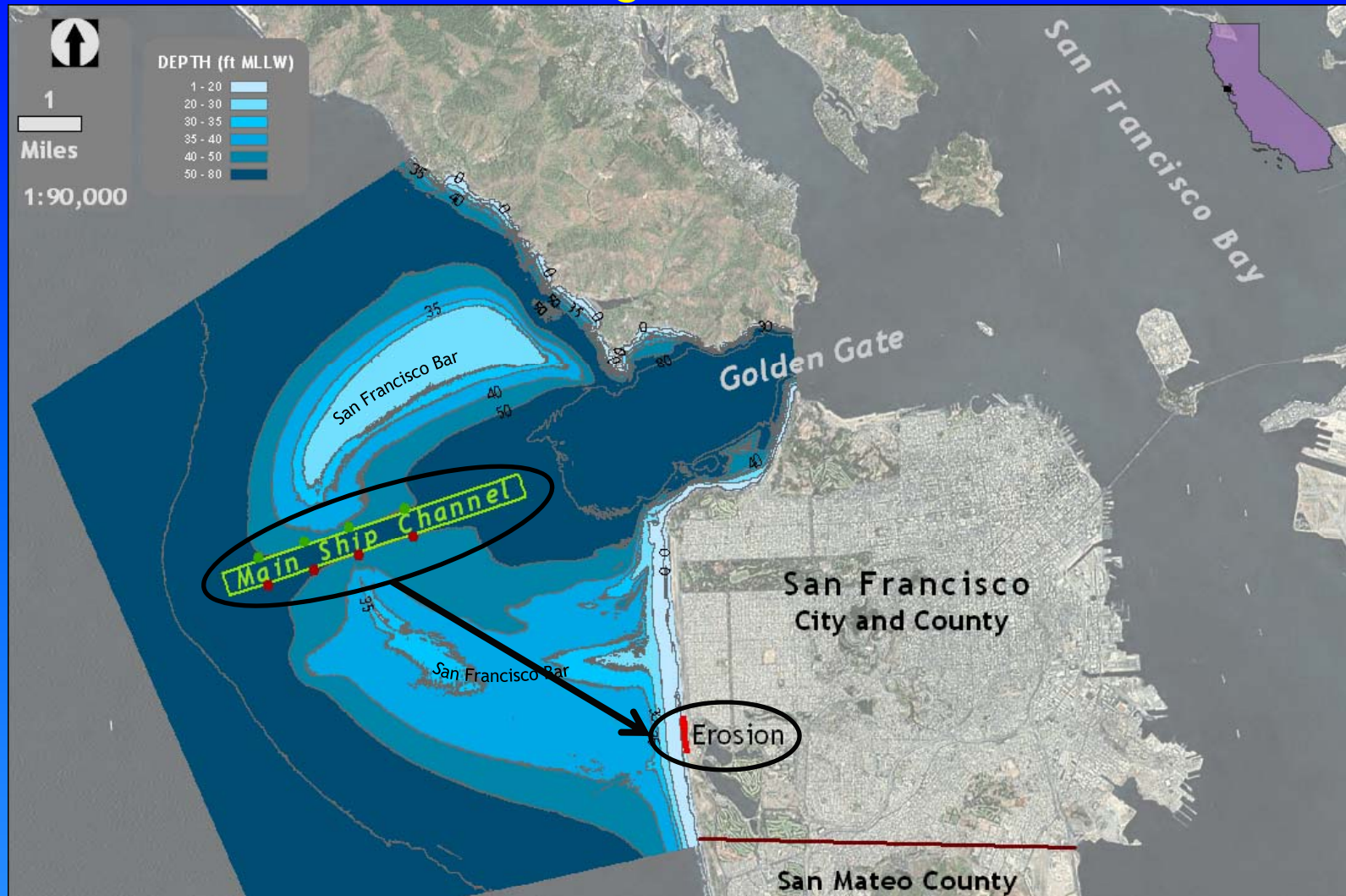


Using Sand Dredged from the San Francisco Main Ship Channel for Storm-Damage Reduction at Ocean Beach



John Dingler, Tom Kendall, Peter Mull

US Army Corps of Engineers
San Francisco District



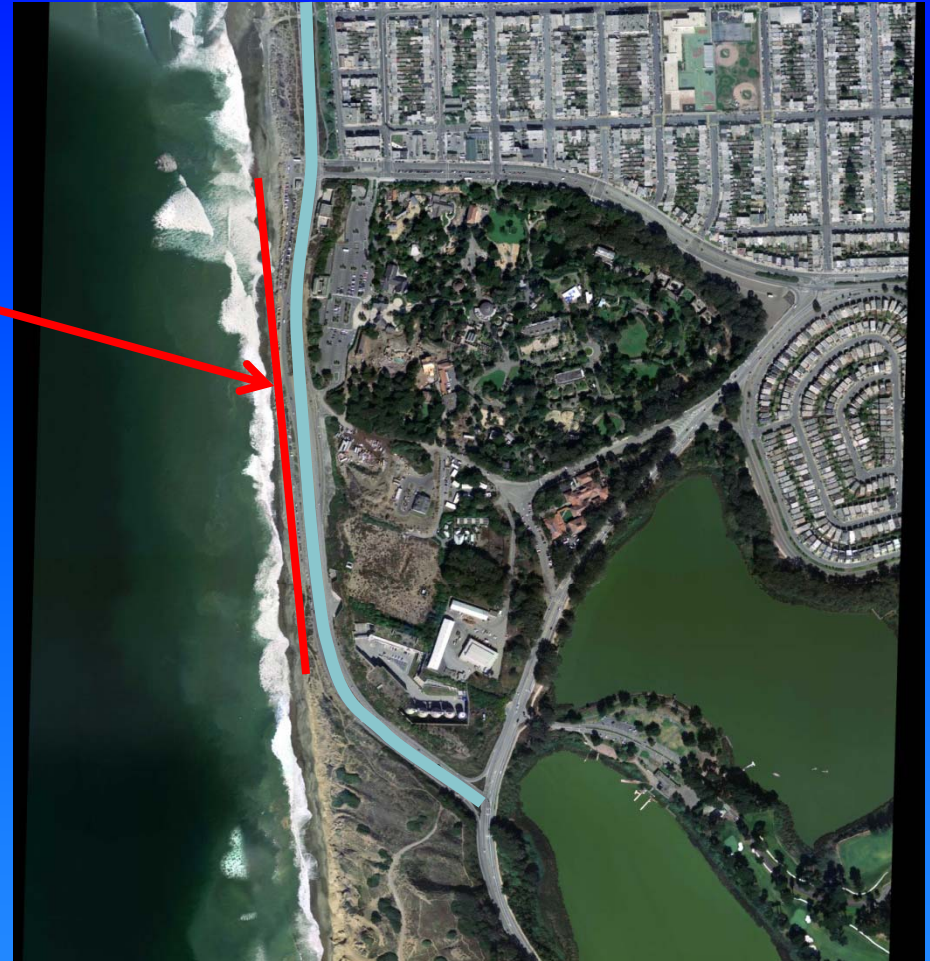
Ocean Beach: San Francisco's Major Beach Access



US Army Corps of Engineers
San Francisco District



Ocean Beach: South-of-Sloat Erosional Area





US Army Corps of Engineers
San Francisco District





US Army Corps of Engineers
San Francisco District



Problem: Beach and Bluff Erosion South of Sloat Boulevard, Ocean Beach

- Severe bluff erosion during the winter of 1997-98 led to the emergency placement of rock and sand and the development of contingency plans in case of further erosion
- Large, El Niño driven storms during the Winter of 2009-2010 caused considerable bluff erosion that forced the temporary closing of the southbound lanes of The Great Highway
- Critical infrastructure – e.g., the Westside Sewage Transport Box and The Great Highway – is in danger of being damaged or destroyed if erosion continues

US Army Corps of Engineers
San Francisco District



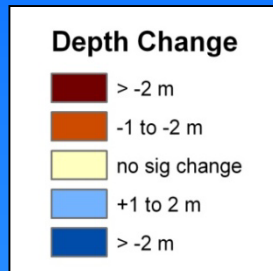
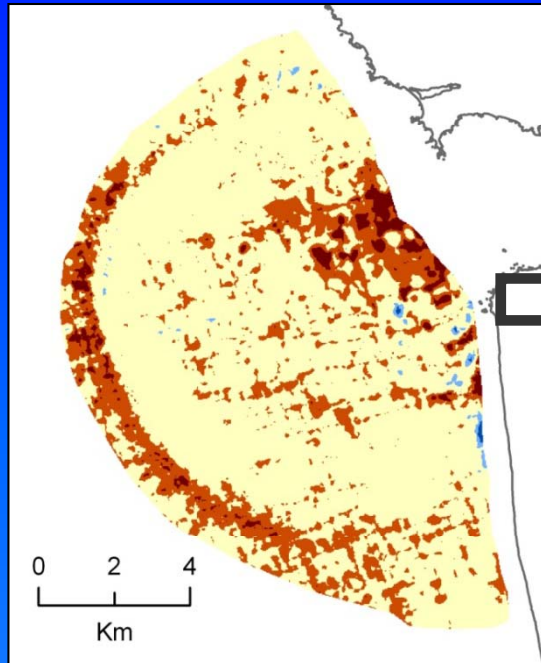
WRDA Section 2037 Guidance

“Section 2037 presents regional sediment management in the context of using sediment obtained through construction, operation, or maintenance of an authorized Federal water resources project for the construction, repair, modification, or rehabilitation of Federal water resources projects[;] for the reduction of storm damages to property[;] and to protect, restore, and create aquatic and ecologically related habitats, including wetlands... *(For example placing dredged sand on a beach or shoreline to provide for hurricane and storm damage reduction.)*”

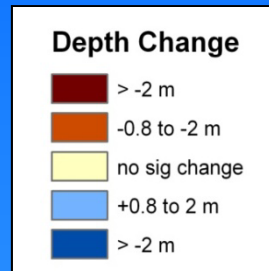
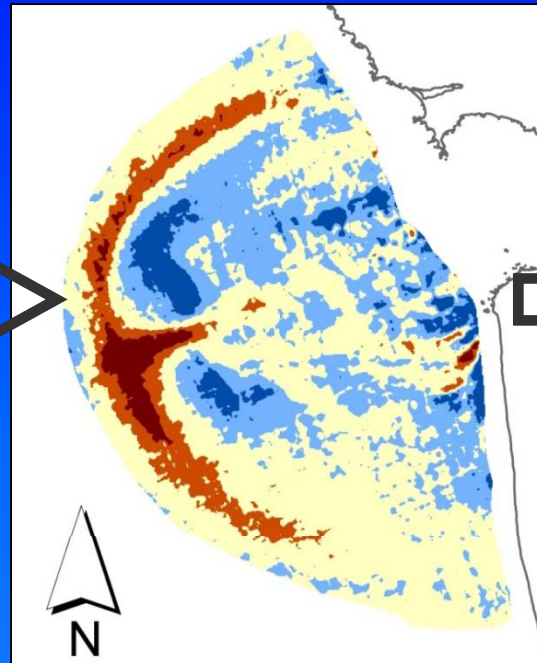


Bathymetric Change

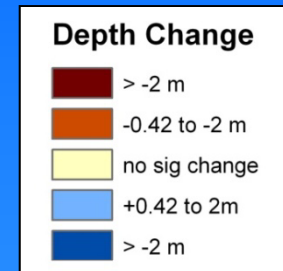
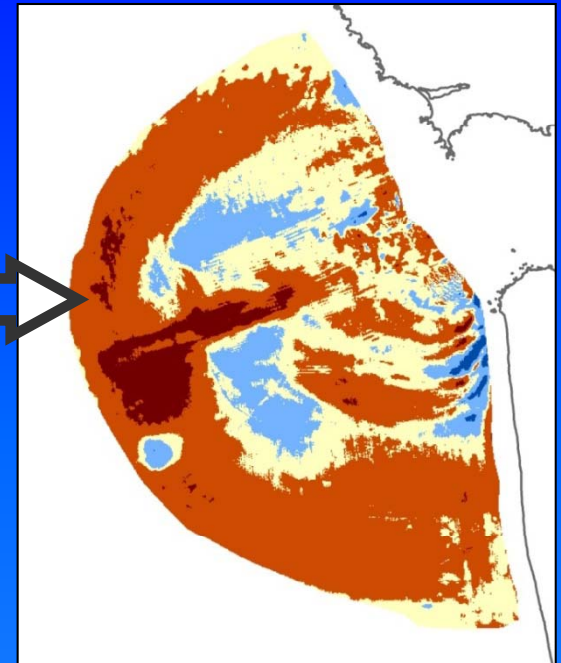
1873 to 1900



1900 to 1956



1956 to 2005

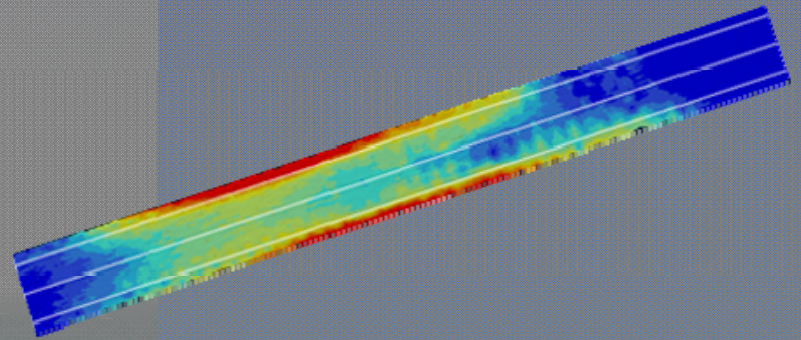


US Army Corps of Engineers
San Francisco District



San Francisco Main Ship Channel

- Channel length: ~26,000 ft; Channel width: ~2000 ft
- Maintained depth: 55 ft MLLW by the USACE *Essayons*
- Offshore disposal (1931 - 1971) = 21 million m³
- Nearshore placement (1971 - present) = 18 million m³



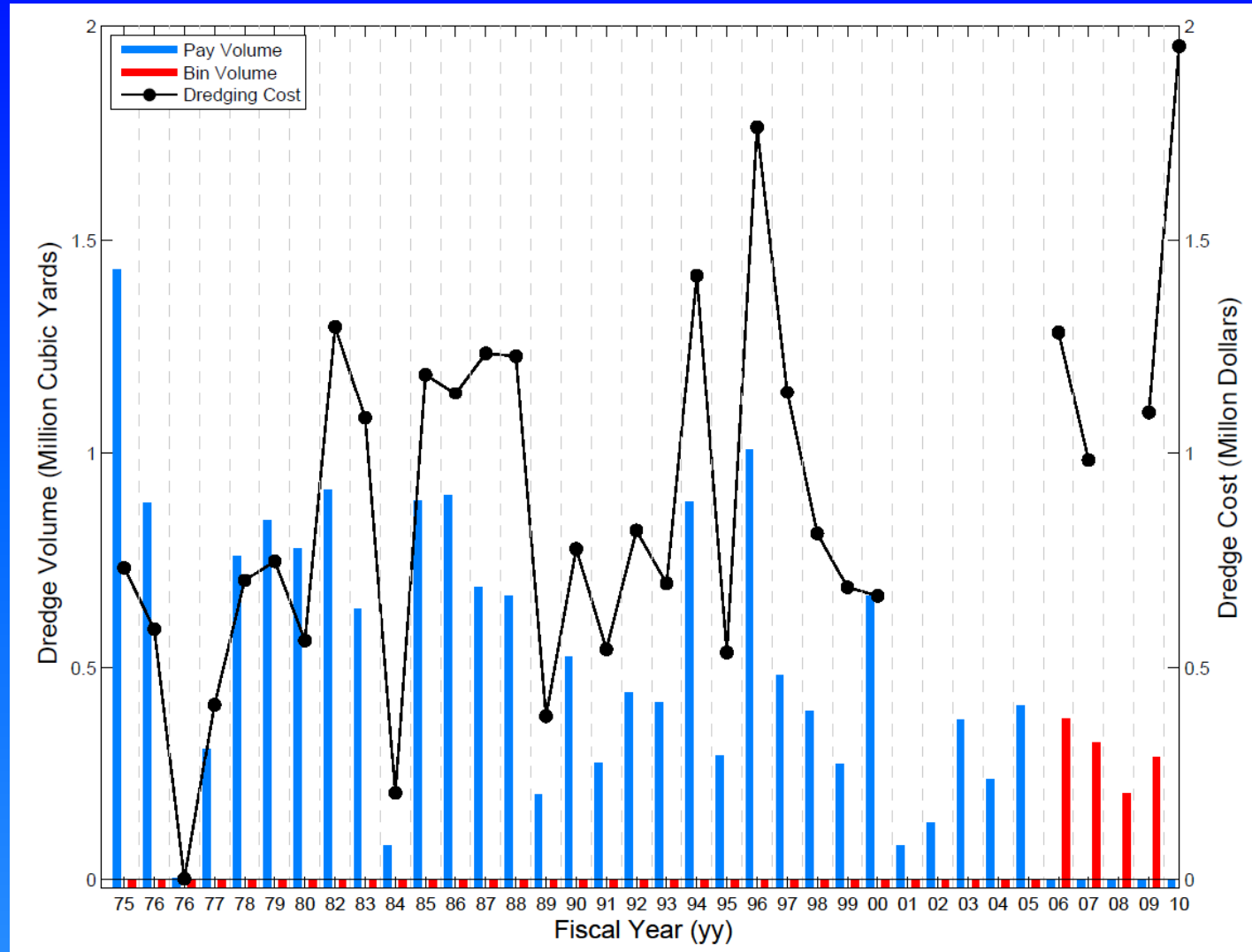
MSC Annual Dredge Volumes

Dredging has
occurred since
~1931

Maximum
Dredge Volume
1.43 mcy
(1975)

Mean Dredge
Volume = 0.51
mcy

General
decline in
dredge
volumes since
1975



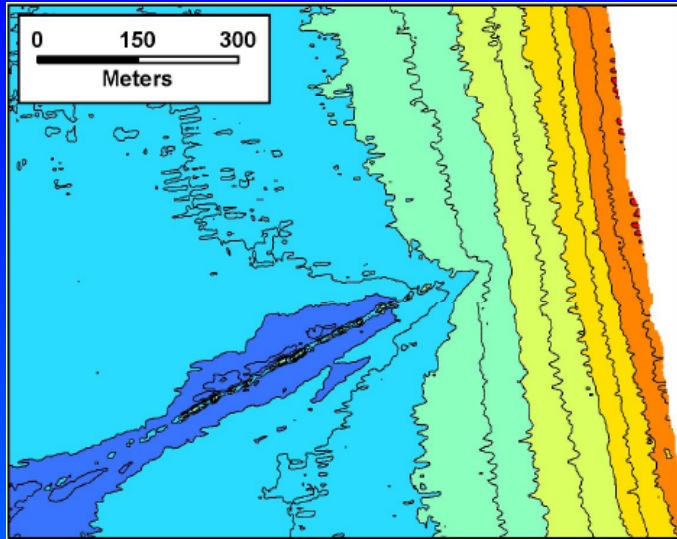
US Army Corps of Engineers
San Francisco District



O&M Placement Sites

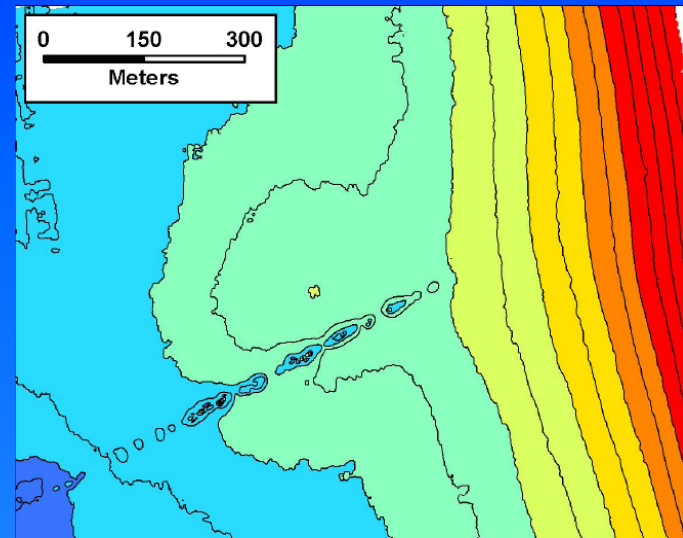


May 2005 - Pre-Placement Survey

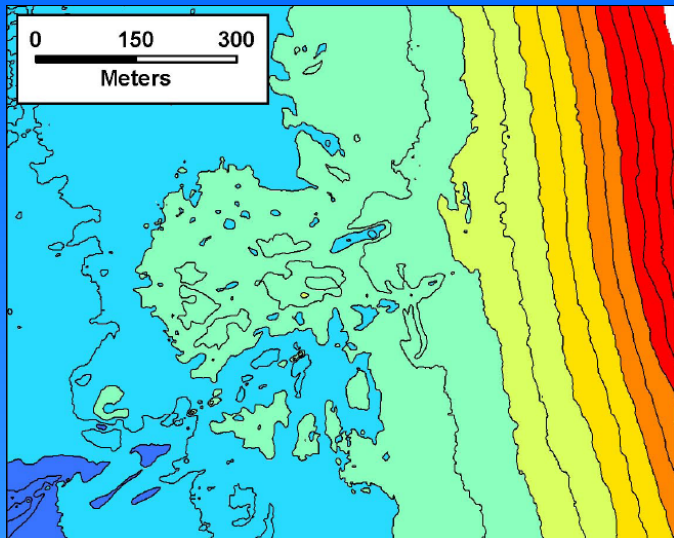


OBDS Hydrographic Surveys

December 2007 - Final Study Survey



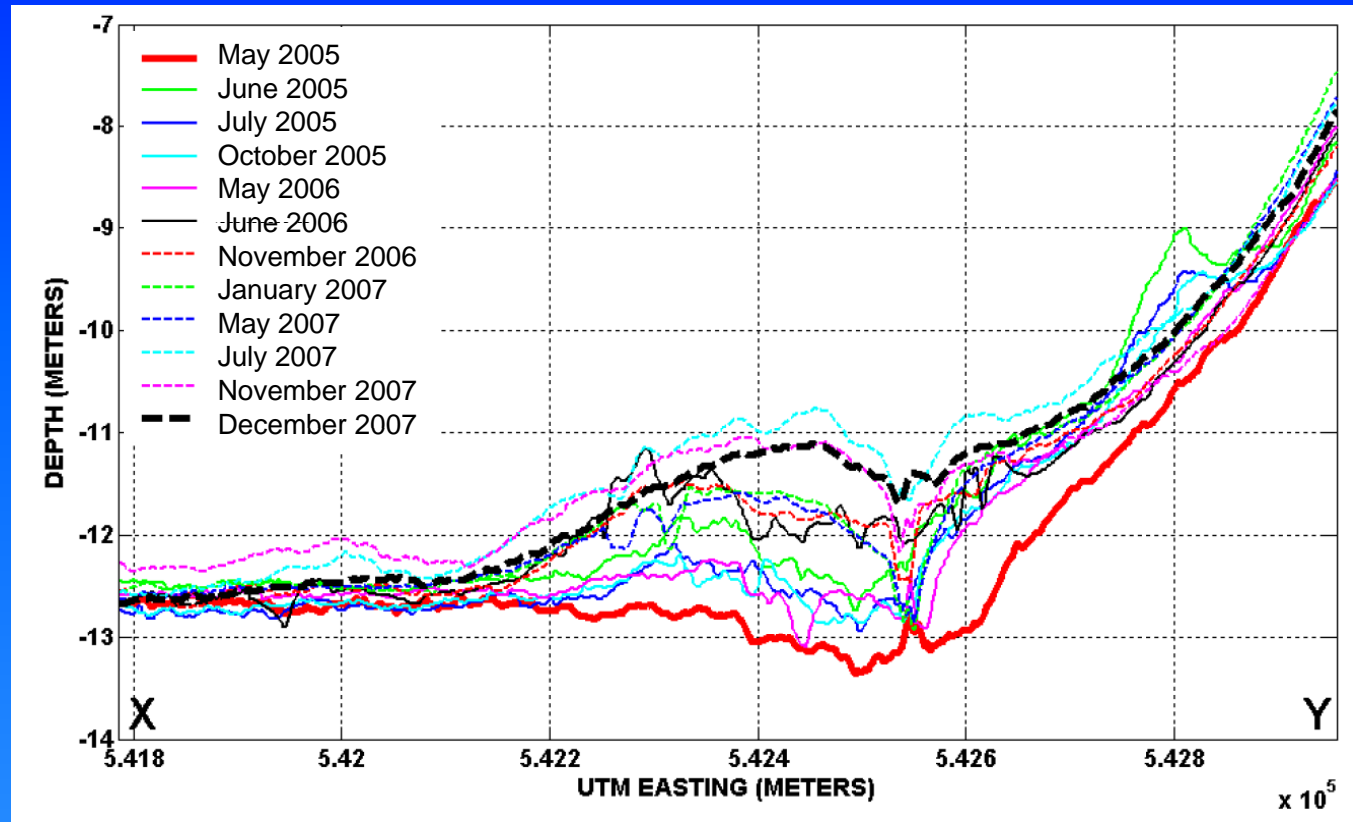
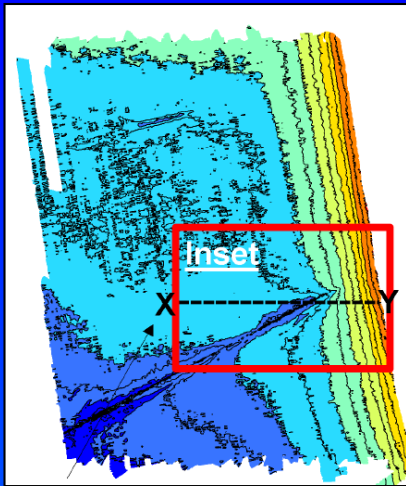
June 2006 - Condition



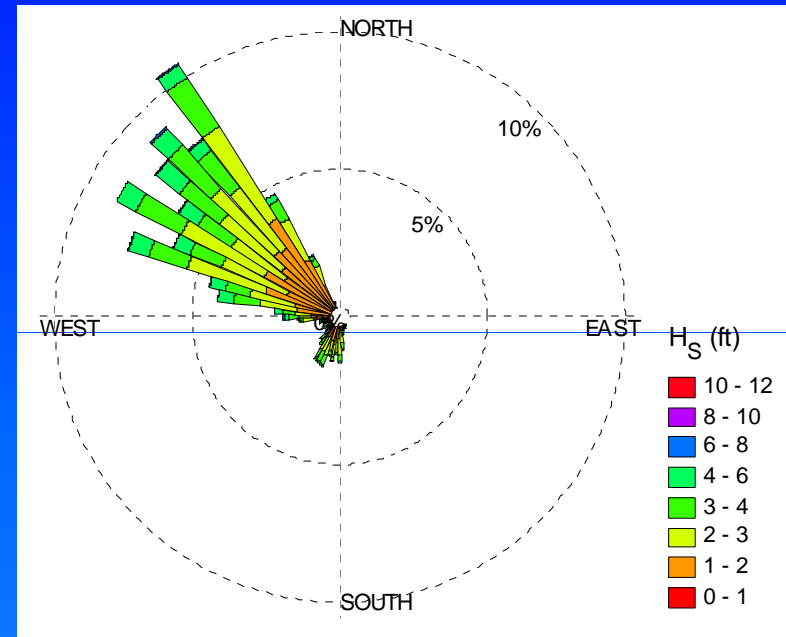
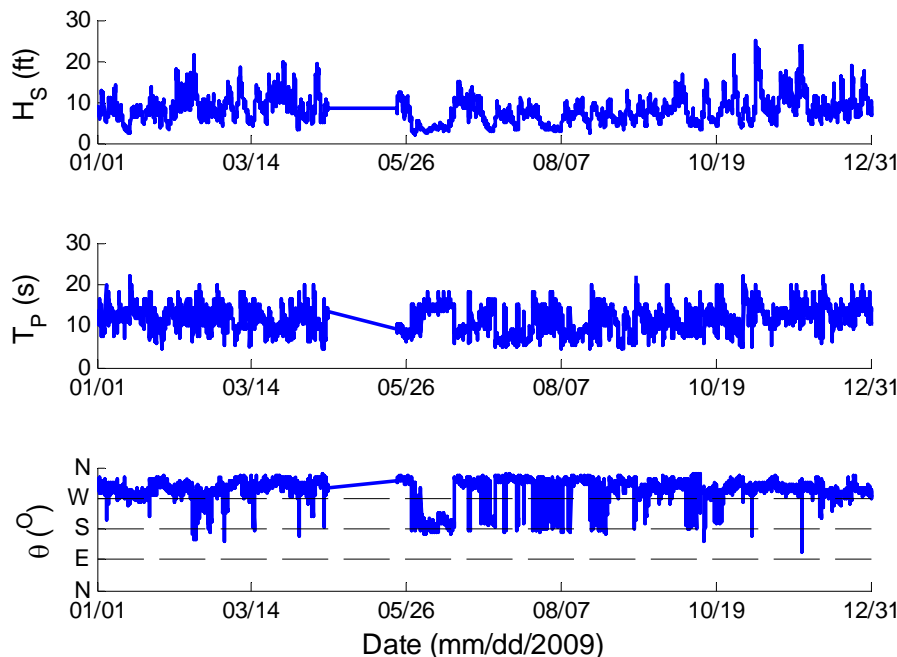
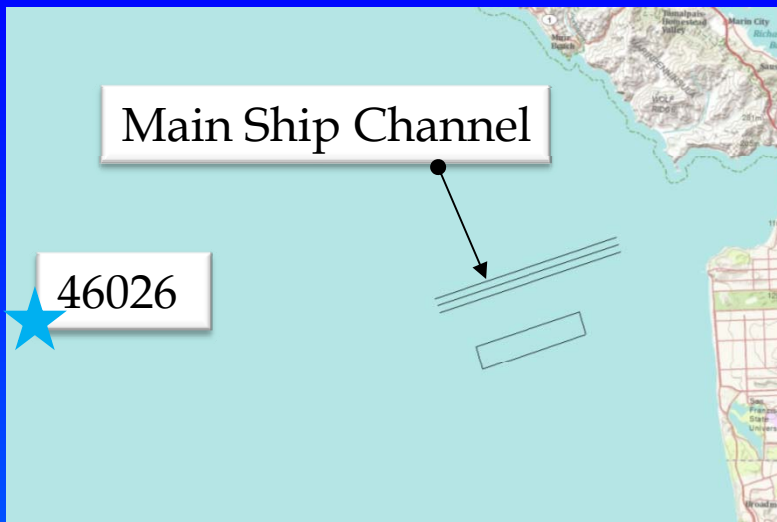
US Army Corps of Engineers
San Francisco District



Evolution of the Placement Mound



2009 Offshore Waves @ NDBC Buoy 46026



General Offshore Wave Statistics:

$H_{S_MAX} = 25$ ft

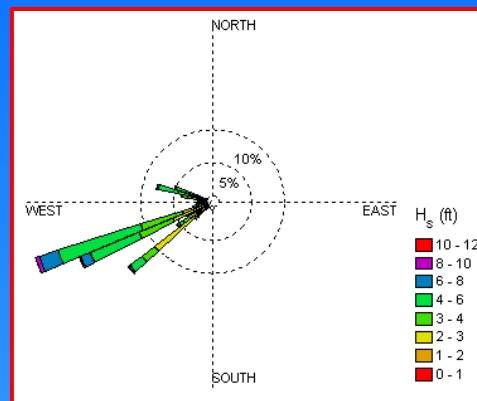
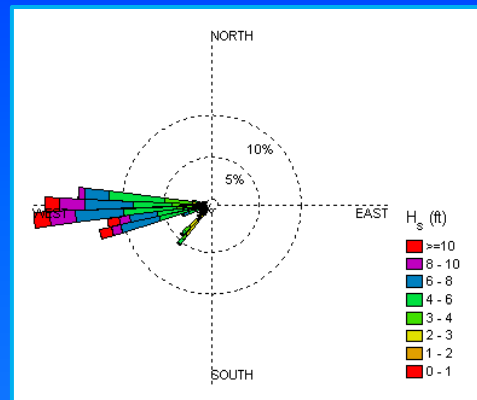
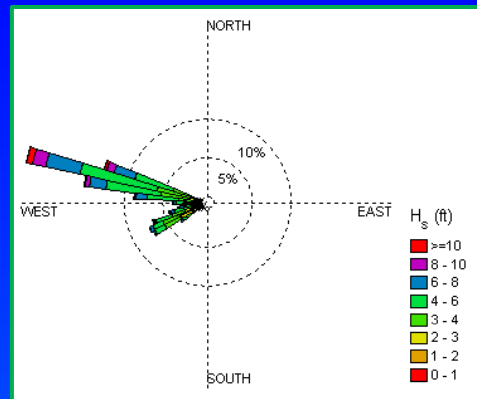
$T_{P_Mean} = 12$ s

Direction = NW

US Army Corps of Engineers
San Francisco District



Variation in Nearshore Waves



US Army Corps of Engineers
San Francisco District



Onshore Placement

Conceptual Layout of Ocean Beach Nourishment DUNE ONLY OPTION

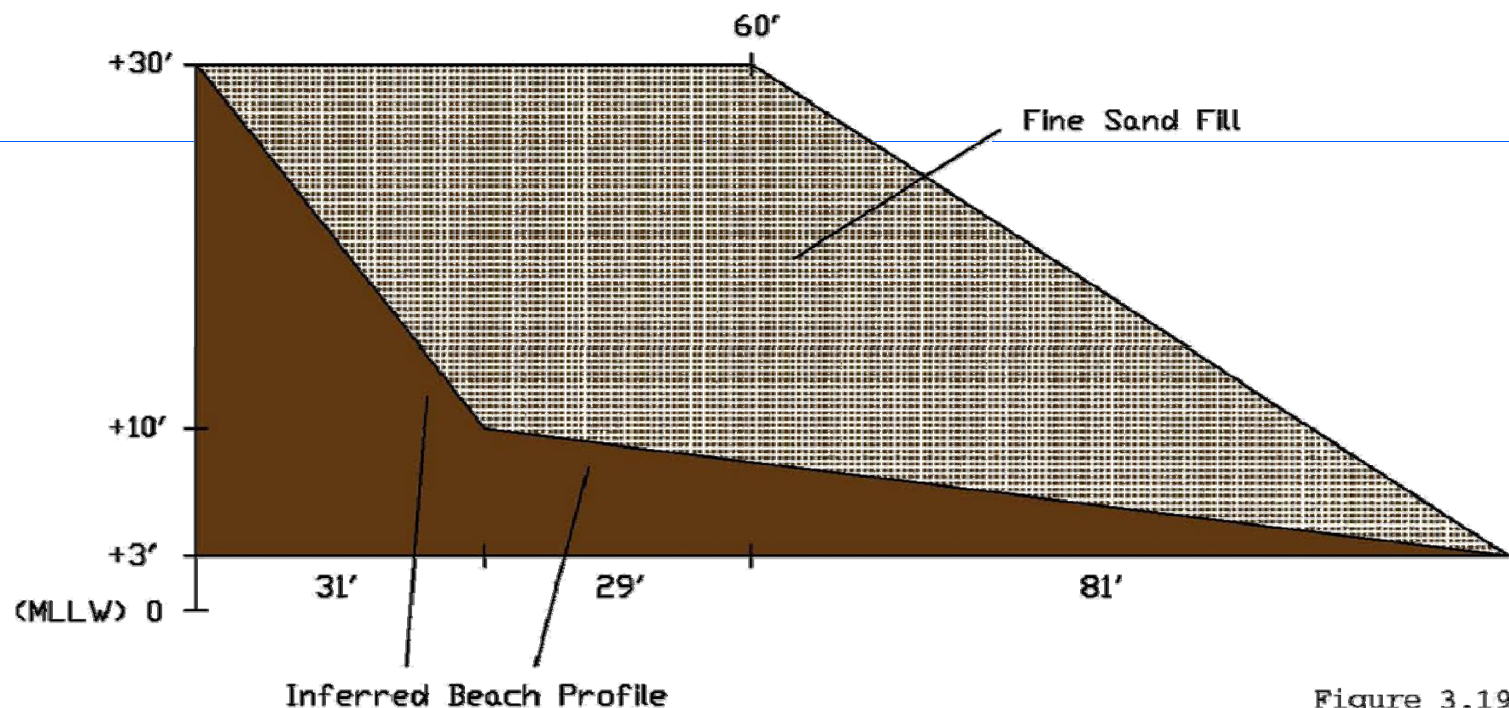
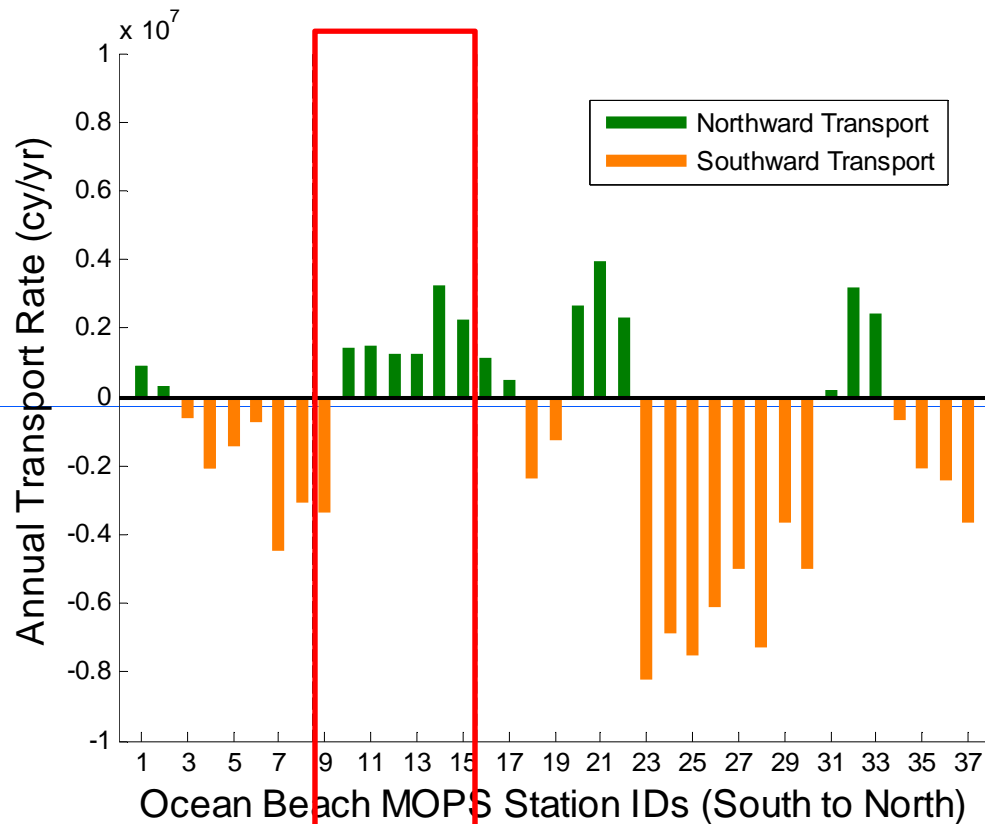


Figure 3.19

Littoral Transport

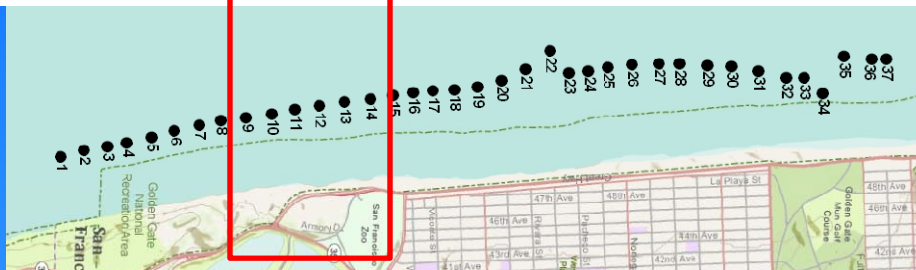


- Transport directions based on CEM equations and CDIP MOPS analysis

- General “Southward” directed transport

- Northward transport at the Hotspot

- Transport reversals related to geomorphologic features



US Army Corps of Engineers
San Francisco District



Discussion

- Questions
- Availability of hopper dredges with pump-off capabilities
- Experience in working in six foot seas
- What will it take to meet the clean air standards
- Other opportunities on the West Coast

