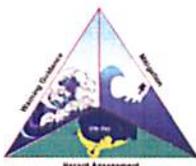


Broadcasters Tsunami Emergency Guidebook



**Washington Military Department
Emergency Management Division**



**National Tsunami Hazard
Mitigation Program**



WASHINGTON STATE DEPARTMENT OF
Natural Resources

ISSUE DATE: APRIL 2006

Introduction

The Pacific Coast of Washington is at risk from tsunamis. These destructive waves can be caused by coastal or submarine landslides or volcanism, but they are most commonly caused by large submarine earthquakes.

Tsunamis are generated when these geologic events cause large, rapid movements in the sea floor that displace the water column above. That swift change creates a series of high-energy waves that radiate outward like pond ripples. Local offshore tsunamis would strike the adjacent shorelines within minutes. The Pacific Coast is at risk both from locally and distantly generated tsunamis.

Tsunami waves can continue for hours. The first wave can be followed by others a few minutes or a few hours later, and the later waves are commonly larger.

Warnings

When an earthquake that might generate a Pacific Coast tsunami is detected, the West Coast/Alaska Tsunami Warning Center calculates the danger to the northeast Pacific Coast and notifies the communities at risk. If the earthquake occurs off our coast, however, there may be no time to send out hazard warnings and may make alert and notification systems inoperable. The first waves

could arrive within 30 minutes of the earthquake. The only tsunami warning might be the earthquake itself.

Broadcasters

This guidebook provides a concise overview of the notification process used to send tsunami alerts to public information broadcasters, local jurisdictions and the public. It includes a Tsunami Warning Flow Chart that shows how information is sent to broadcasters, a contact list of tsunami experts who can provide credible tsunami information during a tsunami event, and Washington coastal community maps of regions most susceptible to tsunamis.

Two DVDs accompany this guidebook (located in the binder sleeve): *Tsunamis in Washington* (running time: 4:31:26); and *U.S. National Tsunami Hazard Mitigation Program Selected Interviews*.

Coastal Tsunami Inundation Maps

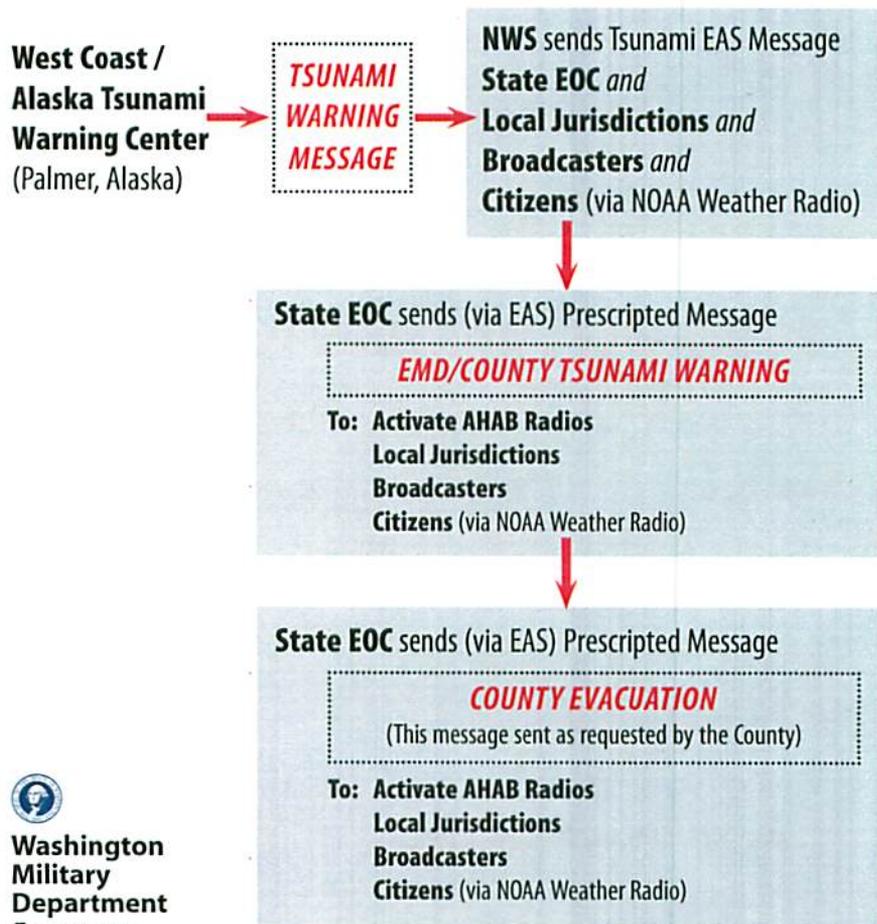
Washington coast maps appear in geographic order. Each map includes a symbol key that pinpoints tsunami hazard zones, evacuation routes, and safer assembly areas for people.

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Tsunami Warning Flow Chart

HOW THE TSUNAMI WARNING SYSTEM WORKS




**Washington
 Military
 Department
 Emergency
 Management
 Division**



WC/ATWC: West Coast/Alaska Tsunami Warning Center (Palmer, Alaska)
 State EOC: State Emergency Operation Center
 NWS: National Weather Service Coastal Offices
 AHAB: All Hazards Alert Broadcast
 EAS: Emergency Alert System

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Local Subject Matter Expert Contacts

TSUNAMI NUMERICAL MODELING

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TSUNAMIS GENERAL

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INUNDATION MAPPING

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EARTHQUAKE/TSUNAMI GEOLOGIST

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Email: atwater@usgs.gov

(Continued next page)

Local Subject Matter Expert Contacts

TSUNAMI WARNING CENTER

West Coast/Alaska Tsunami Warning Center

PALMER, ALASKA

Tel: (907) 745-4212

(Warning Center)

ANCHORAGE, ALASKA

Tel: (907) 271-4767

(NWS Alaska Region PIO)

EMERGENCY ALERT SYSTEM (EAS) OF TSUNAMI MESSAGE

National Weather Service

SEATTLE

PORTLAND

XXXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXXX

Tsunami Bulletin (Example)

From West Coast/Alaska Tsunami Warning Center

BULLETIN

TEST...PUBLIC TSUNAMI MESSAGE NUMBER 1...TEST
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
956 AM PST THU JAN 29 2009

- ... THIS MESSAGE IS FOR TEST PURPOSES TO SHOW AN EXAMPLE WEAK51 MESSAGE...
- ... A TEST TSUNAMI WARNING IS IN EFFECT WHICH INCLUDES THE COASTAL AREAS OF CALIFORNIA - OREGON - WASHINGTON - BRITISH COLUMBIA AND ALASKA FROM THE CALIFORNIA-MEXICO BORDER TO YAKUTAT ALASKA...
- ... A TEST TSUNAMI WATCH IS IN EFFECT WHICH INCLUDES THE COASTAL AREAS OF ALASKA FROM YAKUTAT ALASKA TO ATTU ALASKA...

A TSUNAMI WARNING MEANS... ALL COASTAL RESIDENTS IN THE WARNING AREA WHO ARE NEAR THE BEACH OR IN LOW-LYING REGIONS SHOULD MOVE IMMEDIATELY INLAND TO HIGHER GROUND AND AWAY FROM ALL HARBORS AND INLETS INCLUDING THOSE SHELTERED DIRECTLY FROM THE SEA. THOSE FEELING THE EARTH SHAKE... SEEING UNUSUAL WAVE ACTION... OR THE WATER LEVEL RISING OR RECEDING MAY HAVE ONLY A FEW MINUTES BEFORE THE TSUNAMI ARRIVAL AND SHOULD MOVE IMMEDIATELY. HOMES AND SMALL BUILDINGS ARE NOT DESIGNED TO WITHSTAND TSUNAMI IMPACTS. DO NOT STAY IN THESE STRUCTURES.

ALL RESIDENTS WITHIN THE WARNED AREA SHOULD BE ALERT FOR INSTRUCTIONS BROADCAST FROM THEIR LOCAL CIVIL AUTHORITIES. THIS TSUNAMI WARNING IS BASED SOLELY ON EARTHQUAKE INFORMATION - THE TSUNAMI HAS NOT YET BEEN CONFIRMED.

A TSUNAMI WATCH MEANS... ALL COASTAL RESIDENTS IN THE WATCH AREA SHOULD PREPARE FOR POSSIBLE EVACUATION. A TSUNAMI WATCH

(continued next page)

ISSUE UPDATE: APRIL 2009

IS ISSUED TO AREAS WHICH WILL NOT BE IMMEDIATELY IMPACTED BY THE TSUNAMI. WATCH AREAS WILL EITHER BE UPGRADED TO WARNING OR ADVISORY STATUS OR CANCELED.

AT 940 AM PACIFIC STANDARD TIME ON JANUARY 29 AN EARTHQUAKE WITH PRELIMINARY MAGNITUDE 7.9 OCCURRED 160 MILES/257 KM NORTHWEST OF EUGENE OREGON.

THIS EARTHQUAKE MAY HAVE GENERATED A TSUNAMI. IF A TSUNAMI HAS BEEN GENERATED THE WAVES WILL FIRST REACH CHARLESTON OREGON AT 1022 AM PST ON JANUARY 29. STIMATED TSUNAMI ARRIVAL TIMES AND MAPS ALONG WITH SAFETY RULES AND OTHER INFORMATION CAN BE FOUND ON THE WEB SITE WCATWC.ARH.NOAA.GOV.

TSUNAMIS CAN BE DANGEROUS WAVES THAT ARE NOT SURVIVABLE. WAVE HEIGHTS ARE AMPLIFIED BY IRREGULAR SHORELINE AND ARE DIFFICULT TO FORECAST. TSUNAMIS OFTEN APPEAR AS A STRONG SURGE AND MAY BE PRECEDED BY A RECEDING WATER LEVEL. MARINERS IN WATER DEEPER THAN 600 FEET SHOULD NOT BE AFFECTED BY A TSUNAMI. WAVE HEIGHTS WILL INCREASE RAPIDLY AS WATER SHALLOWS. TSUNAMIS ARE A SERIES OF OCEAN WAVES WHICH CAN BE DANGEROUS FOR SEVERAL HOURS AFTER THE INITIAL WAVE ARRIVAL. DO NOT RETURN TO EVACUATED AREAS UNTIL AN ALL CLEAR IS GIVEN BY LOCAL CIVIL AUTHORITIES.

THE PACIFIC TSUNAMI WARNING CENTER IN EWA BEACH HAWAII WILL ISSUE MESSAGES FOR HAWAII AND OTHER AREAS OF THE PACIFIC OUTSIDE CALIFORNIA/ OREGON/ WASHINGTON/ BRITISH COLUMBIA AND ALASKA.

THIS MESSAGE WILL BE UPDATED IN 30 MINUTES OR SOONER IF THE SITUATION WARRANTS. THE TSUNAMI MESSAGE WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE. FOR FURTHER INFORMATION STAY TUNED TO NOAA WEATHER RADIO... YOUR LOCAL TV OR RADIO STATIONS... OR SEE THE WEB SITE WCATWC.ARH.NOAA.GOV.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST MESSAGE.

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Tsunami Bulletin (Example)

From Washington State Emergency Operation Center

"THIS IS NOT A TEST. A TSUNAMI WARNING HAS BEEN ISSUED FOR THE COASTAL AREAS OF WASHINGTON. A TSUNAMI CAN CAUSE DANGEROUS FLOODING. IF YOU ARE IN A LOW COASTAL AREA YOU ARE AT RISK AND MUST MOVE TO HIGHER GROUND OR INLAND NOW. DO NOT RETURN UNTIL DIRECTED TO DO SO. CLOSELY MONITOR LOCAL RADIO STATIONS FOR ADDITIONAL INFORMATION. THIS IS NOT A TEST. A TSUNAMI WARNING HAS BEEN ISSUED FOR THE COASTAL AREAS OF WASHINGTON. MOVE TO HIGHER GROUND OR INLAND NOW."

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Know the terms used by West Coast / Alaska Tsunami Warning Center

A Tsunami Warning

A tsunami warning is issued when a potential tsunami with significant widespread inundation is imminent or expected. Warnings alert the public that widespread, dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after arrival of the initial wave. Warnings also alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information.

A Tsunami Advisory

A tsunami advisory is issued due to the threat of a potential tsunami that may produce strong currents or waves dangerous to those in or near the water. Coastal regions historically prone to damage due to strong currents induced by tsunamis are at the greatest risk. The threat may continue for several hours after the arrival of the initial wave, but significant widespread inundation is not expected for areas under an advisory. Appropriate actions to be taken by local officials may include closing beaches, evacuating harbors and marinas, and the repositioning of ships to deep waters when there is time to safely do so. Advisories are normally updated to continue the advisory, expand/contract affected areas, upgrade to a warning, or cancel the advisory.

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Know the terms used by the West Coast / Alaska Tsunami Warning Center

A Tsunami Watch

A tsunami watch is issued to alert emergency management officials and the public of an event that may later impact the watch area. The watch area may be upgraded to a warning or advisory — or canceled — based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are normally issued based on seismic information without confirmation that a destructive tsunami is underway.

A Tsunami Information Statement

A tsunami information statement is issued to inform emergency management officials and the public that an earthquake has occurred, or that a tsunami warning, watch or advisory has been issued for another section of the ocean. In most cases, information statements are issued to indicate there is no threat of a destructive tsunami and to prevent unnecessary evacuations as the earthquake may have been felt in coastal areas. An information statement may, in appropriate situations, caution about the possibility of destructive local tsunamis. Information statements may be re-issued with additional information, though normally these messages are not updated. However, a watch, advisory or warning may be issued for the area, if necessary, after analysis and/or updated information becomes available.

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**Know the terms used by the
West Coast / Alaska Tsunami Warning Center**

**An Information Statement
(Example)**

WEAK53 PAAQ 130942
TIBAK1

PUBLIC TSUNAMI INFORMATION STATEMENT NUMBER 1
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
142 AM PST SUN JAN 13 2008

... THIS MESSAGE IS FOR TEST PURPOSES TO SHOW AN
EXAMPLE WEAK53 MESSAGE...

... A STRONG EARTHQUAKE HAS OCCURRED BUT A TSUNAMI
IS NOT EXPECTED ALONG THE CALIFORNIA/ OREGON/
WASHINGTON/BRITISH COLUMBIA OR ALASKA COASTS...
NO WARNING... NO WATCH AND NO ADVISORY IS IN EFFECT
FOR THESE AREAS.

BASED ON THE EARTHQUAKE MAGNITUDE AND HISTORIC TSUNAMI
RECORDS A DAMAGING TSUNAMI IS NOT EXPECTED ALONG THE
CALIFORNIA/ OREGON/ WASHINGTON/ BRITISH COLUMBIA AND ALASKA
COASTS. SOME OF THESE AREAS MAY EXPERIENCE NON-DAMAGING SEA
LEVEL CHANGES. AT COASTAL LOCATIONS WHICH HAVE EXPERIENCED
STRONG GROUND SHAKING LOCAL TSUNAMIS ARE POSSIBLE DUE TO
UNDERWATER LANDSLIDES.

AT 135 AM PACIFIC STANDARD TIME ON JANUARY 13 AN EARTHQUAKE
WITH PRELIMINARY MAGNITUDE 6.7 OCCURRED 100 MILES/161 KM
NORTHWEST OF EUREKA CALIFORNIA.

THE PACIFIC TSUNAMI WARNING CENTER IN EWA BEACH HAWAII WILL
ISSUE MESSAGES FOR HAWAII AND OTHER AREAS OF THE PACIFIC
OUTSIDE CALIFORNIA/ OREGON/ WASHINGTON/ BRITISH COLUMBIA AND
ALASKA.

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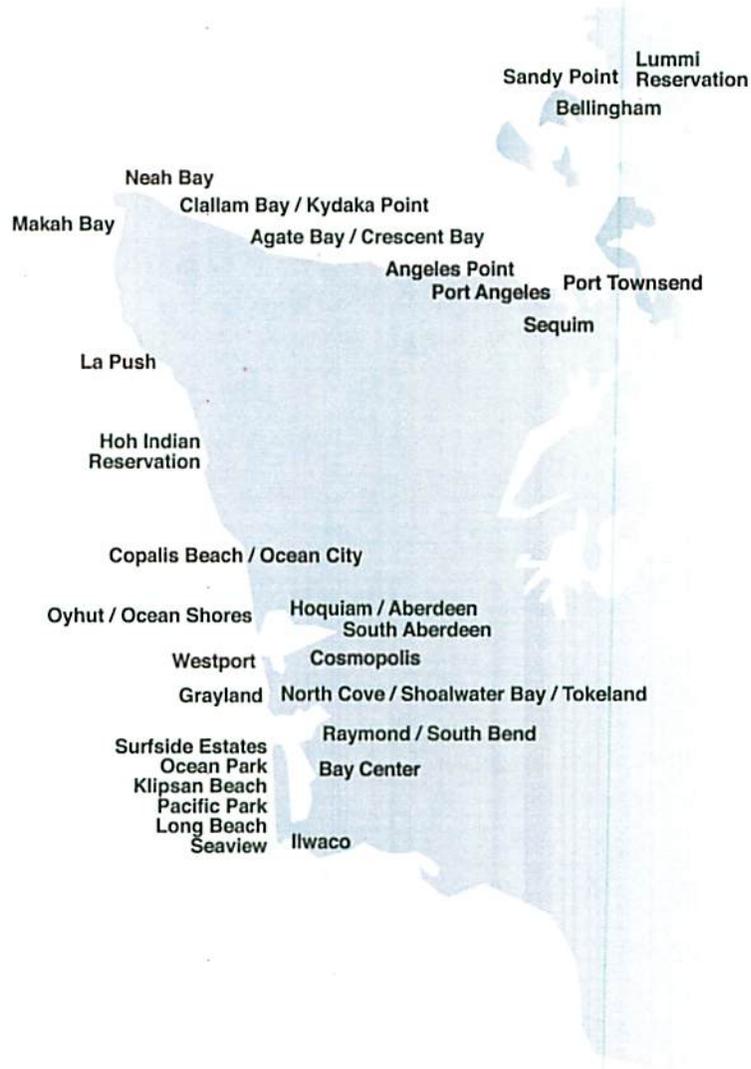
THIS WILL BE THE ONLY STATEMENT ISSUED FOR THIS EVENT BY THE WEST COAST/ALASKA TSUNAMI WARNING CENTER UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE. SEE THE WEB SITE WCATWC.ARH. NOAA.GOV FOR BASIC TSUNAMI INFORMATION - SAFETY RULES AND TSUNAMI TRAVEL TIMES.

THIS IS A TEST MESSAGE. DO NOT TAKE ACTION BASED ON THIS TEST MESSAGE.

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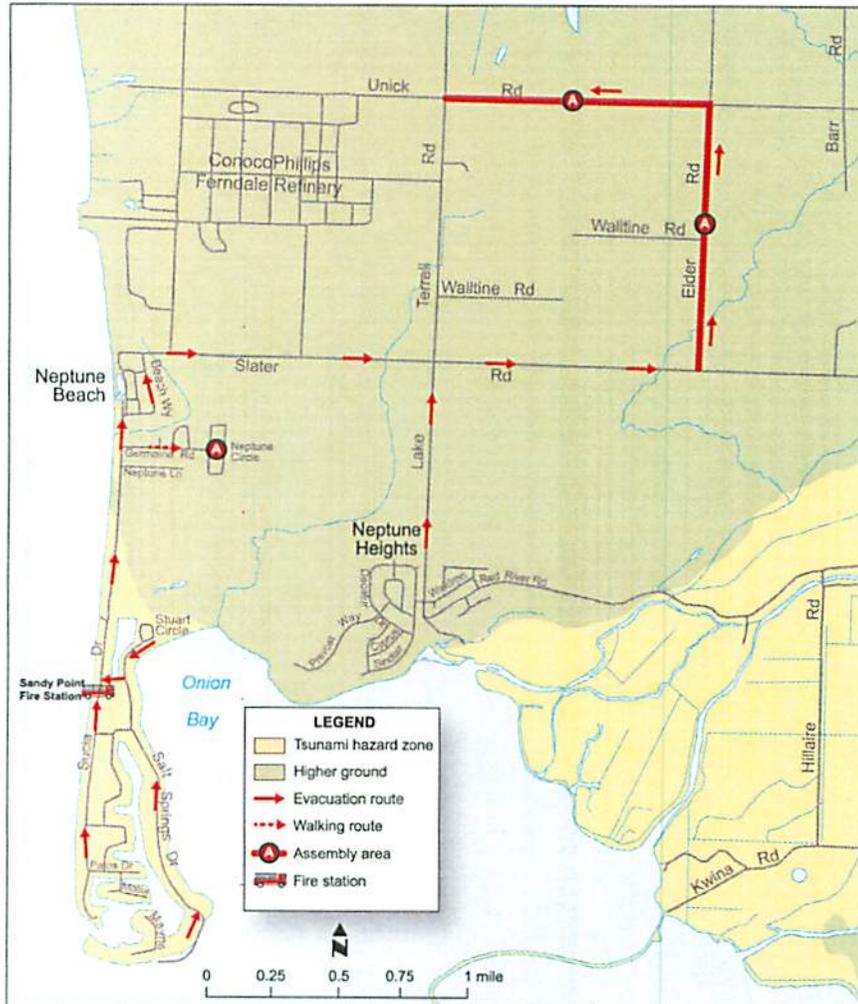
Washington Coast

Tsunami Inundation Maps appear on
the following pages beginning with
the Lummi Reservation



Whatcom County

Sandy Point



2.1.A | BROADCASTERS TSUNAMI EMERGENCY GUIDEBOOK

Whatcom County

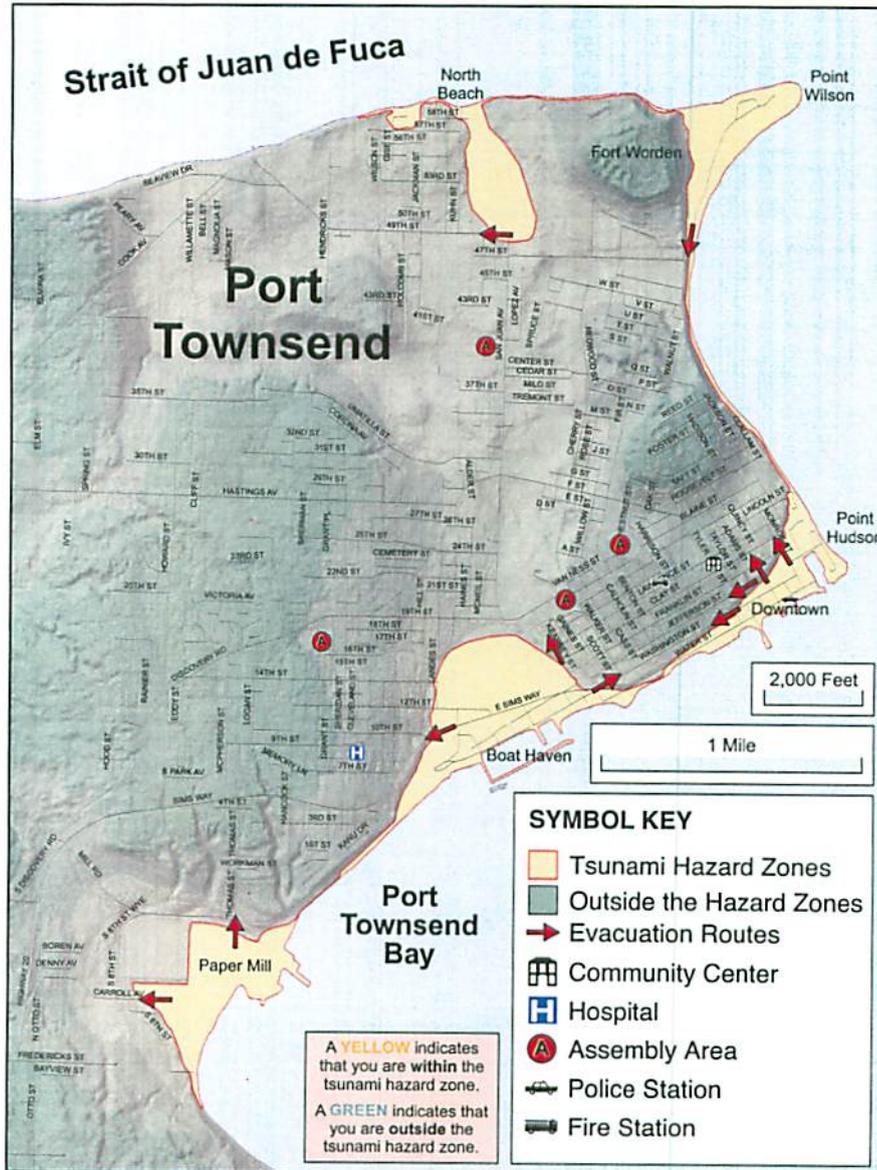
Bellingham



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Jefferson County

Port Townsend

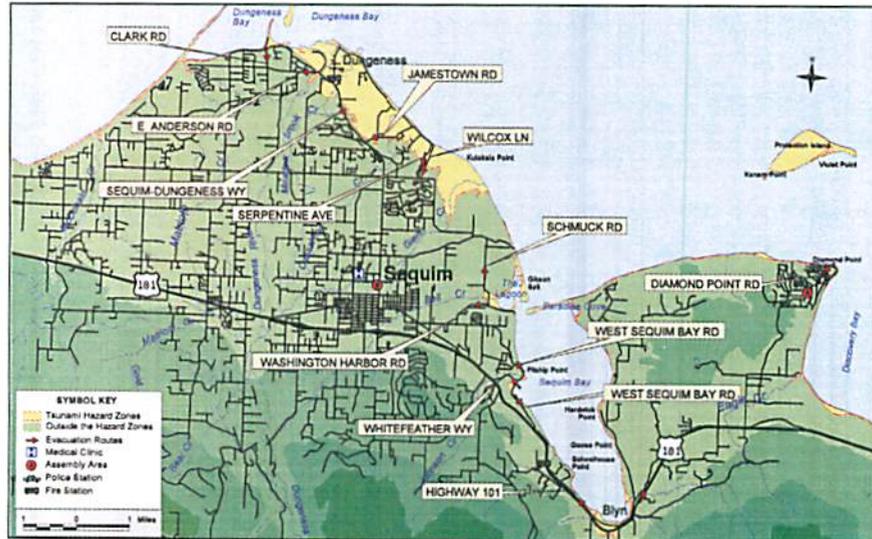


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Clallam County

Sequim



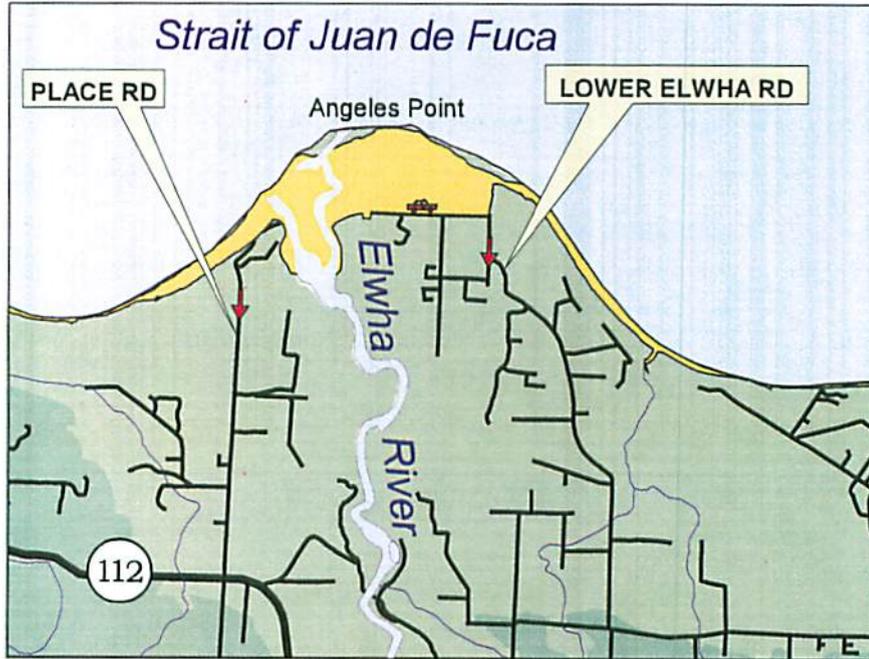
Clallam County

Port Angeles



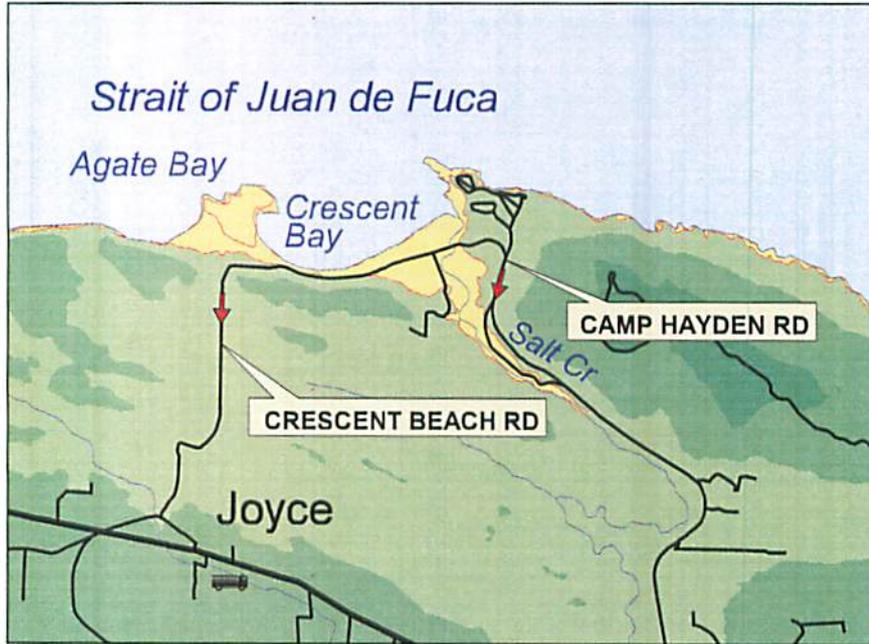
Clallam County

Angeles Point



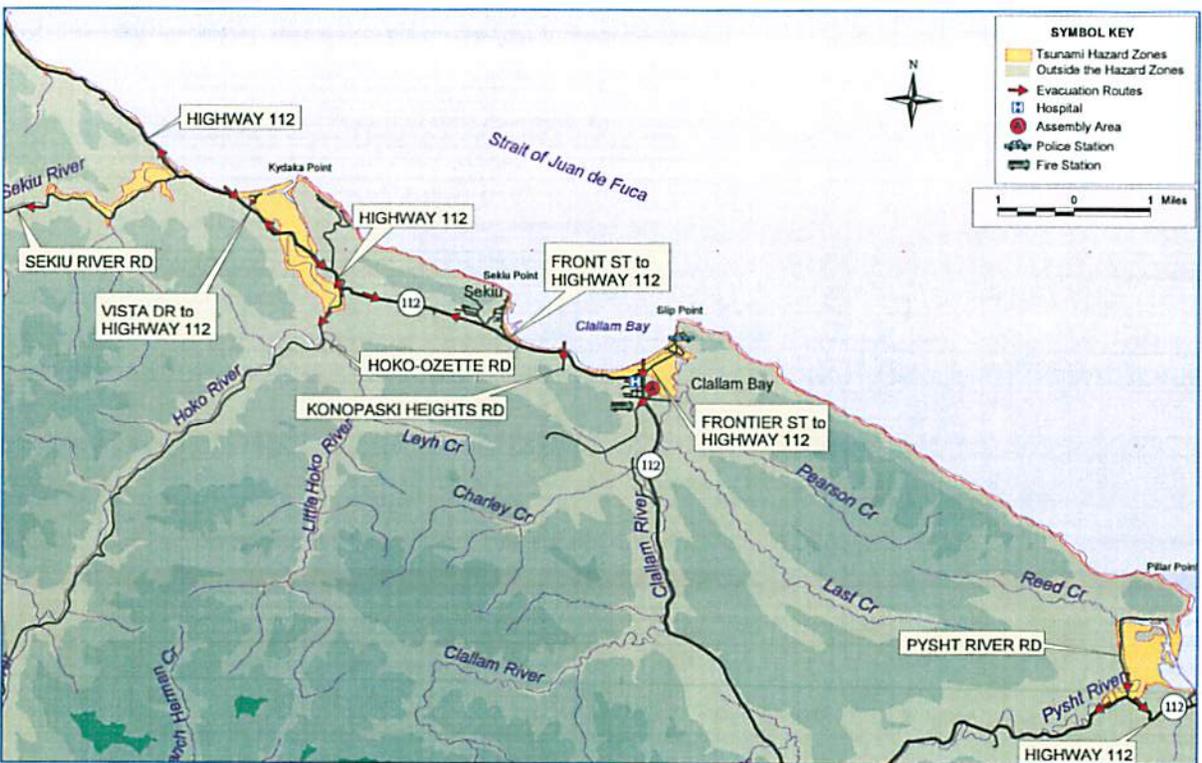
Clallam County

Agate Bay / Crescent Bay (Crescent Beach)



Clallam County

Clallam Bay / Kydaka Point



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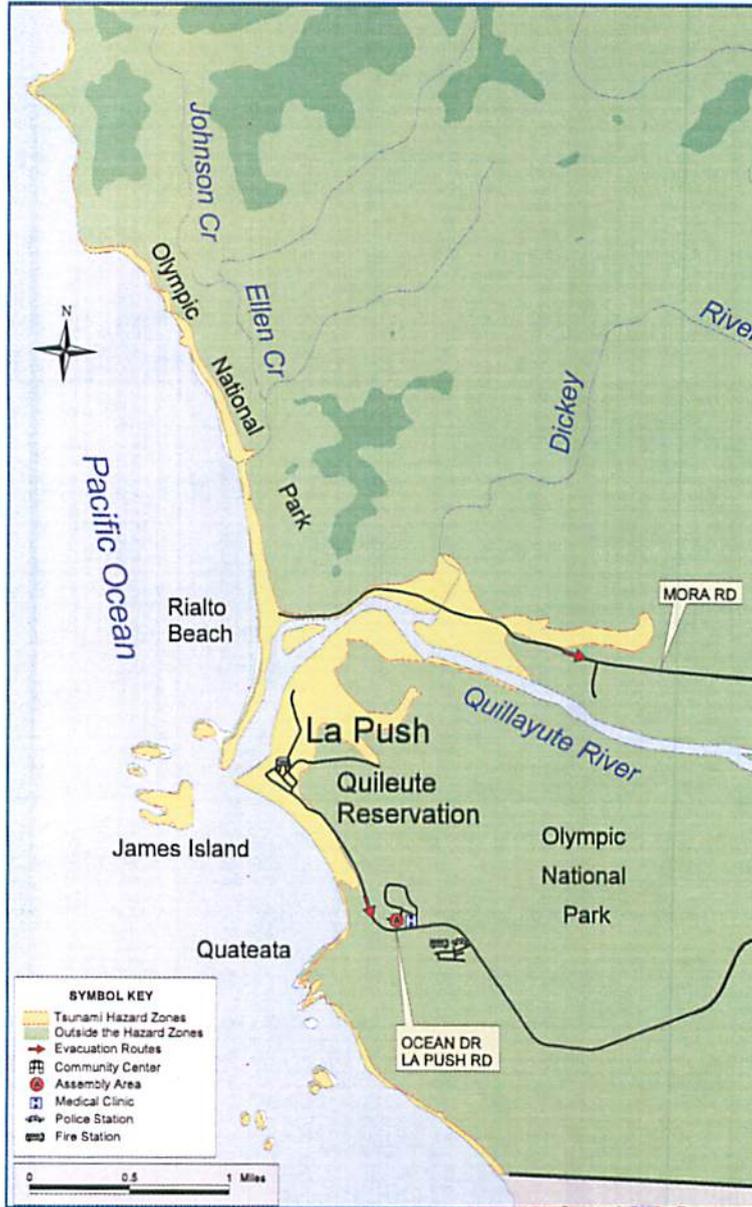
Clallam County

Neah Bay / Makah Bay



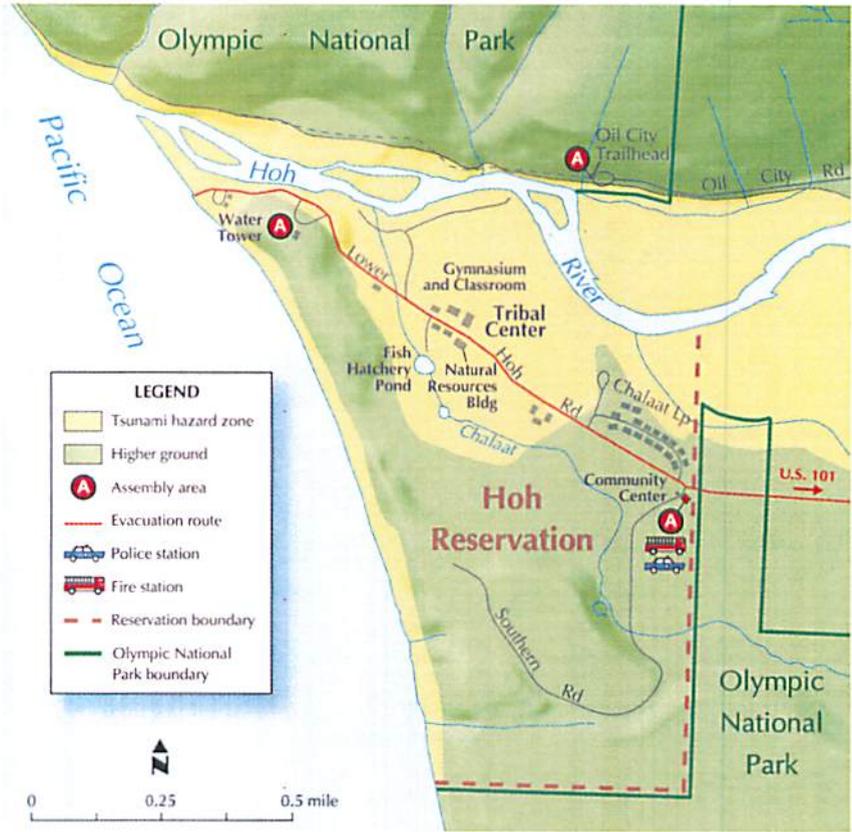
Clallam County

La Push



Clallam County

Hoh Reservation



Grays Harbor County

Copalis Beach / Ocean City



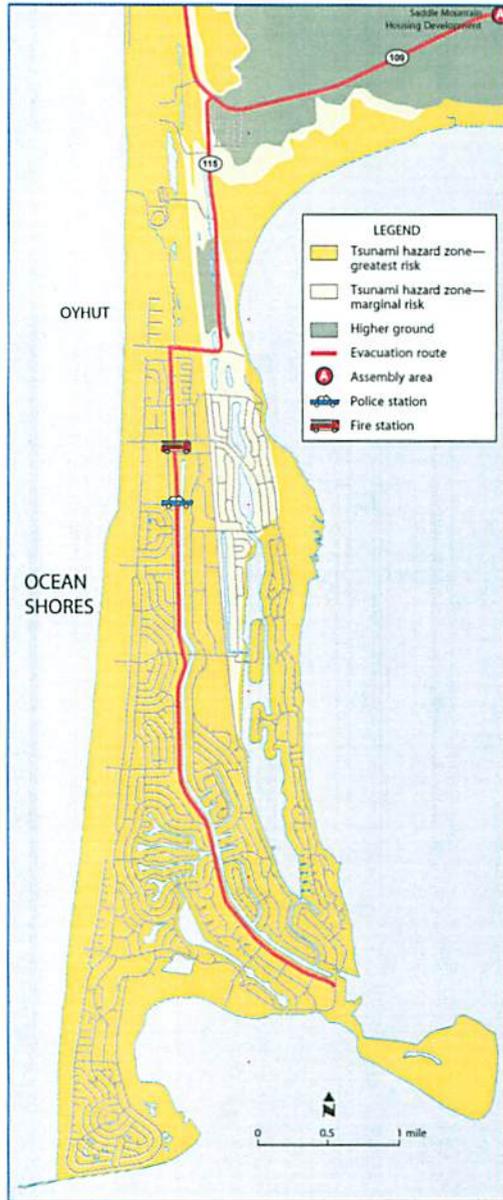
BROADCASTERS TSUNAMI EMERGENCY GUIDEBOOK

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Grays Harbor County

Oyhut / Ocean Shores



Grays Harbor County

Hoquiam / Aberdeen



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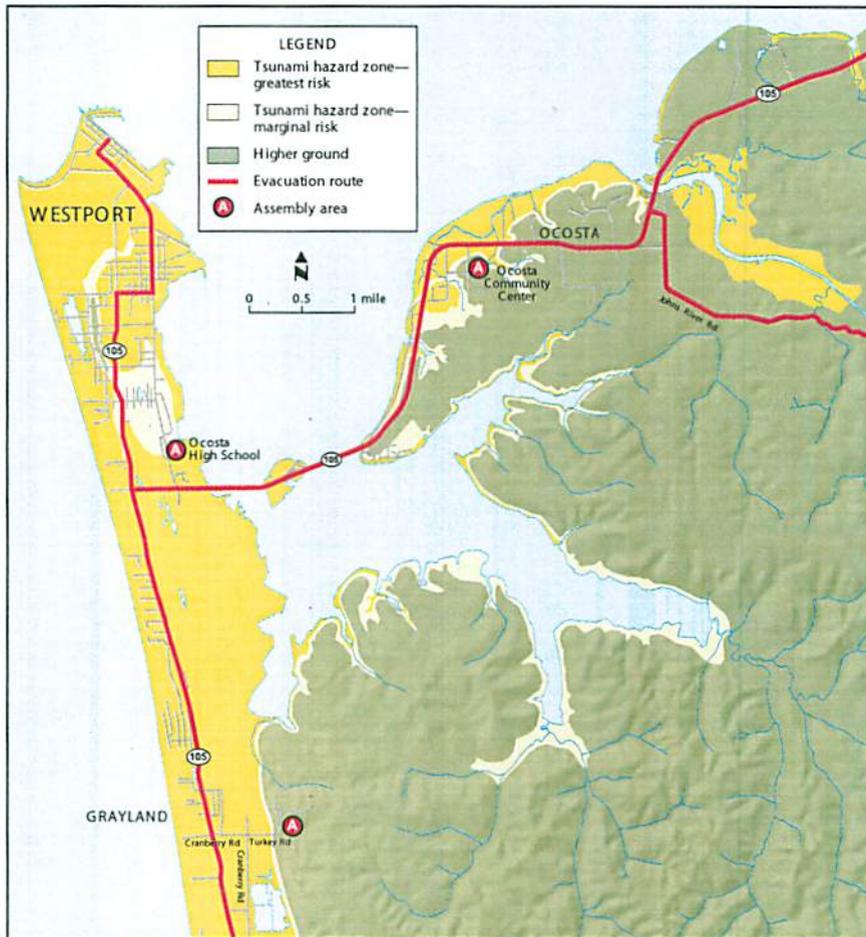
Grays Harbor County

South Aberdeen / Cosmopolis



Grays Harbor County

Westport / Grayland



Pacific County

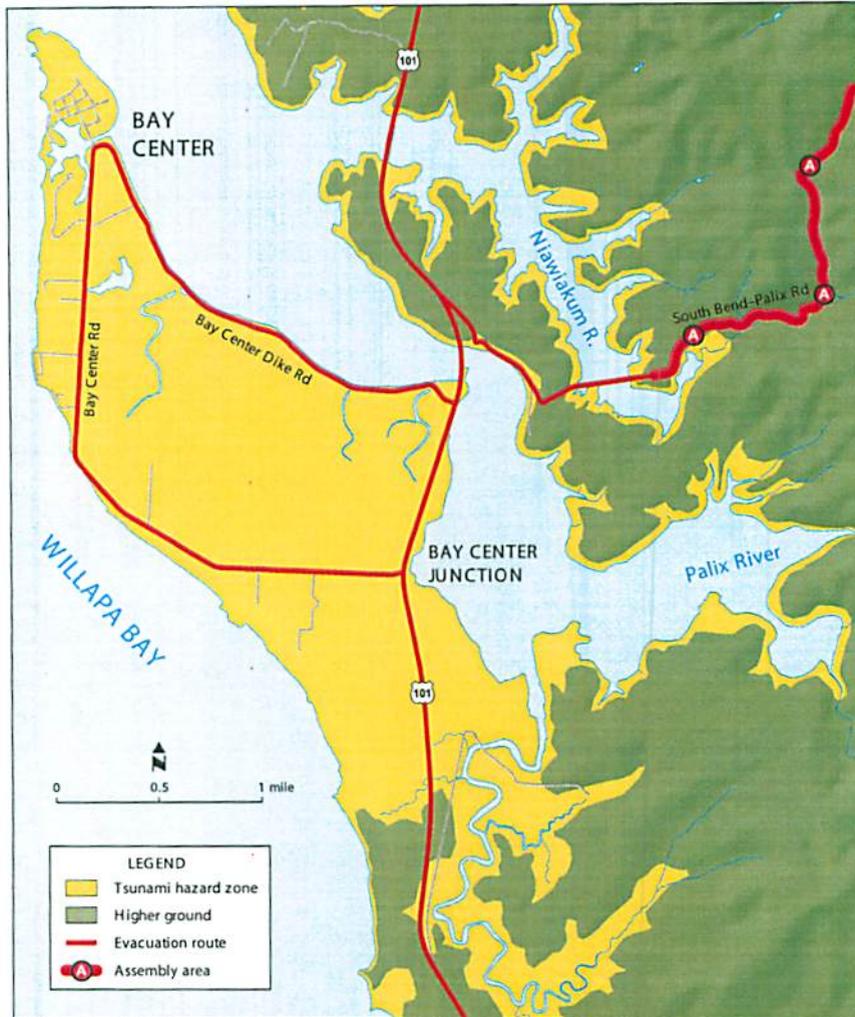
Raymond / South Bend



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Pacific County

Bay Center



Pacific County

Pacific Park / Long Beach / Seaview / Ilwaco



Tsunami Fact Sheet

What is a tsunami?

A tsunami is a series of waves typically generated by vertical displacement of the sea floor or lake bed caused by an earthquake. Tsunamis can cause significant death and destruction, with the greatest impact in areas closest to the source. The initial tsunami wave can arrive on shore within minutes of an earthquake, or up to several hours later, depending upon distance from the source.

Have we experienced a tsunami?

Yes. Tsunamis from locations across the Pacific Ocean basin and from the Cascadia Subduction Zone off the Washington coast have hit coastal communities. Tsunamis generated by sources such as an earthquake on the Seattle Fault or the eruption of Mount St. Helens struck Puget Sound and other inland waters. Tsunamis hit Washington's shorelines in the 900-930 era, 1700, the 1890's, 1944-1953 era, 1949, 1960, 1964, and 1980.

Will a tsunami strike again?

Yes. Great earthquakes in the Pacific Ocean basin generating tsunamis that could impact Washington's outer coast and Strait of Juan de Fuca occur at a rate of about six every 100 years. In the Cascadia Subduction Zone, there is a 10 to 14 percent chance of a magnitude 9 earthquake and tsunami in the next 50 years. A rate of occurrence for local earthquakes and

landslides that generate tsunamis has not been determined.

Who is at risk?

Communities along the Pacific Coast and Strait of Juan de Fuca, including a number of coastal Indian tribes, are at greatest risk. In a Cascadia Subduction Zone earthquake, the level of the coastal region could fall up to six feet, and tsunami waves could reach 30 feet, overtopping several low-lying coastal communities. At-risk population is more than 43,000 on the outer coast, excluding tourists and transient populations that could increase the number significantly.

Special note:

In its earthquake and tsunami potential, the Cascadia Subduction Zone resembles the Sunda Trench off the coast of Sumatra Island, Indonesia. The Sunda Trench produced giant earthquakes and tsunamis in December 2004 and March 2005 that killed more than 284,000 people and displaced another 1.1 million people in the Indian Ocean basin. Waves from the December 2004 tsunami reached 100 feet in places and traveled inland as far as five miles on Sumatra. The tsunami was measured around the world.

This information taken from the 2008 edition of the Washington State Enhanced Hazard Mitigation Plan, Washington Military Department, Nov. 2007.

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