

The Shaping of Ocean Beach

Presented to:
San Francisco Planning and
Urban Research
SPUR

Bob Battalio, PE

October 21, 2010

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Golden Gate Littoral Cell

Ebb Bar

Discharge through Golden Gate

Flood Shoals

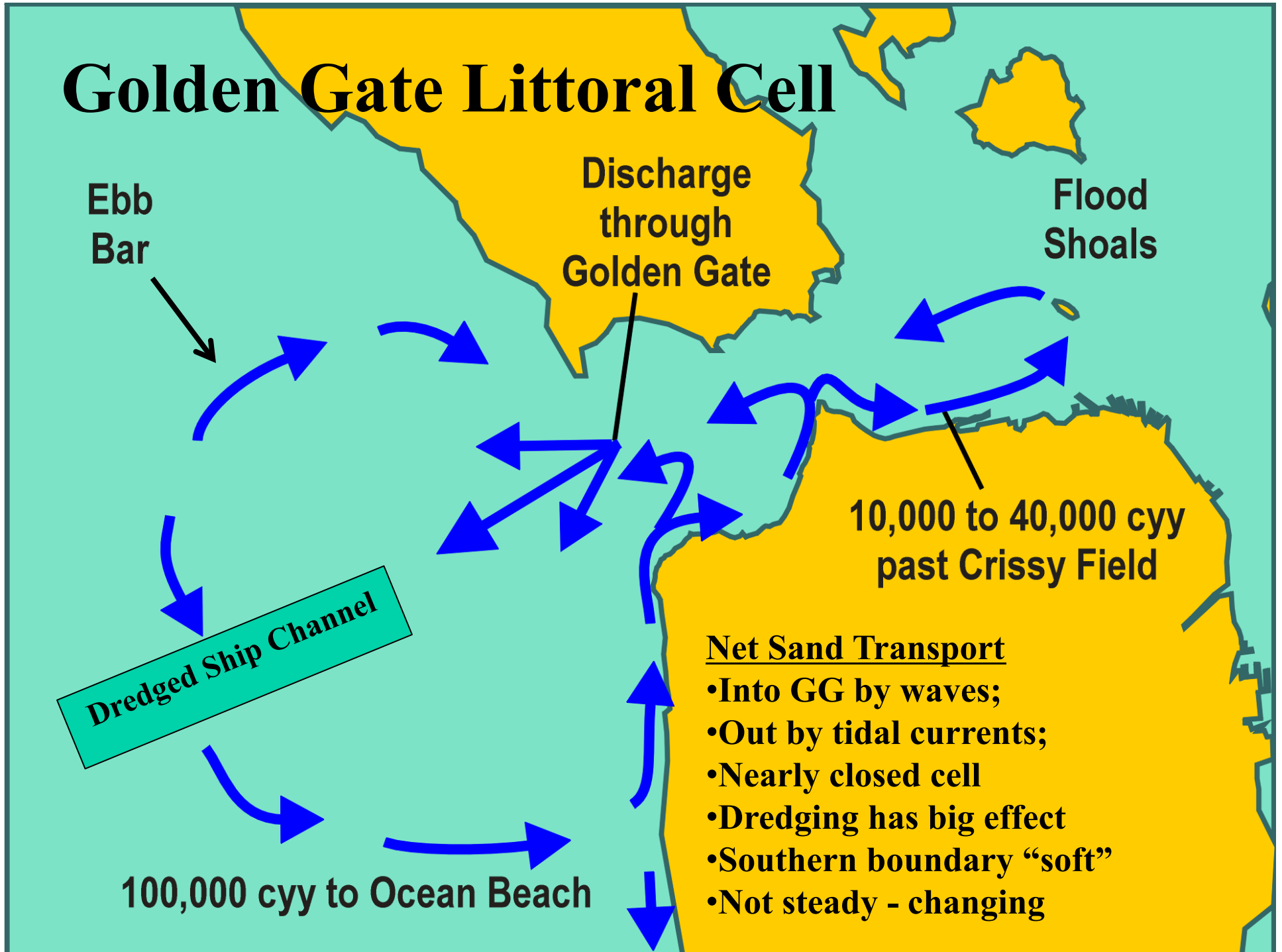
10,000 to 40,000 cyy past Crissy Field

Dredged Ship Channel

100,000 cyy to Ocean Beach

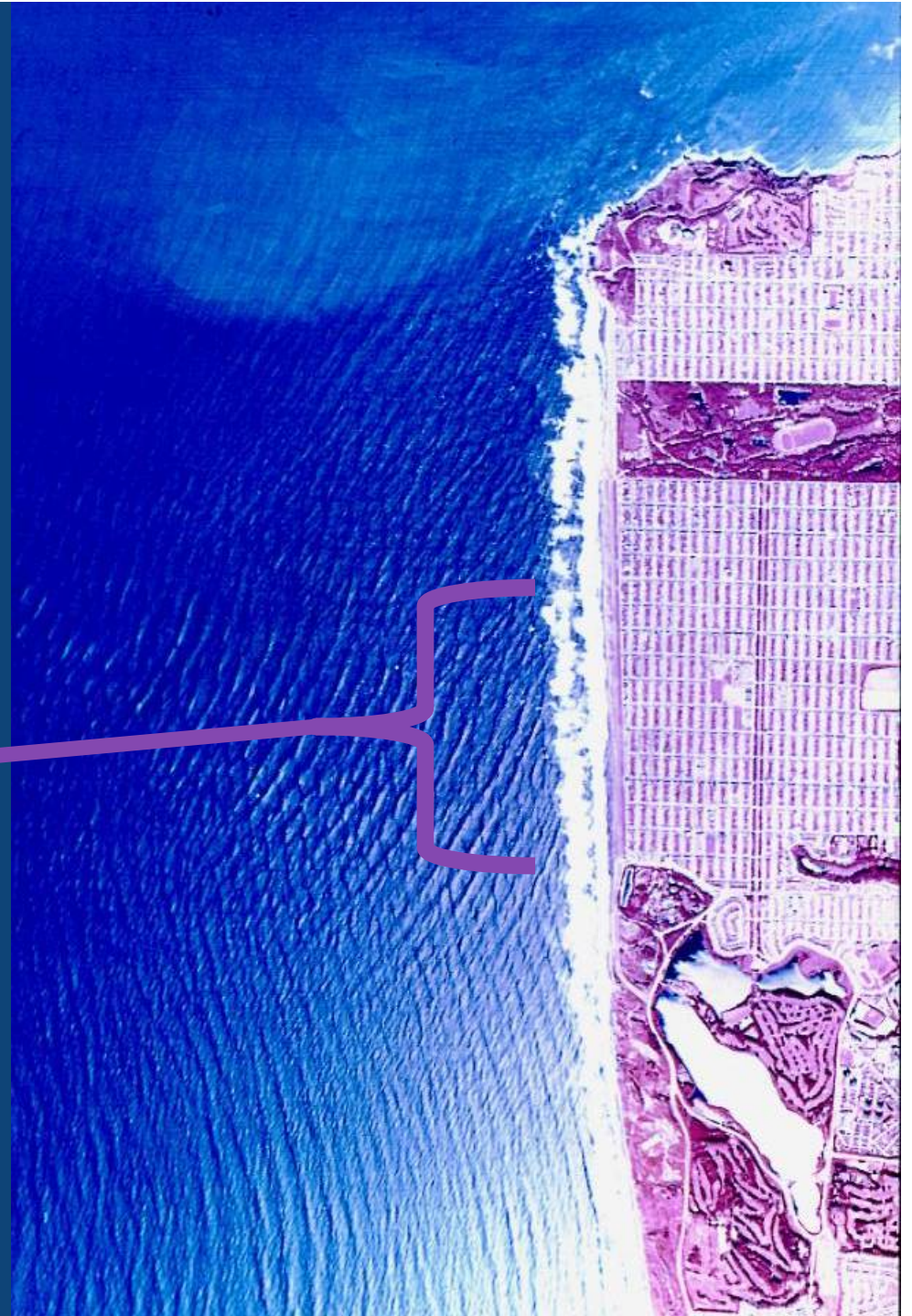
Net Sand Transport

- Into GG by waves;
- Out by tidal currents;
- Nearly closed cell
- Dredging has big effect
- Southern boundary "soft"
- Not steady - changing



Wave Refraction Effects

**Wave Refraction results
in larger waves, roughly
Noriega to Sloat**





Big Waves !



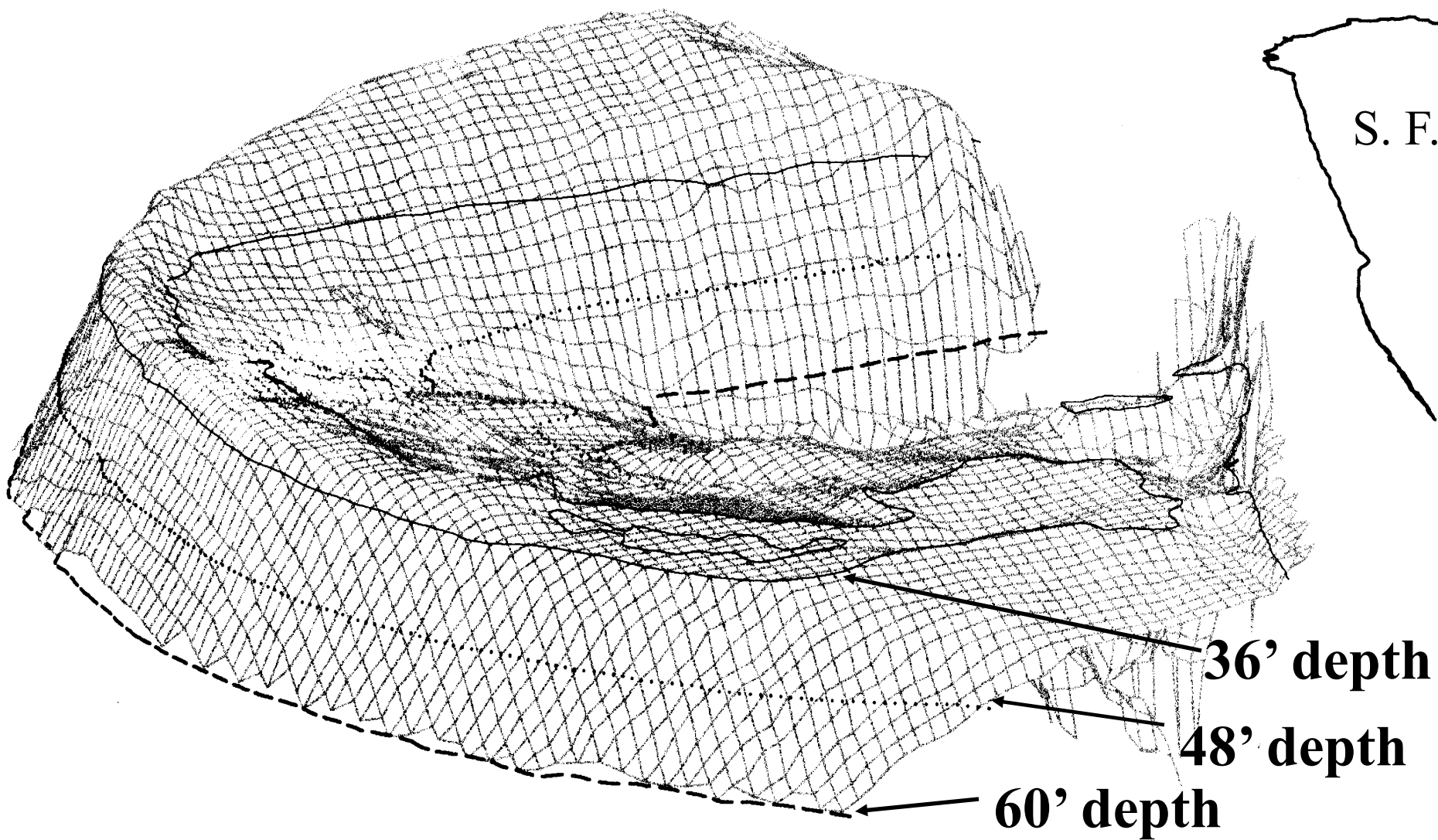
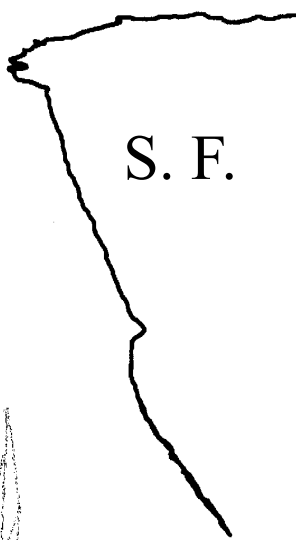
Great Surfing



Photograph © Martha Jenkins, 1994



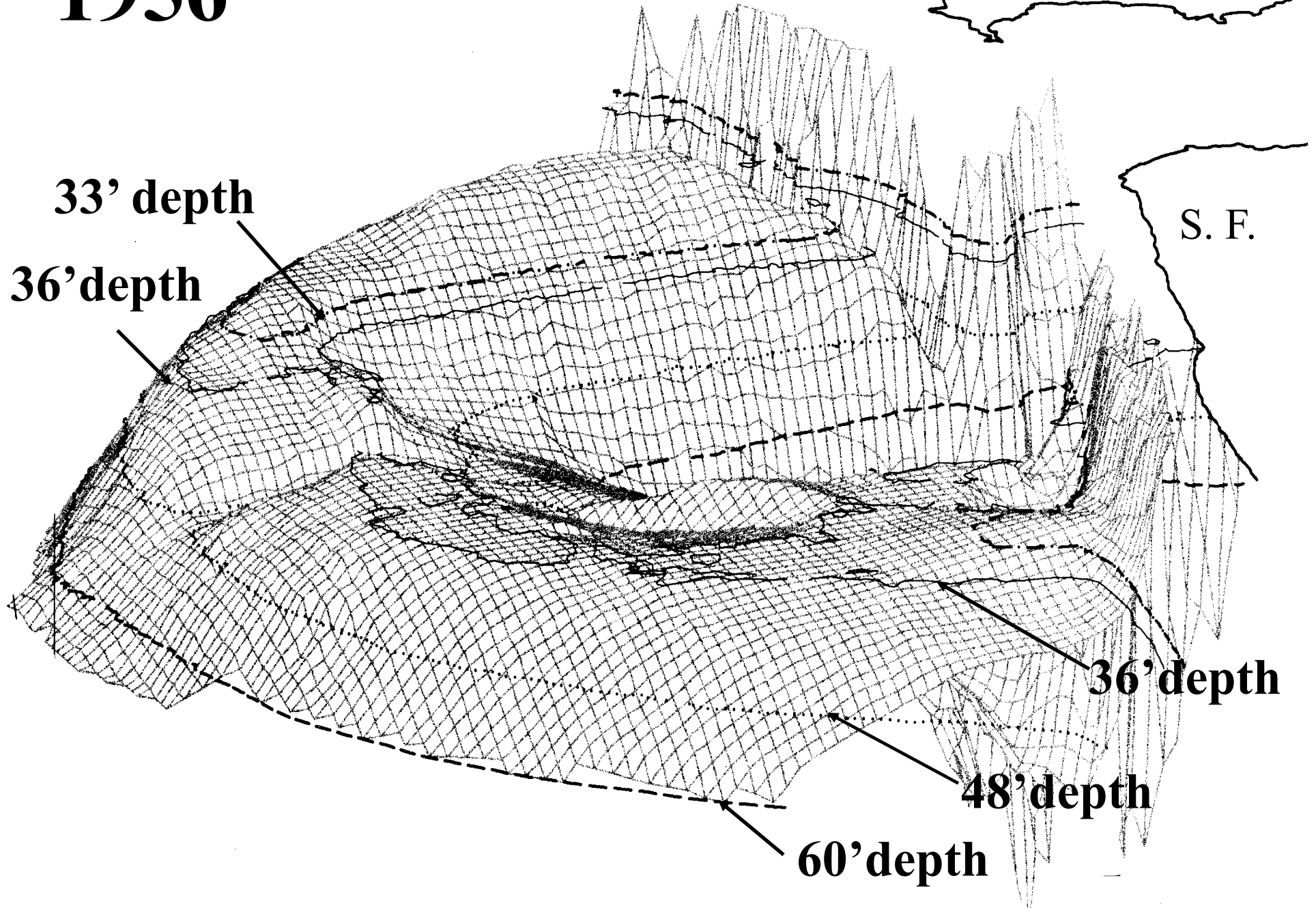
1900



1956

MARIN

S. F.

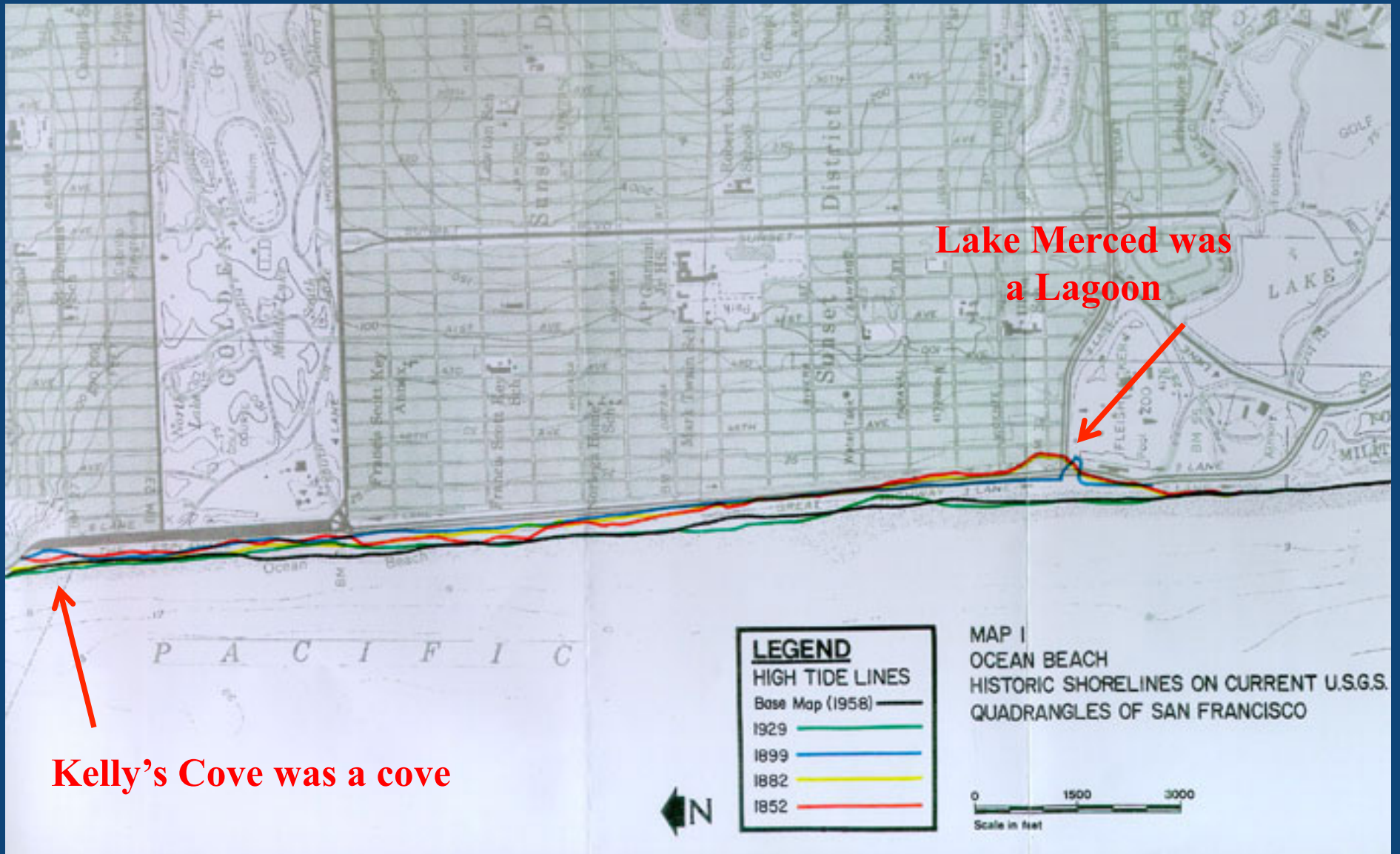




The wider the Great Highway, the more it crumbled, ca. 1907. Plenty of space for buggies and automobiles but not much beach is left. (Bancroft) The Pile Driver at Work on the first Esplanade, May 5, 1916. (Bureau of Engineers) The Cement Bleachers are in Place in Esplanade, Section A. (Calif. Historical Society)

Source: Olmsted and Olmsted, 1979

Ocean Beach pushed seaward 200+ feet 1900-1930



Source: Olmsted and Olmsted, 1979

1972

North end has accreted
substantially since the 1970's;

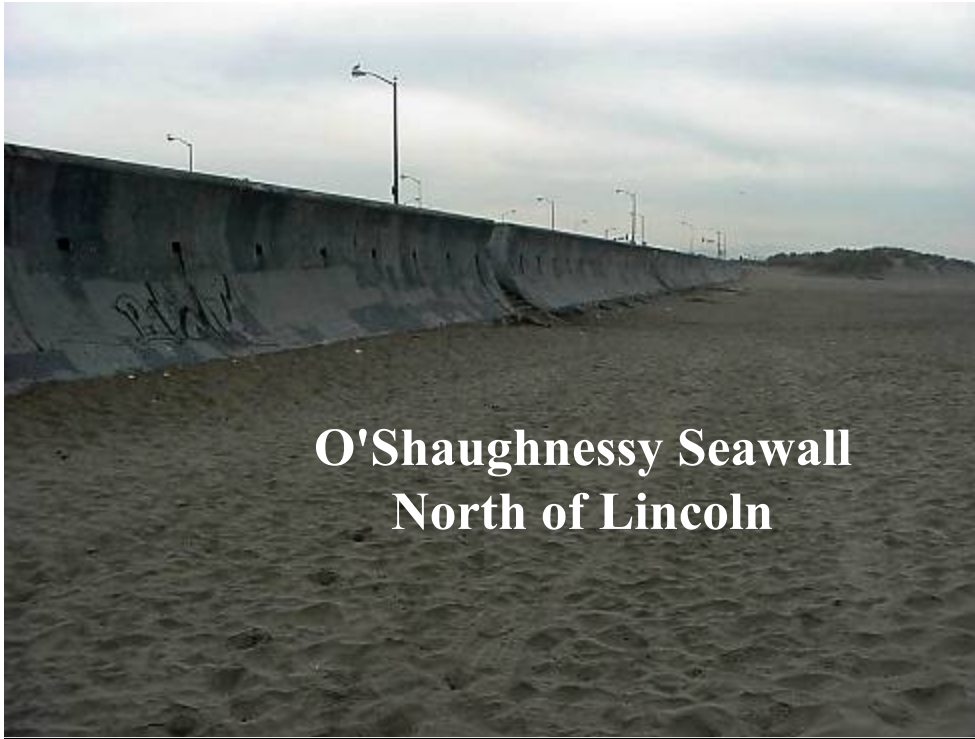
And so has Crissy Field



Photos: California Coastal Records Project
Copyright © 2004-2005 Kenneth & Gabrielle
Adelman - Adelman@Adelman.COM

2009





**O'Shaughnessy Seawall
North of Lincoln**



Taraval Seawall, circa 1998



**New Seawall
Noriega to Rivera**

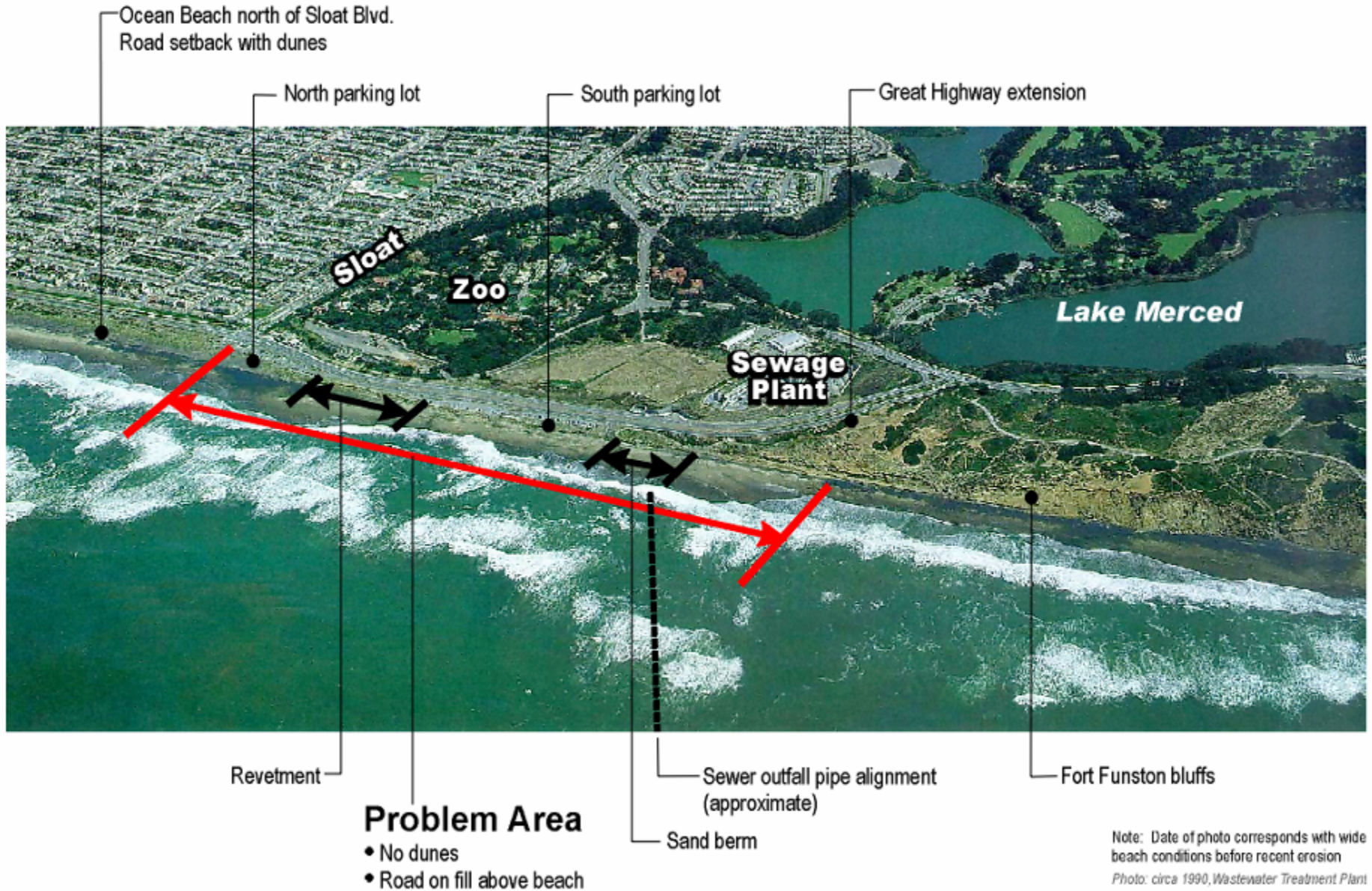




Clean Water Program renovated Great Highway corridor

(source: SFPUC)

SOUTH OCEAN BEACH





© Bob Battalio 2008

Post construction





© Bob Battalio 2008

Early 2000s



© Bob Battalio 2008

Post construction





© Bob Battalio 2008

Early 2000s



Jan 2010



February 12 2010



Erosion damage (early 2010)

Photos: Courtesy of SF DPW

New Rock Revetment (summer 2010)





South Ocean Beach, June 2010 (Photo © Bob Battalio)

Accelerated Sea Level Rise Predictions

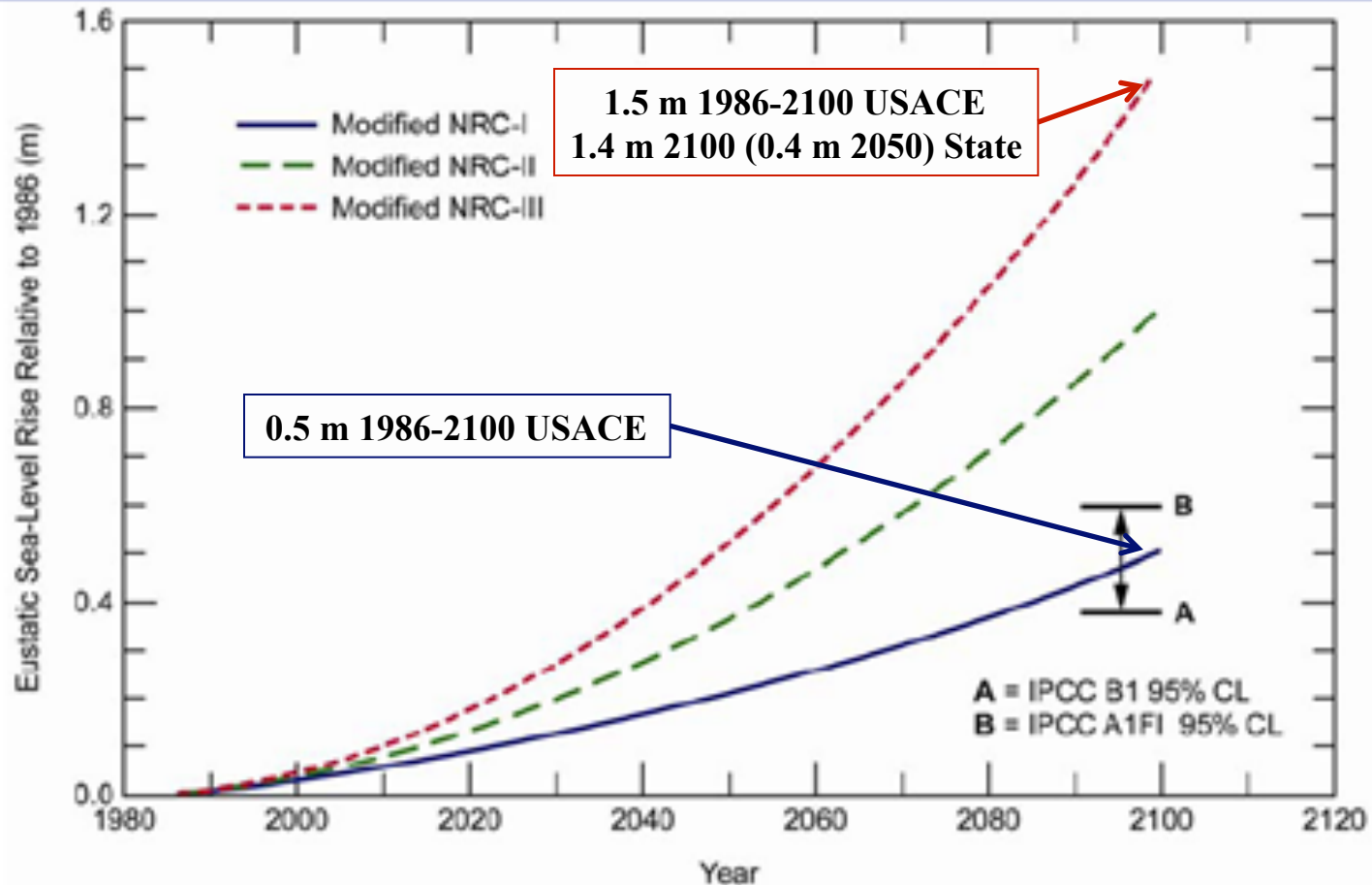


Figure B-11. Modified NRC (1987) eustatic sea-level rise scenarios and the IPCC (2007) scenario estimates for use in predicting future sea-level change.

FMA, 2009



More shaping to come !





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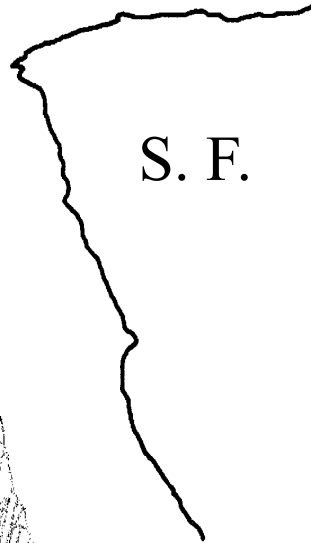
1873

47

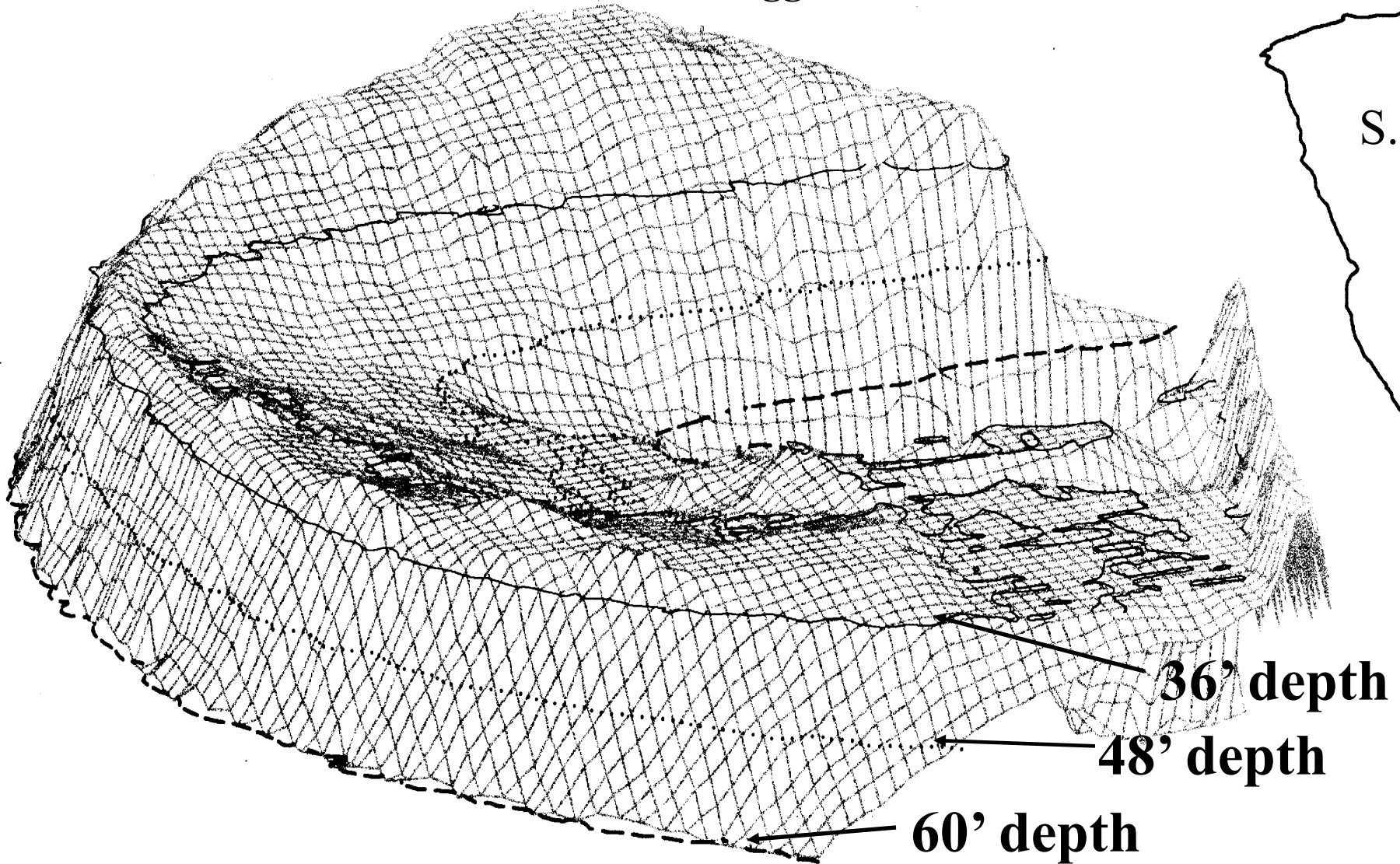
Perspective view of San Francisco Bar:
View elevated from south
Vertical scale exaggerated



MARIN



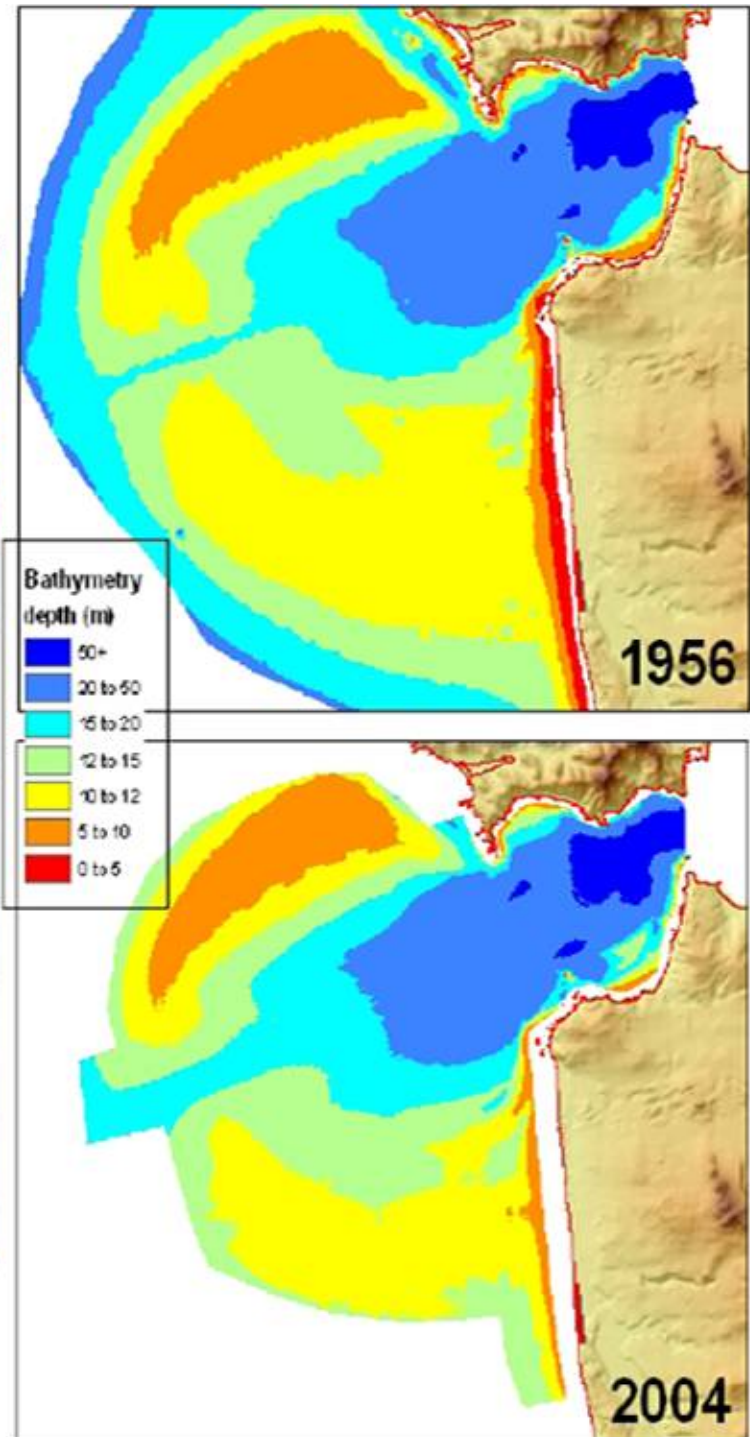
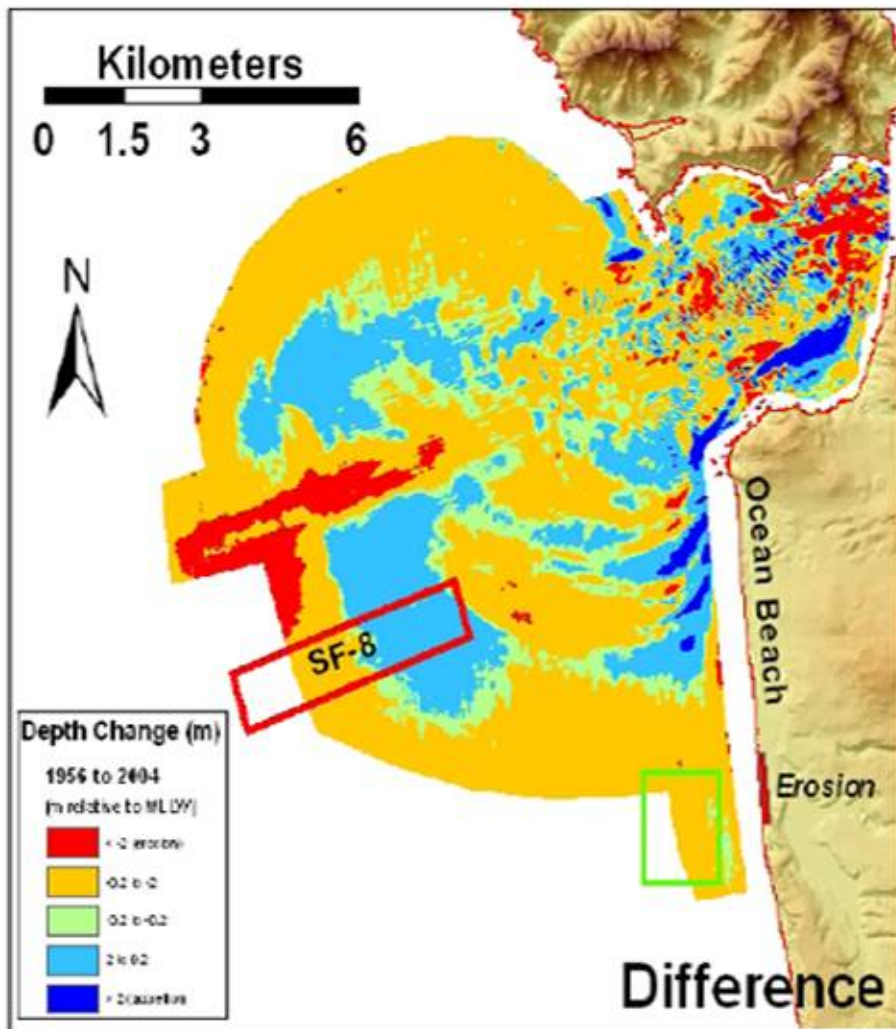
S. F.



36' depth

48' depth

60' depth



Source: Patrick Barnard, USGS



**Seal Rock House and Dunes circa. 1865 (Source, Olmstead
& Olmstead, Bancroft Library)**



Aerial View of Ocean Beach, June, 1915. These two views were made before the Esplanade development to the north had started. By 1915 there was a new Great Highway atop the dune to the west of the Great Highway at the turn of the century. Much of the Sunset District (around Pacheco) was still to be reclaimed into home sites. (Bureau of Engineers)

Uplifted and Eroding

Example – Daly City, CA

- Narrow beach backed by ~150 ft bluffs
- Merced Formation (fine to medium grained sand, weakly consolidated / lithified)
- Prone to large slumps and landslides
- Long-term erosion rate of 1.3-1.6 ft/yr
- Future erosion predicted to be 1.8-4.5 ft/yr, 3 ft/yr recommended for infrastructure setback



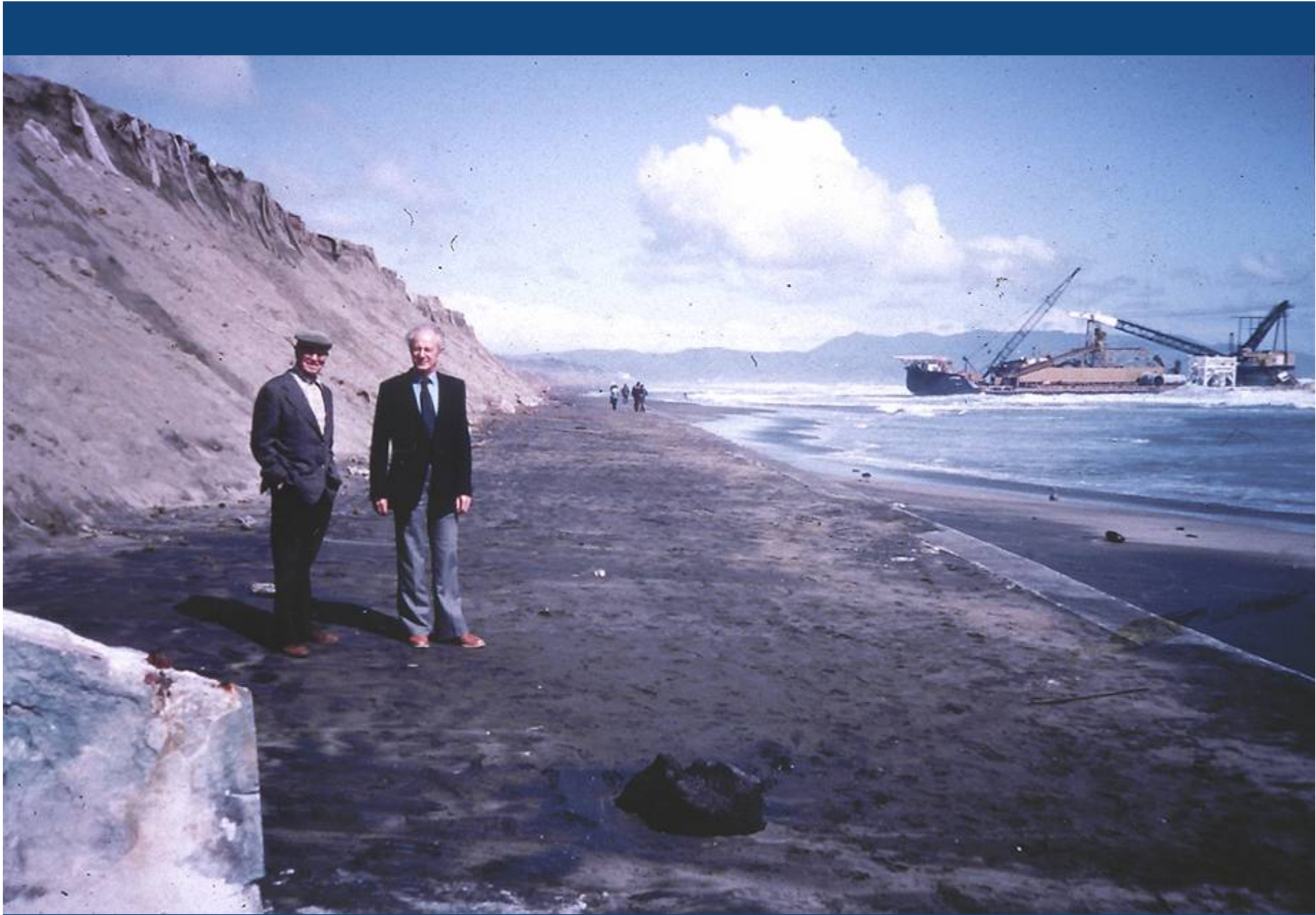


Photo: Bob Wiegel



© Bob Battalio 2008

Retreat & Manage Solution

A Vision of South Ocean Beach

Proposal for the Office of Environment, San Francisco



- 1. Sand Placement – 2 episodes**
 - Fall, 1999 15,000 tons**
 - Second Placement in 2001 (?)**
- 2. Bypass Roadway in Median**





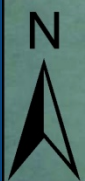
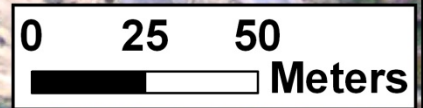


Mean High Water Shoreline Positions

- Oct. 7, 2009
- Oct. 13, 2004
- Oct. 15, 1997 LiDAR

-18 m
2004 to 2009

-27 m
1997 to 2009

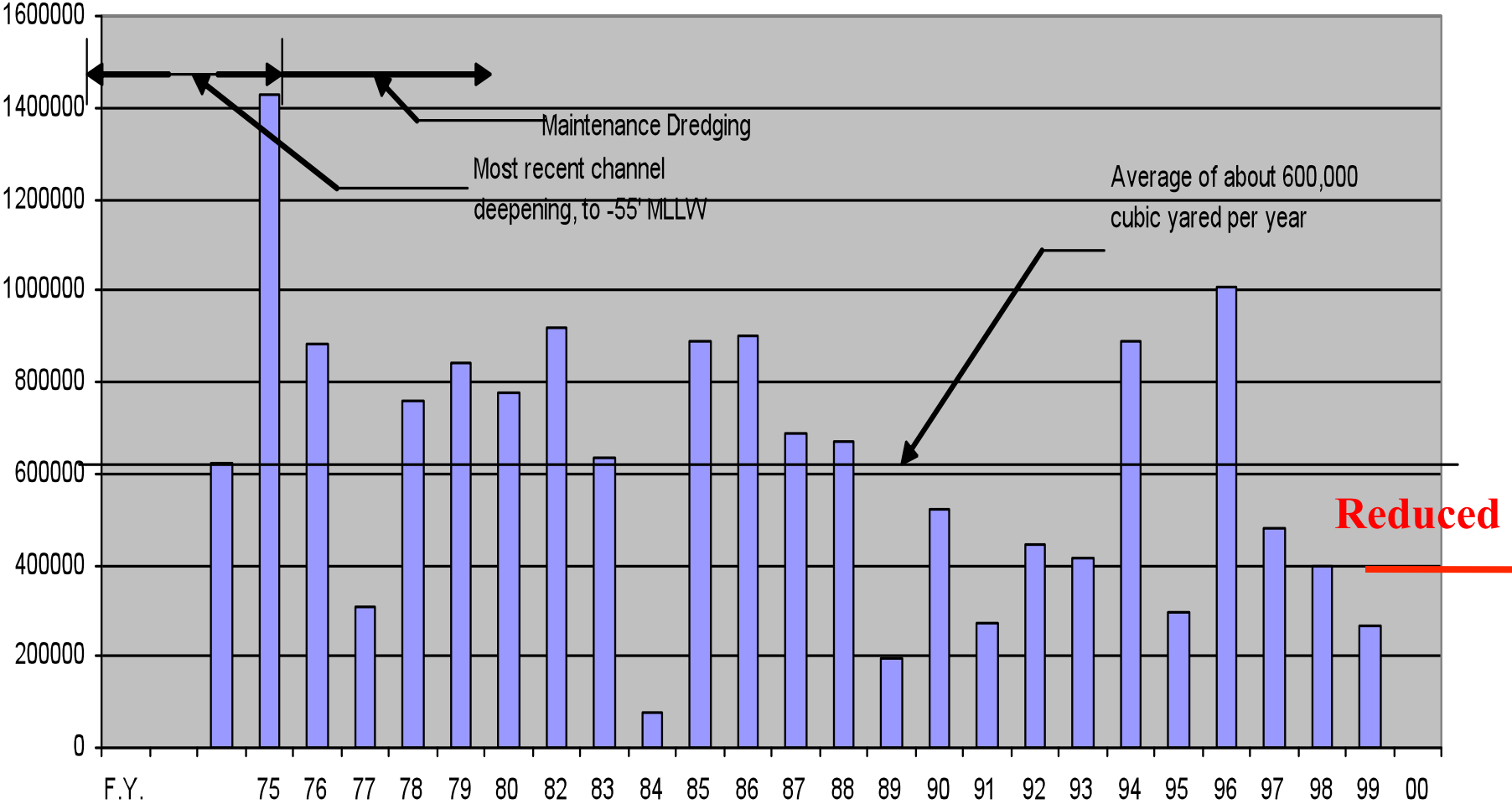


Source: USGS



Volume of Sand Dredged from the San Francisco Bar Channel

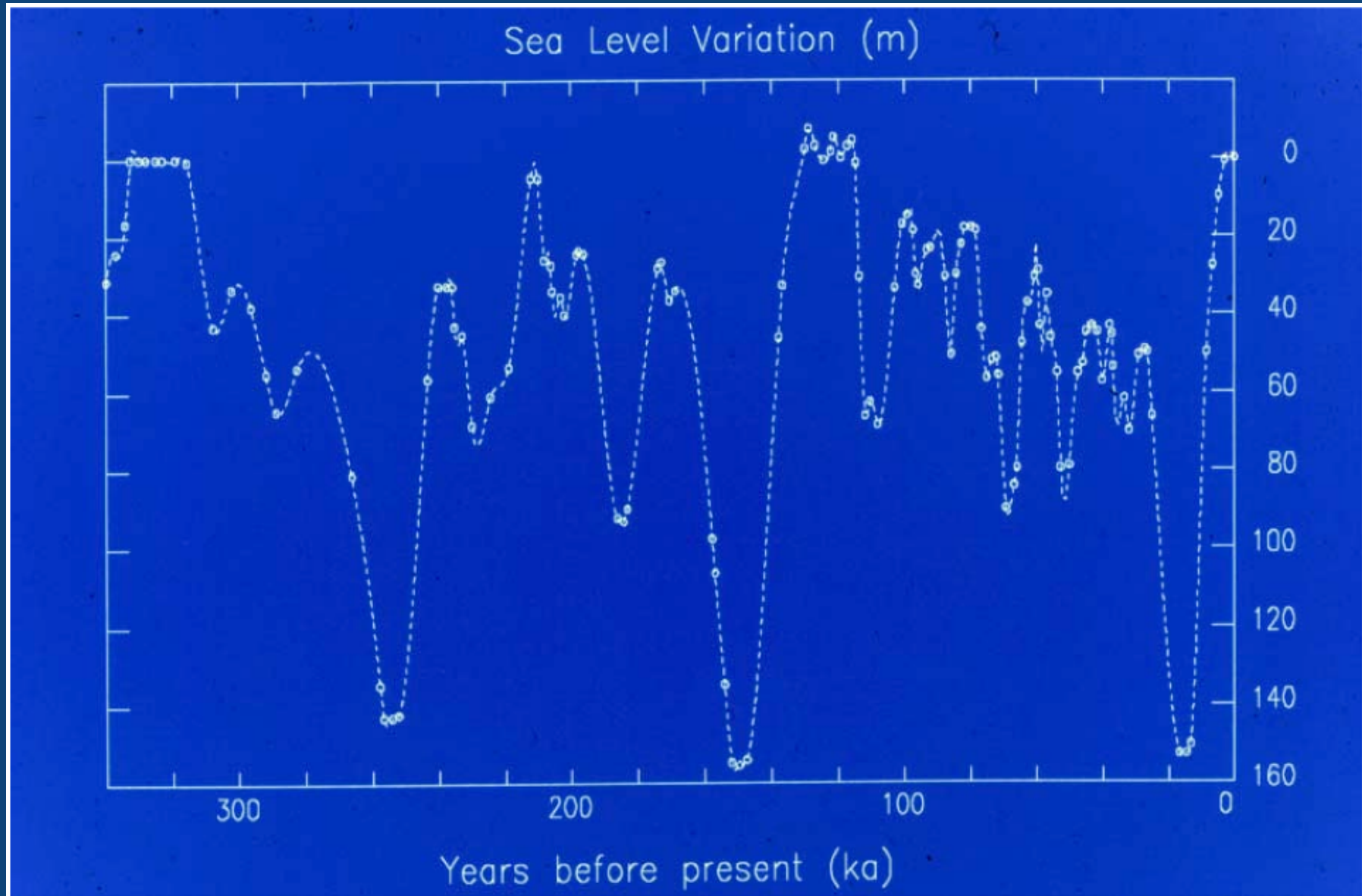
source: US Army Corps, Dredge Material Management Office, San Francisco District



Sea Level Rise and Future



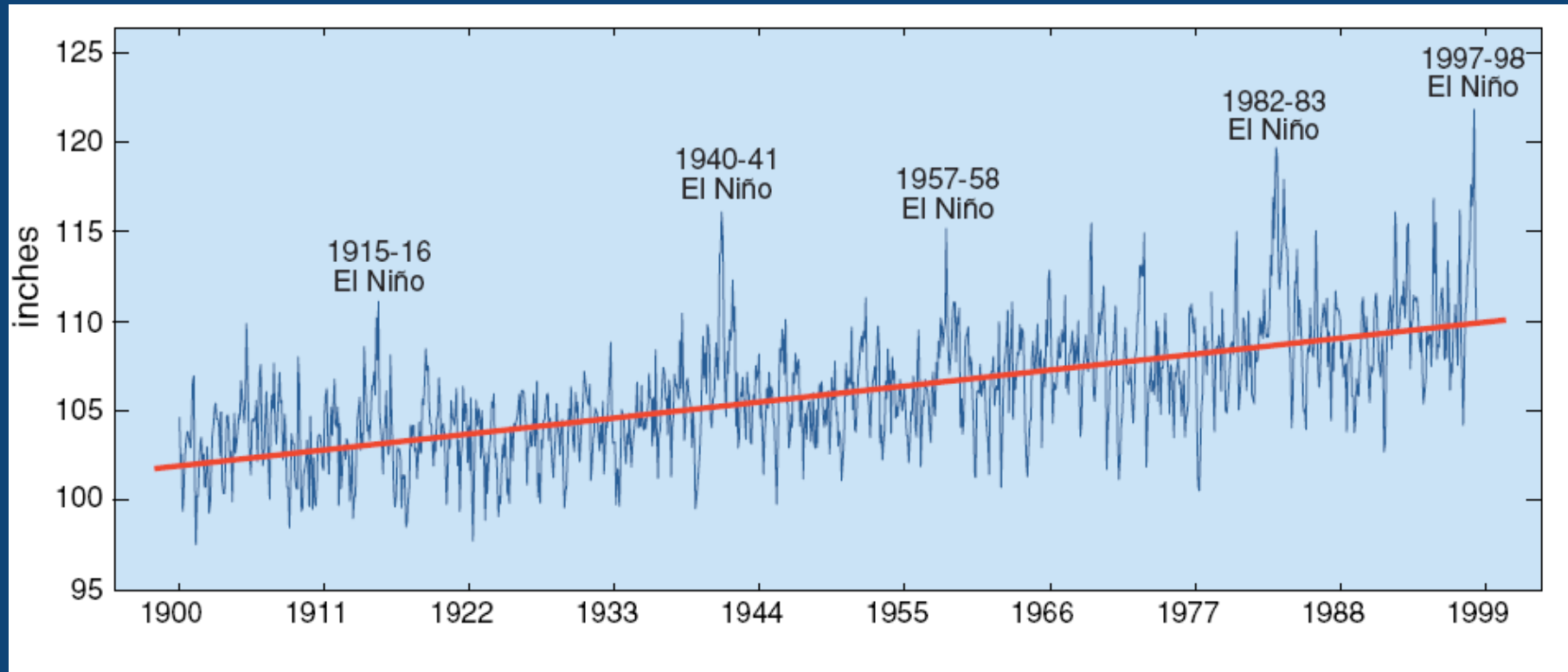
Sea level - the past 300 thousand years



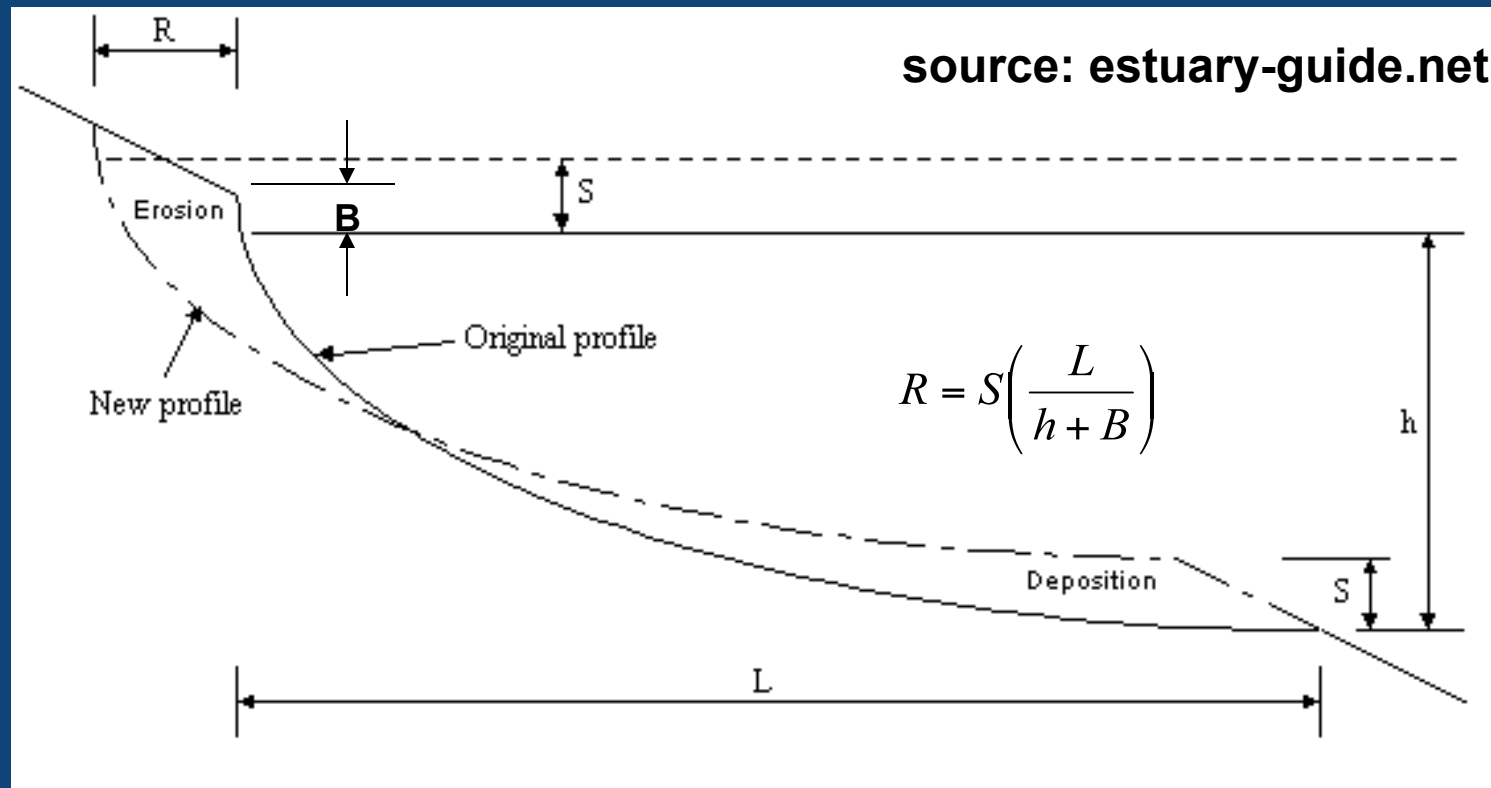
Recent Sea Level Rise

Tide Data, Presidio San Francisco, NOS Tide Gauge 941-4290

Rate of sea level change 2.17 mm yr –
Which is about 8 inches in last 100 years



Sea-Level Rise - Shoreline Response



S = sea level rise
 R = recession
 h = depth of active profile
 L = length of active profile
 B = berm height

Initial Assessment of Statewide SLR Hazard

Final Draft Report
Subject to Revision

California Coastal Erosion Response
to Sea Level Rise - Analysis and Mapping

Prepared
for the

Pacific Institute

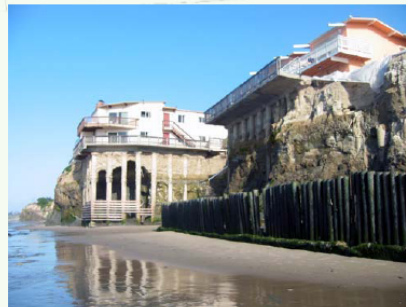
Prepared
by

Philip Williams & Associates, Ltd.
March 11, 2009

**Impacts of Coastal Flooding
AND Erosion**
**Statewide approach using best
available data**
Not for planning purposes



Project Study Area



Houses in Isla Vista threatened by Sea Cliff Erosion. June 2006
Photo by David Revell

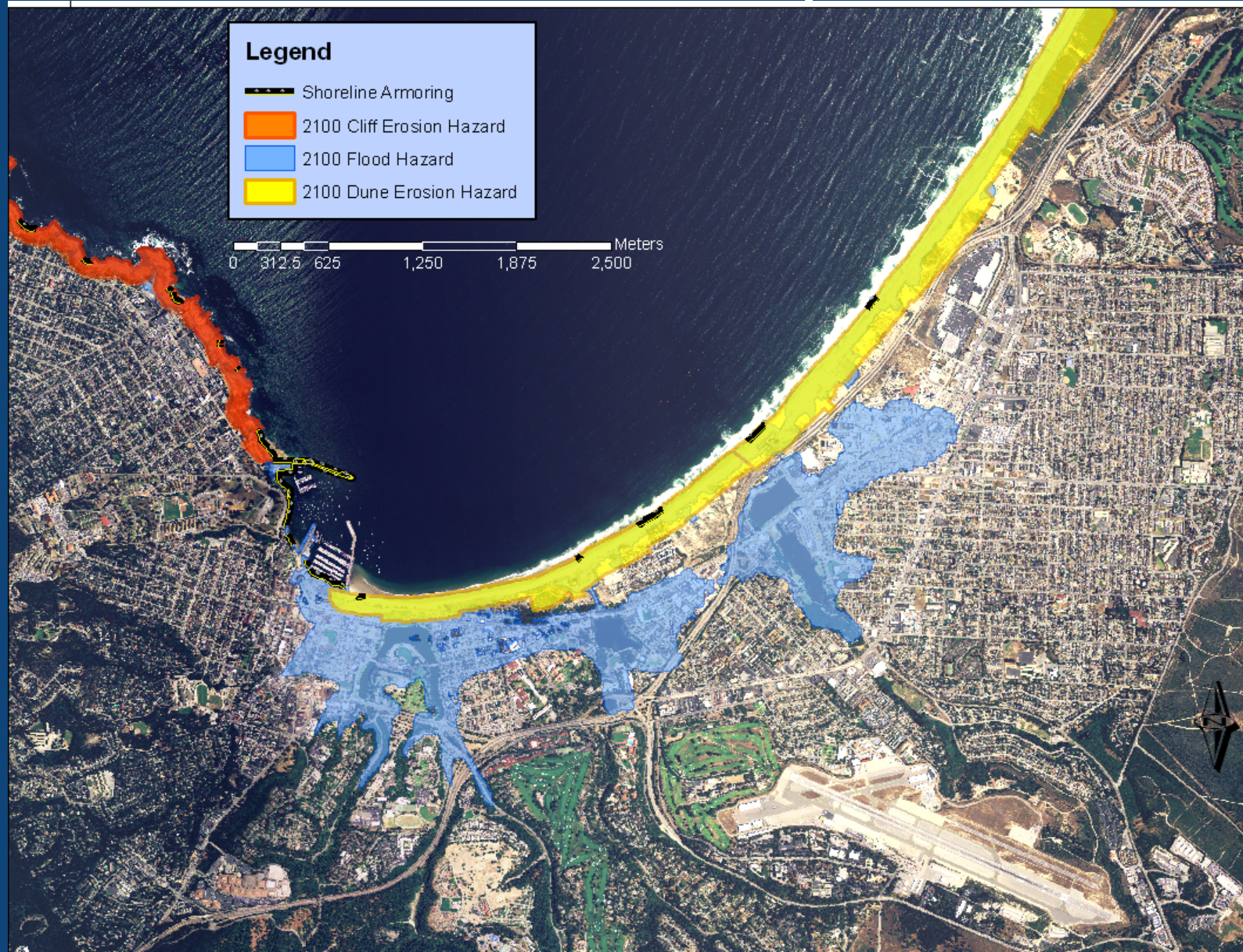


Waves flooding ocean front road in Santa Cruz, February 2008
Photo by David Revell

Project funded by the California Energy Commission's
Public Interest Energy Research Program, CalTrans,
and the California Ocean Protection Council



Hazard Maps



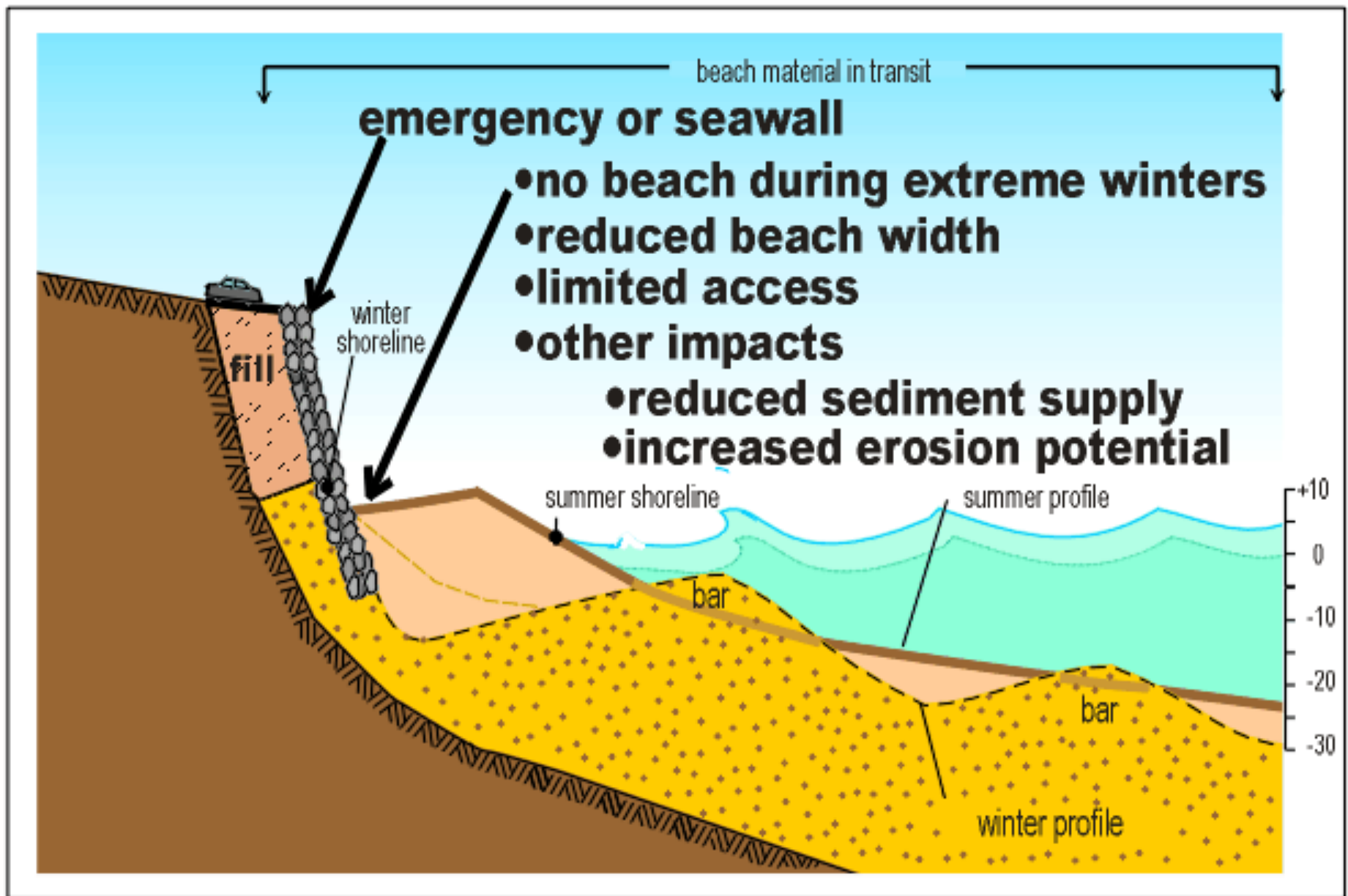
“Not for planning purposes”

Dune Erosion Hazard Zones

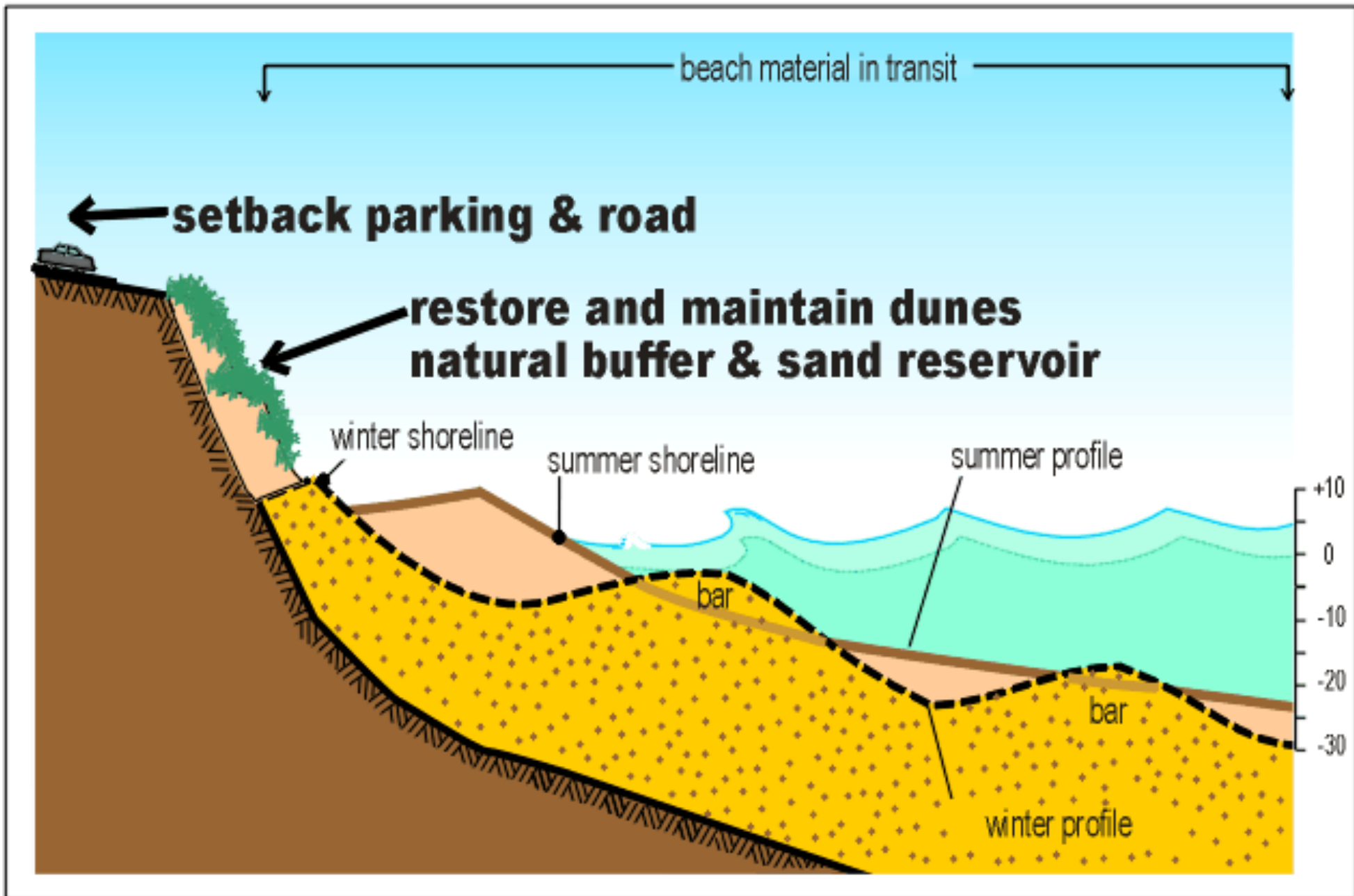


Air Photo from 2005

“Not for planning purposes”

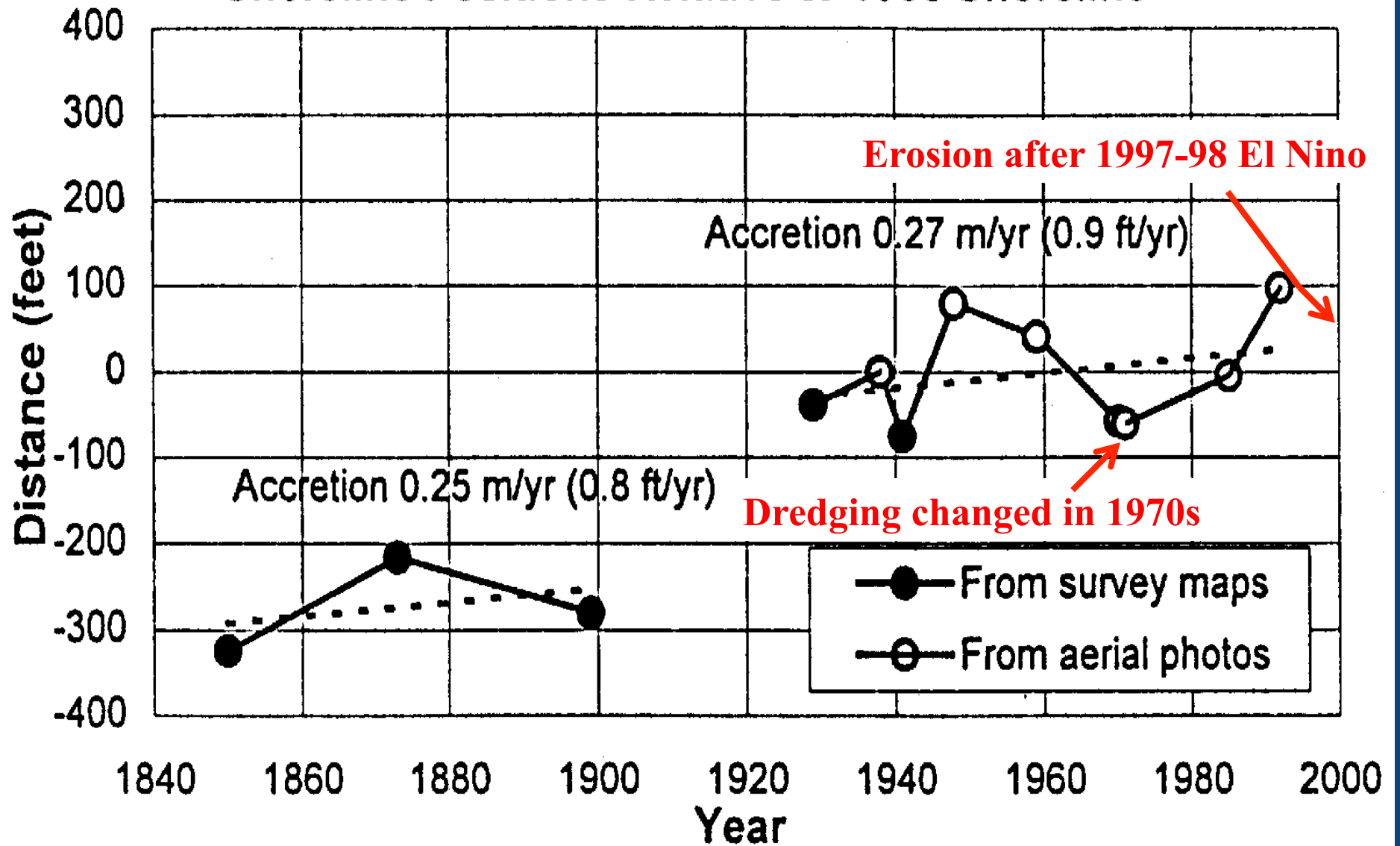


Revetment / Seawall Solution

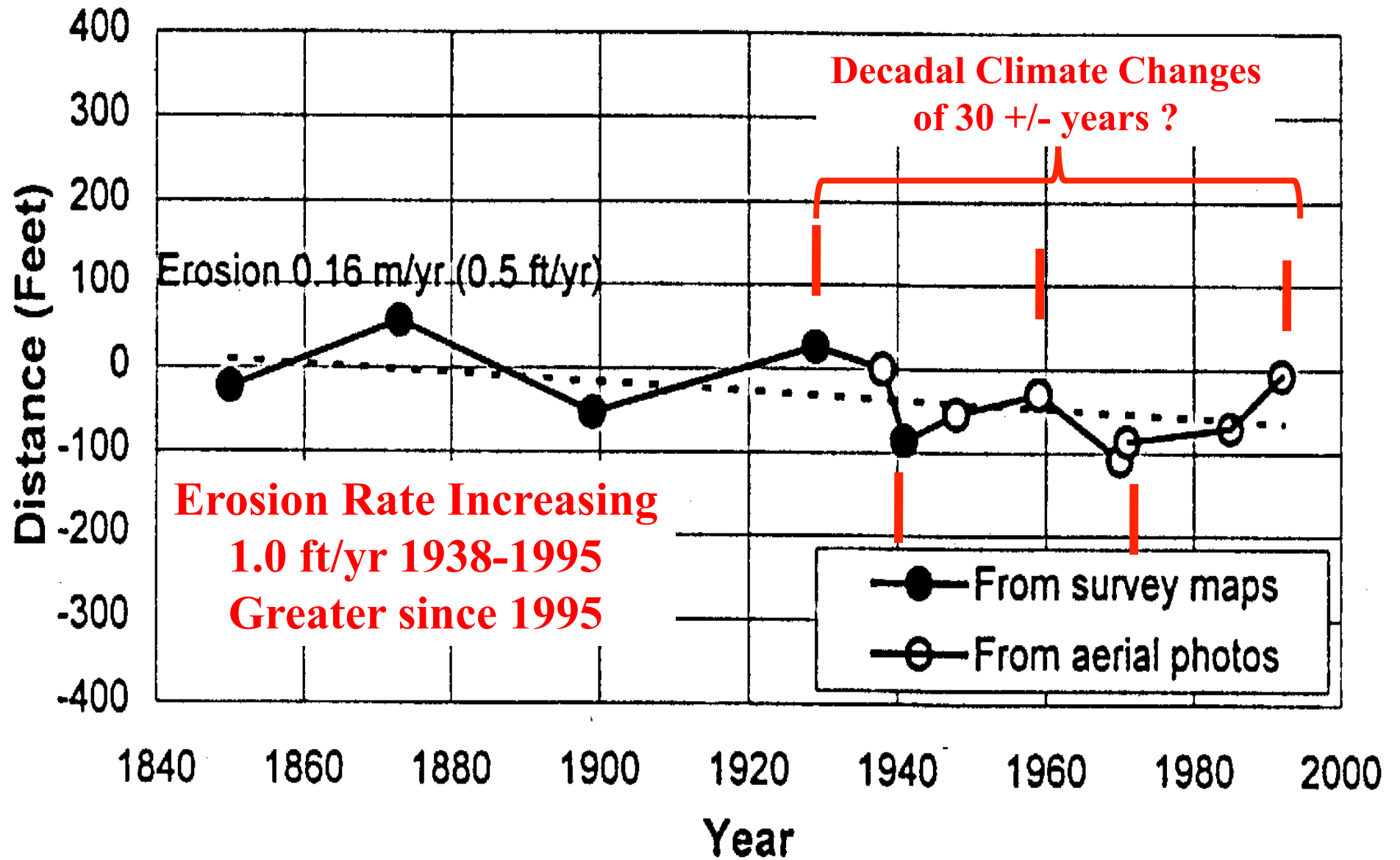


Proposed Solution

Shoreline Positions Relative to 1938 Shoreline



Shoreline Change Data Ocean Beach
Shoreline Positions Relative to 1938 Shoreline



Shoreline Change Data So. Ocean Beach

2010

