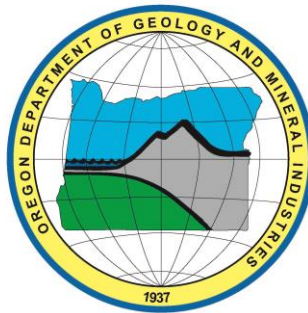


New Tsunami Hazard Information for Tillamook County

George Priest
Oregon Dept. of Geology and Mineral Industries

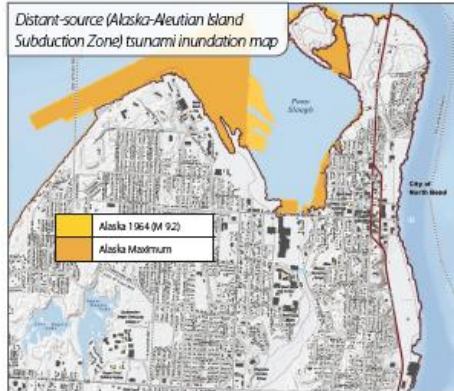
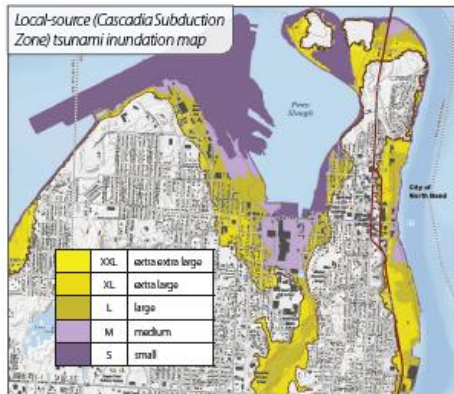
Tillamook 911 Center
January 13, 2015



Check www.oregontsunami.org for new educational and hazard information

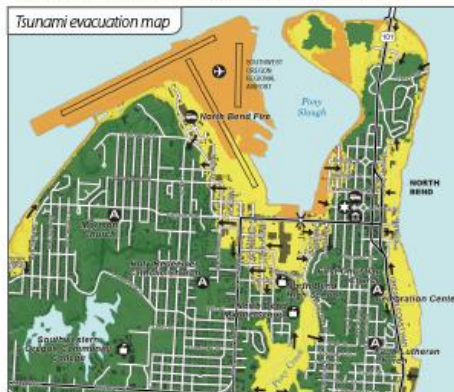
- 7 preparedness steps (animation and bulleted list)
- Tsunami evacuation maps
- Evacuation map viewer
- New maritime guidance brochure (boaters page)
- New Cascadia earthquake comic book (OEM)
http://www.oregon.gov/OMD/OEM/plans_train/Earthquake/Without_Warning%20resized.pdf
- New lodging facility video (OEM)
<https://www.youtube.com/watch?v=adSVWaDmbHE&feature=youtu.be>
- Links to many more resources.

INUNDATION AND EVACUATION MAP PRODUCTS



maximum local source (yellow) maximum distant source (orange)

Combine the maximum tsunami scenario from each map ...



Inundation Maps (TIMs) – 7 inundations whole coast

- 5 Local CSZ “Tsunami T-Shirt Scenarios” (S, M, L, XL, XXL)
 - MHHW Tide
 - Coseismic subsidence taken into account
 - Maps include wave time series, inundated building exposure, and wave elevation profiles
- 2 Distant Alaska Scenarios
 - Alaska 1964
 - Alaska Max

Evacuation Brochures – 2 inundations in towns

- XXL
- Alaska Max
- Routes, preparedness information

Evacuation Mapper 2 inundations whole coast

- XXL + Alaska Max on Google type base maps
- www.oregontsunami.org



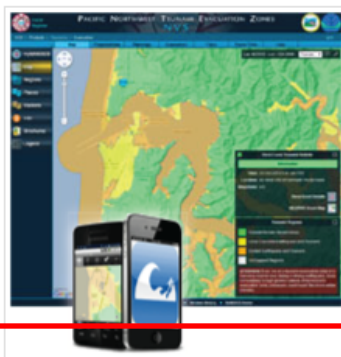
Oregon Tsunami Clearinghouse



[Home](#) | [Coastal Residents](#) | [Visitors](#) | [Kids & Teachers](#) | [Community Planners](#) | [Scientists](#)

[Frontpage](#) [Evacuation Zone Map Viewer](#) [Evacuation Brochures](#) [Regulatory Maps](#) [Resource Library](#)

Is your family prepared for disaster?



[Tsunami Evacuation Zone Map Viewer](#)

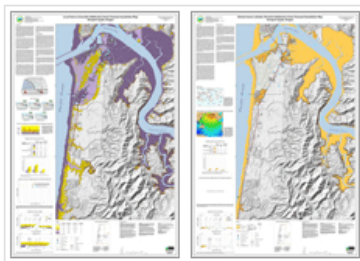
Search by address or coastal area.

[web map](#) | [iPhone app](#) | [Android app](#)



[Tsunami Evacuation Brochures](#)

For coastal communities. [Fact Sheet](#)



[Tsunami Inundation Maps \(TIM Series\)](#)

Maps incorporating all the best tsunami science available today. [Fact Sheet](#)



[Tsunami Regulatory Maps](#)

Official maps for implementation of ORS 455-446 and 455-447.

TsunamiReady, TsunamiPrepared News

» February 2014 - **Tsunami Warnings now part of NOAA's Wireless Emergency Alerts (WEA) from your mobile carrier**

- NOAA Fact Sheet: Tsunami Warnings via Wireless Emergency Alerts (WEA)
- About Wireless Emergency Alerts



Coastal Residents

What to watch for and how to prepare. [More »](#)

Visitors

What to do before and after you get to the coast. [More »](#)

Kids & Teachers

Learn through activities and games. [More »](#)

×

Tsunami news around the web

[Eastern Australia a tsunami](#)

ABC Science Online

Goff and colleague Catharine Chagué-Goff scoured the scientific literature, historical newspaper reports, historical records and other tsunami databases, to arrive at their estimate of the number of tsunamis that have reached Australia since ...

[Scientists to place Swiss lake](#)

spyghana.com

"So, actually, we can predict to a certain degree what sort of earthquake is required to trigger which kinds of slopes, and because our numerical codes then allow us to calculate the resulting tsunami wave, we are somehow able to say which areas will ...







[Mind the Gap: New evidence](#)

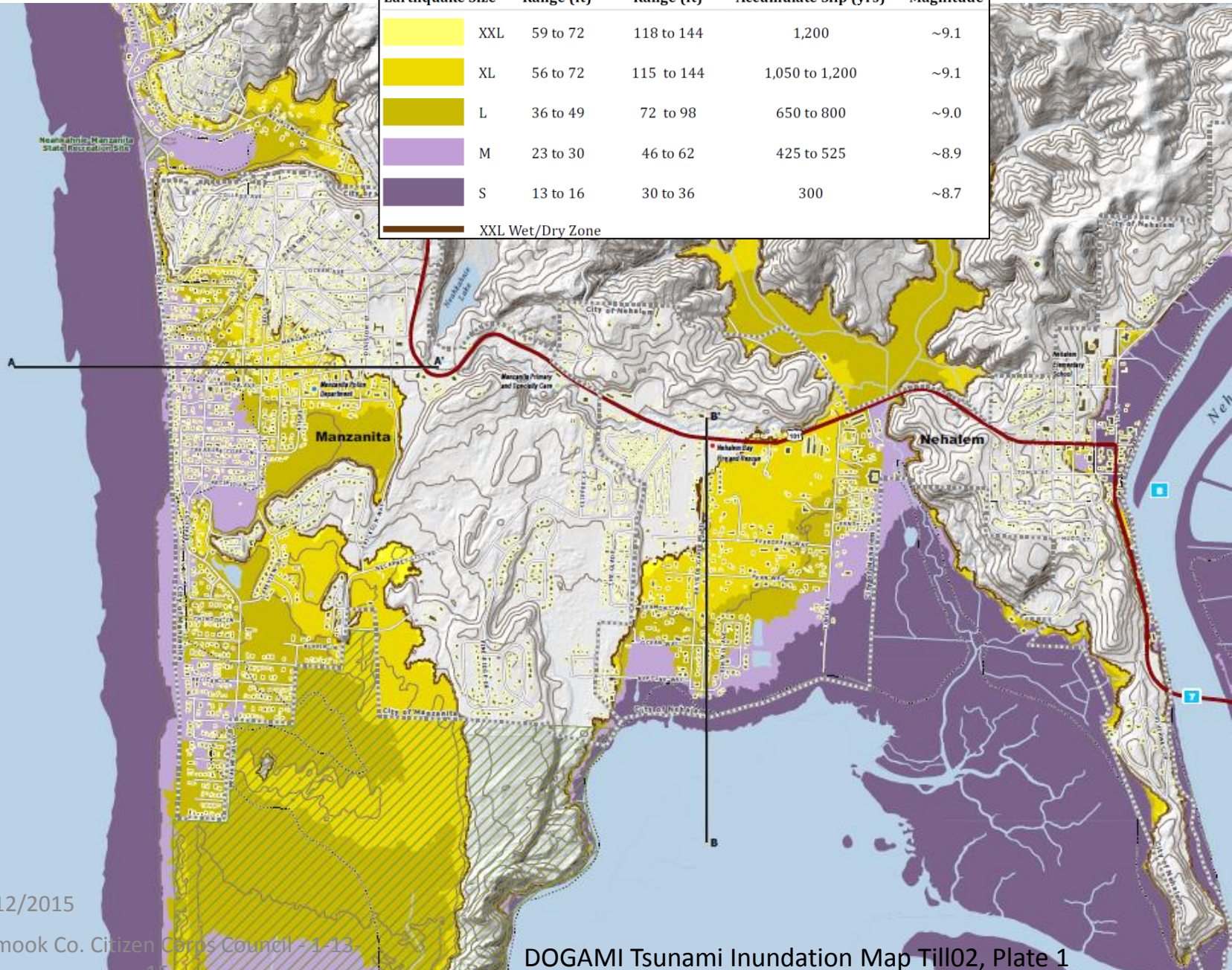
Fox News

"There seems to be more



Tsunami Inundation Map (TIM) - Local Cascadia Tsunamis

Earthquake Size		Average Slip Range (ft)	Maximum Slip Range (ft)	Time to Accumulate Slip (yrs)	Earthquake Magnitude
	XXL	59 to 72	118 to 144	1,200	~9.1
	XL	56 to 72	115 to 144	1,050 to 1,200	~9.1
	L	36 to 49	72 to 98	650 to 800	~9.0
	M	23 to 30	46 to 62	425 to 525	~8.9
	S	13 to 16	30 to 36	300	~8.7
	XXL Wet/Dry Zone				



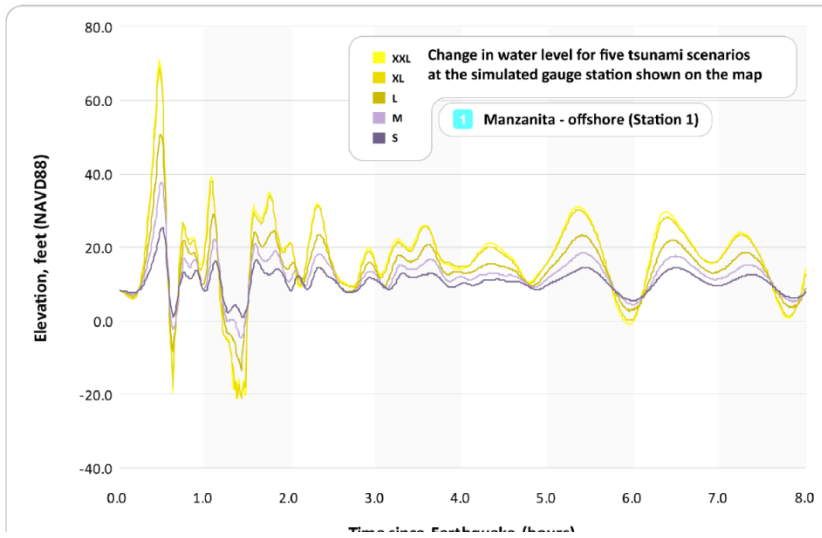
1/12/2015

Tillamook Co. Citizen Corps Council - 1-13-

DOGAMI Tsunami Inundation Map Till02, Plate 1



Tsunami Inundation Map (TIM) - Local Cascadia Tsunamis



Open Coast

1st rise = 14 min. after earthquake

Peak = 25-71 feet at 29-30 min

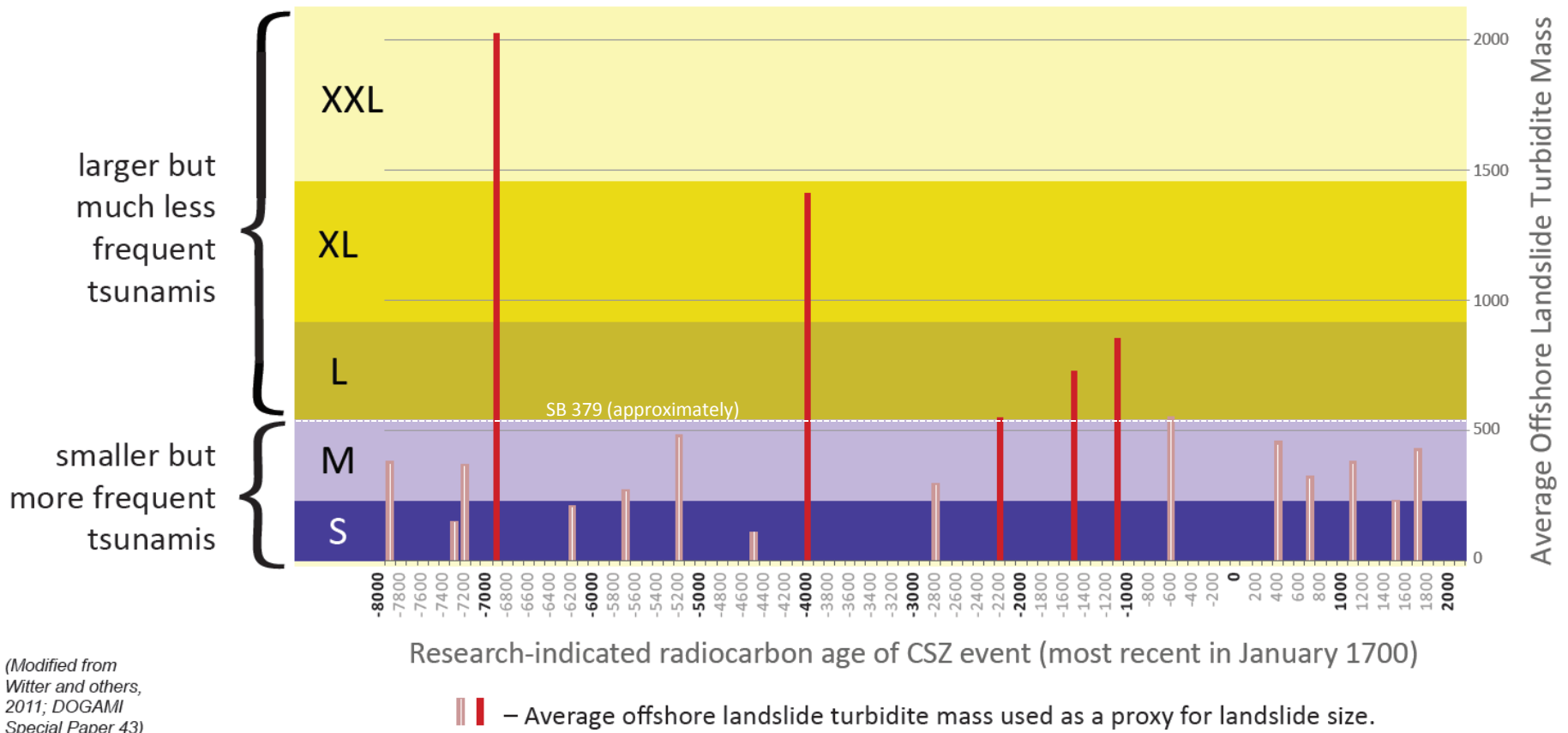
Nehalem

1st rise = 37-43 min

Peak = 13-22 feet at 47-49 min

Qualitative Explanation of Cascadia Tsunami Scenarios shown on published tsunami inundation maps (TIMs)

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes



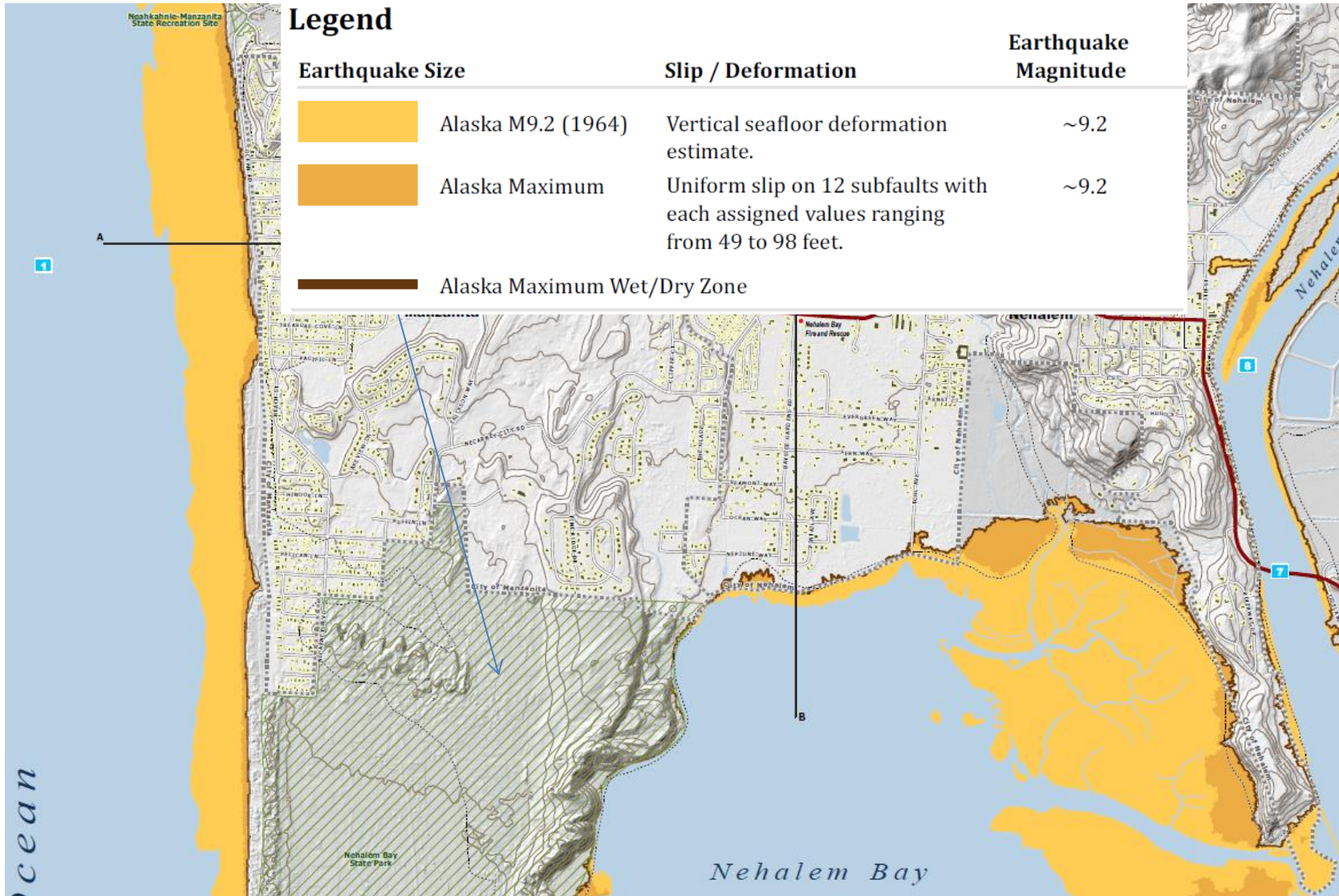
(Modified from
Witter and others,
2011; DOGAMI
Special Paper 43)



1/12/2015

Tillamook Co. Citizen Corps Council - 1-13-15

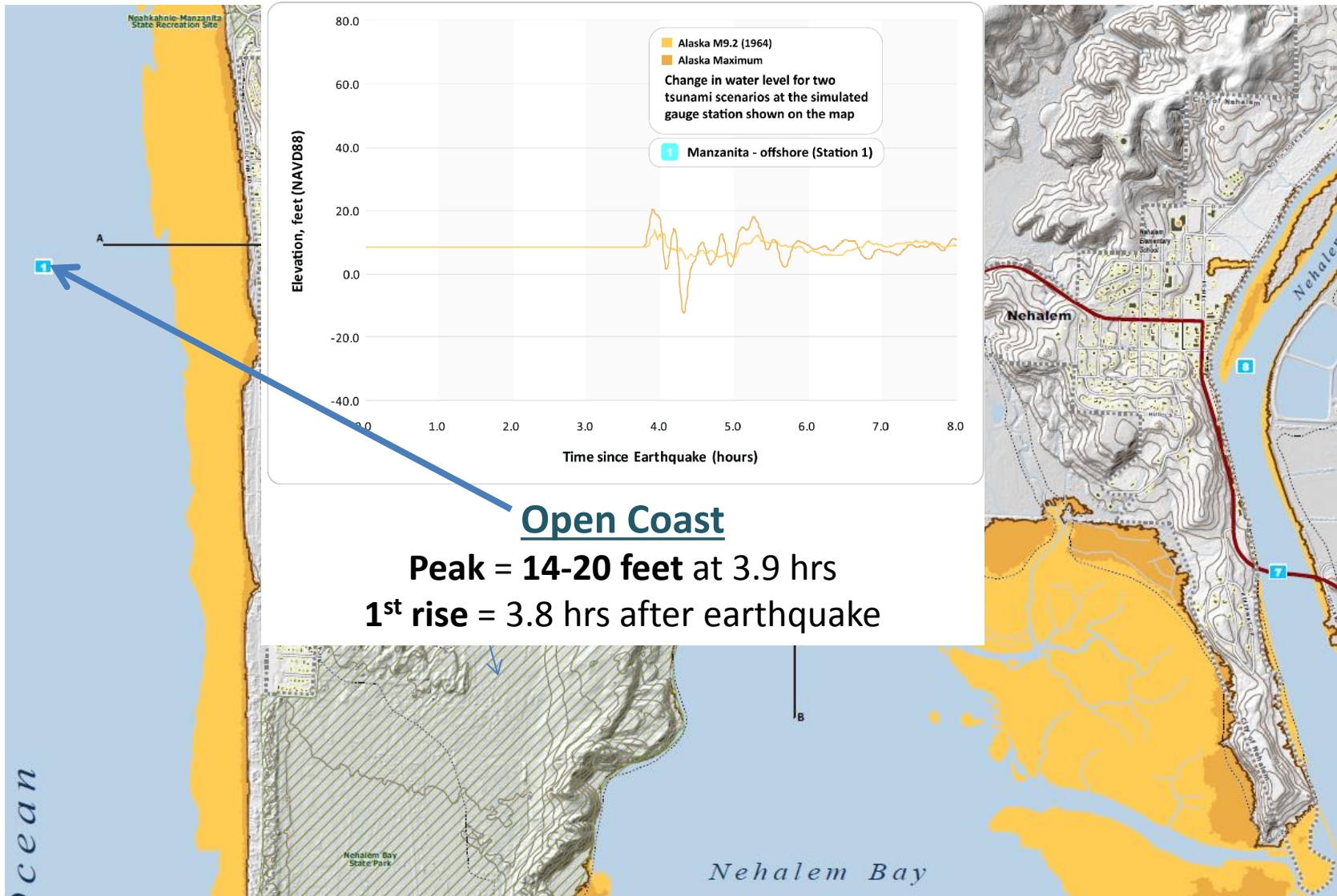
Tsunami Inundation Map (TIM) - Distant Tsunamis



DOGAMI Tsunami Inundation Map Till02, Plate 2



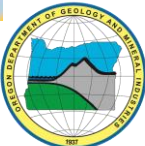
Tsunami Inundation Map (TIM) - Distant Tsunamis



DOGAMI Tsunami Inundation Map Till02, Plate 2

1/12/2015

Tillamook Co. Citizen Corps Council - 1-13-15



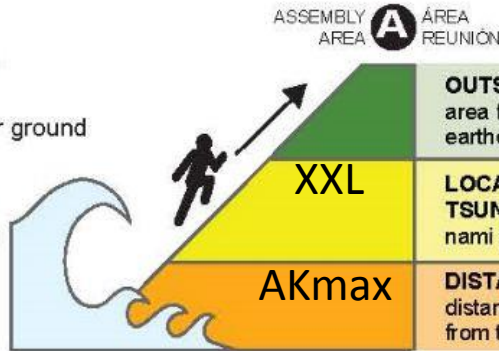
Tsunami Evacuation Map Brochure Explanation

IF YOU FEEL AN EARTHQUAKE:

- Drop, cover, and hold
- Move immediately inland to higher ground
- Do not wait for an official warning

SI USTED SIENTE EL TEMBLOR:

- Tírese al suelo, cúbrase, y espere
- Diríjase de inmediato a un lugar más alto que el nivel del mar
- No espere por un aviso oficial



OUTSIDE HAZARD AREA: Evacuate to this area for all tsunami warnings or if you feel an earthquake.

ZONA DE PELIGRO EXTERIOR: Evacue a esta área para todas las advertencias del maremoto o si usted siente un temblor.

LOCAL CASCADIA EARTHQUAKE AND TSUNAMI: Evacuation zone for a local tsunami from an earthquake at the Oregon coast.

MAREMOTO LOCAL (terremoto de Cascadia): Zona de evacuación para un tsunami local de un temblor cerca de la costa de Oregon.

DISTANT TSUNAMI: Evacuation zone for a distant tsunami from an earthquake far away from the Oregon coast.

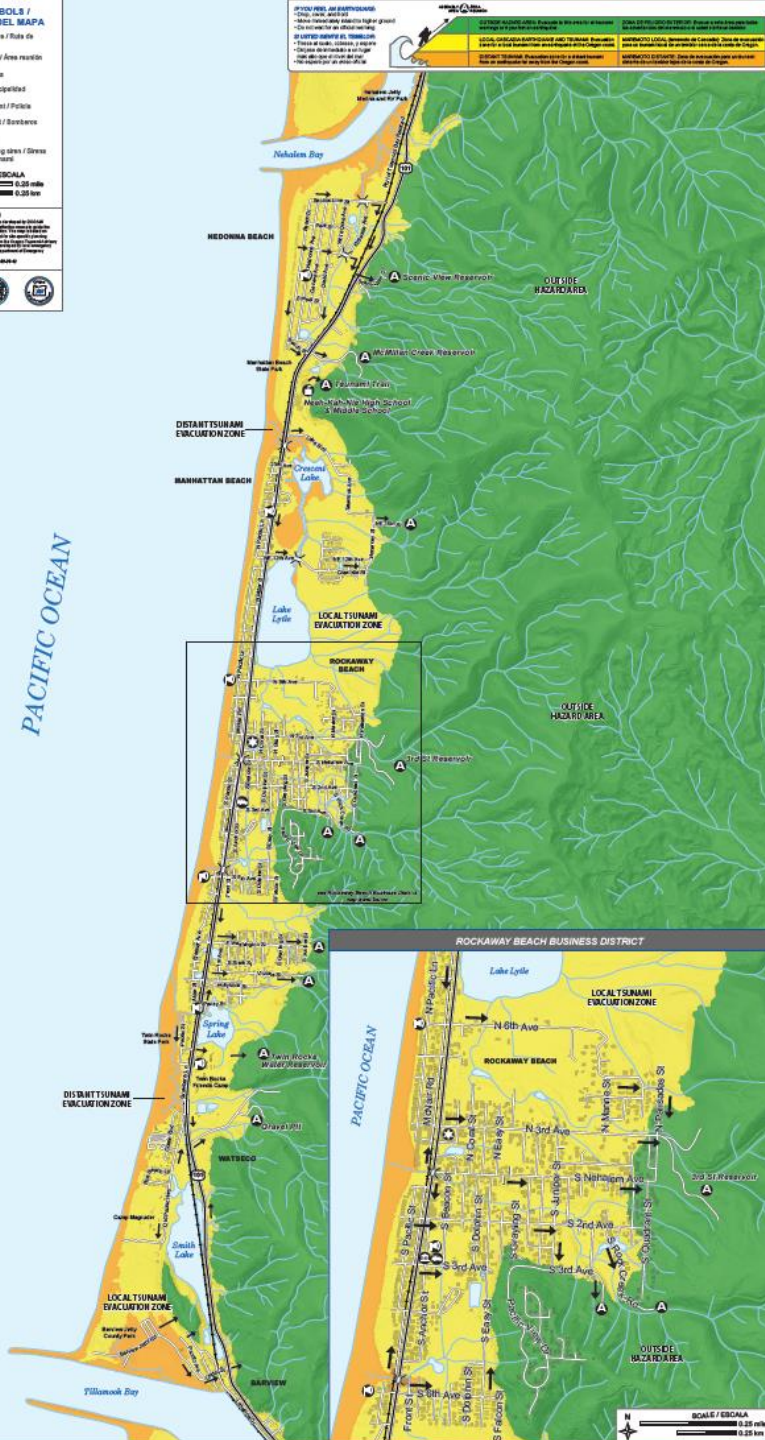
MAREMOTO DISTANTE: Zona de evacuación para un tsunami distante de un temblor lejos de la costa de Oregon.

- **GREEN** = outside of both local + distant tsunami inundation
- **YELLOW** = outside of only distant tsunami inundation



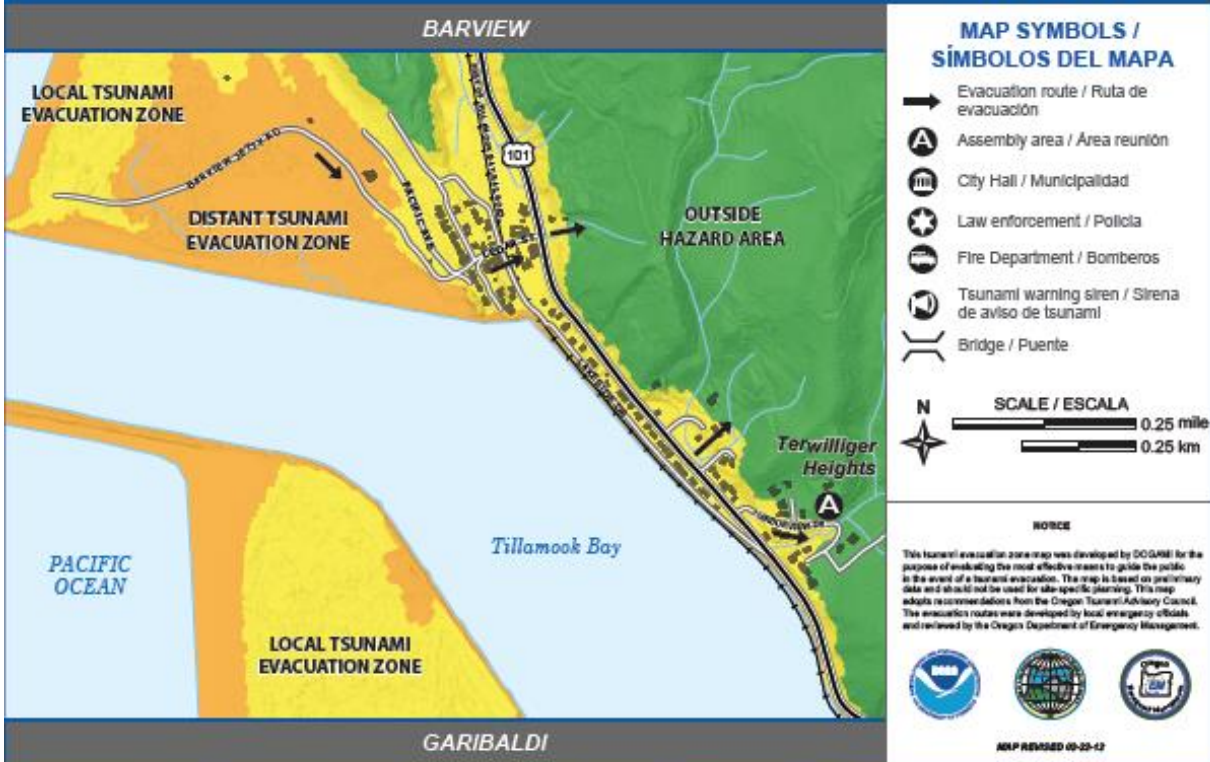
Manzanita-Nehalem Tsunami Evacuation Map





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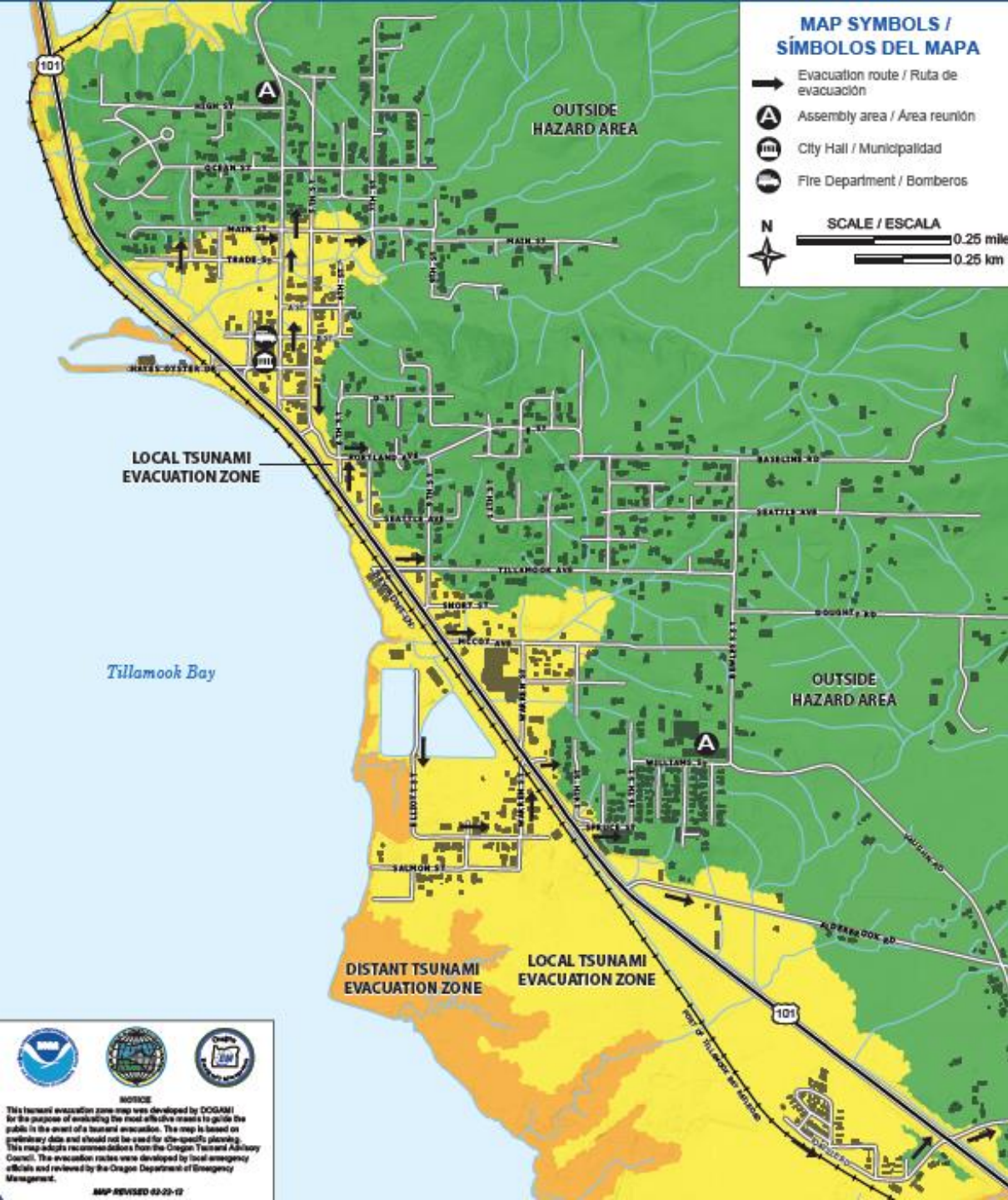
Barview-Garibaldi Tsunami Evacuation Map

Tillamook Co. Citizen Corps Council - 1-13-15

1/12/201
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Bay City Tsunami Evacuation Map



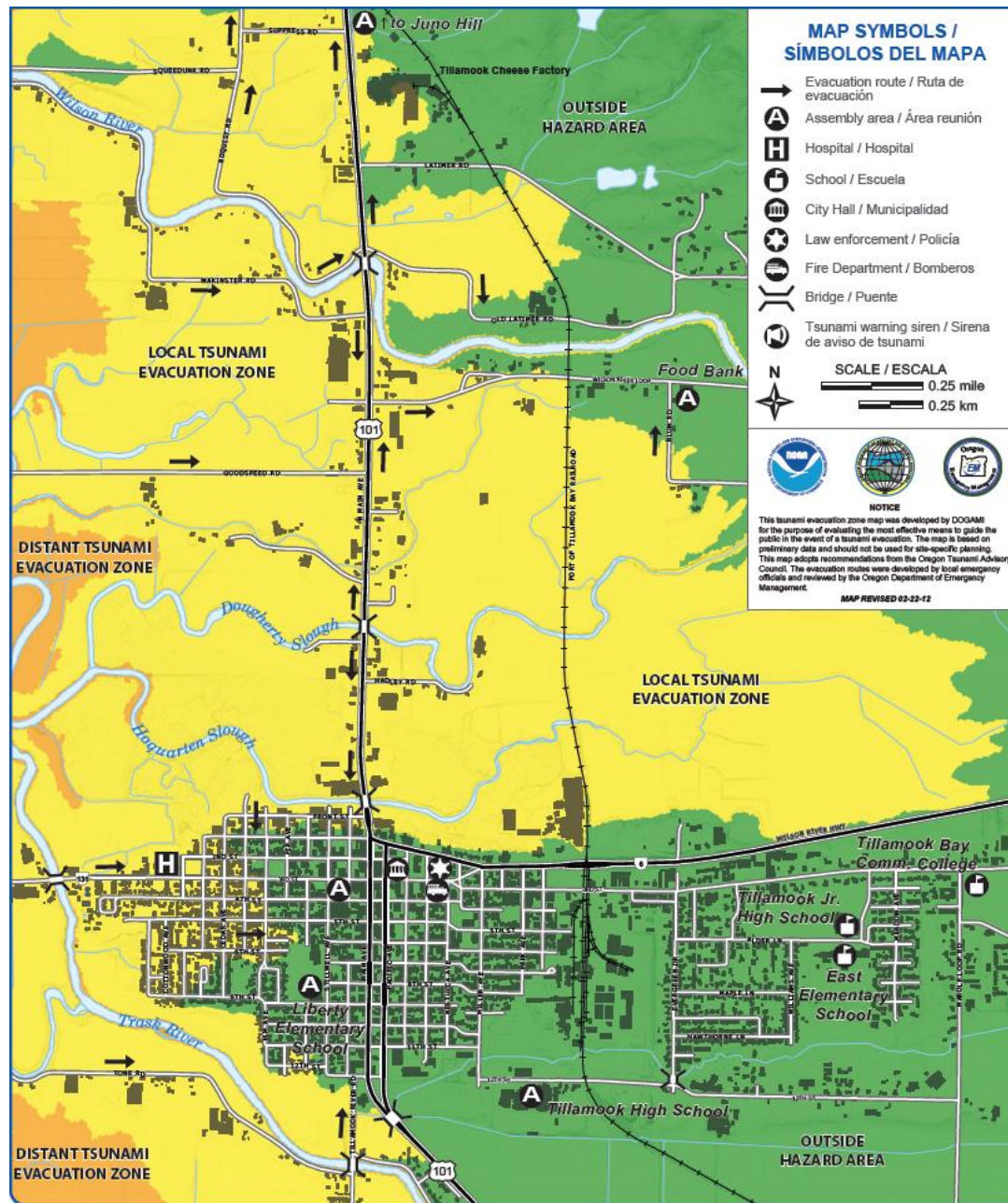
Tillamook Co. Citizen Corps Council - 1-13-15

1/12/201




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Tillamook Tsunami Evacuation Map



MAP SYMBOLS / SÍMBOLOS DEL MAPA

-  Evacuation route / Ruta de evacuación
-  Assembly area / Área reunión
-  Bridge / Puente
-  Tsunami warning siren / Sirena de aviso de tsunami

 N

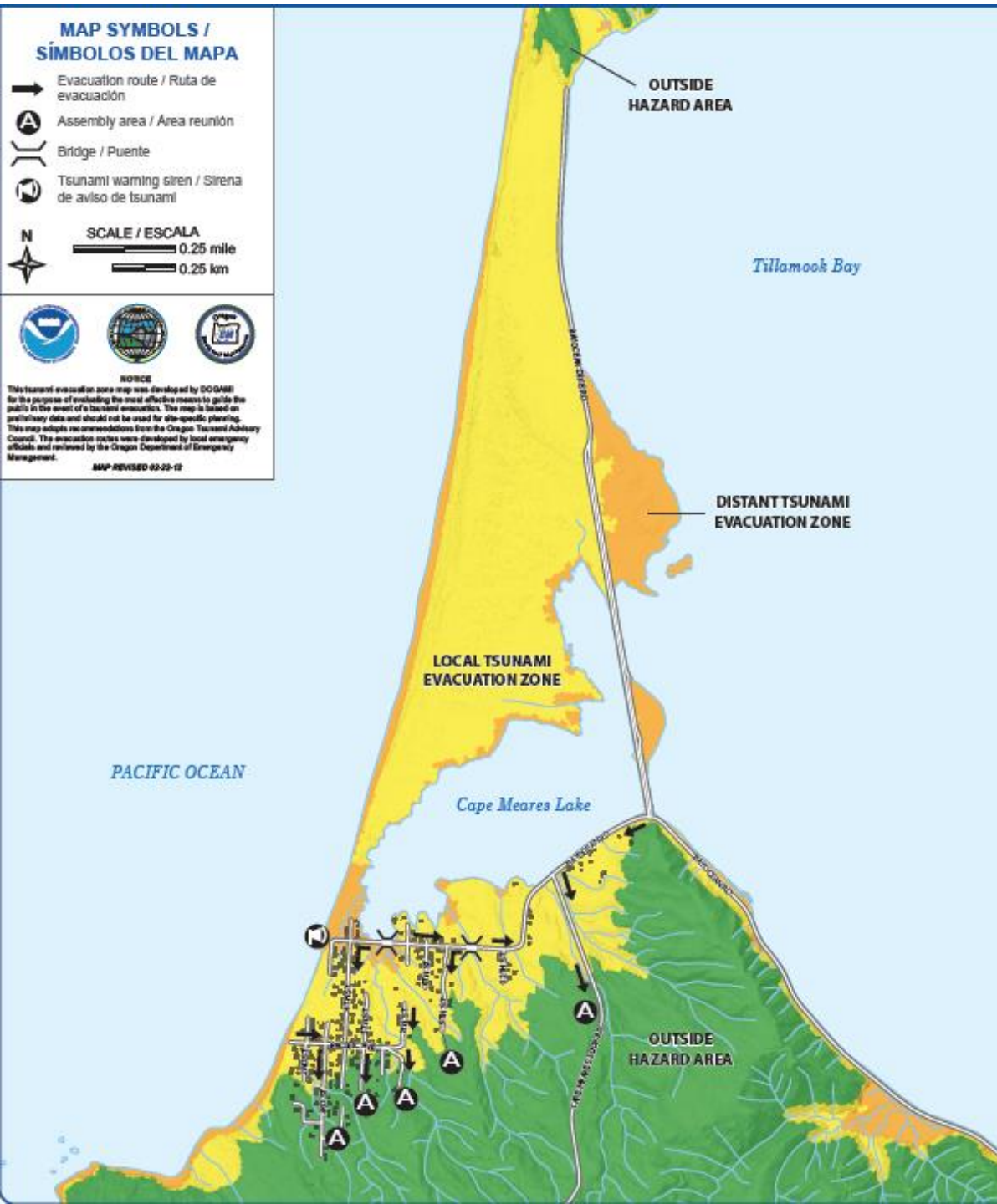
SCALE / ESCALA
 0.25 mile
 0.25 km



NOTICE

This tsunami evacuation zone map was developed by ODEM for the purpose of evaluating the most effective means to guide the public in the event of a tsunami evacuation. The map is based on preliminary data and should not be used for site-specific planning. This map adopts recommendations from the Oregon Tsunami Advisory Council. The evacuation routes were developed by local emergency officials and reviewed by the Oregon Department of Emergency Management.

MAP REVISED 03-25-12



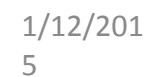
Cape Meares Tsunami Evacuation Map

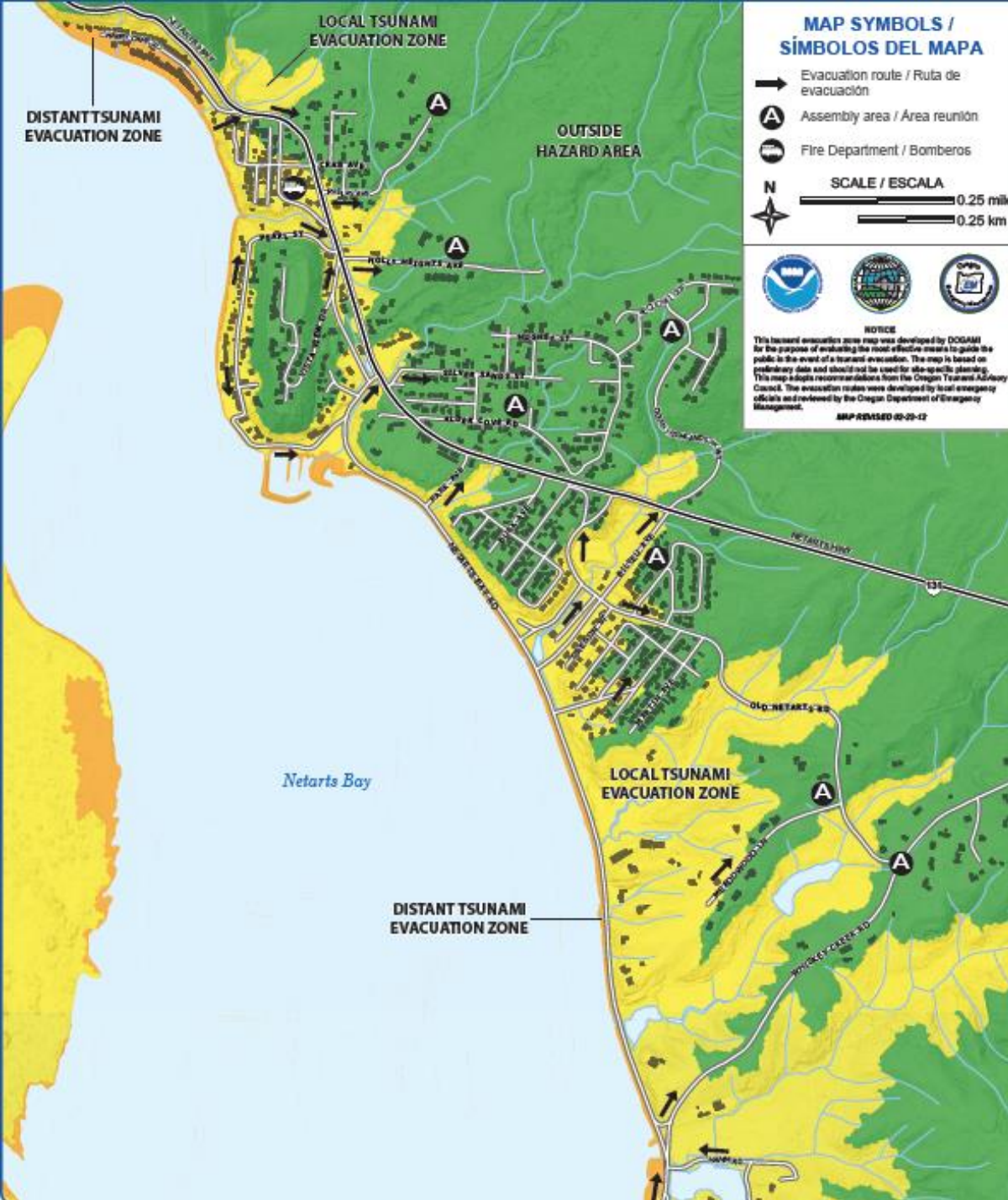
Tillamook Co. Citizen Corps Council - 1-13-15

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Tillamook Co. Citizen Corps Council - 1-13-15





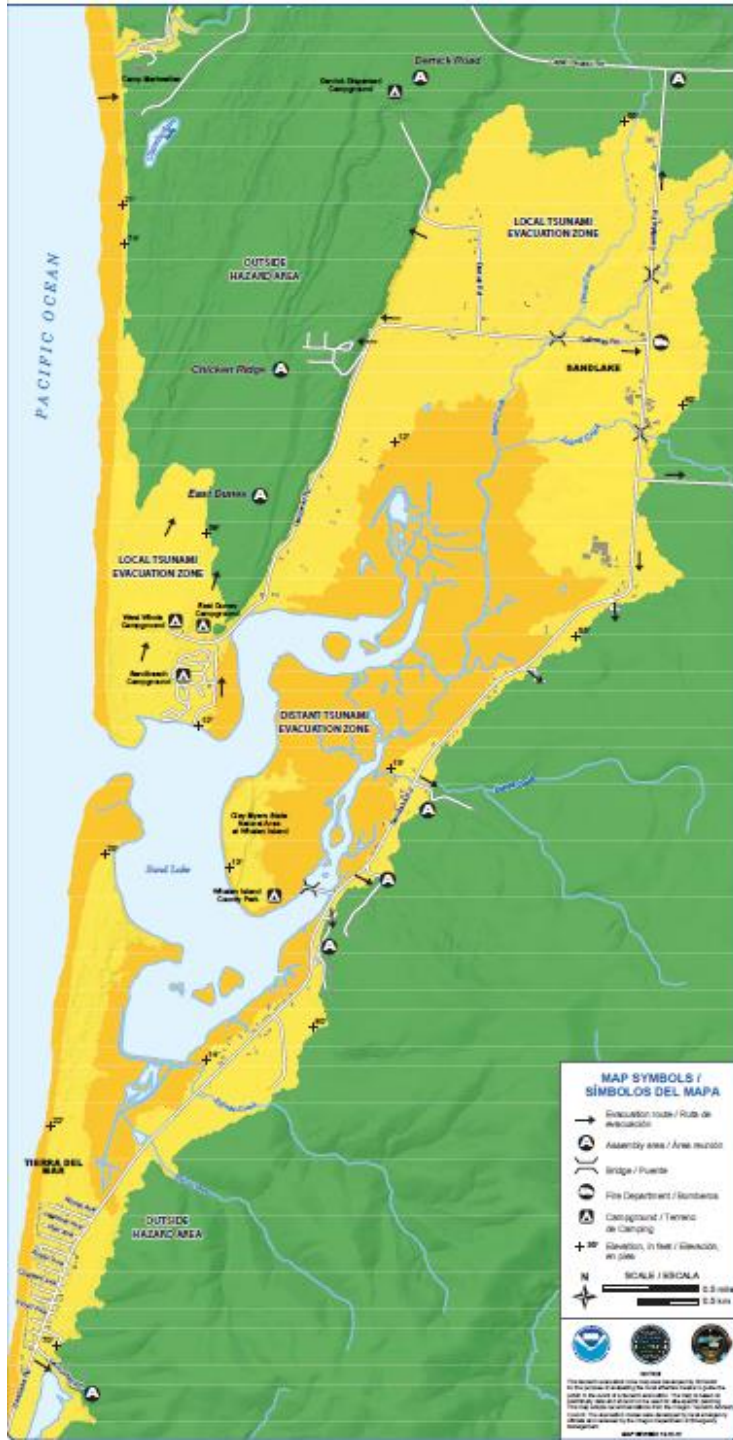
Netarts Tsunami Evacuation Map

Tillamook Co. Citizen Corps Council - 1-13-15

1/12/201
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Sand Lake and Tierra del Mar Tsunami Evacuation Map



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1/12/201
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Pacific City Tsunami Evacuation Map



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1/12/201

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Neskowin Tsunami Evacuation Map

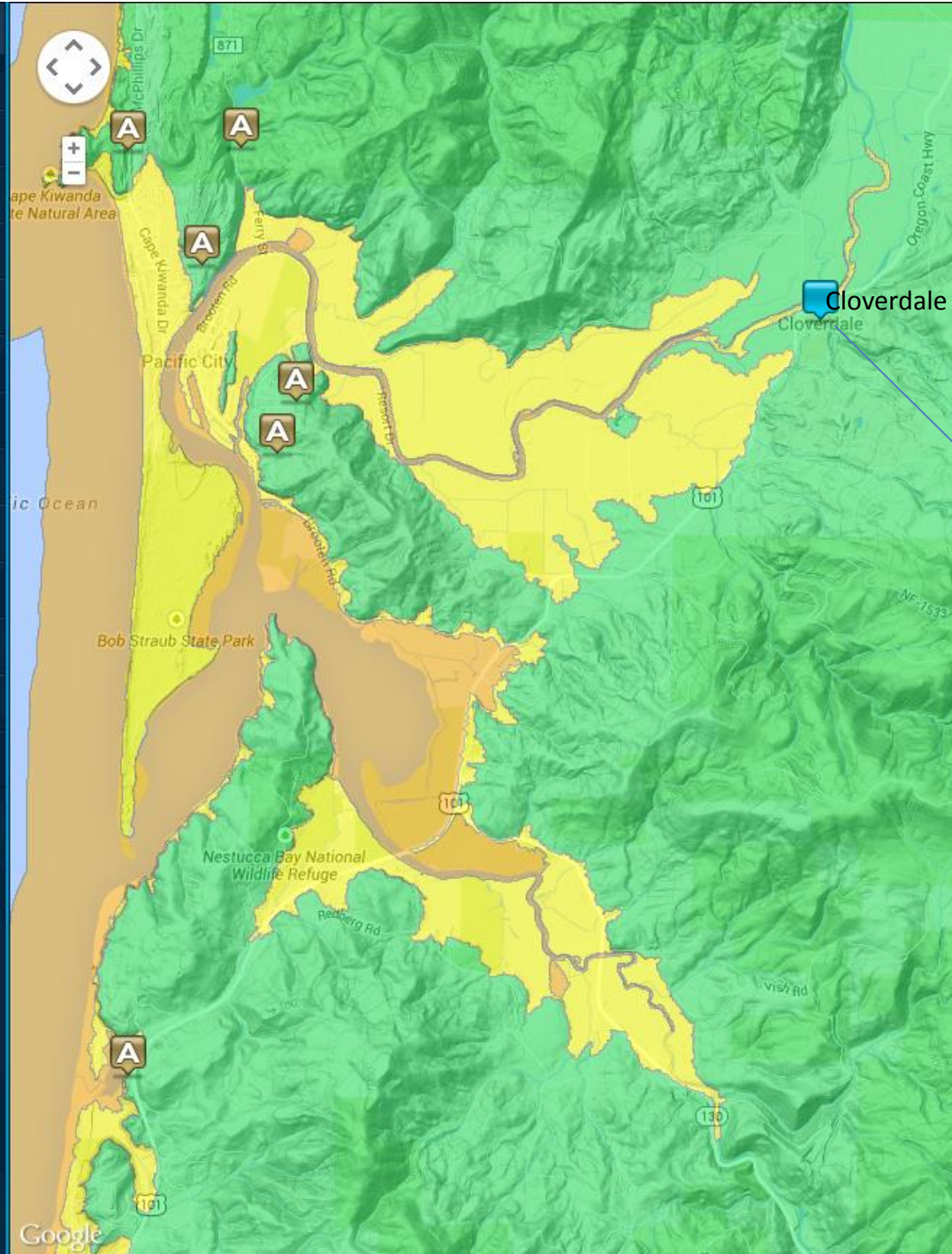


Tillamook Co. Citizen Corps Council - 1-13-15

1/12/201

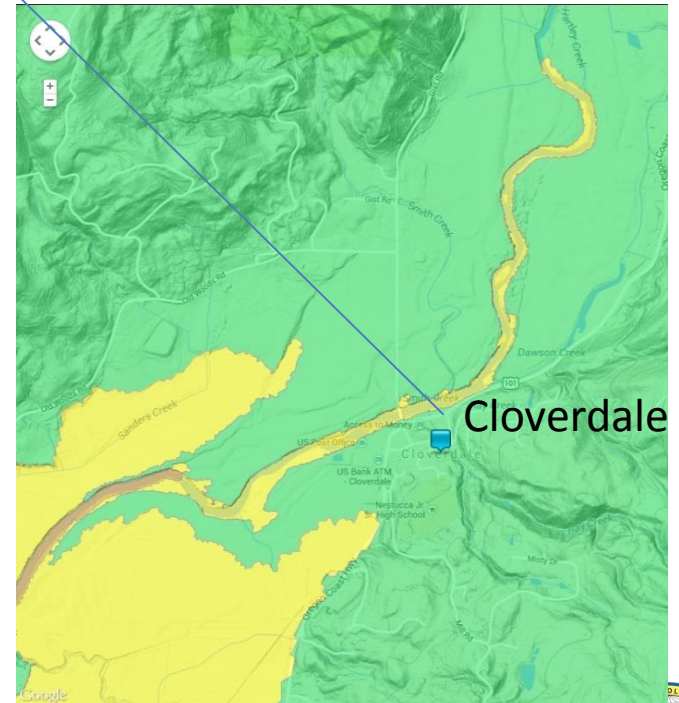
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Cloverdale-upper Nestucca
River is outside published
evacuation maps so must
use map viewer

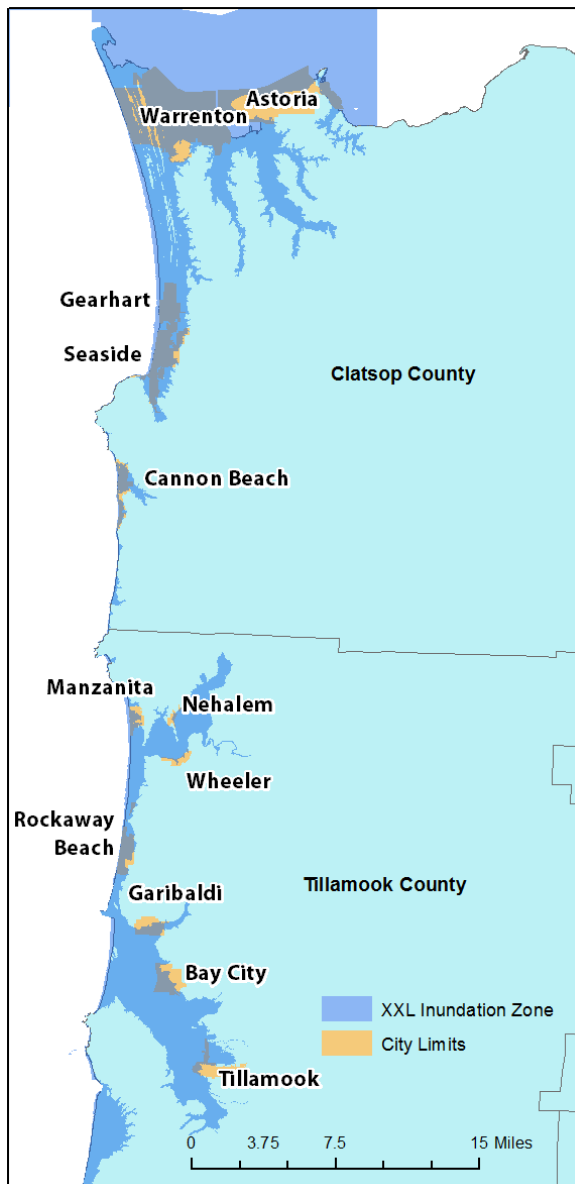
WWW.oregontsunami.org



1/12/201

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Northern Oregon coastal communities face great tsunami risk

- Tsunami arrival time is in the tens of minutes
- Shaking can last 5 minutes
- Timely evacuation is important for survival
- Evacuation by automobile will be virtually impossible in many cases
- **Pedestrian evacuation analysis** is necessary to provide information to city officials and emergency managers



DOGAMI is Developing a New Approach to Pedestrian Tsunami Evacuation Modeling

Old approach: Pick a walking speed and calculate time to safety

ORIGINAL PAPER

Anisotropic path modeling to assess pedestrian-evacuation potential from Cascadia-related tsunamis in the US Pacific Northwest

Nathan J. Wood • Mathew C. Schmittlein

New approach: Determine minimum walking speed to safety

Project Areas:

1. Cannon Beach (early 2015)
2. Seaside-Gearhart (early 2015)
3. Warrenton (summer 2015)
4. Rockaway Beach (2016)



OEM WAYFINDING GRANTS (from NTHMP)

1. “You are Here” Tsunami evacuation map signs
2. Interpretive trail signage
3. Creative and innovative wayfinding (markers on roads/walkways, etc)

DEADLINES:

January 9, 2015 – Announcement of project support money.

- February 13, 2015 – Project Proposals due to OEM
(Email to Althea Rizzo althea.rizzo@state.or.us)
- February 27, 2015 – Contact Approved projects personnel
- March 31, 2015 – Deadline for any signed agreements between OEM and Community/Organization
- May 1, 2015 – Progress Report due to OEM (No more than 1 page)
- July 1, 2015 – Progress Report due to OEM (No more than 1 page)
- Drop Dead Date: July 31, 2015 – all projects must be completed.
- August 31, 2015 – all invoices MUST be submitted to OEM for reimbursement



SUMMARY OF NEW MARITIME GUIDANCE

Distant Tsunamis

- **Warning:**
NOAA broadcasts
- **≥ 4 hours to take action**
- **Offshore:** go to **>30 fathoms;**
Guidance during event: USCG
- **Tied to dock:**
 - Check with local officials
 - Explore options in advance
(e.g. go upriver? Out to sea?)
- **On Land:**
 - Go to evacuation site
 - Wait until local officials say it is safe to return.

Local Tsunamis

- **Warning:**
 - Ground shaking
 - Ocean roar
 - Water receding or surging
- **10 minutes to take action**
- **Offshore:** go to **>100 fathoms;**
Guidance during event: USCG
- **Tied to dock or on land:**
 - Go to evacuation site
 - Wait until local officials say it is safe to return.
- Plan to be out to sea for days with nearby ports out of commission (fuel, food, etc.).



WHAT TO KNOW ABOUT TSUNAMIS

Tsunami Dangers

A tsunami is a series of waves, usually caused by an earthquake beneath the sea floor. As tsunamis enter shallow water near land, they increase in height and can cause great loss of life and property damage.

For boaters, tsunami dangers also include:

- Sudden water-level fluctuations
- Grounding of vessels as water level suddenly drops
- Capsizing from incoming surges (bores), complex coastal waves, and surges hitting grounded boats
- Strong and unpredictable currents that can change direction quickly
- Eddies/whirlpools
- Drag on large-keeled boats
- Collision with other boats, docks, and debris

Tsunami Types and Warnings

LOCAL TSUNAMIS are caused by great earthquakes near the Oregon coast and will strike in 10 to 30 minutes. The earthquake is the warning for a local tsunami. Be alert for natural warning signs:

- Onshore
 - Strong ground shaking for minutes
 - Loud ocean roar
 - Water receding unusually far, exposing the sea floor
 - Water surging onshore faster than any tide
- Offshore
 - You may feel the earthquake through the hull of your boat
 - You could see a rapid and extreme shift in currents and simultaneous changes in wind wave heights

Smaller **DISTANT TSUNAMIS** are caused by great earthquakes far away from the Oregon coast and will strike four hours or more after the earthquake. Be alert for warning statements and natural warning signs:

- Sign up to receive notifications from the National Tsunami Warning Center, which issues two types of warnings for Oregon boaters:
 - **Advisories:** Peak tsunami wave heights of 1 to 3 feet are expected, indicating strong and dangerous currents can be produced in harbors
 - **Warnings:** Tsunami wave heights could exceed 3 feet, indicating very strong, dangerous currents and inundation of dry land is anticipated
- Contact your harbormaster or emergency services office to find out what notifications you can sign up for locally
- Listen for warnings from sirens or announcements from airplanes and from the media
- Heed natural warnings such as a loud ocean roar or rapid changes in sea level or currents

Tsunamis Can Trick You

- The first surge may not be the last or the largest
- It is not unusual for tsunami surges to continue for 12 hours
- Dangerous currents can persist in harbors for 60 hours or more
- The National Tsunami Warning Center forecasts how long dangerous conditions persist

WHAT TO DO TO PREPARE

Are you prepared for a great earthquake and tsunami to strike, rendering ports, fuel supplies, and other infrastructure inaccessible?

For more information on how to better prepare, check with:

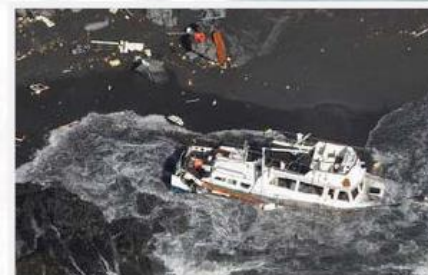
- Harbor masters and port captains
- US Coast Guard contacts
- State and local emergency managers
- National Tsunami Warning Center:
www.wcatwc.arh.noaa.gov
- Oregon Department of Geology and Mineral Industries – download evacuation maps:
www.oregontsunami.org
- National Weather Service – sign up for alerts:
www.weather.gov/emailupdates/
- Weather Forecast Offices
 - Medford www.wrh.noaa.gov/mfr/
 - Portland www.wrh.noaa.gov/pqr/
- Oregon Emergency Management:
www.oregon.gov/OMD/OEM/
- NOAA: www.tsunami.gov
- Federal Emergency Management Agency:
www.ready.gov/tsunamis
- Centers for Disease Control:
www.bt.cdc.gov/disasters/tsunamis
- Red Cross: www.redcross.org



Support provided by the National Tsunami Hazard Mitigation Program, NOAA Award Number NA11OHS4670013

TSUNAMI!

WHAT OREGON BOAT OWNERS NEED TO KNOW



Port of Brookings, Ore., following wave surges from the March 11, 2011 tsunami off the coast of Japan. Photo: Jamie Francis/The Oregonian



Marina damage near Chetco River, Ore., following wave surges from the March 11, 2011 tsunami off the coast of Japan. Photo: U.S. Coast Guard



If you are on the water and a tsunami is coming, how far offshore should you take your boat?

Minimum safe distance offshore for local tsunamis: 100 fathoms

Minimum safe distance offshore for distant tsunamis: 30 fathoms

Nautical Miles 40 20 0
Miles 40 20 0

Astoria
Seaside
Cannon Beach
Manzanita
Rockaway Beach
Tillamook
Pacific City
Lincoln City
Depoe Bay
Newport
Waldport
Yachats
Florence
Reedsport
Coos Bay
Bandon
Port Orford
Gold Beach
Brookings



WHAT TO DO WHEN A TSUNAMI STRIKES

What to do depends on what type of tsunami occurred and where you are

Distant Tsunamis

You generally have at least 4 hours after the distant earthquake to take action.

If you are on the water

- Check with the US Coast Guard (USCG) before taking any action. If advised that offshore evacuation is an option and this option looks practical for your vessel, proceed to a staging area **greater than 30 fathoms (180 ft)**. If conditions do not permit, dock your boat and get out of the tsunami evacuation zone.

If you are on land or tied up at the dock

- Your choices are to a) evacuate out to sea beyond 30 fathoms, b) leave your vessel and evacuate out of the distant tsunami inundation zone, or c) go upriver. DO YOUR HOMEWORK before the event to understand how practical these options are for the largest distant tsunamis that might strike your area. Check with local authorities and www.oregontsunami.org for information.
- Check with local authorities before taking any action. Most distant tsunamis are small enough that it is safer to keep your boat docked. Congestion in the waterway or among those trying to pull boats out with trailers can create serious problems. Sea and weather conditions may be more dangerous than the tsunami! Get yourself out of the tsunami evacuation zone.

After the tsunami

- If in an offshore staging area**, check with the USCG for guidance before leaving the staging area; conserve fuel by drifting until you know what actions you need to take.
- If in an onshore assembly area**, check with local authorities for guidance before returning to the inundation zone.

BROADCASTS DURING A TSUNAMI EVENT

USCG will issue Urgent Marine Information Broadcasts on CH 16, and additional information will be available from NOAA Weather Radio.



Local Tsunamis

You have only ~10 minutes to take action, so have a plan ahead of time that includes a quick way to release commercial fishing gear so your boat is not dragged down by currents; have at least 3 days of food, fuel, and water.

If you are on the water

- At less than 100 fathoms (600 ft):** (1) Stop commercial fishing operations immediately, (2) free the vessel from any bottom attachment (cut lines if necessary), and (3) if you can beach or dock your boat and evacuate on foot within 10 minutes of a natural warning, then this is your best chance. If that is not possible, head to greater than 100 fathoms, keeping in mind the following:
 - Proceed as perpendicular to shore as possible.
 - Sail directly into wind waves, keeping in mind that wind waves opposed by tsunami currents will be greatly amplified.
 - Maintain as much separation as possible from other vessels.
 - Synchronize movements with other vessels to avoid collisions.
- At greater than 100 fathoms:** If you are in deep water but not quite 100 fathoms, head to deeper water. If you are already at greater than 100 fathoms, then you are relatively safe from tsunamis, but deeper water is safer from tsunami currents and the amplification of wind waves by those currents.

If you are on land or tied up at dock

- Evacuate out of the tsunami evacuation zone.** You don't have time to save your boat and could die if you try to do so.

After the tsunami

- If in an offshore staging area**, check with the USCG for guidance before leaving the staging area; conserve fuel by drifting until you know what actions you need to take.
- If in an onshore assembly area**, check with local authorities for guidance before returning to the inundation zone.
- Do not return to local ports** until you have firm guidance from USCG and local authorities.
 - Local ports will sustain heavy damage from a local tsunami and may not be safe for days, weeks or months.
 - If at sea, check to see if you can reach an undamaged port with your current fuel supply and watch for floating debris or survivors that may have been washed out on debris.
 - If at sea, consider checking with USCG about your role in response and recovery.

