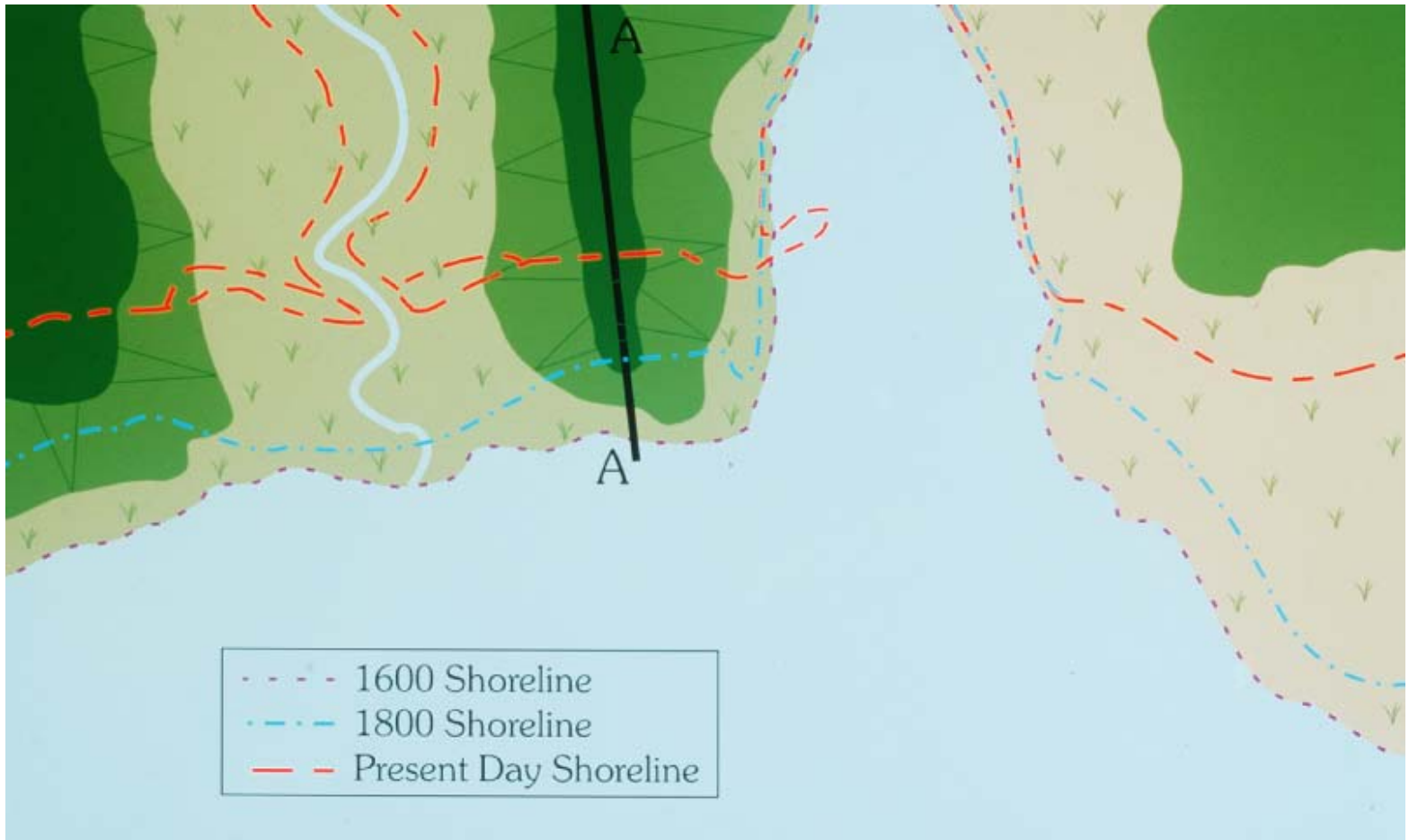
Shoreline Evolution

Erosion of sandy upland banks along the Eastern Shore provides significant sediment to create spits and offshore sand bars that protect the “mainland” from wave attack in addition to providing a haven for submerged aquatic vegetation.



Shoreline Evolution

Change in shore morphology due to erosive and accretive processes and sea level change is depicted through time.



Shoreline Evolution

Cross-sectional change in shoreline morphology due to erosive or accretive processes and sea level change.

Marsh advancing upon uplands as sea level rises

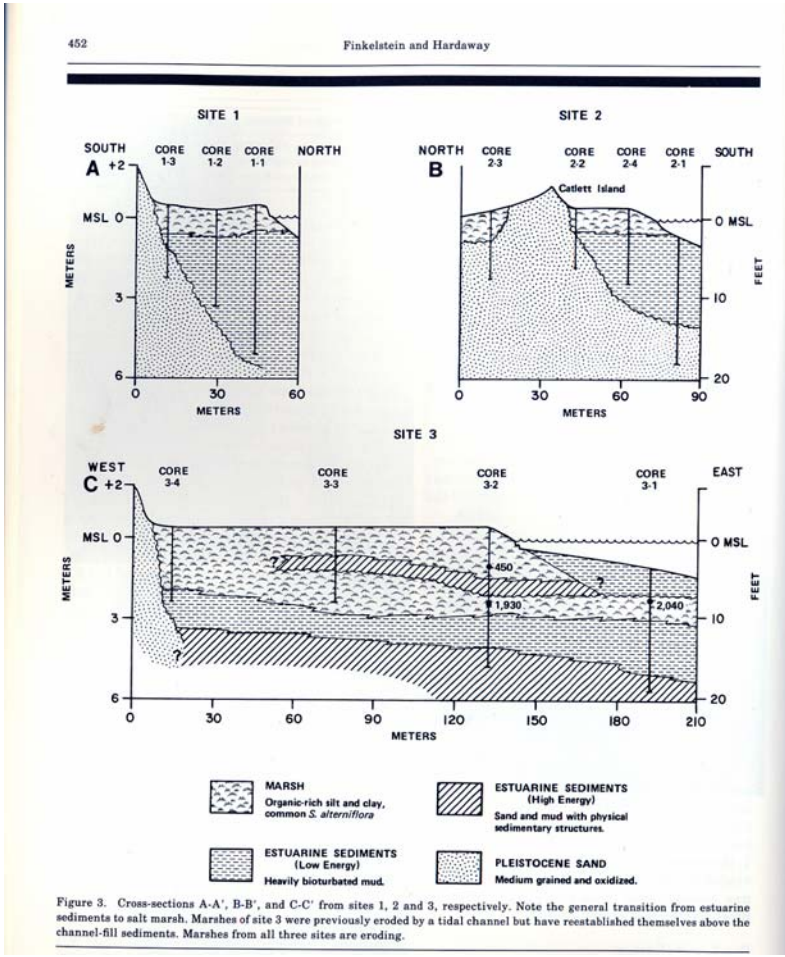
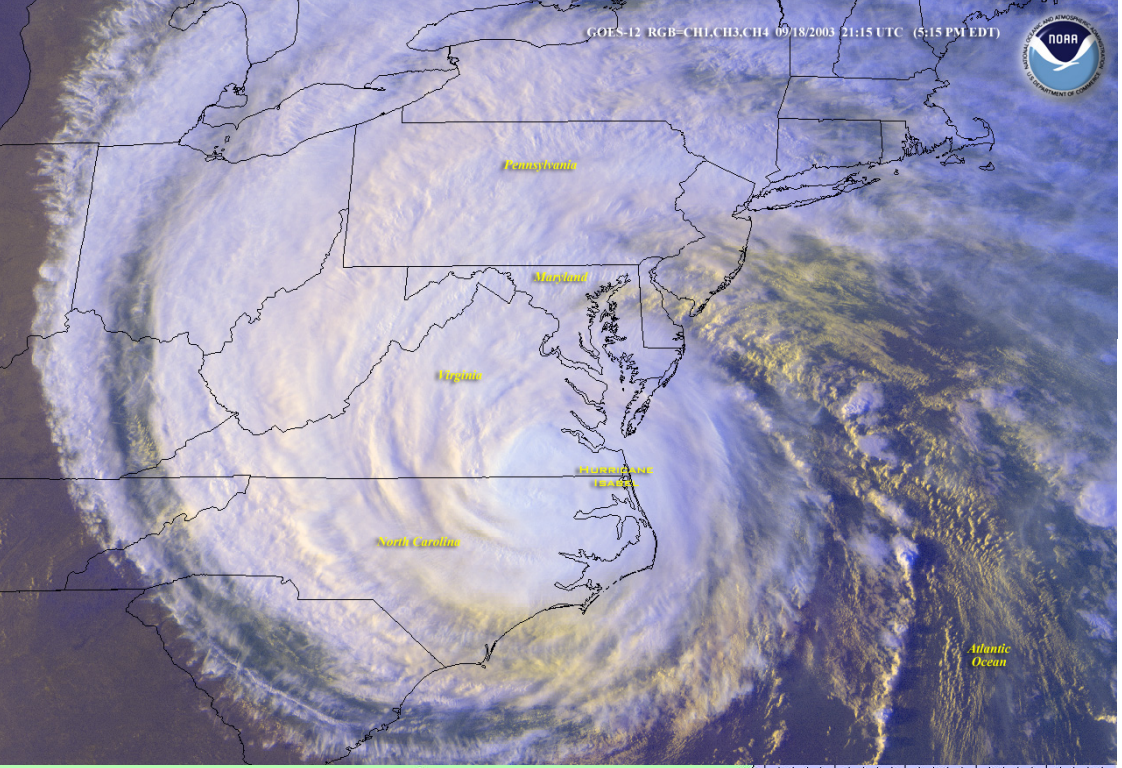
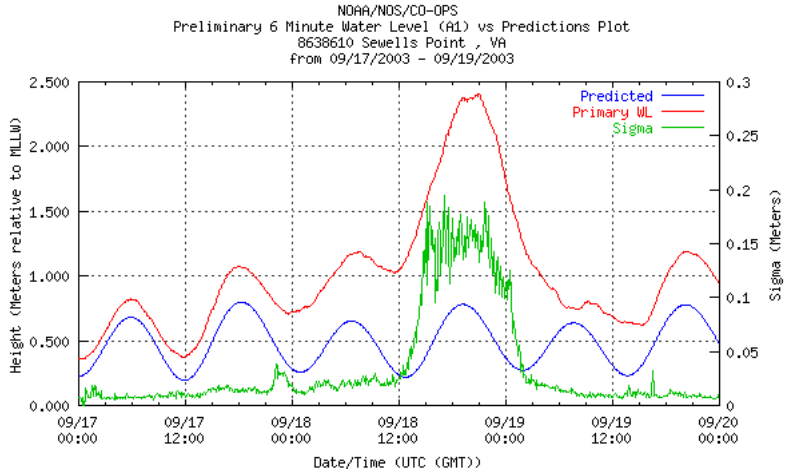


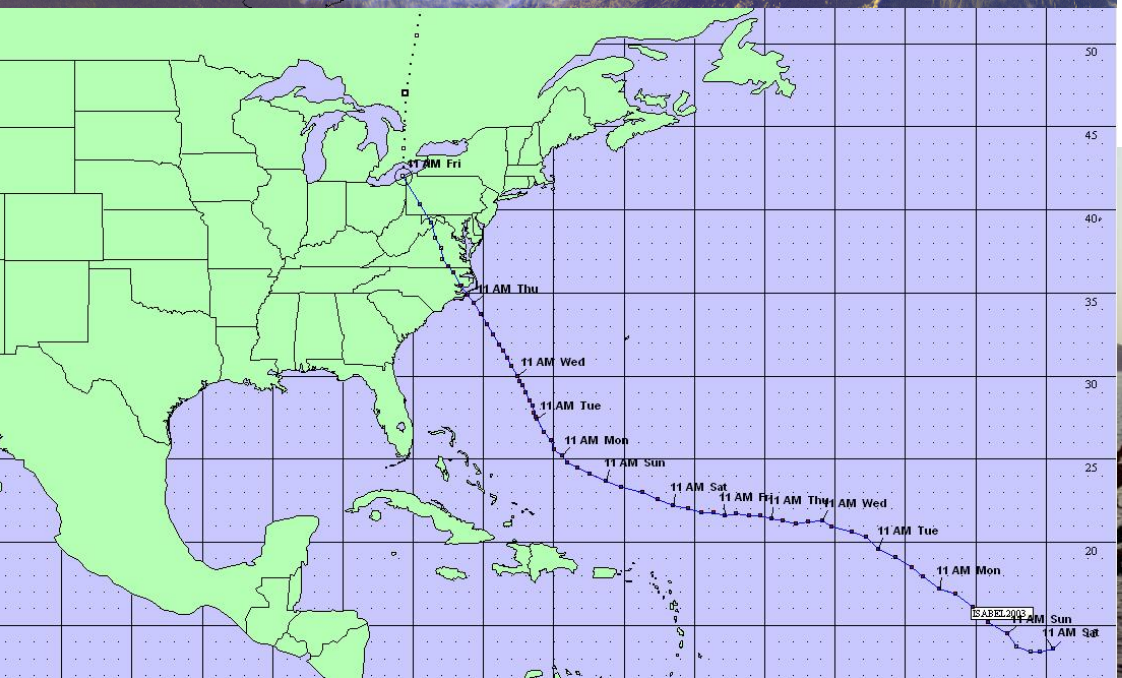
Figure 3. Cross-sections A-A', B-B', and C-C' from sites 1, 2 and 3, respectively. Note the general transition from estuarine sediments to salt marsh. Marshes of site 3 were previously eroded by a tidal channel but have reestablished themselves above the channel-fill sediments. Marshes from all three sites are eroding.

Hurricane Isabel

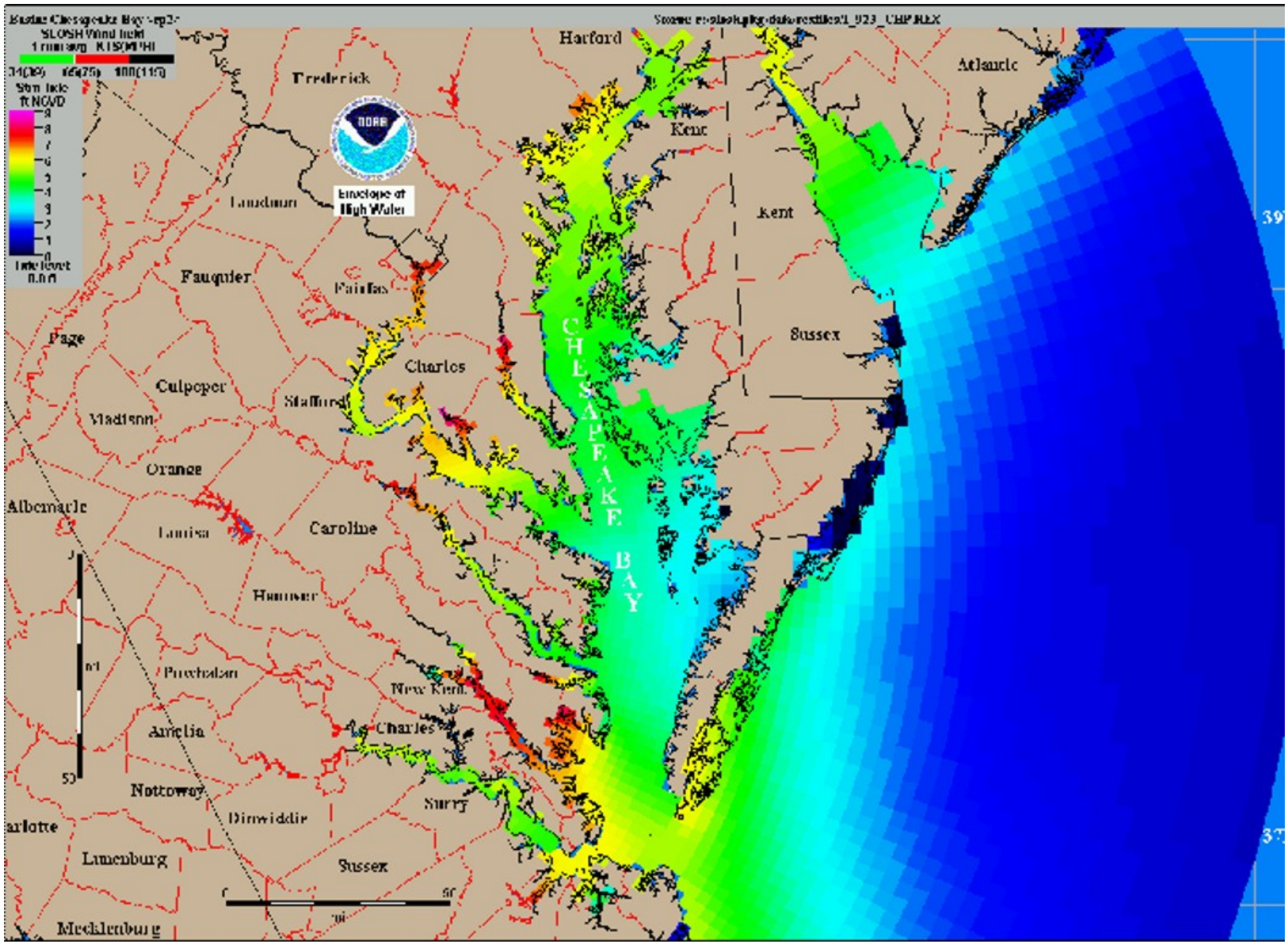
September 18, 2003



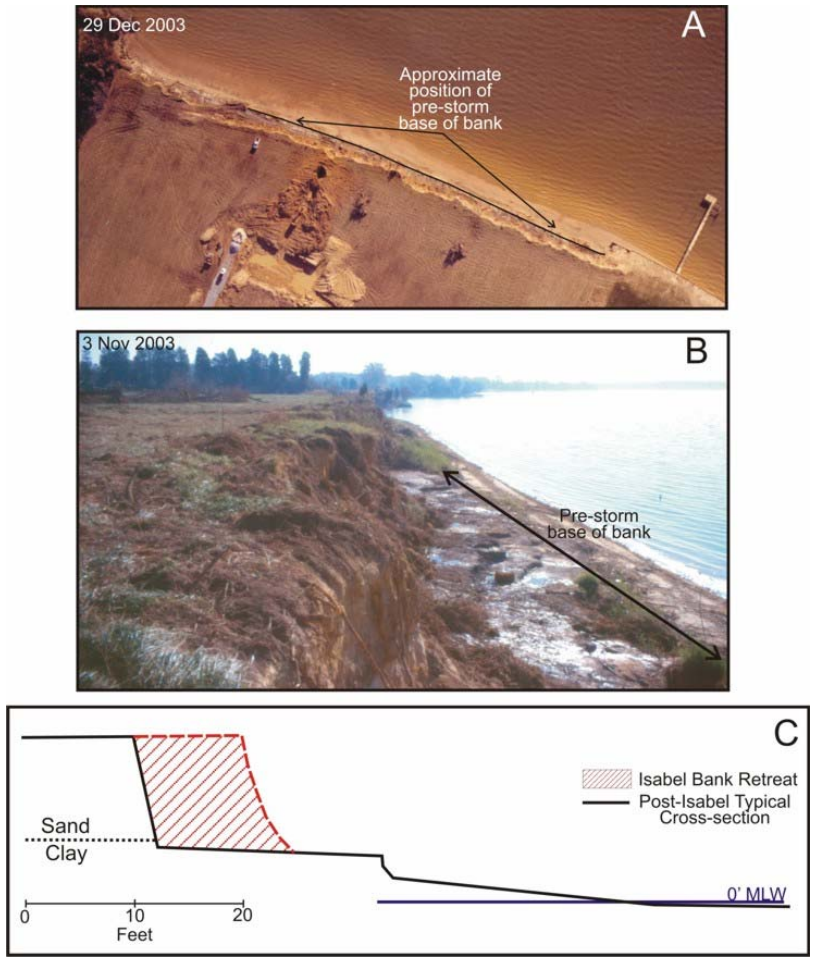




SLOSH Model


Harford
Atlantic
Frederick
Kent
Kent
Loudoun
Fauquier
Fairfax
Page
Charles
Sussex
Culpeper
Stafford
Madison
Orange
Albemarle
Caroline
Louisa
Hanover
Prince Edward
New Kent
Amelia
Charles
Nottoway
Surry
Dinwiddie
Lunenburg
Sussex
Mecklenburg
CHESAPEAKE BAY

Potomac River, Charles Co. Maryland, Post Izzy



Colonial Parkway, James River, post-Izzy

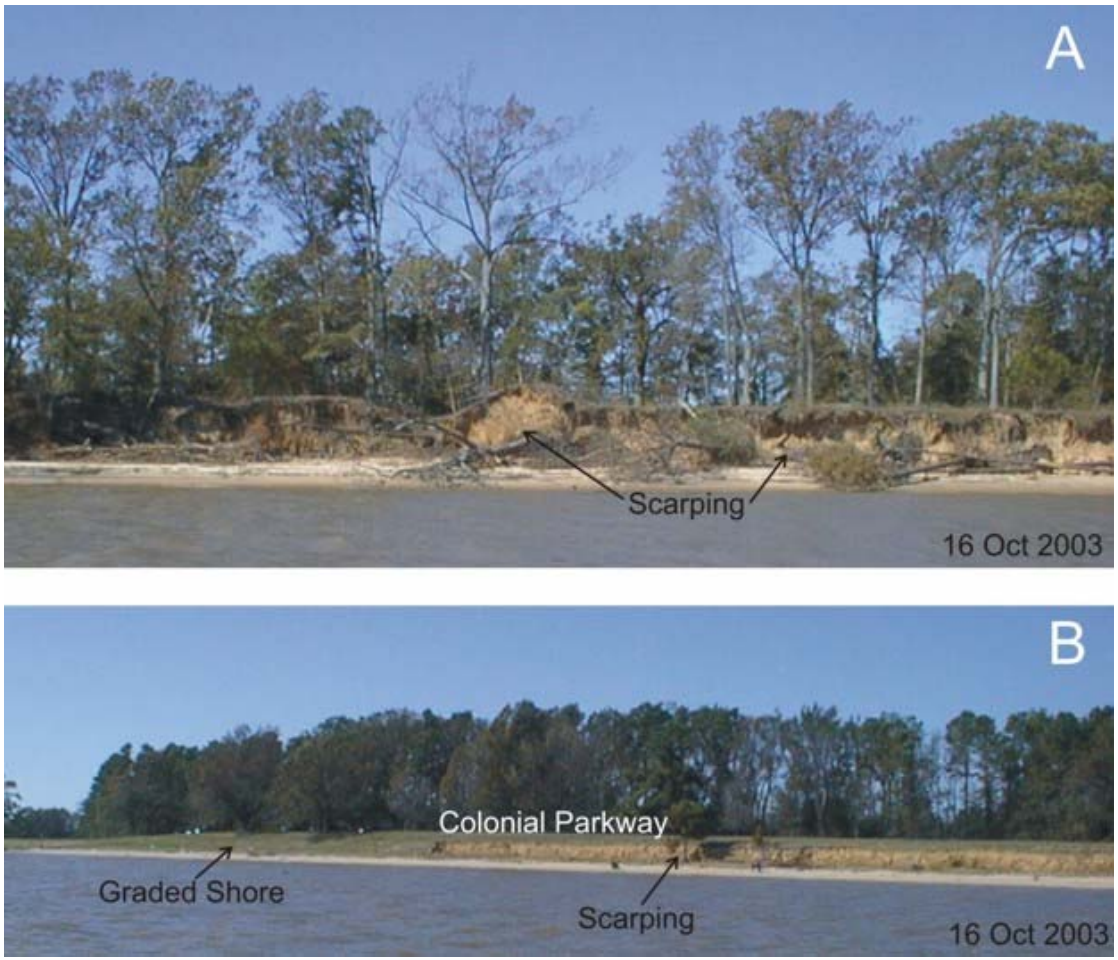
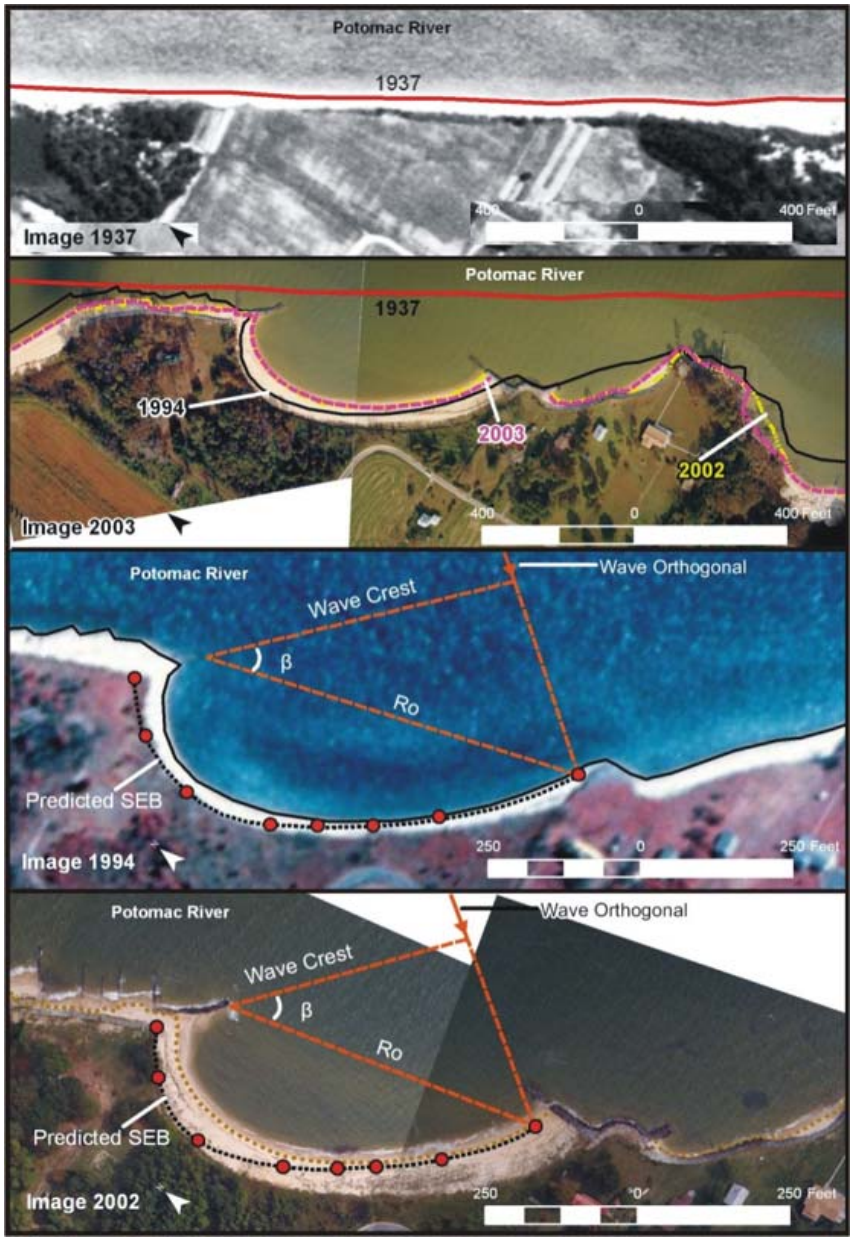


Image 2002

Red = 1937 **Brown = 1969** **Black = 1994** **Pink = 2002**



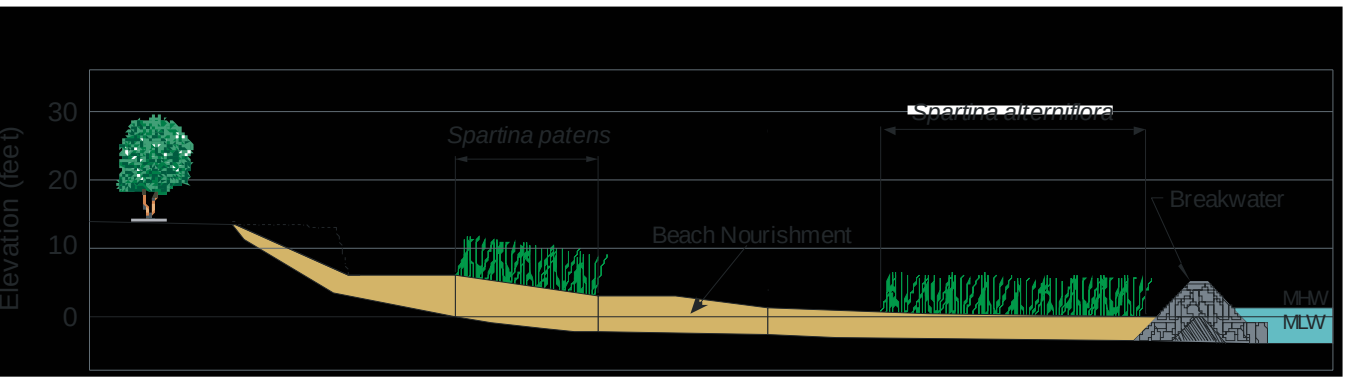
Summerille/Staples, Coastal bay evaluation and predicted bay shoreline using SEB

Summerille/Staples

March 8, 1988

April 28 2004

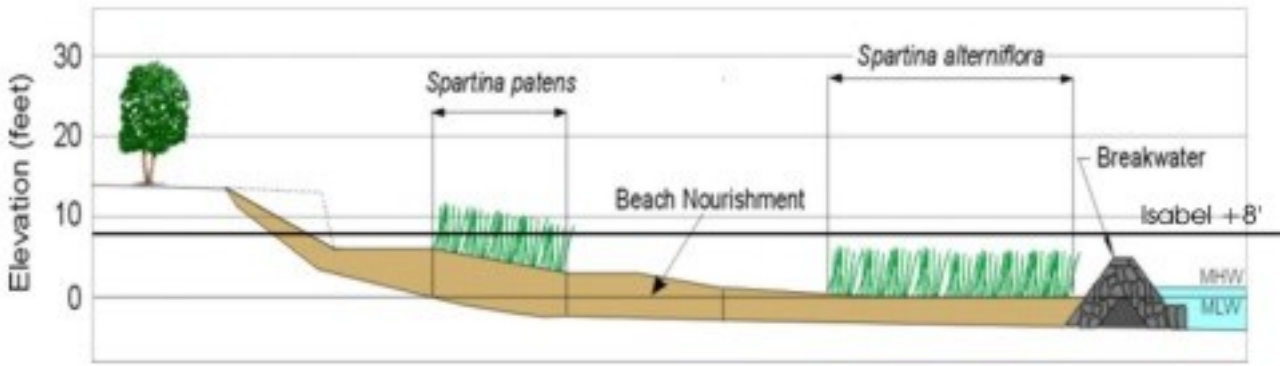
Breakwater system on Patuxent River in Calvert County, MD



Typical Breakwater Cross-section

Shore Protection

Asbury site before the project (November 1994), after the project (October 1998), and in August 2000.


Elevation (feet)
30
20
10
0
Spartina patens
Spartina alterniflora
Breakwater
Beach Nourishment
Isabel +8'
MHW
MLW

Van Dyke

Post Isabel
21 Oct 2003

The revetment at the east end of the site was overtopped by the storm surge and waves.

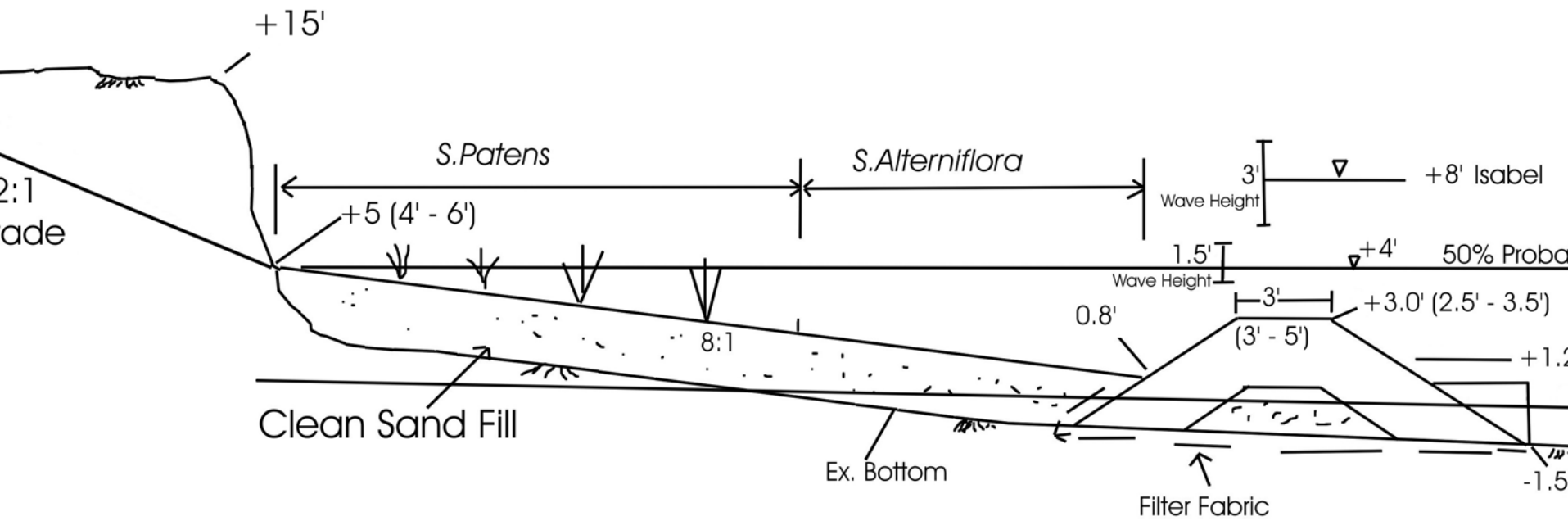
Note: no erosion of graded bank and beach is wide behind a headland breakwater.

Note: revetment crest elevation is +8 ft MLLW

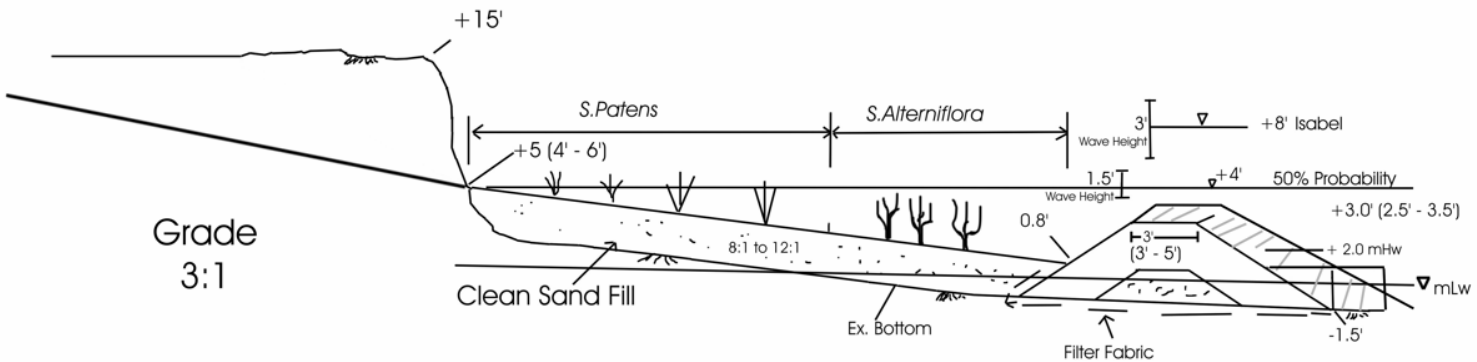
Webster Field Pre-Construction

Webster Field Post-Construction

Webster Field Post-Isabel

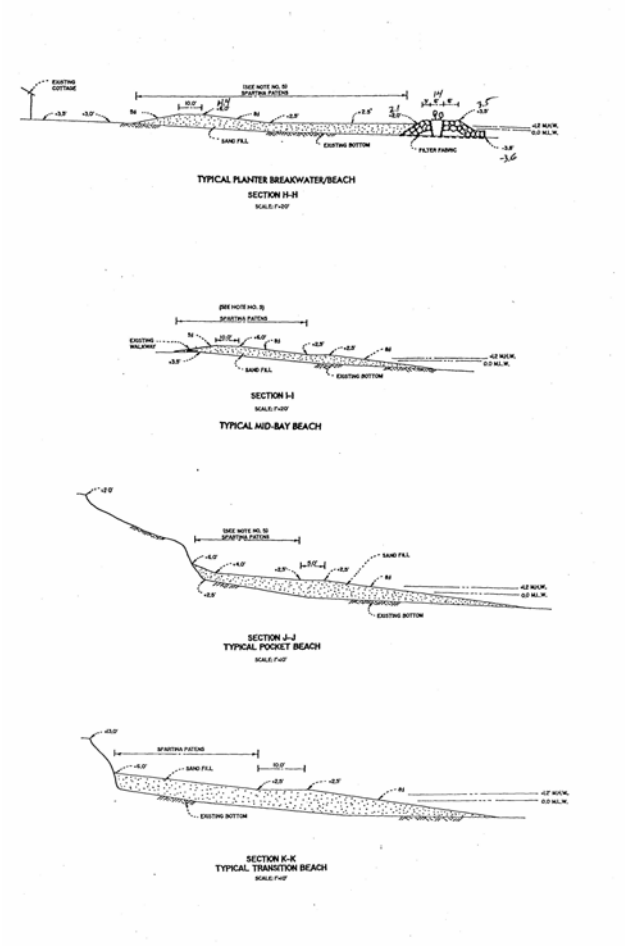


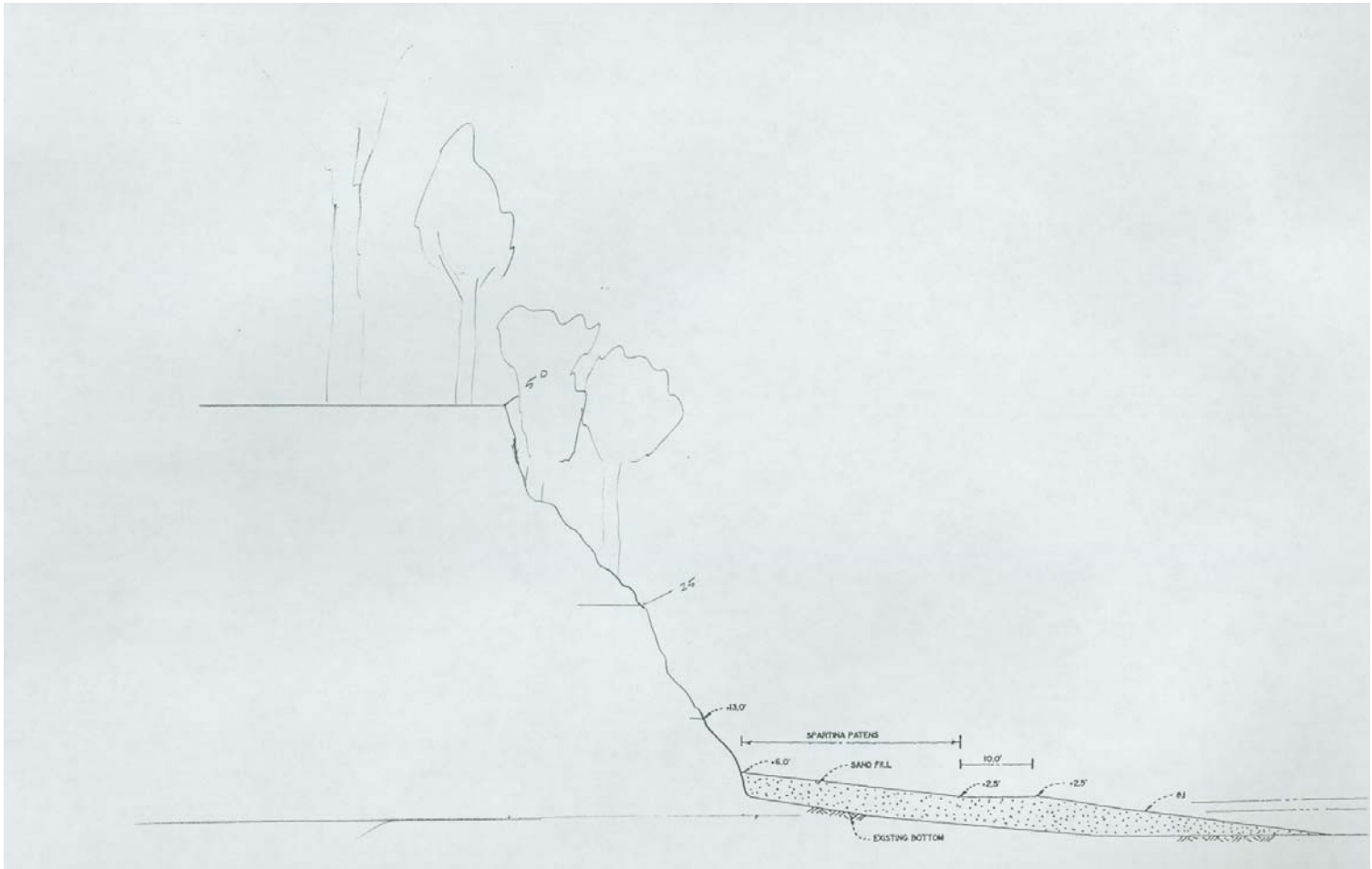
Typical Sill

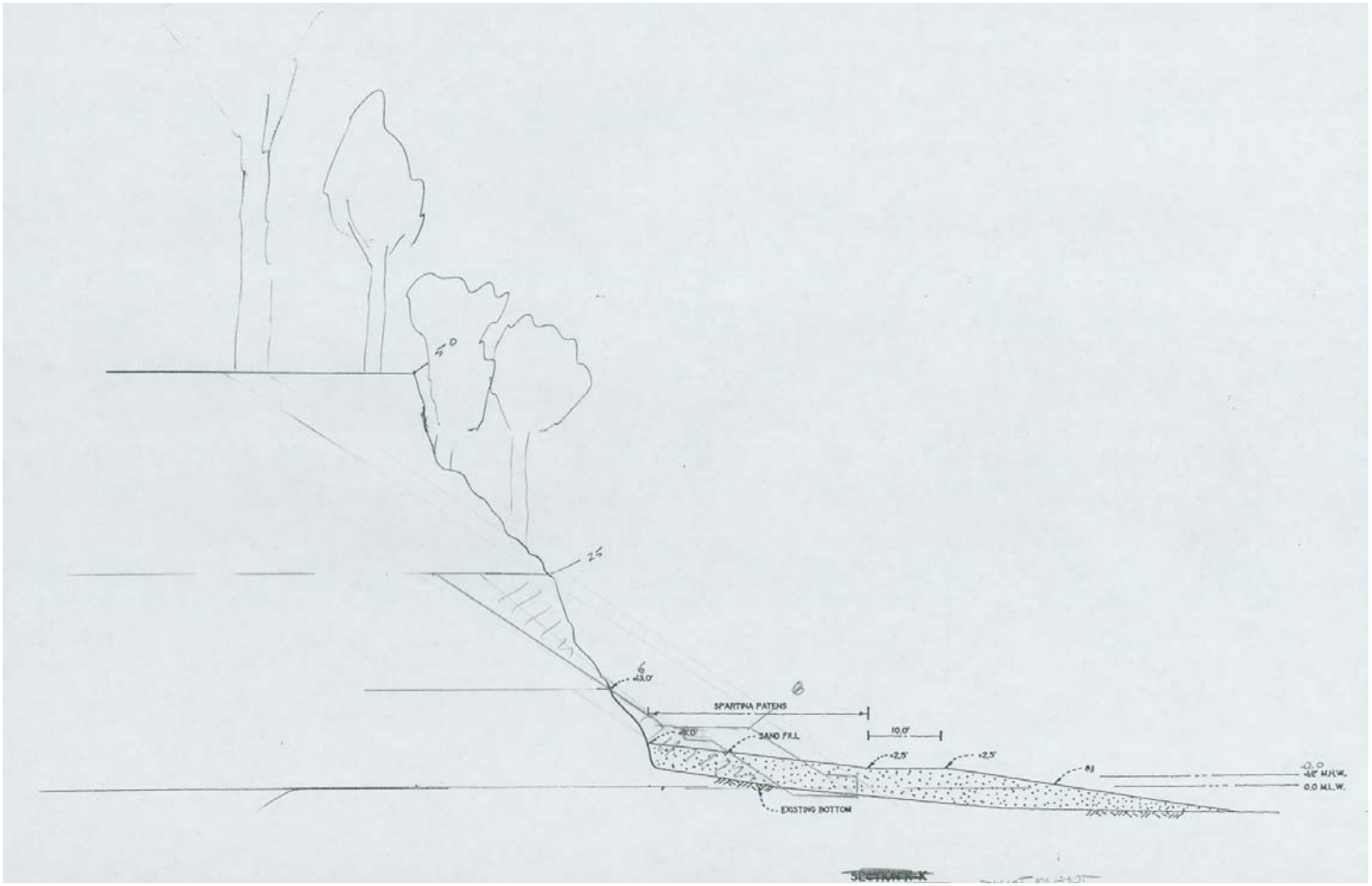


Typical Sill - Modifaction to Plan
1' Sea Level Rise

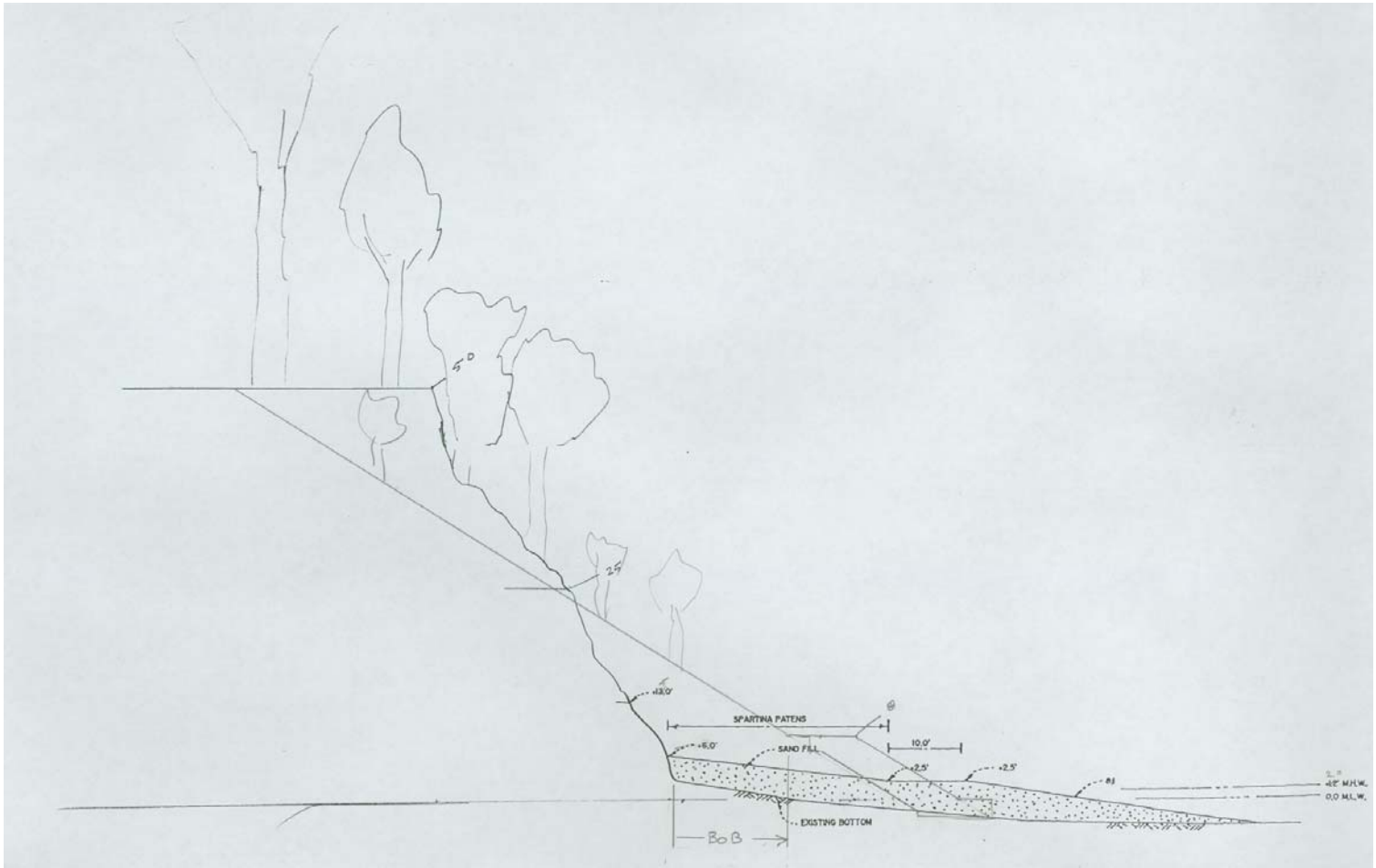
Beach Application to High and Low Banks




5.0
2.5
+13.0'
SPARTINA PATENS
+6.0'
SAND FILL
10.0'
+2.5'
+2.5'
EXISTING BOTTOM


5'0
25
+3.0'
SPARTINA PATENS
SAND FILL
10.0'
+2.5'
+2.5'
+1.5
+0.0 M.H.W.
0.0 M.L.W.
EXISTING BOTTOM

SECTION K-K


5:1
2:1
+12.0'
SPARTINA PATENS
10.0'
+6.0'
SAND FILL
+2.5'
+2.5'
EXISTING BOTTOM
BoB

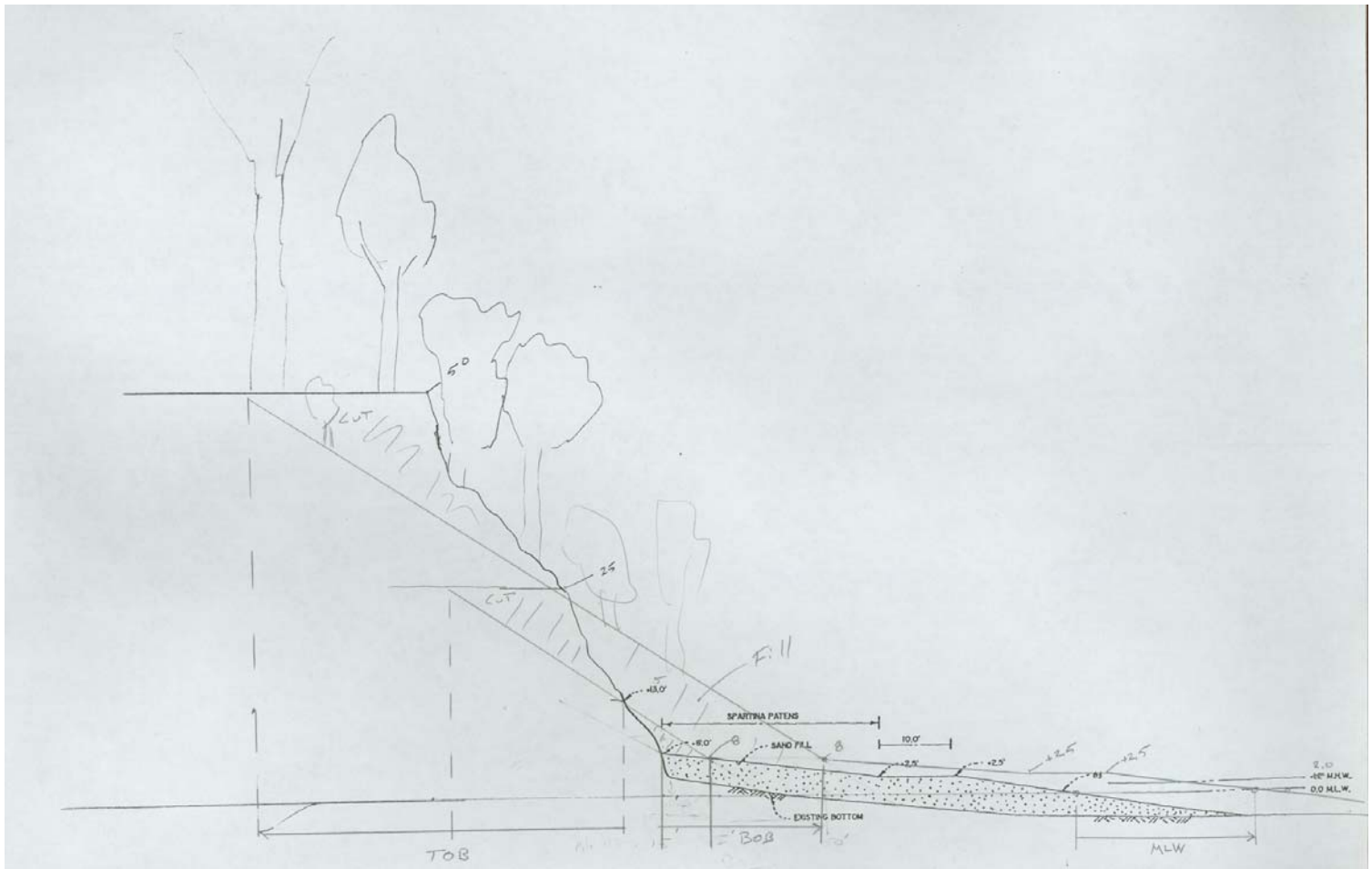
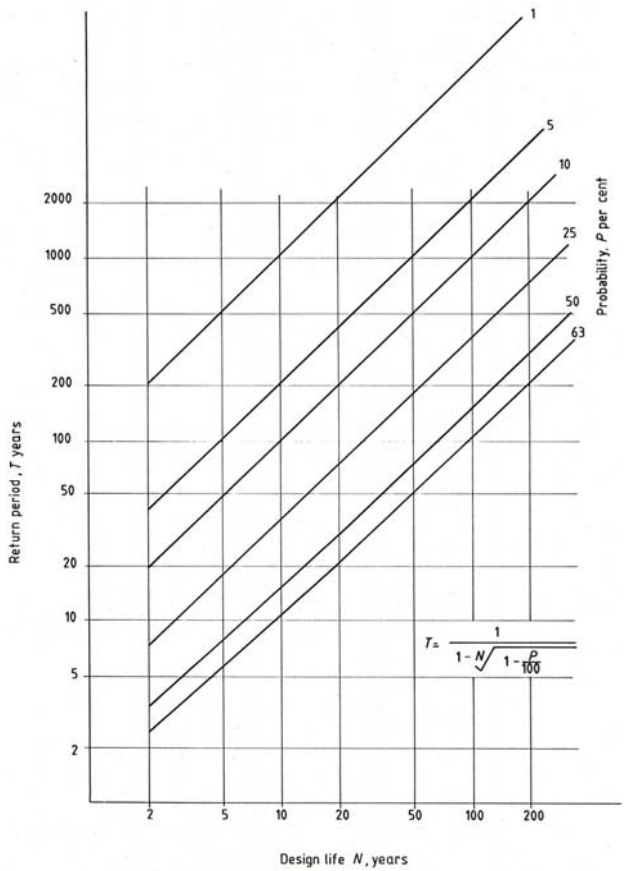

5:0
CUT
2:5
CUT
FILL
+13.0'
SPARTINA PATENS
+8.0'
SAND FILL
10.0'
+2.5'
+2.5'
+2.5'
+2.5'
2.0
+0.0 M.H.W.
0.0 M.L.W.
EXISTING BOTTOM
TOB
BOB
MLW

Table 3-2. Project Life vs. Risk

Project Life (years)	Design Condition Return Percent (years)	
	10	25
1	10	4
2	19	8
5	41	18
10	65	34
15	79	46
20	88	56
25	93	64
30	96	71
40	99	80
50	99	87

Example design conditions from graph at right.



From: British Standard for Maritime Structures, Part 7: 1991 Guide to the design and construction of breakwaters.

Shore Management Goals

Drum Point before a breakwater project (August 11, 1989),

after a project (September 7, 1990)

and in September 1994.