

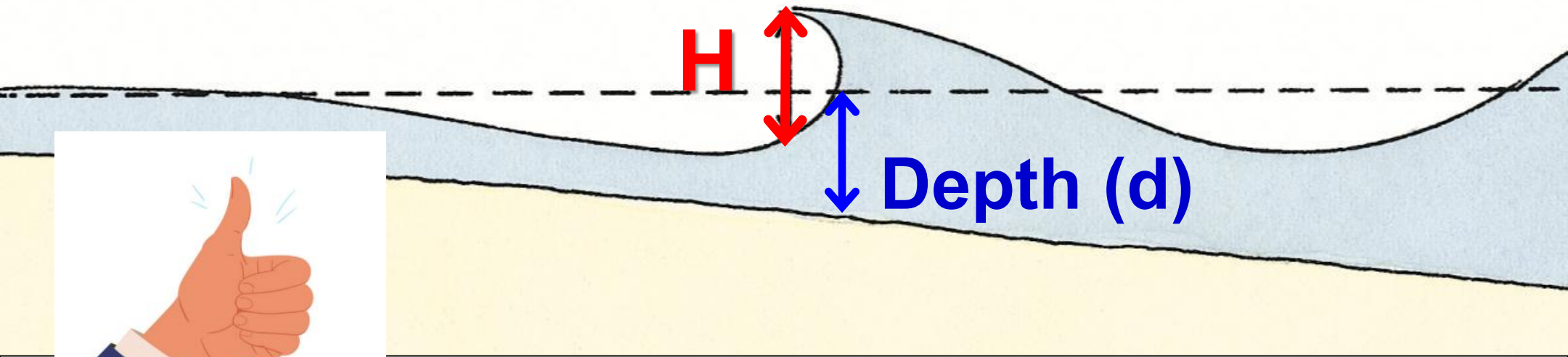
EROSION MANAGEMENT OPTIONS LIFE IS FULL OF TRADEOFFS

Spencer Rogers

UNC-Wilmington Coastal Engineering Program



BREAKING WAVE HEIGHT (H) LIMITED BY DEPTH (d)



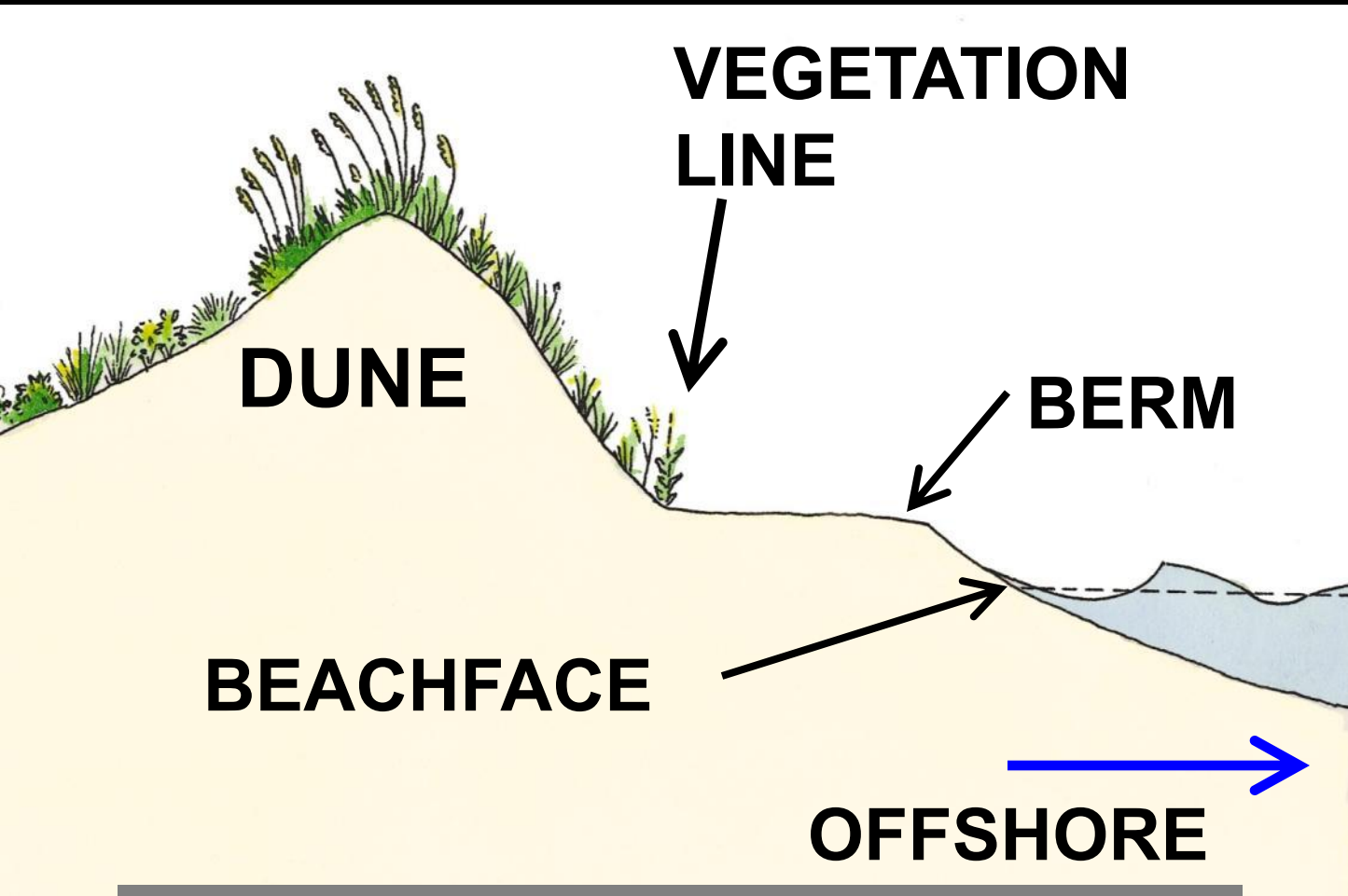
MAX WAVE HEIGHT=WATER DEPTH
(Engineers) $H = 0.78 \times d$



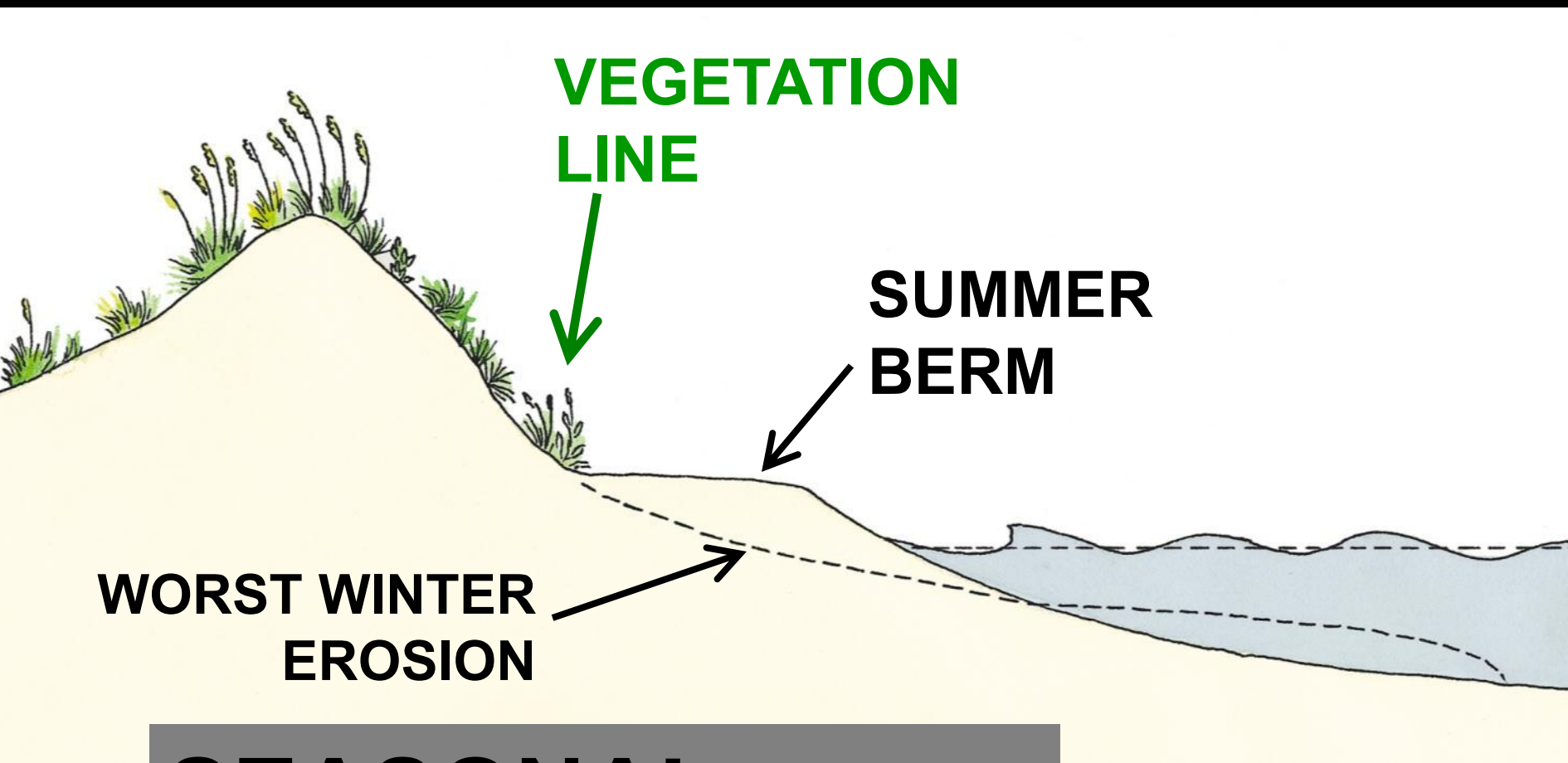
EROSION “TYPES”



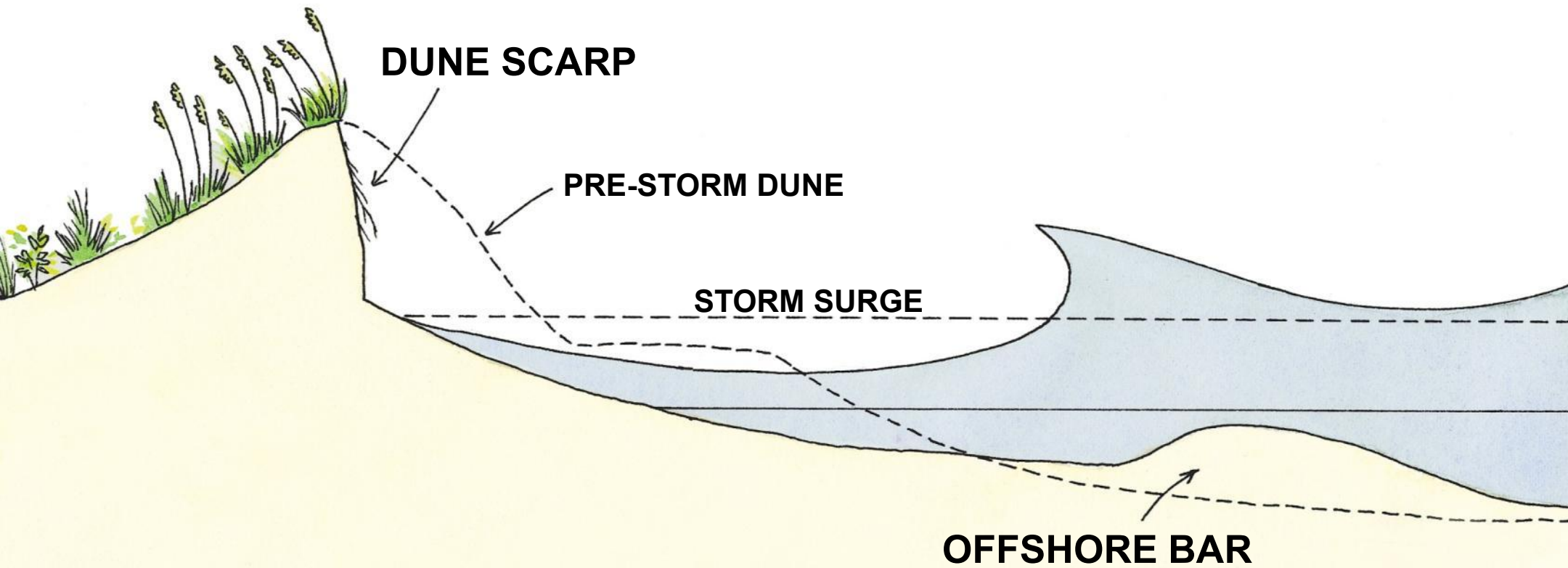
- **Seasonal**
- **Storm-induced**
- **Long-Term**
- **Inlet**



DEFINITIONS



**SEASONAL
FLUCTUATIONS**



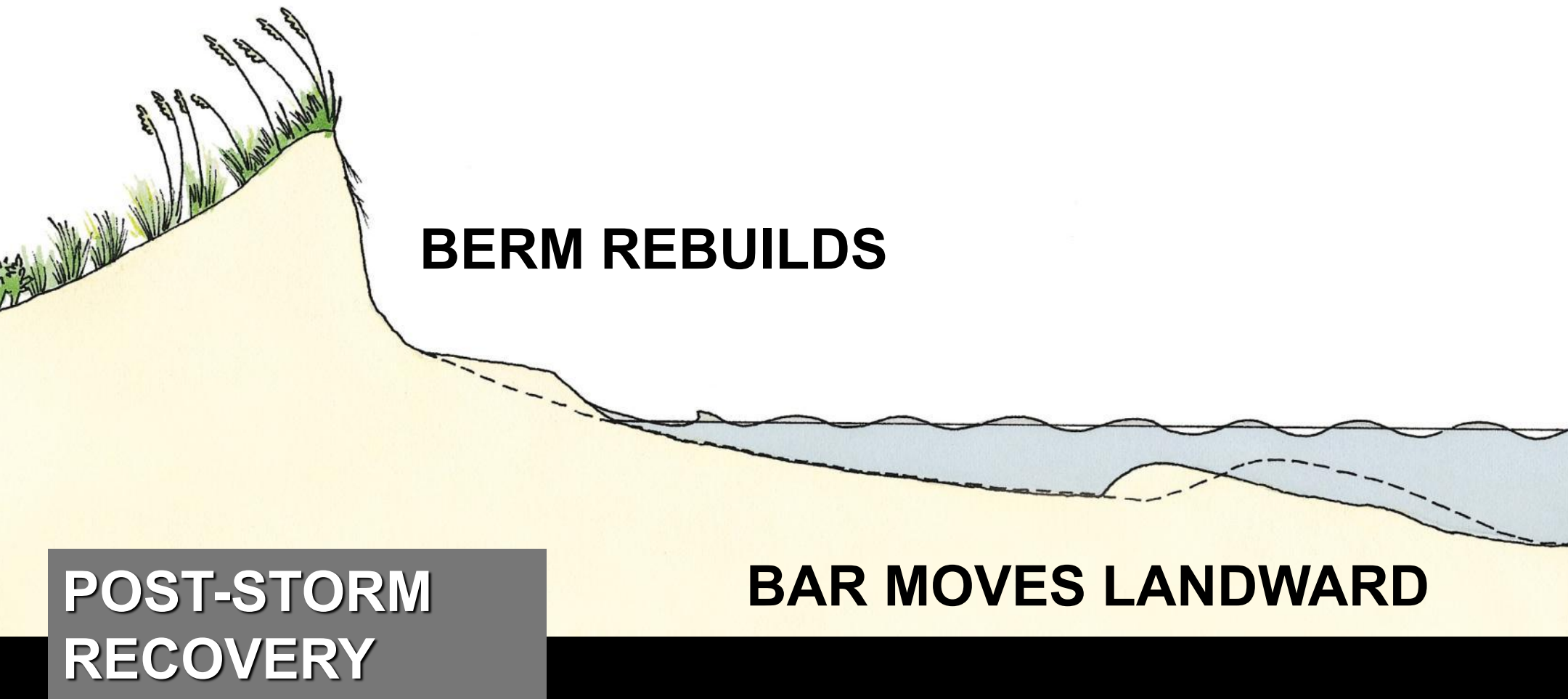
STORM-INDUCED







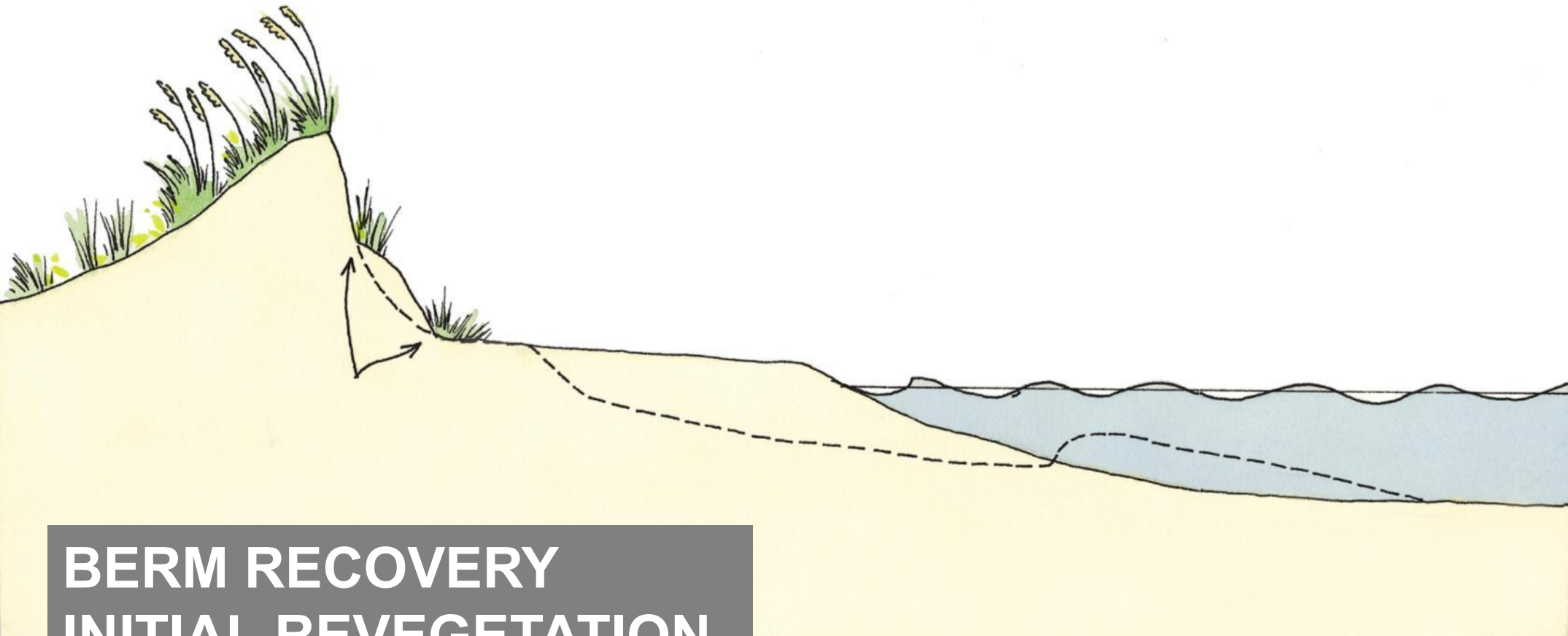




BERM REBUILDS

**POST-STORM
RECOVERY**

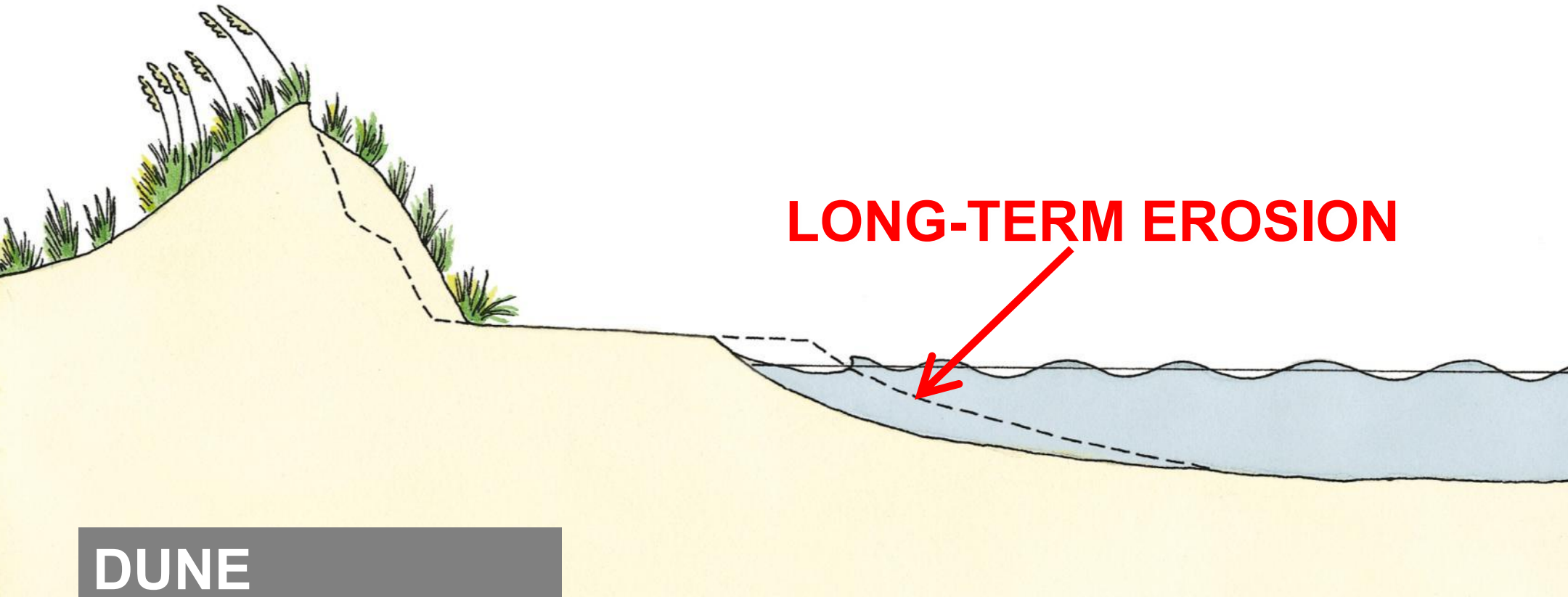
BAR MOVES LANDWARD



**BERM RECOVERY
INITIAL REVEGETATION**







LONG-TERM EROSION

**DUNE
RECOVERY**

CAUSES OF LONG-TERM EROSION

- Offshore storm transport
- Longshore transport into inlets
- Storm overwash
- Sea level rise

South Nags Head



Two weeks later

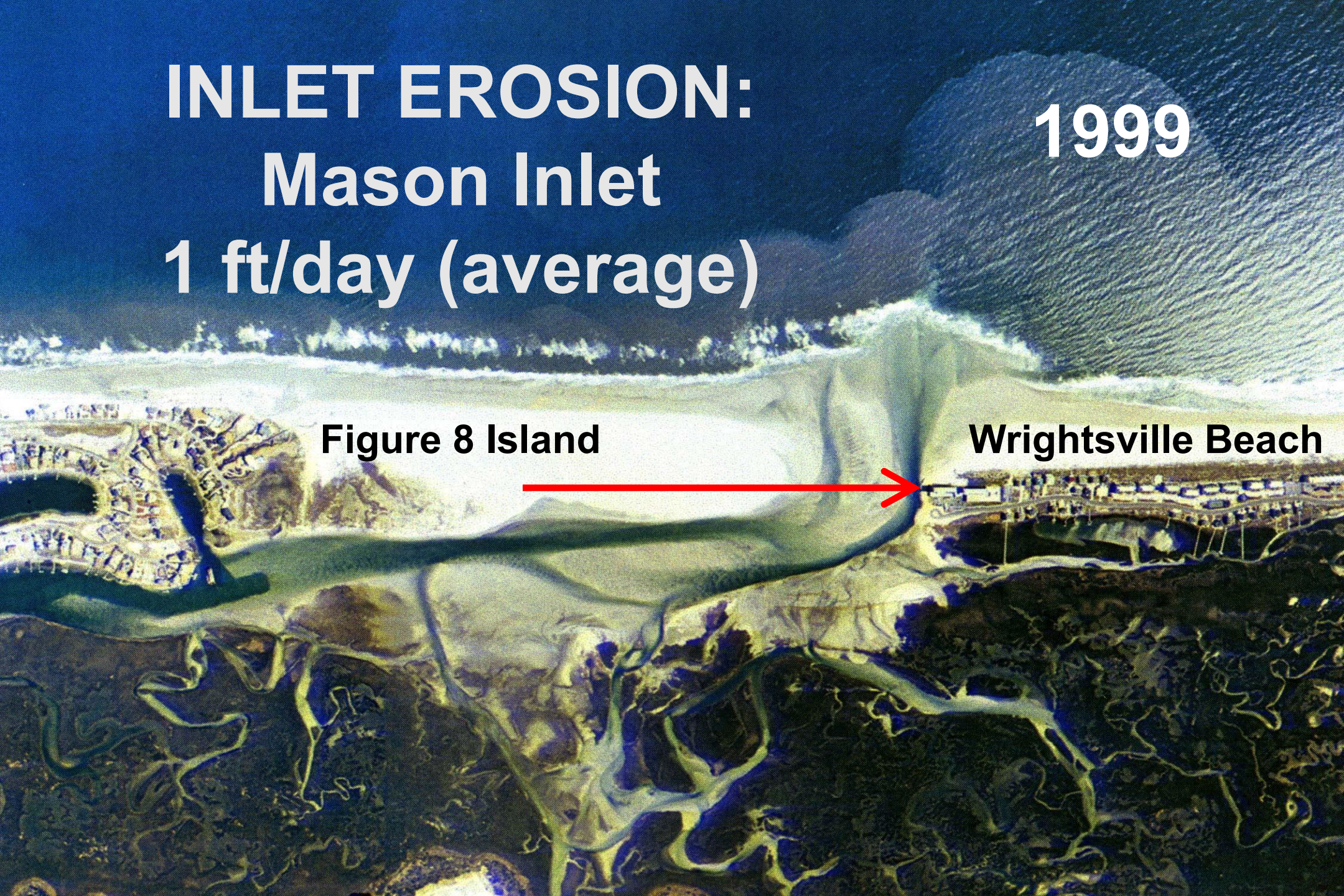


INLET EROSION: Mason Inlet 1 ft/day (average)

1999

Figure 8 Island

Wrightsville Beach



CLASSES OF EROSION MANAGEMENT OPTIONS

- **Tradeoffs**
- **Practical Limits**

CLASSES OF EROSION MANAGEMENT OPTIONS

- 1. Avoid the problem**
- 2. Plant it**
- 3. Harden the shoreline**
- 4. Trap sand**
- 5. Add Sand**

1. Avoid the Problem

Shoreline setbacks & relocation

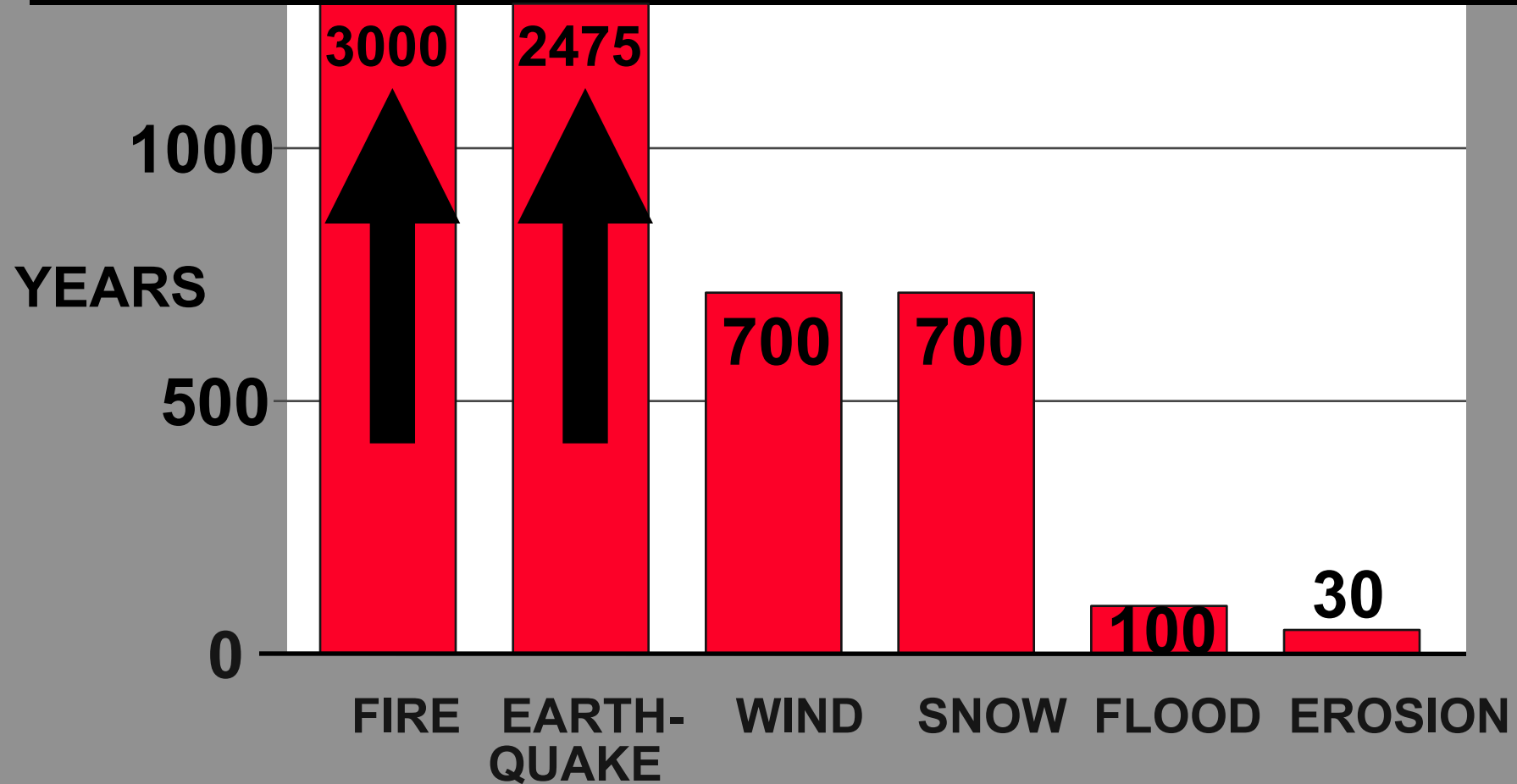
- **Prime tradeoff: Available land**
- **Practical limits: Low density
development**
- **Extreme example: Cape Hatteras
Lighthouse**



By owner **FOR SALE**
or **TRADE**
200' Ocean Front
(803) 449-5855
(919) 467-2120



CONSTRUCTION STANDARDS: RETURN PERIODS



**STREET
SETBACK**

**AVAILABLE FOR
INCREASED SETBACK**



30 X E

MINIMUM SETBACK

NEW CONSTRUCTION





MACK

Expert

MOVERS

HOUSE

WIDE

LOAD

VIRGINIA
Y40-841

CAPE HATTERAS LIGHTHOUSE ON THE MOVE





2. Plant it

Dune grasses, sand fences & other dune building

- **Prime tradeoff: Limited effectiveness**
- **Practical limits:**
 - **Storm protection only**
 - **Ineffective against long-term erosion**





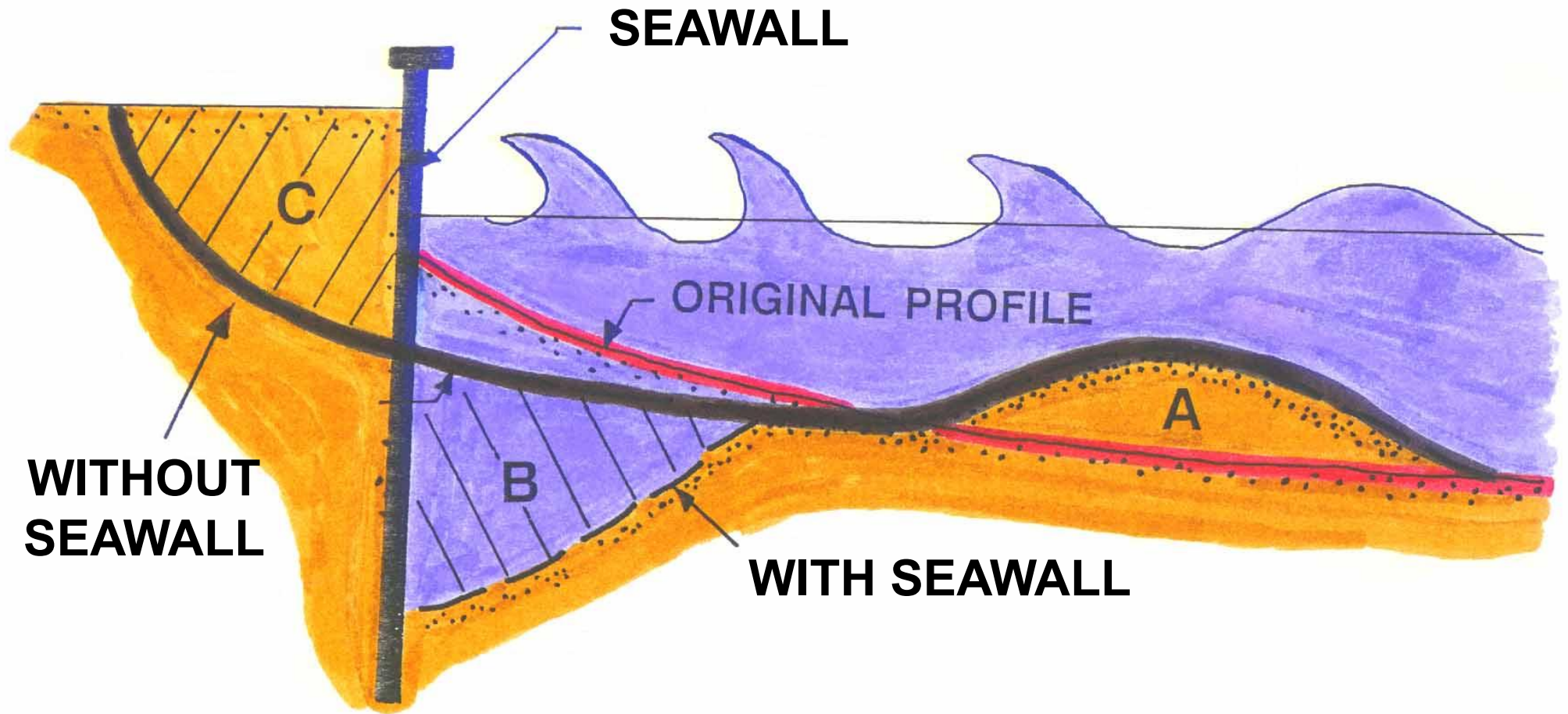
3. Harden the Shoreline

Seawalls, bulkheads, retaining walls & revetments (sloping)

- **Prime tradeoff: Lose the beach with long-term erosion**
- **Practical limits: \$\$**
- **Example: Galveston Seawall**



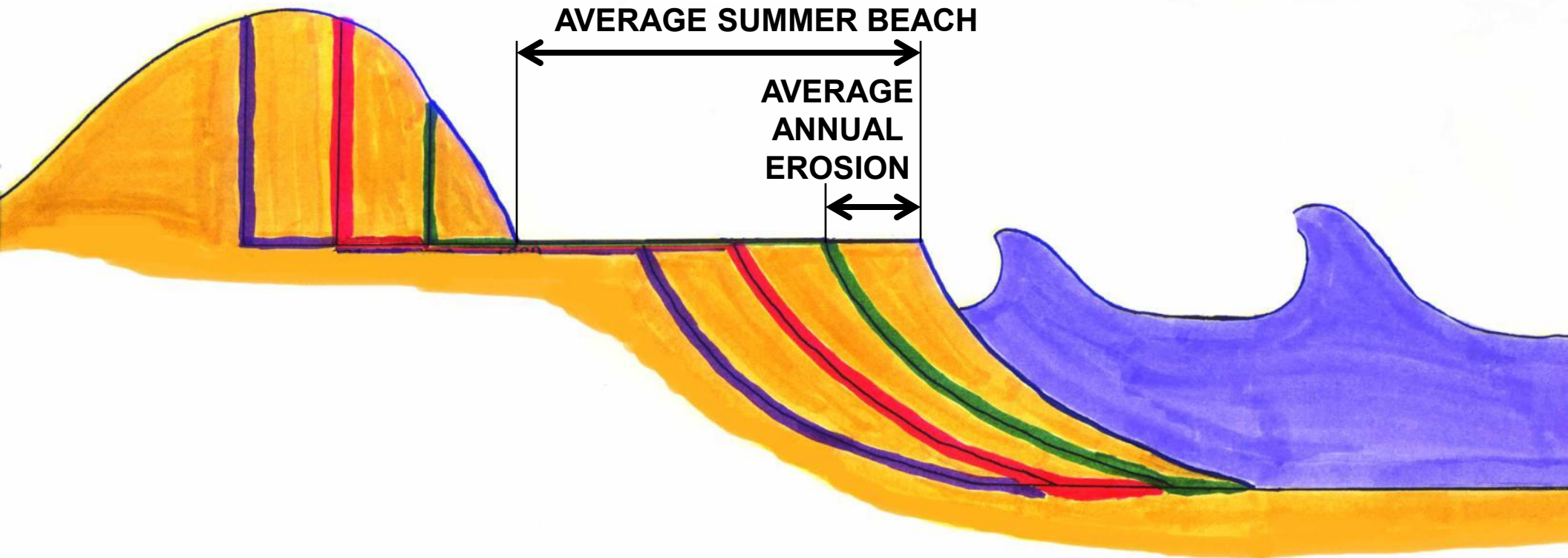




TEMPORARY PROFILE CHANGES

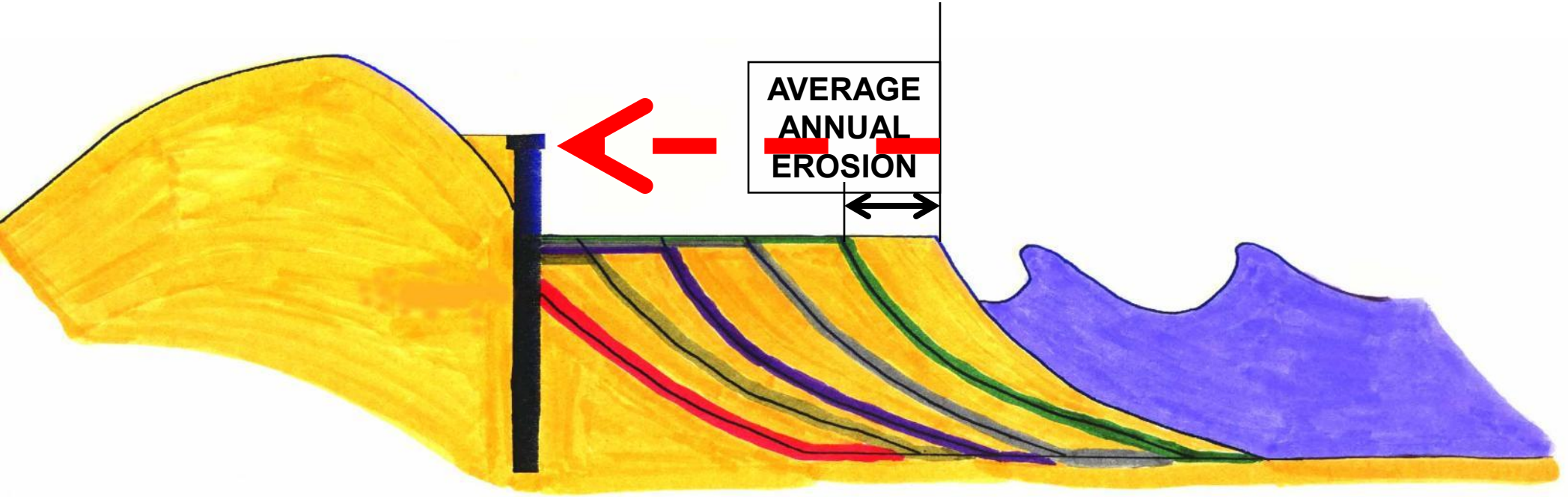
Oak Island c.1979





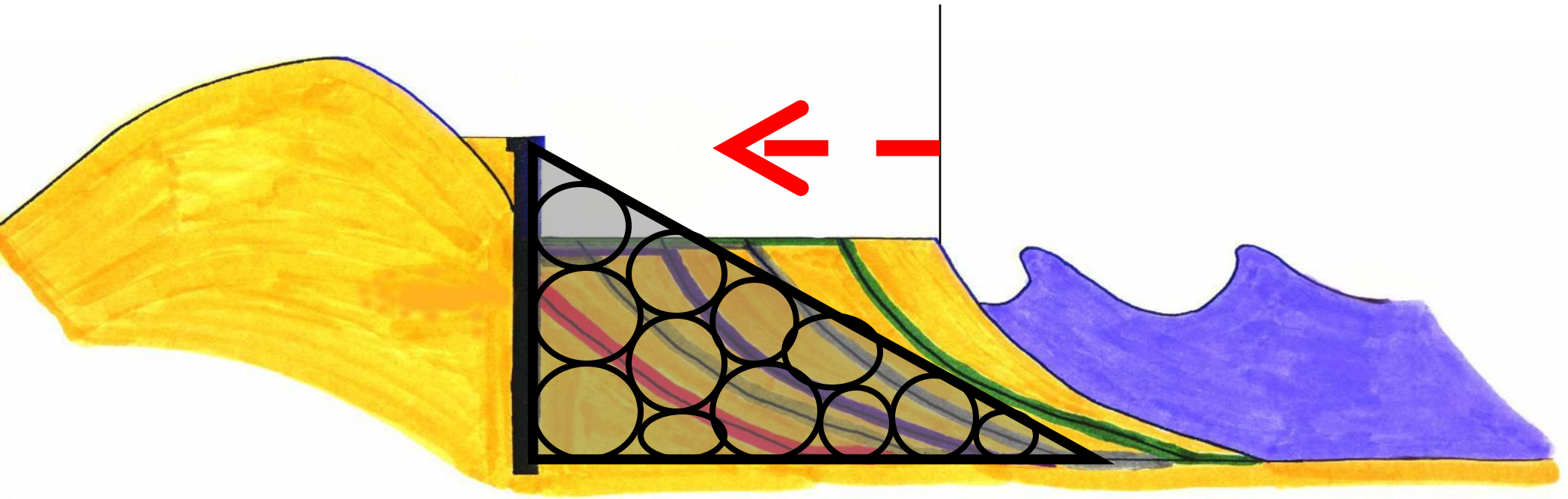
**LONG-TERM EROSION
WITHOUT SEAWALL**

SHRINKING BEACH WIDTH WITH TIME



NO BEACH

**LONG-TERM EROSION
WITH SEAWALL**

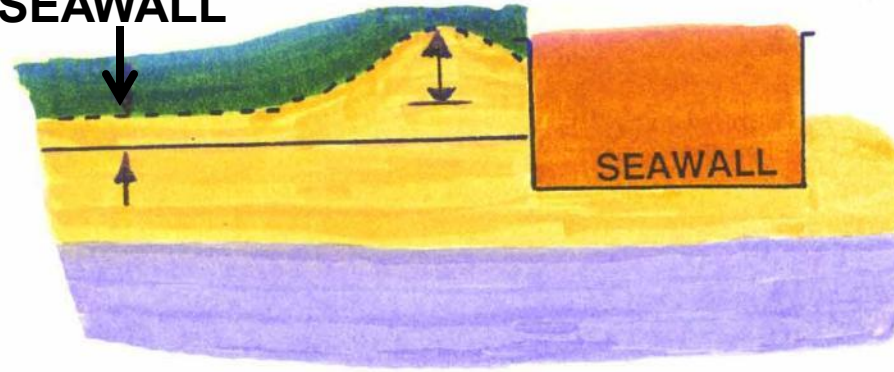


NO BEACH SOONER

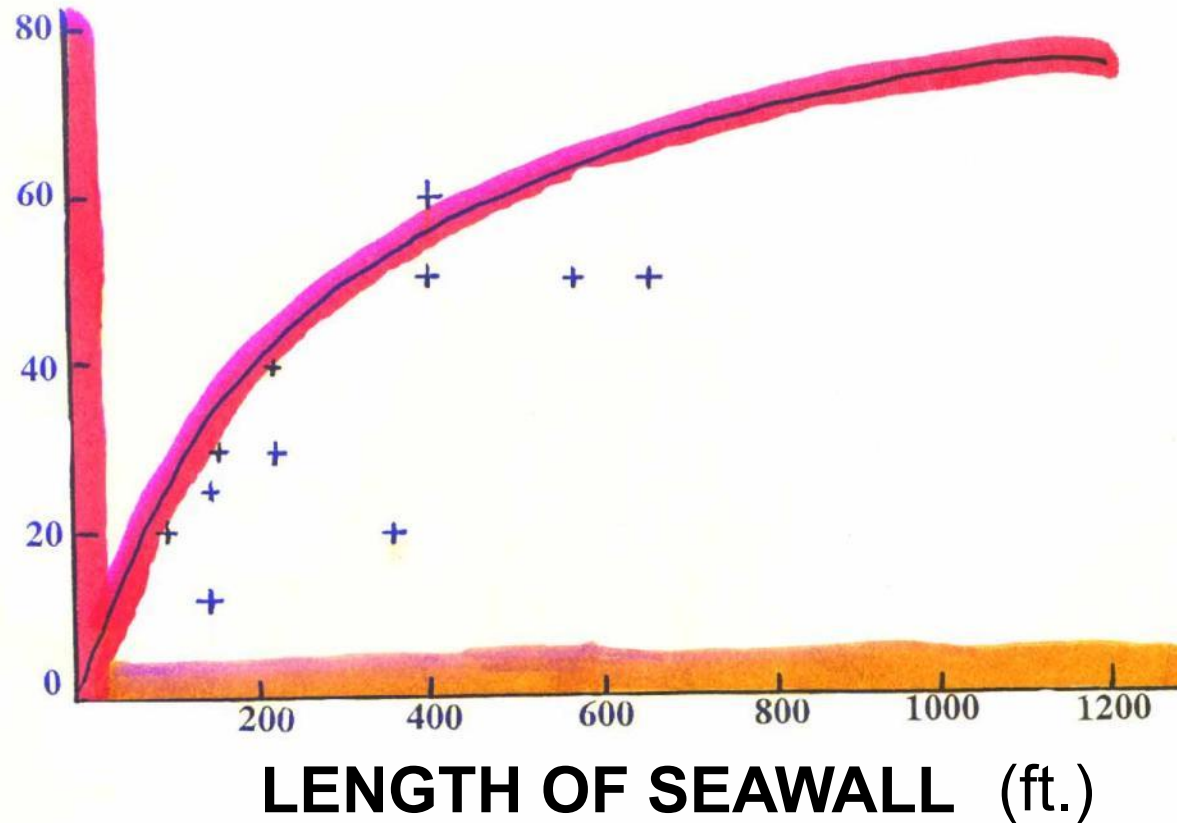
**LONG-TERM EROSION
WITH REVETMENT**

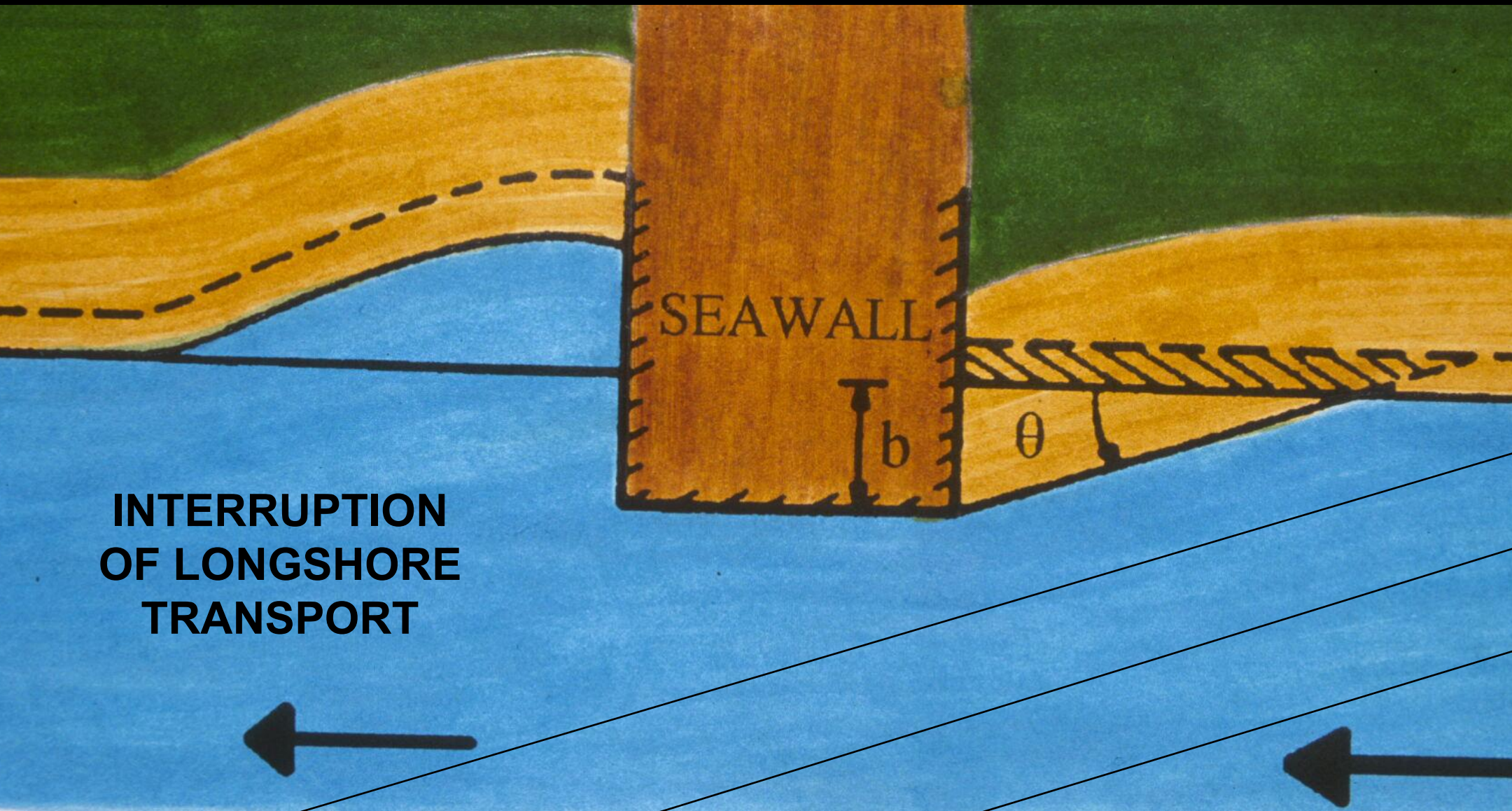
**EROSION
WITHOUT
SEAWALL**

**EROSION WITH
SEAWALL**



**INCREASED
EROSION
DUE TO
WALL**





INTERRUPTION
OF LONGSHORE
TRANSPORT

Galveston Seawall





West end

SEAWALL



East end



Fort Fisher

4. Trap Sand

Groins, jetties & offshore breakwaters

- **Prime tradeoff: Takes someone's sand**
- **Practical limits: Localized protection, end of sand supply applications & \$\$**
- **Example: Fort Macon terminal groin**

Definitions

JETTY: A structure used to stabilize a navigation channel. Usually found in pairs on each side of an inlet.

GROIN: A structure perpendicular to the shoreline used for shoreline stabilization. Used as single or multiple structures

TERMINAL GROIN: A groin located at the end of a sand transport system, typically an inlet. Usually a single structure.

Size

JETTY: Large, in some cases over a mile in length.

TERMINAL GROIN: Much smaller than a jetty, ~5 times smaller.

Structure sizes vary with the size of the inlet.



Longshore Current



South Nags Head
260,000 cy/yr
71 Dump truck/day



**Cape Hatteras
Lighthouse**



Navy groins





Miami Beach
c. 1975



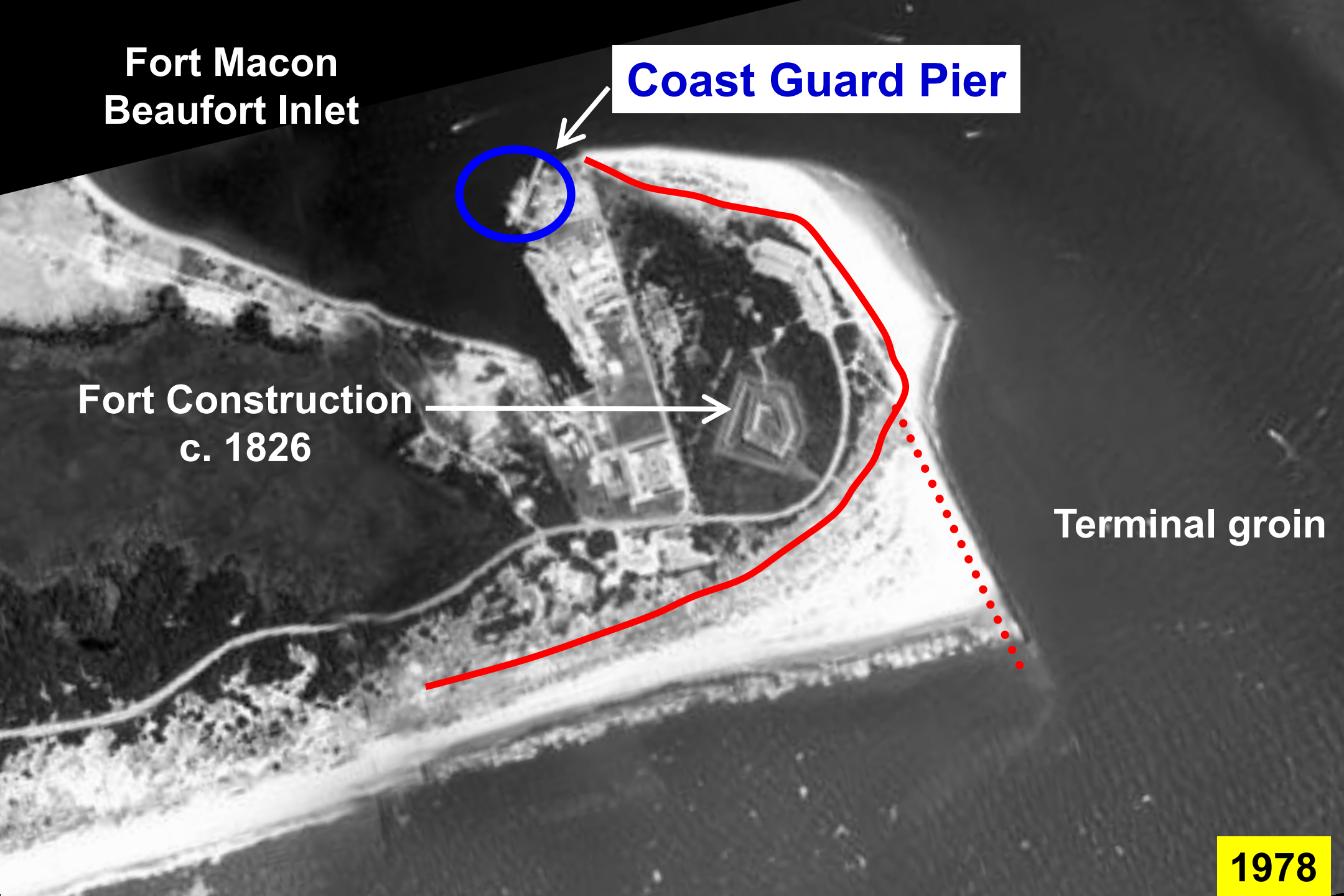
**Fort Macon
Beaufort Inlet**

Coast Guard Pier

**Fort Construction
c. 1826**

Terminal groin

1978





1996

NC Aquarium Roanoke Island



5. Add sand

Beach Nourishment

A treatment not a cure

- **Prime tradeoff: \$\$\$\$**
Regular maintenance required
- **Practical limits:**
Community application
Moderate erosion rate
Available sand
Denser development
- **Example: Wrightsville Beach**



**Wrightsville Beach
1979, NO MAINTENANCE**



1980 RECONSTRUCTION



1995, PRE-HURRICANES

Hard structures with beachfill as mitigation

- Structures not needed where beach nourishment successful

Example: Wrightsville & Carolina Beach

- Structures will be of interest where beach nourishment is not cost effective.





EROSION MANAGEMENT

- Solving one owner's erosion problem with structures is not difficult (but often costly).
Tradeoffs will occur.
- Solving a community erosion problem is far more complicated.
Who pays the tradeoffs?

EROSION MANAGEMENT

NO EASY ANSWERS

Questions & Discussion

