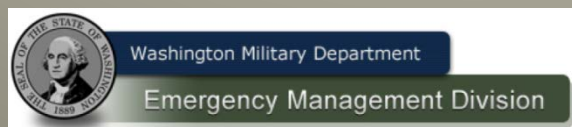


State & National Tsunami Hazard Mitigation Programs... **Increasing our Nation's Overall Resilience to Tsunamis**



John D. Schelling
Washington Emergency Management



Why Vertical Evacuation?

&

Why Now?

Because **TODAY**, our Estimated Population at Risk in Cascadia-related Tsunami Hazard Zones is...

Population Counts	Washington	Oregon	Northern California	Regional Total
Number of Residents	44,710	22,201	10,344	77,255
Number of Employees	17,021	14,857	9,389	41,267
Average Daily State Park Visitors	17,029	53,714	2,889	73,632
Totals	78,760	90,772	22,622	192,154

Number of Visitor Facilities	Washington	Oregon	Northern California	Regional Total
Number of Public Venues	135	60	67	262
Number of Dependent-care Facilities	149	43	32	224
Totals	284	103	99	486



* Assuming there are 100 people at a public venue and 50 people at a dependent-care facility, then there are approximately **another 37,400 people** in tsunami-prone areas.

** Numbers compiled from various USGS reports on community exposure to tsunamis (Oregon is based on 2000 data; Washington and California are based on 2010 data)

Because we know it is only a matter of time...

➤ DISTANT Tsunamis:

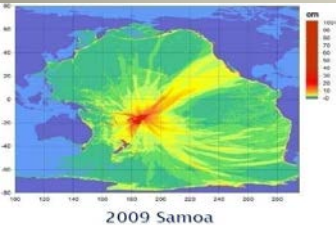
- Events with 2+ hours arrival time from around Pacific Rim
- Time & capability to issue 'official' warnings
- Much smaller than local tsunamis
- NOAA Tsunami Warning Centers (TWCs), Dart Buoys provide useful data

➤ LOCAL Tsunamis:

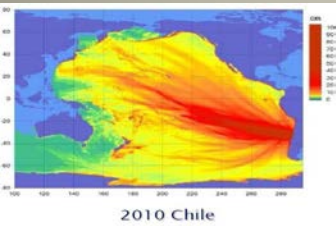
- Events with 5-30 min. arrival time & most casualties occur w/in 45 min.
- Massive tsunamis with large inland penetration possible
- People must be trained on life-safety protective actions & act immediately!
- TWCs & buoys ineffective for initial life-safety actions

➤ ***"The time's, they are a changin'?"***

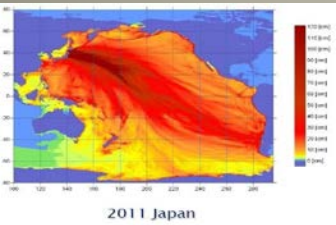
- M8+ EQ in the next 50-years:
 - 10 – 14 % Northern CSZ (USGS)
 - 37 % Southern CSZ (C. Goldfinger)



2009 Samoa



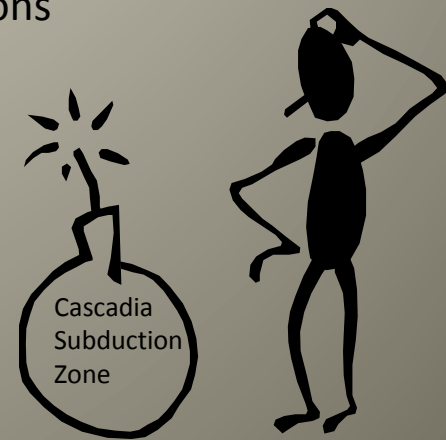
2010 Chile



2011 Japan



20?? United States



Because, perhaps most importantly, for 90-95% of coastal populations... Local Tsunamis are Survivable. *

****Disclaimer: Provided, coastal residents, visitors, schools, etc:***

- 1. Know the 'natural warning signs'***
- 2. Know what areas are at risk***
- 3. Know where to escape***
- 4. Practice evacuations***

***What about the Other 5-10%
of Coastal Communities?***

Current Situation:

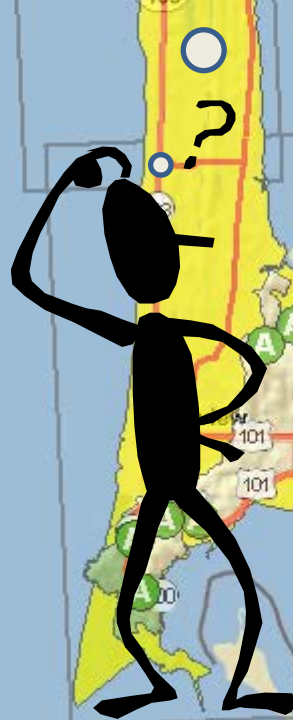
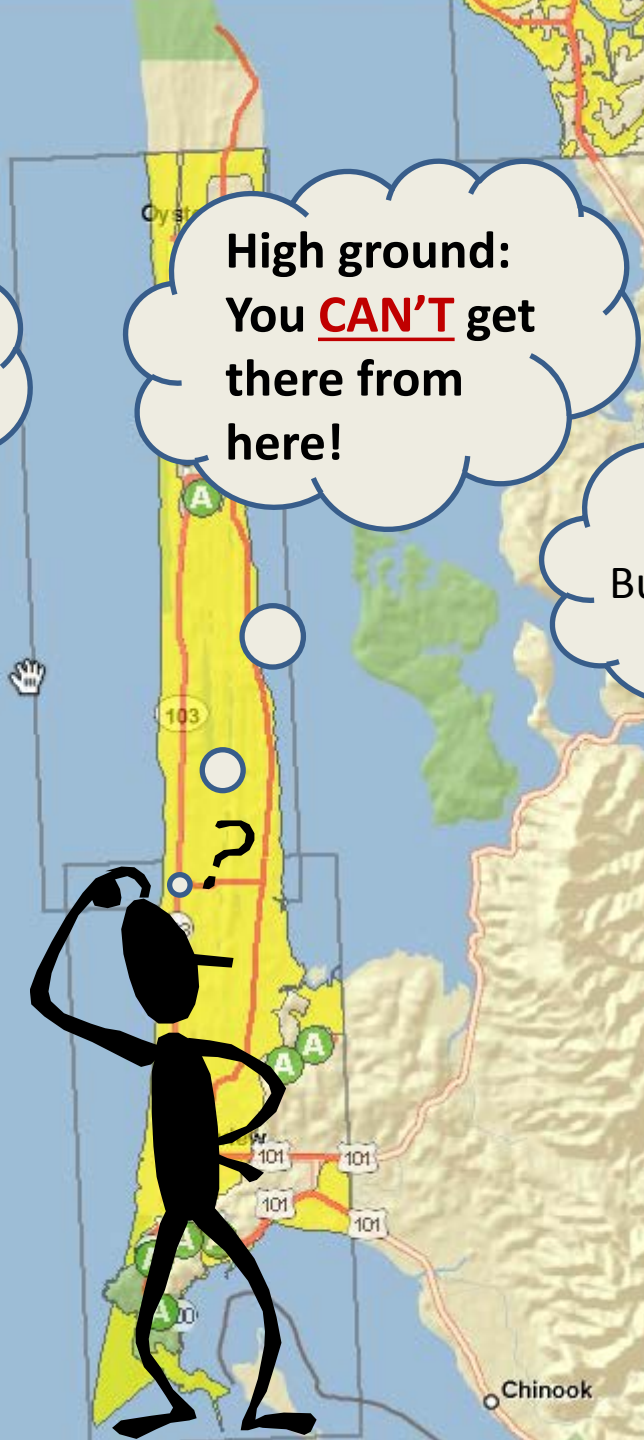
Local
Earthquake!

Ah ha!

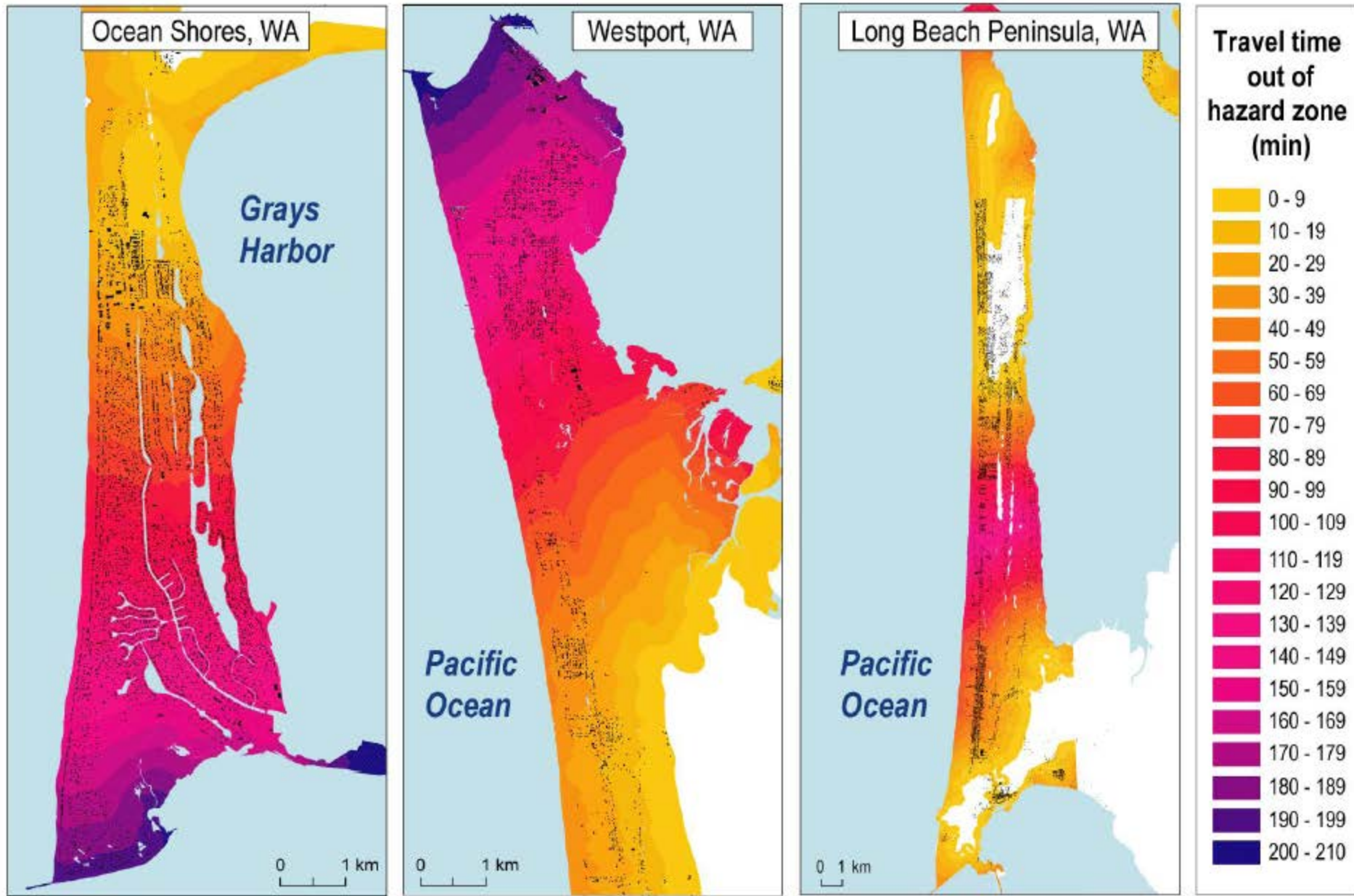


High ground:
You **CAN'T** get
there from
here!

Bummer!



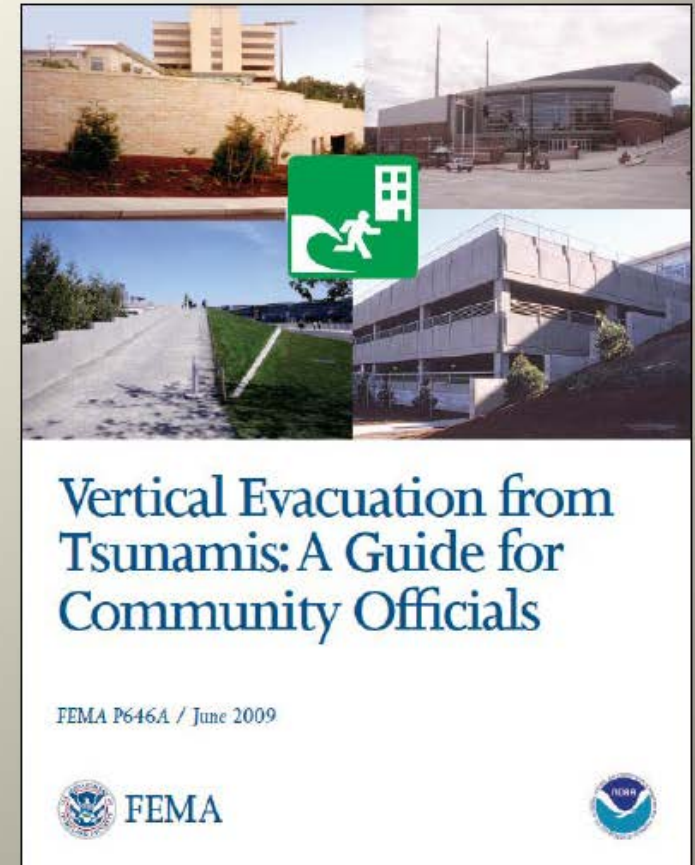
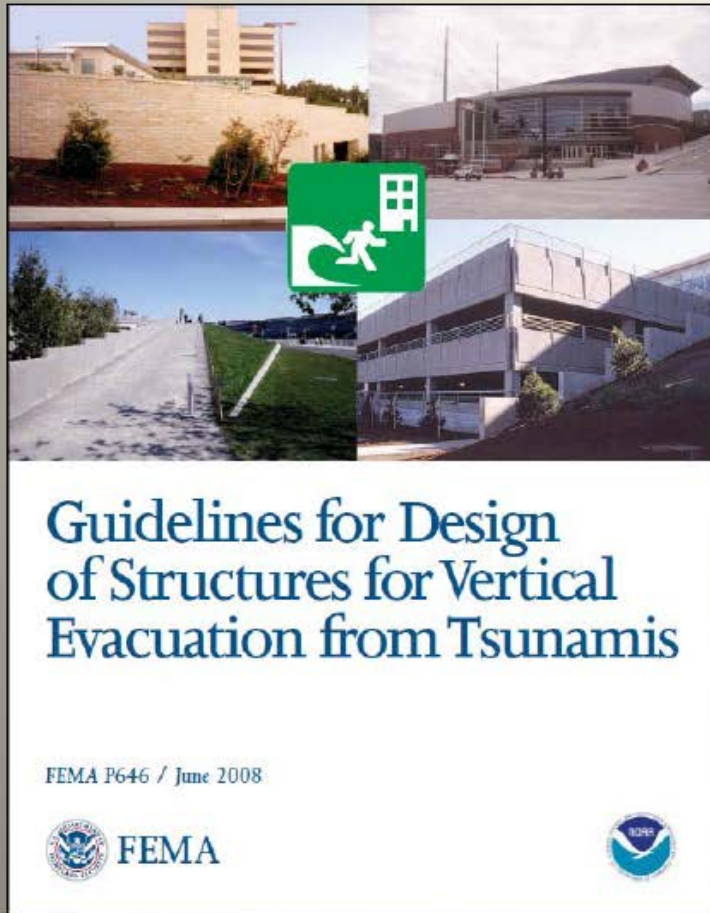
Hotspots of Evacuation Challenges



Source: Wood & Schmidtlein, 2011

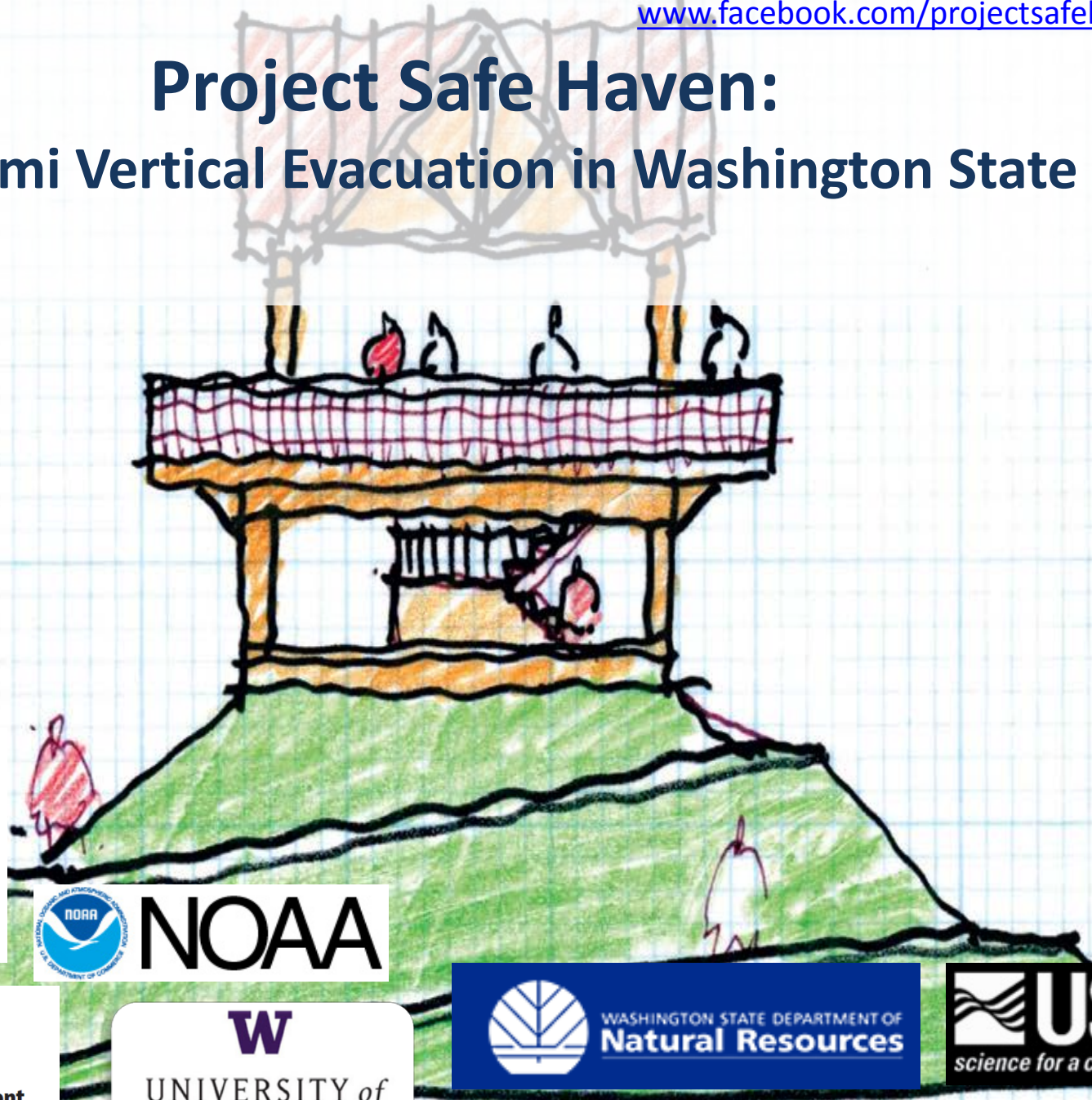
Based on 1.1 m/s travel speed

Official Engineering/Planning Guidance



**+ ASCE 7 DRAFT
CODE LANGUAGE**

Project Safe Haven: Tsunami Vertical Evacuation in Washington State



National Tsunami Hazard
Mitigation Program



NOAA



Washington Military Department
Emergency Management Division

W

UNIVERSITY of
WASHINGTON



WASHINGTON STATE DEPARTMENT OF
Natural Resources



USGS
science for a changing world

ron kasprisk

Safe Haven Planning Process



Kick off Meeting with Local
Emergency Manager

Community World Café Meeting
(Gather initial community input)

Alternatives Analysis (SWOT)
By Community Members

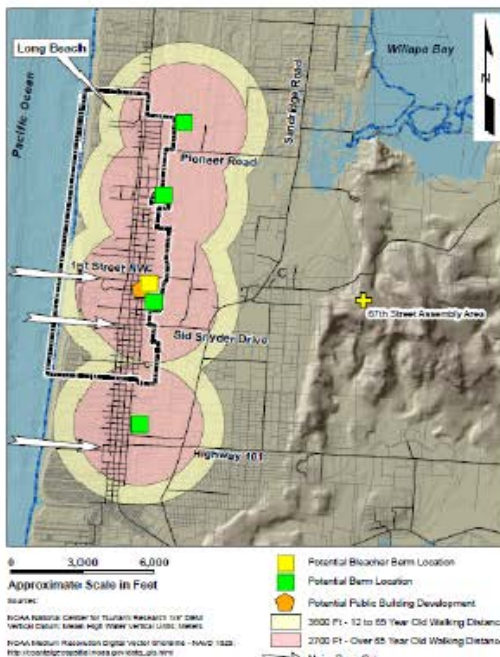
Community Development of
Preferred Alternative

Urban Design Charrette with
Architects

Community Ranking of Locations
& Final Plan Development



Figure 2 - Preferred Strategy



Implementation!

- Phase IV (FY12 NHTMP funds) – Site Specific Vertical Evacuation Modeling Analysis Completed to support 2 projects
 - Long Beach Elementary School Berm
 - Ocosta Elementary School Gym
- Used Oregon's L1 Source (~2,500 year recurrence) for consistency and based on FEMA/NOAA guidance and draft ASCE 7 recommendations.
- Iterative process for hazard assessments
- Funding Test Balloons (federal, state, local)
- In FEMA speak they may be considered... "Tsunami Safe Areas"
- Eligible but Not Funded...
- Ocosta School District is moving forward! First structure in U.S. purposefully built to new tsunami-design criteria.
- Long Beach Elementary School is in Environmental Review

Tsunami Hazard Assessment of the Ocosta School Site in Westport, WA

Final Report: September 11, 2013

Supersedes February 24, 2013 Report

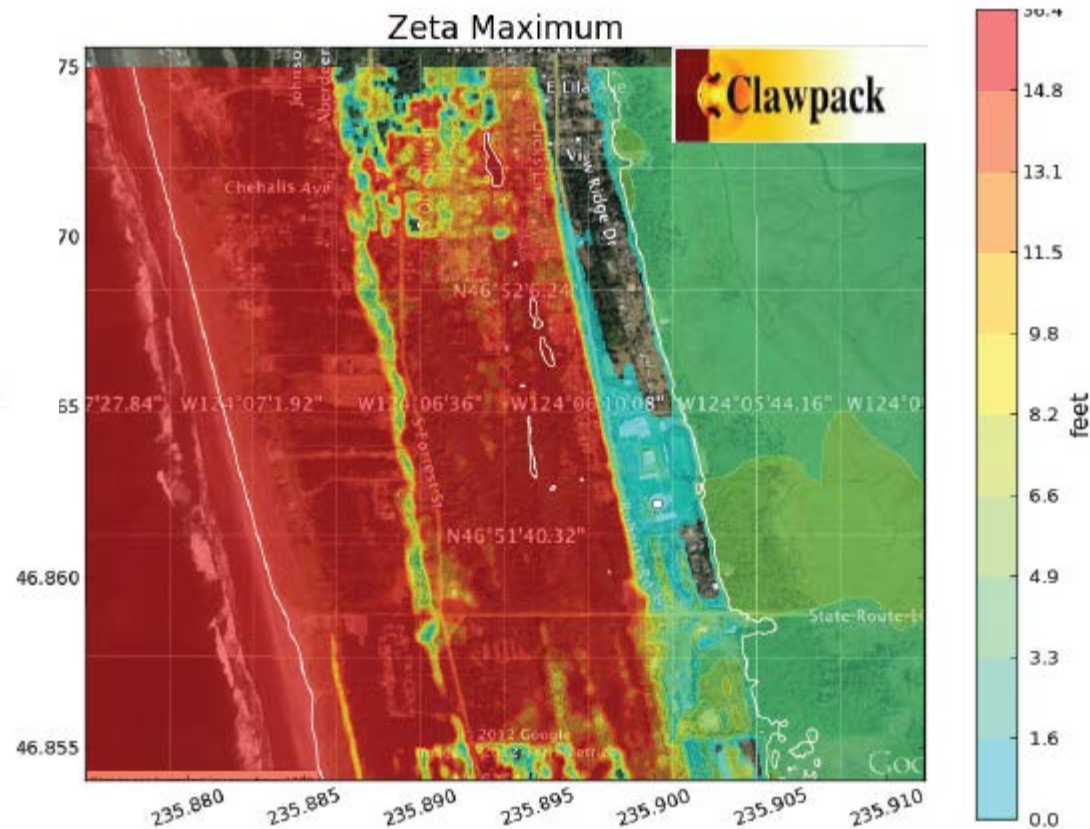
Frank González, Randy LeVaque and Loyce Adams

University of Washington



Westport, WA, Google Earth image. Blue rectangle is area of fine resolution GeoClaw tsunami model grid; white circle encompasses Ocosta School campus.

Study funded by Washington State Emergency Management Division



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Originally published October 15, 2013 at 8:49 PM | Page modified October 16, 2013 at 6:04 AM

Grays Harbor County school to build first U.S. vertical-tsunami refuge

A new scenario for a Cascadia megaquake and tsunami warns that more than 10,000 could be killed and 30,000 injured. But a school district near Westport, Grays Harbor County, is doing everything it can to keep its students safe.


By [Sandi Doughton](#)
Seattle Times science reporter




A new [scenario](#) for a megaquake and tsunami off the Washington coast warns that the death toll could top 10,000 — but Paula Akerlund is doing everything she can to keep her kids safe. All 700 of them.

The Grays Harbor County school district Akerlund oversees on the Washington coast is preparing to build the nation's first tsunami refuge.

Share:



 Recommend 0

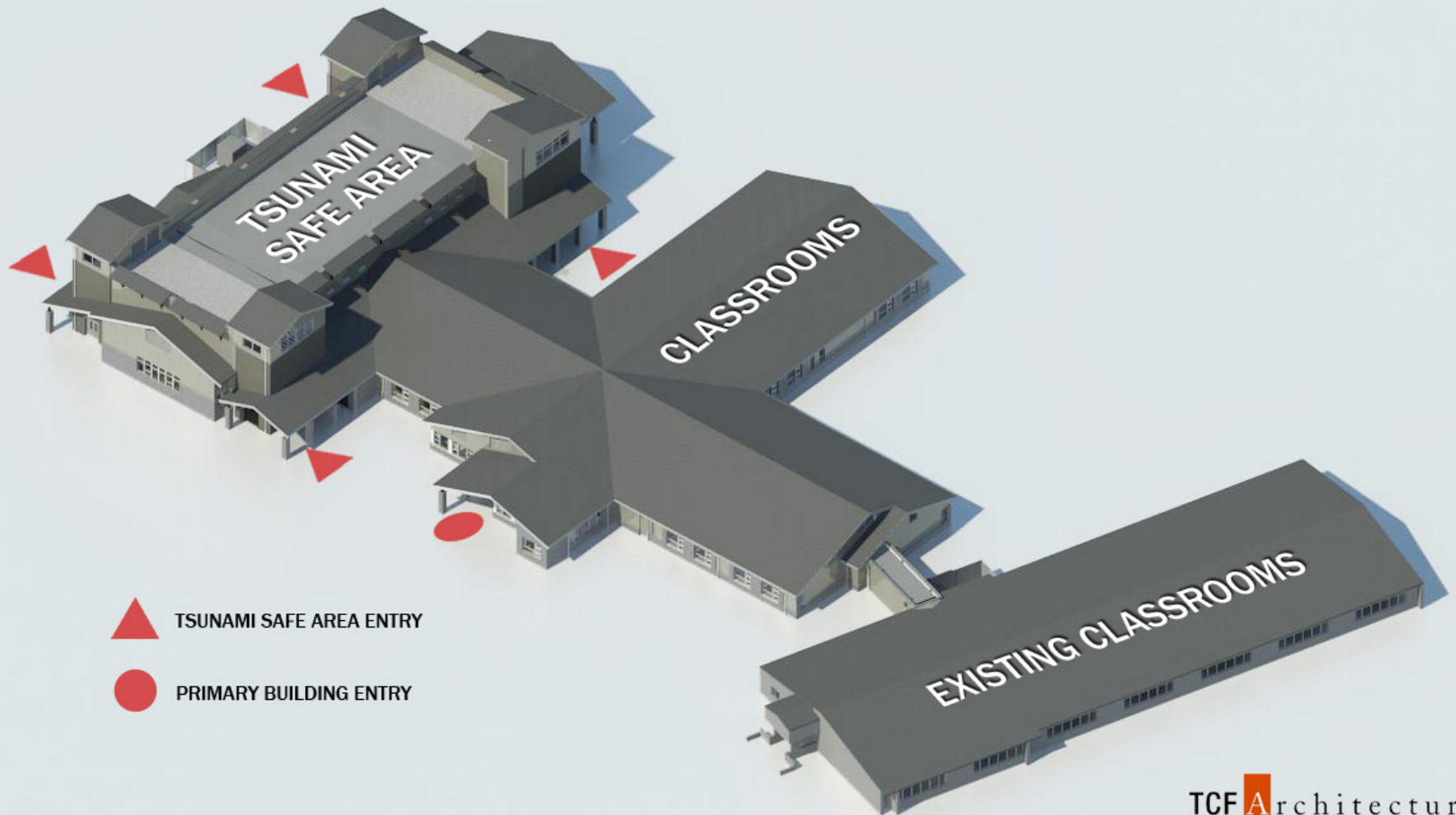
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MIKE COVERDALE / SPECIAL TO THE SEATTLE TIMES

School Layout

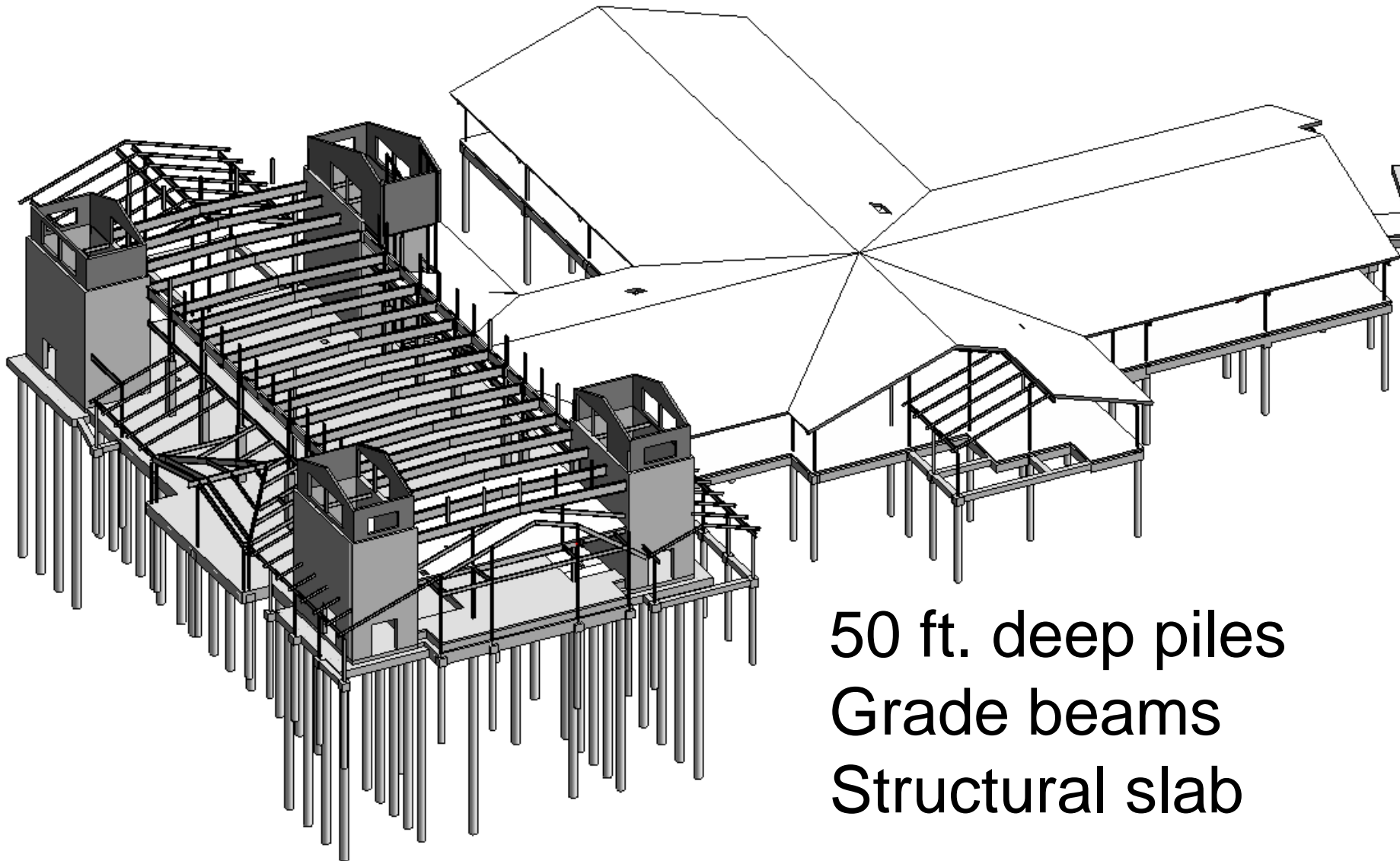


Foundation Design

- Overturning
 - Buoyancy
 - Hydrodynamic
- Scour
 - Depth = 12 ft
- Liquefaction



Foundation Design



Structural Design

- Hydrostatic
- Hydrodynamic
- Impact
 - Logs
 - Vehicles
- Progressive collapse



Finished Design



image courtesy TCF Architecture

Finished Design



image courtesy TCF Architecture

Finished Design

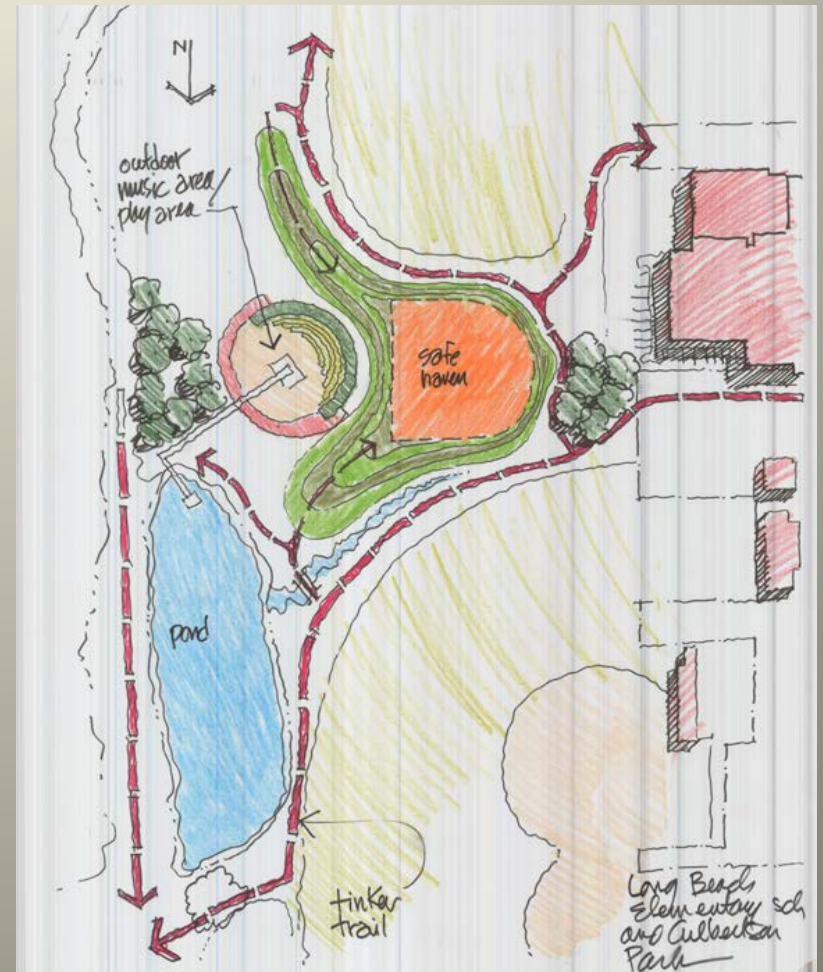


image courtesy TCF Architecture

Long Beach Safe Haven Berm

- Funded through FEMA Hazard Mitigation Grant Program
- Received Phased Award
- Currently in 30% Design Phase and Detailed Environmental Review

Table 1: Long Beach Berm	
Scope	Cost
Site Utilities	\$49,814
Excavation-Backfill	\$289,512
Concrete	\$153,951
Landscaping	\$74,094
Construction Totals	\$567,370
Design Fees (8%)	\$45,390
General Conditions (10%)	\$56,737
Contractor Fees, O&P (15%)	\$85,106
Construction Contingency (5%)	\$28,369
Estimate/Design Contingency (10%)	\$56,737
Project Total	\$839,708



If you build it, they will come.

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Quinault tribe set to expand Quinault Beach Resort & Casino

Peninsula Daily News



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OCEAN SHORES — The Quinault tribe expects to begin a \$25 million expansion of the Quinault Beach Resort & Casino in March.

The expansion follows the completion of a 159-room remodel at the resort and will expand the property's fast food services, add two additional bars and include a combined gift and coffee shop, according to Fawn Sharp, tribal president.

More space

The casino will have up to 70 percent more space to house new slot machines.

A new 500-car, four-story parking garage also can serve the area as a tsunami shelter, Sharp said.

The expansion project will employ more than 100 laborers during the construction as well as add to the resort's current workforce upon completion.

Sharp said that the resort and casino "has been a major component of Quinault Nation's employment and economic structure for the past 16 years.

"It is largely due to its success that we have been able to diversify."

The tribe is the largest employer in Grays Harbor County, providing more than 1,200 jobs.

"I am excited that the Quinault Nation will continue to expand its properties," said Don Kajans, general manager of Quinault Beach Resort & Casino.

"This expansion project not only allows us to employ more locals, it will also help us to bring more people to the area."

Last modified: January 11, 2016 7:49PM



Questions?