



MARIN BAYWAVE PROJECT
**BAY WATERFRONT ADAPTATION
 VULNERABILITY EVALUATION**

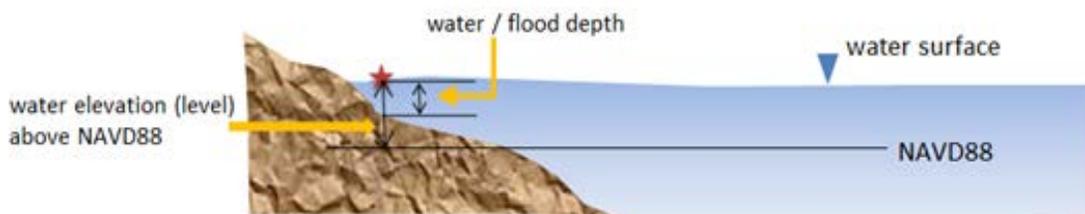
Water Surface Elevation Comparison

This memo explains differences in water surface elevations along the San Francisco Bay shoreline for the new Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) and the United States Geological Survey’s Coastal Storm Modeling System (CoSMoS) maps. FIRM maps inform flood insurance rates while CoSMoS is used for [Marin Bay Waterfront Adaptation Vulnerability Evaluation](#) (BayWAVE) and thus inform Marin County sea level rise planning efforts. Both FEMA and CoSMoS map areas at risk to the 100 year storm under baseline conditions (e.g., no sea level rise). However, modeling approaches vary as FEMA flood zones are based on historical data, while CoSMoS scenarios are based on future projections.

Vertical datums are used in modeling efforts as zero elevation surfaces to which other points are referenced for consistency in a system. Both FEMA and CoSMoS use the same datum, NAVD88, the vertical control datum of orthometric height for vertical control surveying in the United States and Canada which was established in 1991 as local mean sea level in Rimouski, Quebec, Canada. In 1993 NAVD 88 was affirmed as the official vertical datum in the National Spatial Reference System for the conterminous United States and Alaska.¹

Water Surface Elevation is defined by FEMA as: *the heights, usually in relation to mean sea level, reached by flows of various magnitudes and frequencies at pertinent points in the floodplain.*² For both CoSMoS and FEMA, water elevation is measure in feet NAVD. However, as the below table illustrates, water elevation varies amongst the two.

Model	Water Elevation (Marin’s Bayside)	Datum
CoSMoS	8.89-9.84 ft NAVD ³	NAVD88
FEMA	≈11 ft NAVD	NAVD88



Water elevation relative to NAVD88.

Figure courtesy of USGS.

¹ NOAA. *vertical datums*. Accessed 4/15/16

² FEMA. 1986 *Floodproofing Non-Residential Structures*.

³ Erikson, Li (USGS). Personal Communications. 2/11/16

Marin Bay Waterfront Adaptation Vulnerability Evaluation

FIRM Maps

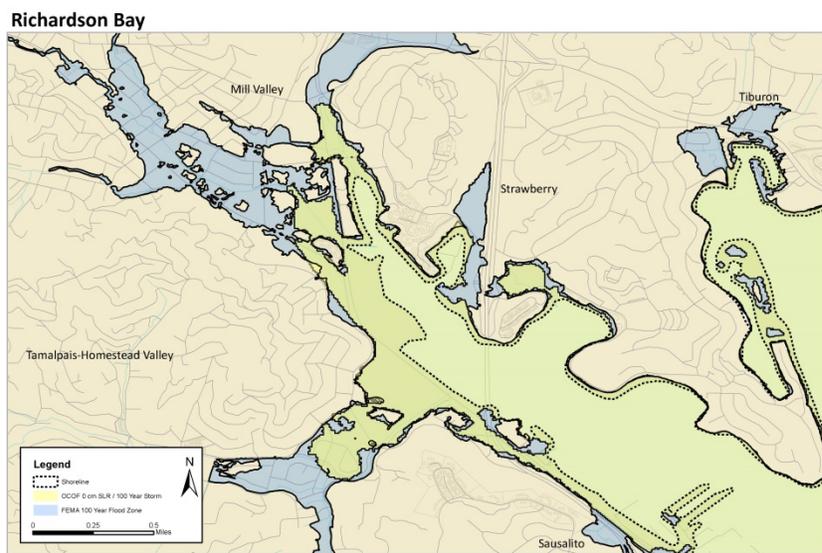
FEMA recently developed new [FIRMs](#) for East Marin, which delineate the Special Flood Hazard Areas and risk premium zones applicable to the community and are used for regulatory purposes including general plans and building permits. SFHA (A and V Zones) are areas that will be inundated by a 1% chance of flooding (100 year storm). Special Flood Hazard Areas are delineated and Base Flood Elevations are determined based upon historical flooding trends and do not account for future Sea Level Rise which is currently not reflected in FEMA’s Flood Insurance Rate Maps.

CoSMoS Maps

CoSMoS maps, which can be viewed through the [Our Coast, Our Future website](#), is a model which delineates areas projected to be exposed to static sea level rise at increments of 0, 25, 50, 75, 100, 125, 150, 175, 200, and 500 centimeters, plus storm events (none, annual, 20-year, and 100-year) to total 40 scenarios. The BayWAVE project uses 25-, 50-, and 150-centimeters of sea level rise to plan for the near-, medium-, and long-term impacts of sea level rise on our built and natural resources.

Hazard Zones

As is evident in maps such as this one for Richardson Bay which overlays the FEMA floodzone with OCOF’s 100-year floodzone (no storm), the higher water elevation of the FEMA zone causes flooding to extend further inland. For planning purposes, this difference should be noted.



MORE INFORMATION

BCDC, USGS, and AECOM. 2016.

Adapting to Rising Tides and Our Coast, Our Future – A

Comparison of the Approaches

FEMA Region IX National Flood Insurance Program. Risk Mapping, Assessment, and Planning (Risk MAP).

Marin, California. <http://www.r9map.org/Pages/countyPage.aspx?choLoco=21&choProj=>

Our Coast, Our Future website. <http://data.pointblue.org/apps/ocof/cms/>

REFERENCES

FEMA. 1986. *Floodproofing Non-Residential Structures*.

NOAA. *Vertical Datums*. <http://www.ngs.noaa.gov/datums/vertical/> Accessed April 15, 2016.