



**CALIFORNIA
AMERICAN WATER**

Weather/Erosion Impacts on Slant Wells

Presented to: MPWSP Governance Committee

Date: December 16, 2015

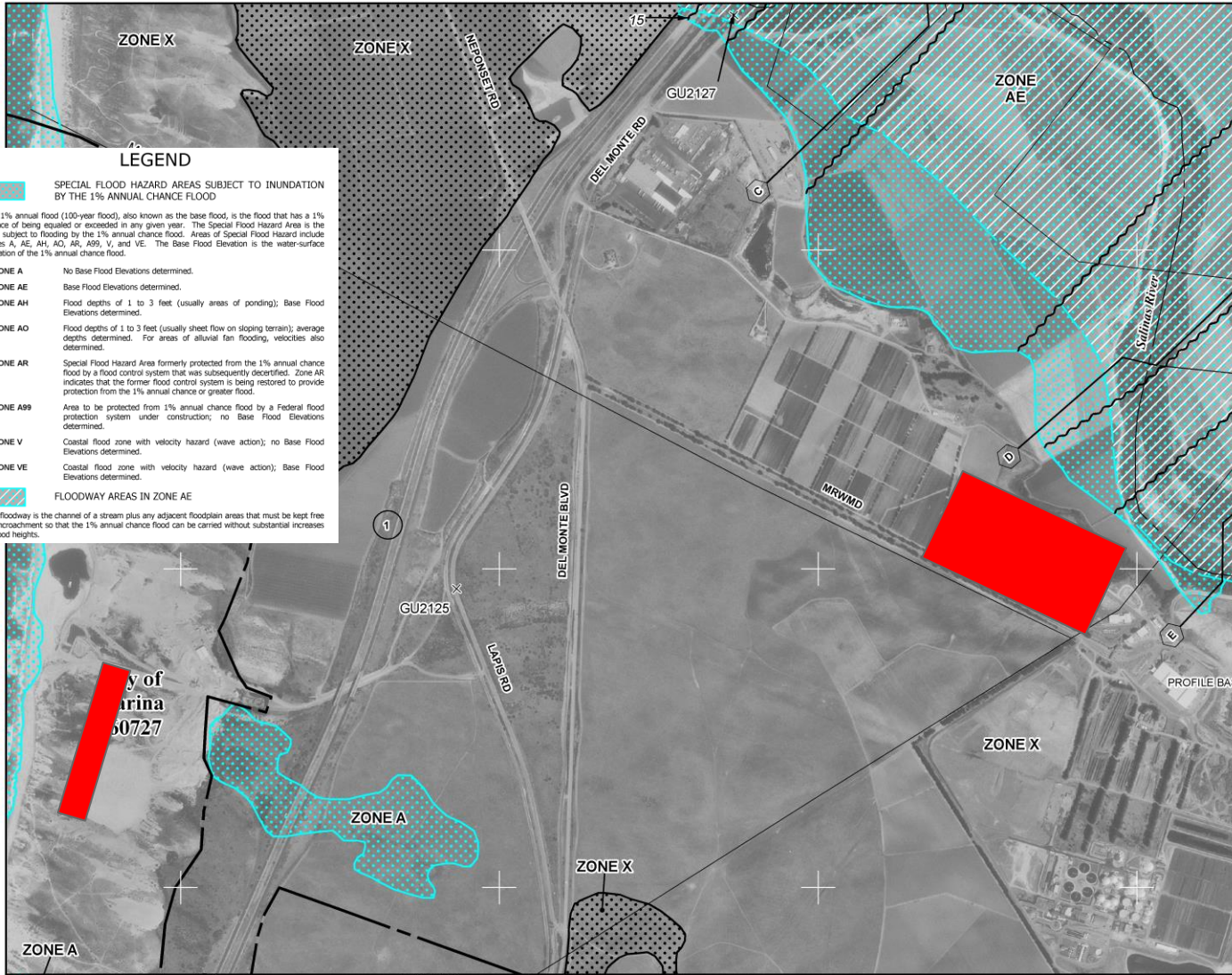
Wave Climate and Storm Characteristics

- **Largest Waves Fall/Winter**
 - Average 9 feet
 - 12-14 second duration
- **100- yr Storm**
 - Offshore Significant Wave Height = 40 feet
 - Wave period of 32 seconds
 - 1% occurrence chance each year
- **Most Damaging Erosion during El Nino events**



Shoreline Change Trends

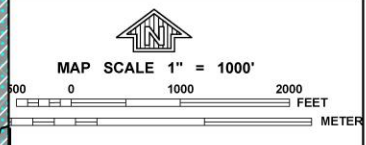
- **Changes due to:**
 - Localized Erosion (rip currents)
 - Long Term Erosion
 - Sea Level Rise
- **Minimizing Damage to Facilities**
 - Avoid areas of erosion
 - Avoid Flood plain Areas

Flood Plain Map



LEGEND

-  SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
- The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
-  FLOODWAY AREAS IN ZONE AE
- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



NFP PANEL 0185G

FIRM
FLOOD INSURANCE RATE MAP

MONTEREY COUNTY,
CALIFORNIA
AND INCORPORATED AREAS

PANEL 185 OF 2050
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
MARINA, CITY OF MONTEREY COUNTY	060727	0185	G
	060188	0185	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
06053C0185G

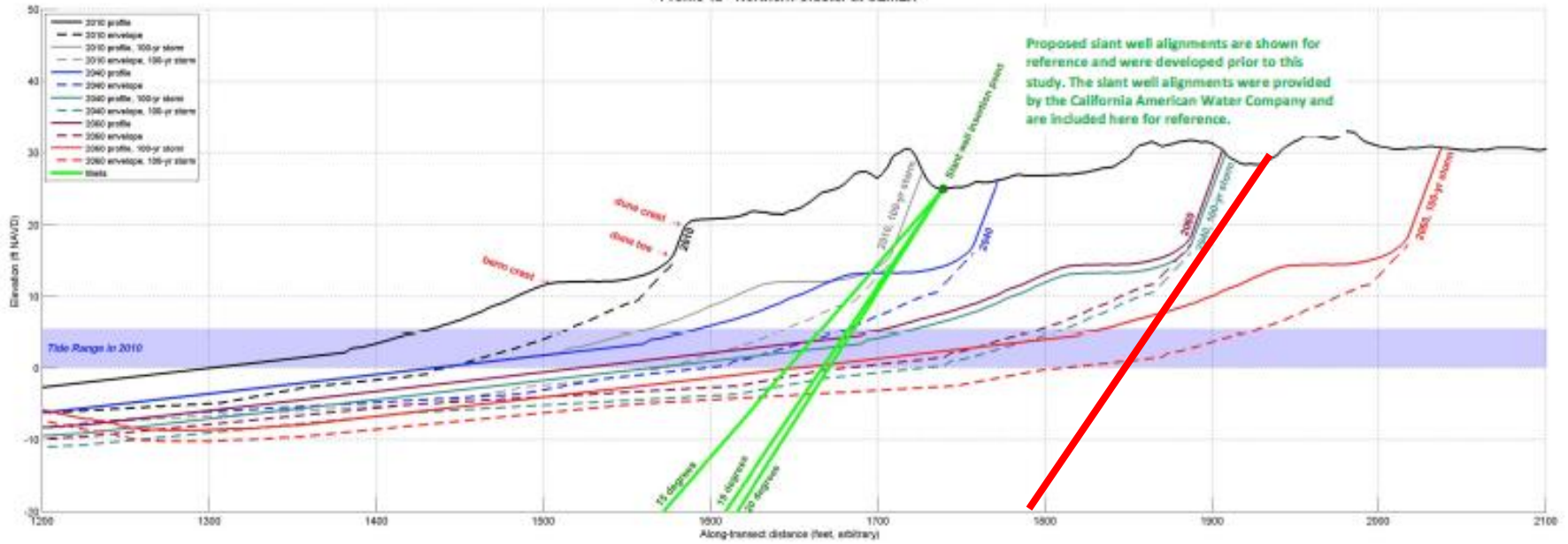
EFFECTIVE DATE
APRIL 2, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Coastal Erosion Rates

Profile 4a - Northern Cluster at CEMEX



Initial Location of Slant Wells
at time of MPWSP Application

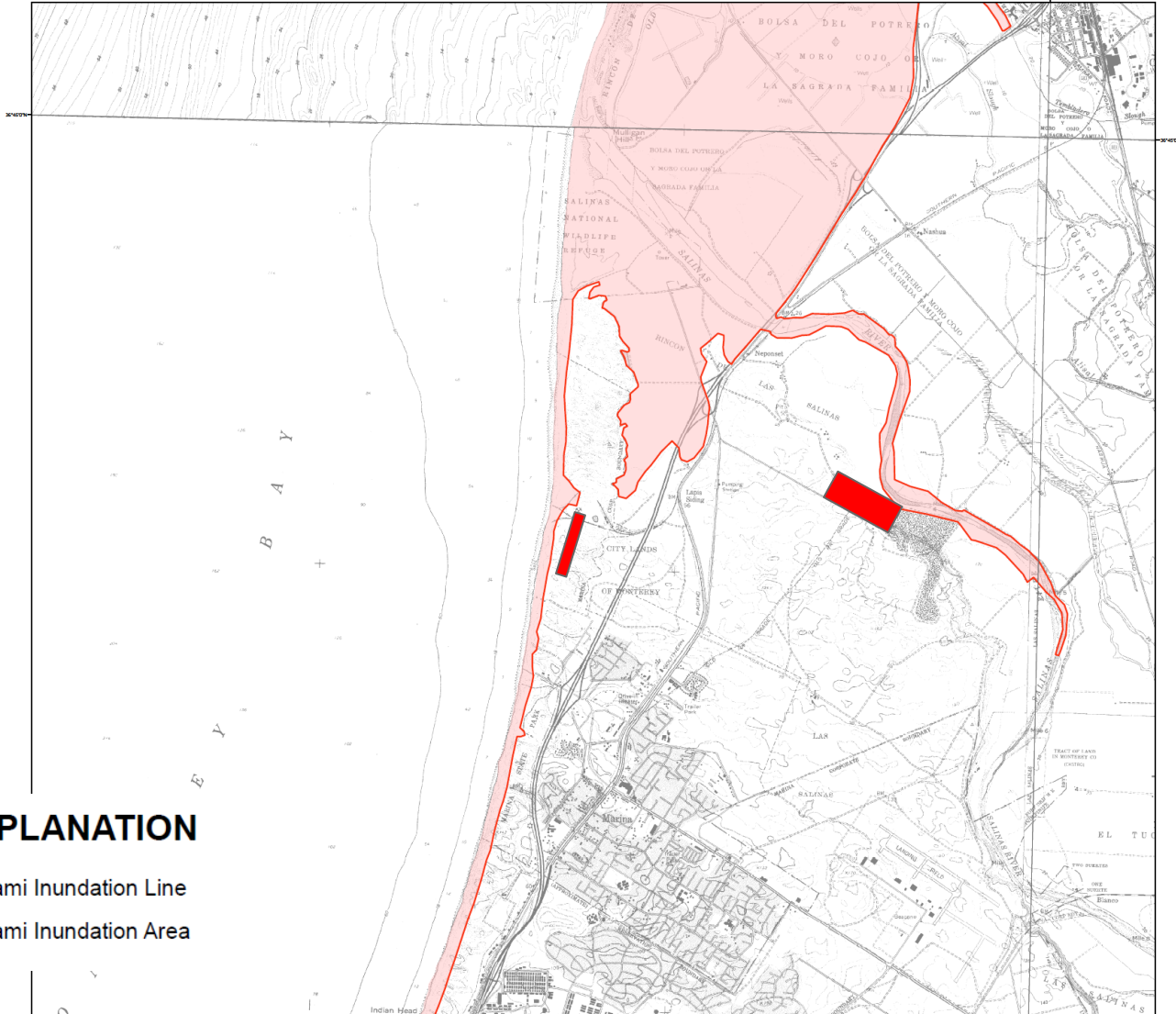
Current Design Location of Slant Wells
2060-Erosion rate, 2040-100 yr storm

Flood Plain Map



California Emergency Management Agency
California Geological Survey
University of Southern California

Tsunami Inundation Map for Emergency Planning
Marina Quadrangle

State of California
County of Monterey



MAP EXPLANATION

-  Tsunami Inundation Line
-  Tsunami Inundation Area

Conclusion

- **Slant well equipment moved inland based on CPUC analysis**
- **Slant Well Above Grade Equipment behind dunes**
- **Facilities located out of 100 yr flood zone**