State of California Tsunami Preparedness & Mitigation Program

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California Geological Survey

NTHMP Partner 101

- Key Stakeholders
  - And how you work with them
- What you do and do not do?
- How do you use and facilitate Alert & Warning messages?
- What are 1 or 2 key activities and what are some lessons learned that could be useful to the NTHMP community?
  - Science/Engineering
  - Evacuation/Response

Key Stakeholders

Cal OES – Program Lead, Chair - CA Tsunami Steering Comm., Emergency Management NTHMP Rep., NOAA Grant

CGS – Science Lead, Co-Chair CA Tsunami Steering Comm., NTHMP Science Rep., Hazard Mapping Products

National Weather Service – Manage TsunamiReady Program, Alert & Warning Coordination, Response & Exercises

University of Southern California – TsunamiZone.org, Outreach & Media, Maritime/Inundation Modeling & Research

Redwood Coast Tsunami Work Group/Humboldt State Univ. – Preparedness & Planning Efforts in Cascadia Region of CA

California Coastal Commission – Support & Advise Tsunami Technical Advisory Committee

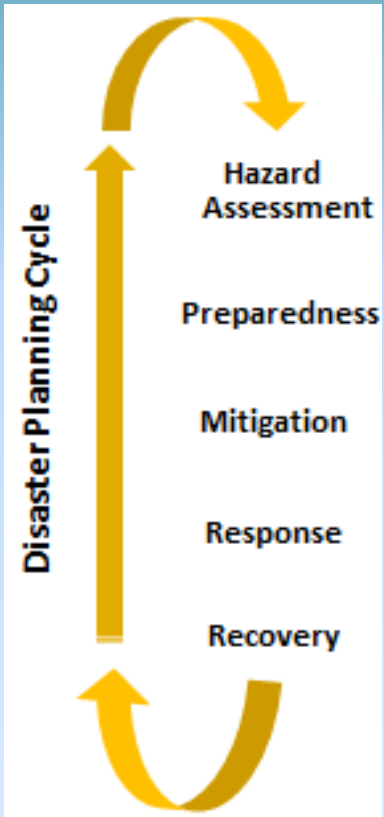
AECOM – Probabilistic Tsunami Hazard Assessment (PTHA)

FEMA – PTHA, Mitigation Project Planning & HAZUS model development and training

USGS – Science Application for Risk Reduction Projects, Pedestrian Evacuation Modeling Analysis, Powell Center Tsunami Source Work Group

100 communities, 20 counties, and more than 70 ports/harbors

California Tsunami Program Mission
(What We Do and Do Not Do)



Hazard Assessment & Understanding
- Inundation Modeling & Maps
- Evacuation Modeling & Maps
- Probabilistic Modeling & Maps
- Hazus Assessments

Preparedness
- Training & Exercise Support
- System & Communications Testing
- TsunamiReady® Program
- Tsunami Preparedness Week
- Public Education

Response
- 24/7 Duty Officer Program
- Evacuation/Maritime Playbooks
- Real-Time/Post-Tsunami Field Teams

Mitigation & Recovery
- Policy Analysis & Development
- Resiliency & Improvement Reports

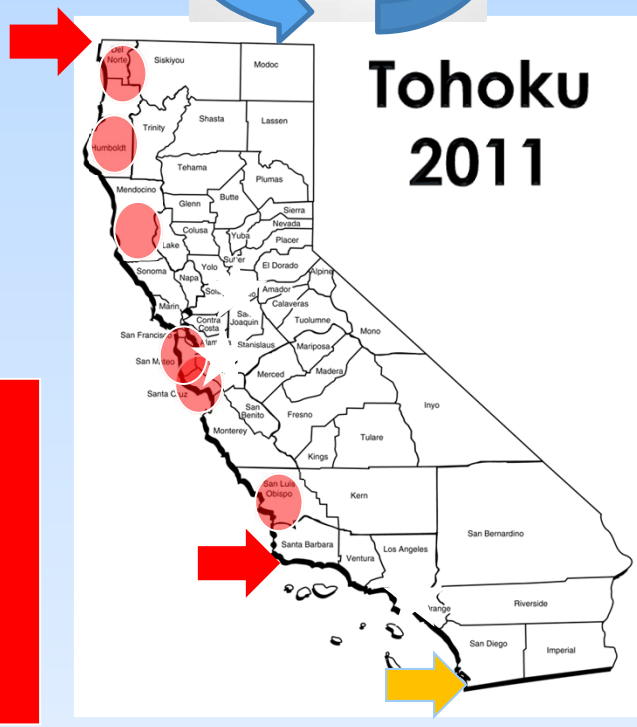
Tsunami Alert & Response

How We Use & Facilitate Alert & Warning Messages

State Response To: WARNING and/or ADVISORY

ACTIONS:

- Participate: Calls With NOAA Tsunami Warning Center
- Activate: State EOC's (SOC/REOC's)
- Calls With Emergency Managers In Coastal Counties



Focus: Locations of Heightened Concern:

Start of Tsunami

Wave Heights

Tide Conditions

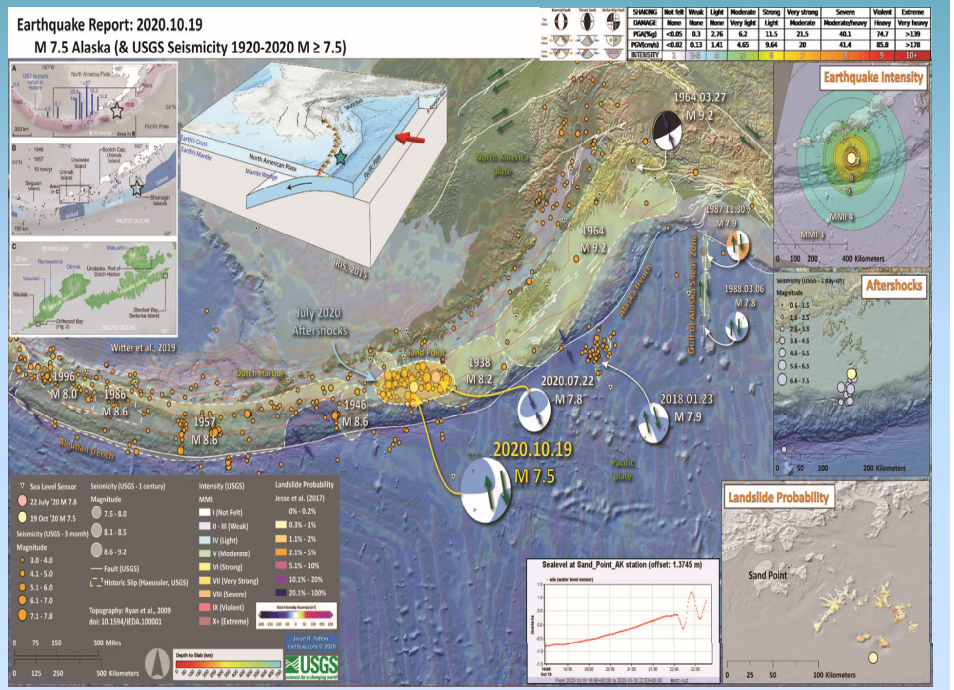
Tsunami Response Protocol 10/19/20

5-10 min: Review First Tsunami Information Statement

10-15 min: Cal OES, CGS, & NWS-Monterey – Situation Status & FASTER

15-30 min: Evaluate Potential CA Impact:

- **CGS: Historical Events**
- **NTWC: Tsunami Data/Alerts**
- **USGS: EQ/Fault Data**
- **NOAA: Forecasted Tides & Currents, Historical Database**



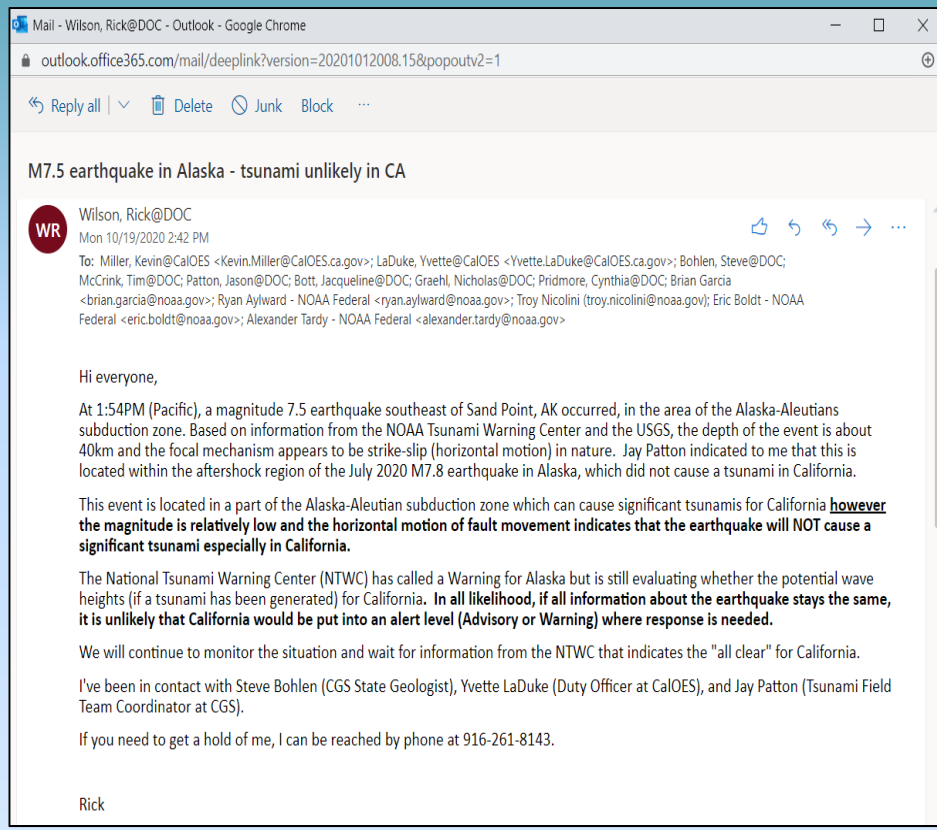
Tsunami Response Protocol 10/19/20

30-45 min: Response Recommendation for CA

- Pending NTWC Forecast & Alert Notification
- CGS to Cal OES & NWS-WCMs
- Cal OES Distributes to Partners

45 min – All Clear: On-Going Communication

- Conference Calls w/ NTWC & Local Partners
- Run FASTER & Provide Playbook Recommendations
- Deploy Field Observation Team
- Monitor Coastal Camera Network



Mail - Wilson, Rick@DOC - Outlook - Google Chrome

outlook.office365.com/mail/deeplink?version=20201012008.15&popoutv2=1

Reply all | Delete | Junk | Block | ...

M7.5 earthquake in Alaska - tsunami unlikely in CA

WR

Wilson, Rick@DOC

Mon 10/19/2020 2:42 PM

To: Miller, Kevin@CalOES <Kevin.Miller@CalOES.ca.gov>; LaDuke, Yvette@CalOES <Yvette.LaDuke@CalOES.ca.gov>; Bohlen, Steve@DOC; McCrink, Tim@DOC; Patton, Jason@DOC; Bott, Jacqueline@DOC; Graehl, Nicholas@DOC; Pridmore, Cynthia@DOC; Brian Garcia <brian.garcia@noaa.gov>; Ryan Aylward - NOAA Federal <ryan.aylward@noaa.gov>; Troy Nicolini (troy.nicolini@noaa.gov); Eric Boldt - NOAA Federal <eric.boldt@noaa.gov>; Alexander Tardy - NOAA Federal <alexander.tardy@noaa.gov>

Hi everyone,

At 1:54PM (Pacific), a magnitude 7.5 earthquake southeast of Sand Point, AK occurred, in the area of the Alaska-Aleutians subduction zone. Based on information from the NOAA Tsunami Warning Center and the USGS, the depth of the event is about 40km and the focal mechanism appears to be strike-slip (horizontal motion) in nature. Jay Patton indicated to me that this is located within the aftershock region of the July 2020 M7.8 earthquake in Alaska, which did not cause a tsunami in California.

This event is located in a part of the Alaska-Aleutian subduction zone which can cause significant tsunamis for California **however the magnitude is relatively low and the horizontal motion of fault movement indicates that the earthquake will NOT cause a significant tsunami especially in California.**

The National Tsunami Warning Center (NTWC) has called a Warning for Alaska but is still evaluating whether the potential wave heights (if a tsunami has been generated) for California. **In all likelihood, if all information about the earthquake stays the same, it is unlikely that California would be put into an alert level (Advisory or Warning) where response is needed.**

We will continue to monitor the situation and wait for information from the NTWC that indicates the "all clear" for California.

I've been in contact with Steve Bohlen (CGS State Geologist), Yvette LaDuke (Duty Officer at CalOES), and Jay Patton (Tsunami Field Team Coordinator at CGS).

If you need to get a hold of me, I can be reached by phone at 916-261-8143.

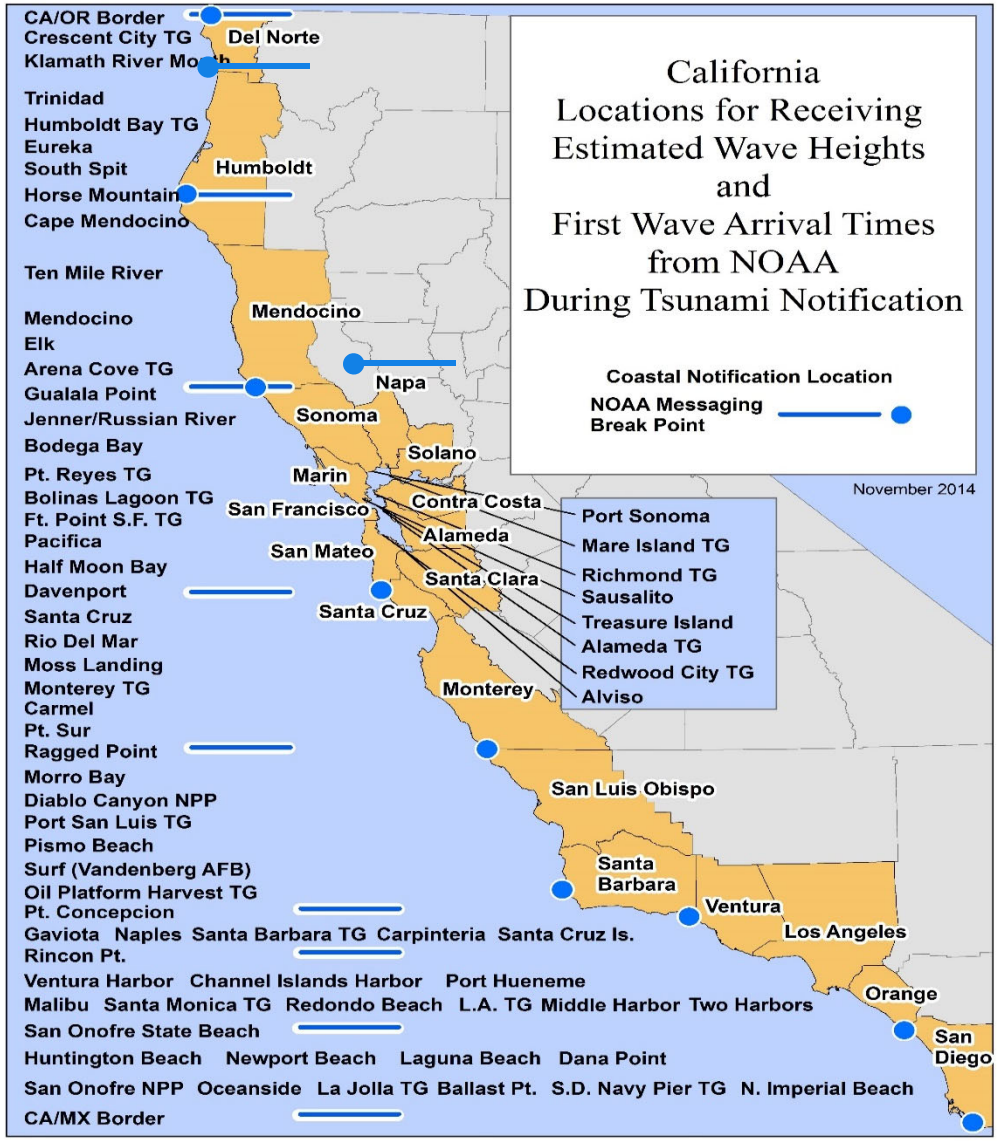
Rick

CA Tsunami Forecast Points Start Times & Amplitudes

NTWC sends forecasts for tsunami arrival times & max. tsunami amplitudes for Advisory & Warning level events at 60+ locations in CA.

These points correspond to tide gauge locations & communities vulnerable to tsunamis.

This data is projected/ interpolated for 200+ locations along the coast.



Evacuation Planning Playbooks
Use of FASTER in CA

Computer program formula for determining minimum Playbook evacuation line to use (FA-S-T-E-R):

FA: **Forecasted Amplitude (Wave Height)** maximum for near-shore region from Warning Center

+

S: **Storm** surge or existing ocean conditions (first 6 hours)

+

T: Maximum **tidal** height (first 6 hours)

+

E: Forecast **error** potential (+30%; analysis of 2010-11 events)

+

R: Site amplified **run-up** potential (from existing modeling, unique to each location; applied if inundation expected)

+

(Other non-storm, non-tidal anomalies and wave-setup impact)

= Realistic maximum tsunami run-up height

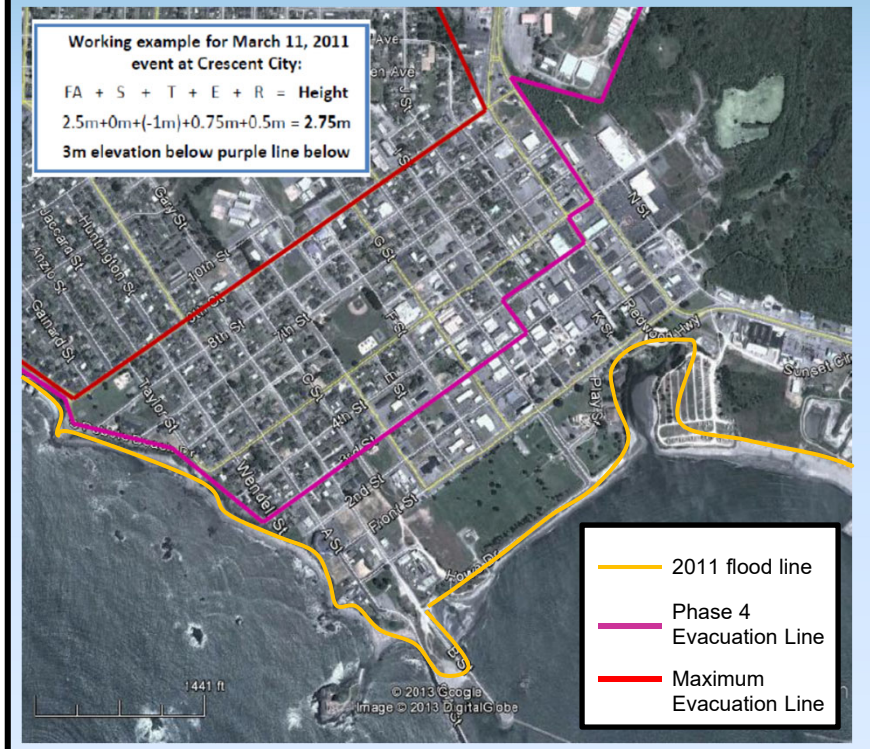
= Minimum Playbook elevation line

Working example for March 11, 2011 event at Crescent City:

FA + S + T + E + R = **Height**

2.5m+0m+(-1m)+0.75m+0.5m = **2.75m**

Phase 4 (3.5m) purple line below



Maritime Tsunami Playbooks

Real-time recommendation from State and NWS:

RECOMMENDED MINIMUM TSUNAMI EVACUATION PLAYBOOK PLAN - The following table provides recommendations for evacuation planning for each California community. The recommended Evacuation Phase number in Column Three

RECOMMENDED MINIMUM MARITIME TSUNAMI RESPONSE PLAYBOOK PLAN - The following table provides recommendations for maritime response planning for each California maritime community at risk to tsunamis. The

Playbook Plan E

(based on M9.2 Eastern Aleutian-Alaska Scenario)

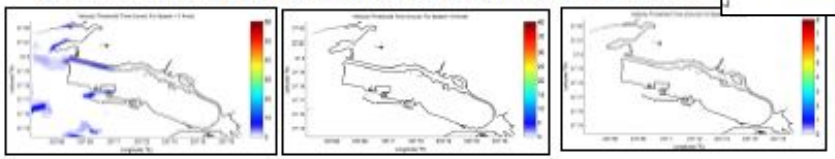
Background Information:
Alert level = Warning
Peak Amplitude = 2.2+ meters
Peak Velocity = 9 knots
Projected duration of strong currents (see location maps below):
3-6 knots = 20 hrs; 6-9 knots = 10 hrs; >9 knots = 3 hrs

Specific Instructions:

- Follow general guidance for Warning-level tsunamis (Page 5)
- Inundation of dry land could occur in this scenario
- Strong currents and potential scour are expected in areas identified in blu yellow-red on the map to the right. Consider relocating vessels located wi 100 meters (300 feet) of these areas.
- Specific areas where vessels should be relocated from and docks secured: (completed with maritime community input)

Safe areas for repositioning vessels within the Oakland/Alameda maritime communities:
(completed with maritime community input)

Time thresholds for currents >3 knots.....>6 knots.....>9 knots
(Colors below represent HOURS of potential activity for blue, yellow, and red zones on oppos

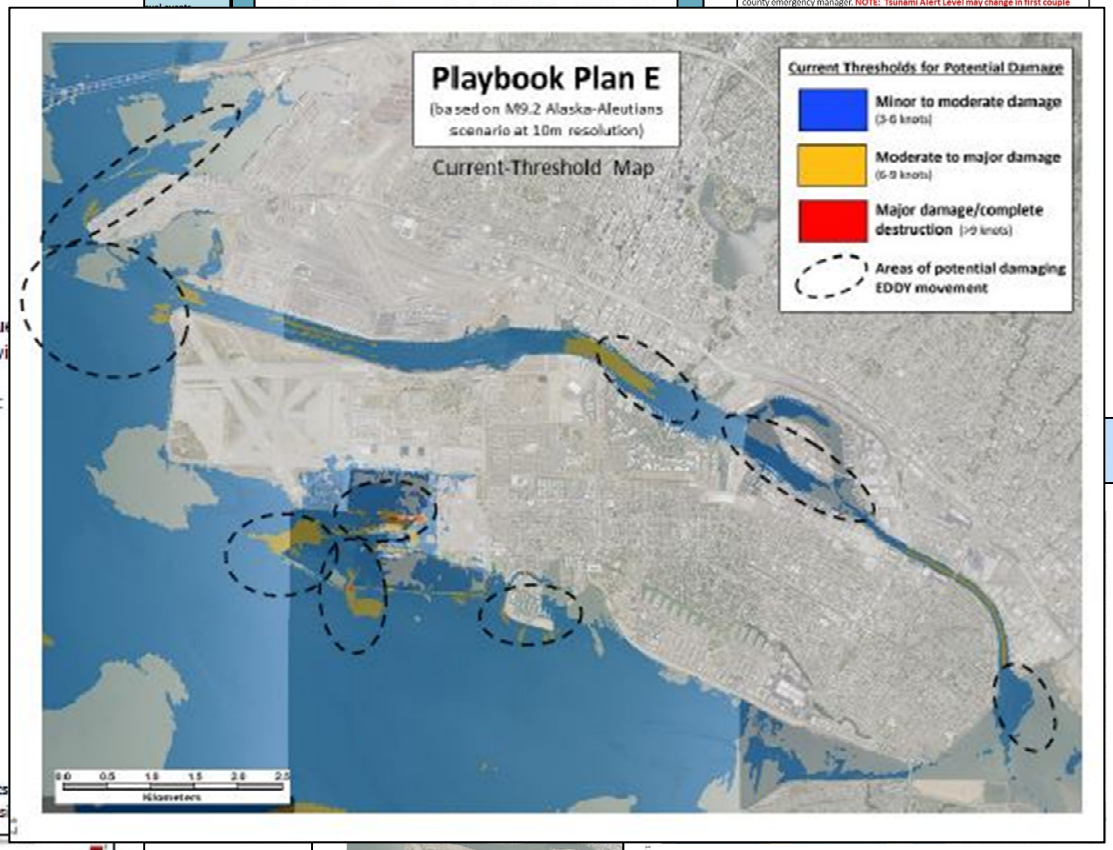


California Maritime Tsunami Response Playbook And Mitigation Guidance

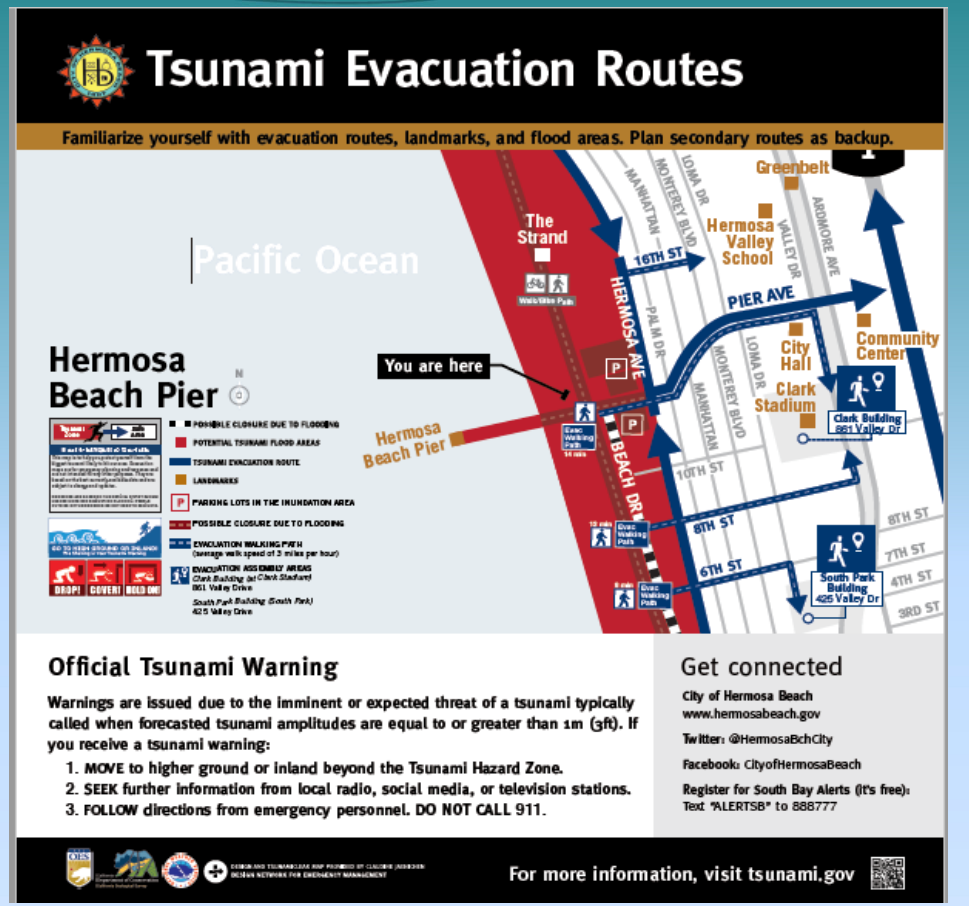
Oakland/Alameda – Alameda County

APPENDIX
Quick Reference Page for Determining Real-Time Maritime Tsunami Response Activities

Step 1: Obtain basic information about the earthquake and tsunami from National Tsunami Warning Center in Alaska, regional National Weather Service office, and/or county emergency manager. NOTE: Tsunami Alert Level may change in first couple



Public Evacuation



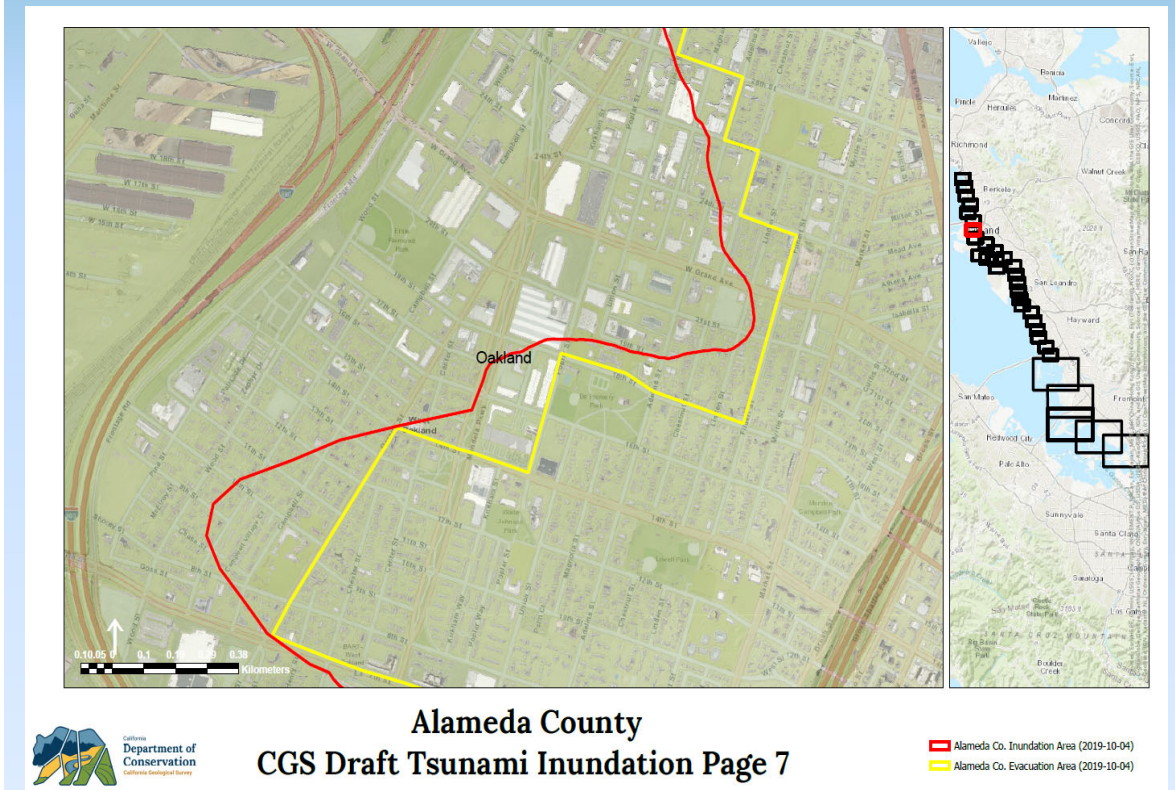
Program Activities & Lessons Learned

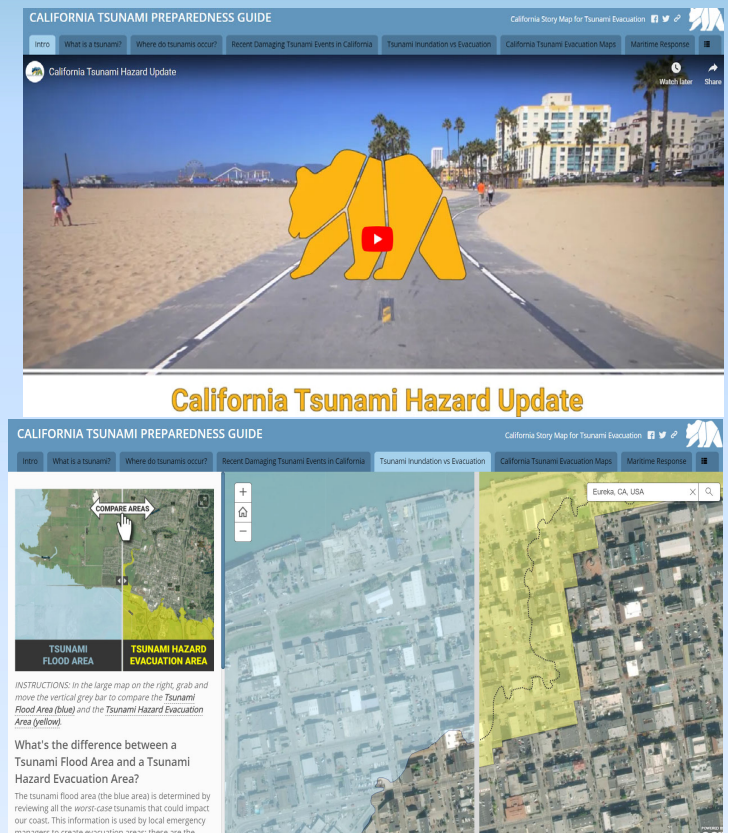
- Science/Engineering
- Preparedness/Response

Updated Inundation and Evacuation Maps

10-Year Update

- Enhanced understanding of tsunami sources (M9.3 EQ Off Alaska Coast & Local CA Off Coast Sources) , computer modeling & topo-bathy DEM resolution.

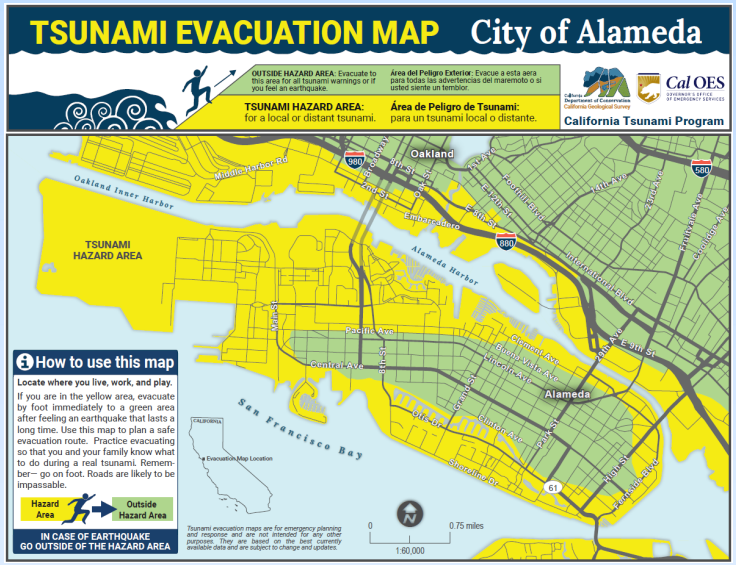




Updated Inundation and Evacuation Maps

Partner Coordination

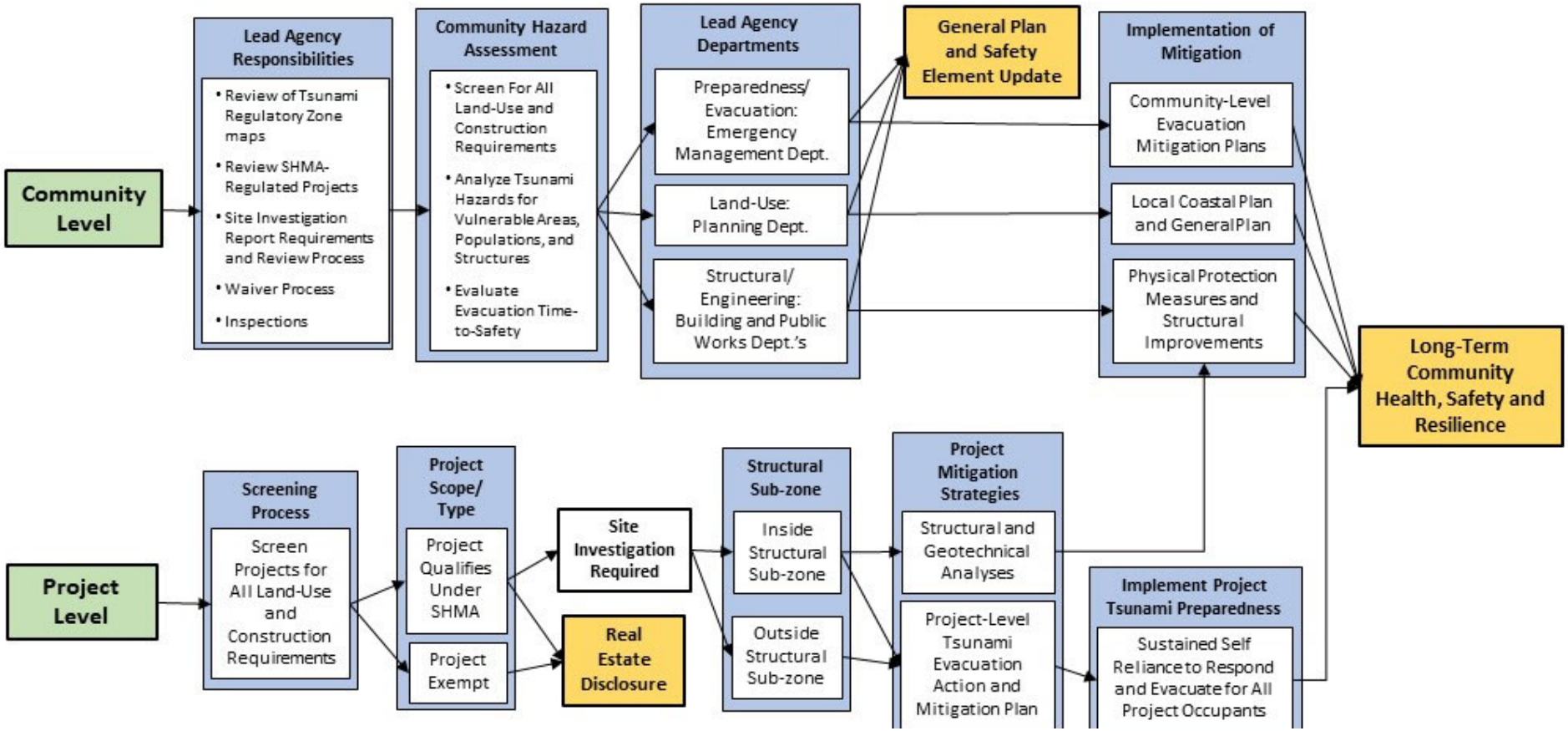
- Work with Jurisdictions to review new tsunami hazard inundation maps
- Develop Evacuation Maps for Emergency Response
- Create California Tsunami Preparedness Guide (Story Map) – Explains Maps and Two-Pager


TSUNAMI EVACUATION MAP City of Alameda
OUTSIDE HAZARD AREA: Evacuate to this area for all tsunami warnings or if you feel an earthquake.
Área del Peligro Exterior: Evacue a esta aera para todas las advertencias del maremoto o si usted siente un temblor.
TSUNAMI HAZARD AREA: for a local or distant tsunami.
Área de Peligro de Tsunami: para un tsunami local o distante.
California Tsunami Program
Oakland
Alameda
TSUNAMI HAZARD AREA
Oakland Inner Harbor
Middle Harbor Rd
Alameda Harbor
Pacific Ave
Central Ave
Encinal Ave
Clement Ave
Buena Vista Ave
Lincoln Ave
Eighth St
Sixth St
Fifth St
Fifth Ave
Sixth Ave
Seventh Ave
Eighth Ave
Ninth Ave
Tenth Ave
Eleventh Ave
Twelfth Ave
Thirteenth Ave
Fourteenth Ave
Fifteenth Ave
Sixteenth Ave
Seventh

Science/Engineering Activity

Requirements for Residential & Commercial Developments
Seismic Hazard Mapping Act – Community & Project Recommendations

- 975-year PTHA maps for Tsunami Regulatory Zones & 475-year PTHA Structural Analysis Subzones for project-level requirements.
- Guidance, Requirement Checklists, & Website w/ Instructional Materials from CGS & TsuTAP.



Preparedness/Response Activity

- Hazus Tsunami Model Assessments
- 20 Coastal Counties (Ocean and Bay)
- Statewide and County Level Results
- 975 Average Return Period PTHA Hazard Data
- NSI2.0 Statewide Database
- Customizing Reports and Maps

FEMA

Building Damage Count by Building Occupancy Type

Occupancy	Estimated Extent of Damage* None	Moderate	Extensive	Complete	Total Buildings
Residential	245	0	2	487	734
Commercial	79	0	10	59	148
Industrial	5	0	1	6	12
					7
					2
					13

table in short
or damage t
is no

Exposed Population*

Under 65 years old: 2,615 to 3,149

65 years and older: 434 to 492

Total Exp

* Ranges
census bl
2010 Cer

Total Estimated Casualties*

Fatalities: 522 to 636

Injuries: 22 to 28

* Range of casualties for day and night populations in tsunami inundation zone for a moderately prepared community.

Residential Estimated Economic Losses*

Economic Losses: XXX million

* Includes direct residential building losses. Direct
the
value.

Total Estimated Economic Losses*

Economic Losses: 682 million

* Includes direct building losses and business interruption losses. Direct building losses are the costs to repair or replace the building and its contents and is not the property value.

Thank You!

TsunamiZone.org

tsunami.ca.gov

myHazards.CalOES.ca.gov

tsunami.gov