Klamath Tsunami Readiness Plan

Yurok Office of Emergency Services

A Lesson Learned

Experts have argued that tsunami warning systems need to be underpinned by public awareness campaigns and emergency response plans if they are to be effective. Warnings are of little use if people do not know how to respond to them. Knowledge becomes even more critical if warning times are short or there is no warning at all – in which case people must know how to re-act immediately.

The value of indigenous knowledge was highlighted by Simuelue islanders during the 2004 Indian Ocean Tsunami. The Simuelue islanders lost only seven of their 78,000 inhabitants even though the 2004 Indian Ocean tsunami struck them just eight minutes after the earthquake. Populations of other nearby coastal areas were decimated. The Simuelue islanders have kept alive, through oral history, the lessons of a tsunami that struck in 1907, and knew exactly what to do when the tsunami struck.

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Introduction

The community of Klamath, California in cooperation with the Yurok Tribe is working towards obtaining a *TsunamiReady* designation from NOAA's National Weather Service. The Klamath Tsunami Readiness Plan is an integral step towards Klamath becoming a TsunamiReady community.

The TsunamiReady program is a federal initiative aimed at improving public safety during tsunami emergencies. The program promotes tsunami preparedness as an active collaboration among federal, tribal, state and local emergency management agencies, the public, and the National Weather Service tsunami warning system. This collaboration supports better and more consistent tsunami awareness and mitigation efforts among communities at risk.

Why does Klamath need to become TsunamiReady? All ocean regions of the world can experience tsunamis. But, large destructive tsunamis occur most frequently in the Pacific Ocean because of the Pacific Ocean's immense size and many earthquakes. According to a 2005 compilation by the World Data Center for Solid Earth Geophysics, 82% of the 1106 verified tsunamis have occurred in the Pacific Ocean. Altogether, about 500,000 deaths have been reported with 470,000 of these caused by 23 major tsunamis.

The Pacific Cascadia Subduction Zone is located approximately 75 miles off the coastline of Klamath. Paleoseismic and tsunami research in the last 10 years have pieced together evidence that a magnitude 9+ earthquake occurred off the Pacific Northwest on January 26, 1700 that generated a teletsunami that was recorded in northern Japan. Scientists predict that another great earthquake associated with the Cascadia Subduction Zone may be overdue, creating a need to increase tsunami preparedness activities along northwestern North America.

In 1964, a tsunami generated by an 8.6 magnitude earthquake in Alaska killed a man who was eeling at the mouth of the Klamath River. The tsunami struck the Klamath area approximately four and half hours after the earthquake occurred in Alaska. First hand reports indicate that the 1964 tsunami caused the Klamath River to reverse directions for several miles, before the man was swept out to sea.

TsunamiReady communities must develop hazard plans that include evacuation routes to safe zones and shelters outside hazardous run-up zones, as well as plans and drills for schools located within hazard zones. *TsunamiReady* communities are also required to establish an Emergency Operations Center, disseminate tsunami warnings using sirens and local media, set up a community awareness program, and develop multiple ways of receiving National Weather Service warnings. It has been found, as communities become more tsunami ready, the more prepared they become to save lives, increase contacts with

emergency experts, identify community readiness needs and enhance their core infrastructure to support other community concerns.

Tsunami Vocabulary and Terminology

Tsunami - Tsunamis are ocean waves produced by earthquakes, meteor impact, volcanic eruption, or underwater landslides. Tsunamis that strike coastal locations in the Pacific Ocean Basin are most always caused by earthquakes.

The word *tsunami* is Japanese and means "harbor wave," because of the devastating effects these waves have had on low-lying Japanese coastal communities. Tsunamis are often incorrectly referred to as tidal waves, but a tsunami is actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour in the open ocean.

In the open ocean, tsunamis would not be felt by ships because the wavelength would be hundreds of miles long, with amplitude of only a few feet. This would also make them unnoticeable from the air. As the waves approach the coast, their speed decreases and their amplitude increases. Unusual wave heights have been known to be over 100 feet high. However, waves that are 10 to 20 feet high can be very destructive and cause many deaths or injuries.

From an initial tsunami generating source area, waves travel outward in all directions much like the ripples caused by throwing a rock into a pond. As these waves approach coastal areas, the time between successive wave crests varies from 5 to 90 minutes. The first wave is usually not the largest in the series of waves, nor is it the most significant. Furthermore, one coastal community may experience no damaging waves while another, not that far away, may experience destructive deadly waves. Depending on a number of factors, some low-lying areas could experience severe inland inundation of water and debris of more than 1,000 feet.

Tsunami Watch - An alert issued to areas outside the warned area. The area included in the watch is based on the magnitude of the earthquake. For earthquakes over magnitude 7.0, the watch area is 1 hour tsunami travel time outside the warning zone. For all earthquakes over magnitude 7.5, the watch area is 3 hours tsunami travel time outside the warning zone. The watch will either be upgraded to a warning in subsequent bulletins or will be cancelled depending on the severity of the tsunami.

Tsunami Warning - Indicates that a tsunami is imminent and that coastal locations in the warned area should prepare for flooding. The initial warning is typically based on seismic information alone. Earthquakes over magnitude 7.0 trigger a warning covering the coastal regions within 2 hours tsunami travel time from the epicenter. When the magnitude is over 7.5, the warned area is

increased to 3 hours tsunami travel time. As water level data showing the tsunami is recorded, the warning will be cancelled, restricted, expanded incrementally, or expanded in the event of a major tsunami.

Emergency Alert System (EAS) - The EAS is designed to provide the President with a means to address the American people in the event of a national emergency. EAS enables any radio station to automatically put a warning message over the air without any human intervention. This means that, whether the station is attended or not, that warning will be broadcast to its audience. The EAS uses digital technology to distribute messages to the public over AM, FM, and TV broadcast. The EAS digital signal is the same signal that the National Weather Service (NWS) uses on NOAA Weather Radio (NWR). This allows NWR signals to be decoded by the EAS equipment at broadcast stations and cable systems. Broadcasters and cable operators can then retransmit NWS weather warning messages almost immediately to their audiences. http://www.fcc.gov/.

All-Hazards NOAA Weather Radio - NOAA Weather Radio All Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from a nearby National Weather Service Office. NWR broadcasts National Weather Service warnings, watches, forecasts and other hazard information 24 hours a day. Working with the Federal Communication Commission's Federal Communication (FCC) Emergency Alert System, NWR is an "All Hazards" radio network, making it your single source for comprehensive weather and emergency information. In conjunction with Federal, State, and Local Emergency Managers and other public officials, NWR also broadcasts warning and post-event information for all types of hazards – including natural (such as earthquakes or tsunami, avalanches), environmental (such as chemical releases or oil spills), and public safety (such as AMBER alerts or 911 Telephone outages). All-hazards NOAA weather radios can be purchased from commercial vendors, such as Radio Shack for less than $100 and must be installed in all tribal offices, schools and public buildings in a NOAA approved TsunamiReady Community. http://www.nws.noaa.gov/nwr/

All-Hazard Alert Broadcast (AHAB) - A self-sufficient wind or solar powered warning system located in remote locations. It activates a brilliant blue US Coast Guard light and siren heard for at least a mile upon receipt of an emergency message, such as a tsunami watch or warning. It also records and repeats the verbal emergency message for those near the AHAB. http://www.earthquakeconference.org/response.html

Area of Responsibility (AOR) - The geographical area within which a tsunami warning center has the responsibility for the dissemination of Tsunami Warnings, Watches, Advisories, and Information Bulletins and the provision of interpretive information to emergency managers and other officials, news media, and the

public. The West Coast/Alaska Tsunami Warning Center's (WCATWC) area of responsibility includes California.

Bores – A bore is a step-like wave with a steep breaking front. A bore can happen if the tsunami moves from deep water into a shallow bay or river. A bore from a tsunami may travel several miles up the Klamath River.

Cascadia Subduction Zone - The Cascadia Subduction Zone is a very long sloping fault that stretches from mid-Vancouver Island to Northern California. It separates the Juan de Fuca and North America plates. The Cascadia Subduction Zone is where the two plates meet. New ocean floor is being created offshore of Washington, Oregon and Northern California. As more material wells up along the ocean ridge, the ocean floor is pushed toward and beneath the continent. http://www.pnsn.org/HAZARDS/CASCADIA/cascadia_zone.html

Deep Ocean Assessment and Reporting of Tsunamis (DART) – Dart is part of the U.S Tsunami Hazard Mitigation Program (NTHMP). The Deep Ocean Assessment and Reporting of Tsunamis (DART) Project is an ongoing effort to maintain and improve the capability for the early detection and real-time reporting of tsunamis in the open ocean. Developed by NOAA's Pacific Marine Environmental Laboratory (PMEL) and operated by NOAA's National Data Buoy Center (NDBC), DART is essential to fulfilling NOAA's national responsibility for tsunami hazard mitigation and warnings. Project goals are the reduction in the loss of life and property in U.S. coastal communities and elimination of false alarms which result in high economic costs for unnecessary evacuations.

DART stations have been sited in regions with a history of generating destructive tsunamis to ensure early detection of tsunamis and to acquire data critical to real-time forecasts.

DART systems consist of an anchored seafloor bottom pressure recorder (BPR) and a companion moored surface buoy for real-time communications. An acoustic link transmits data from the BPR on the seafloor to the surface buoy. The data are then relayed via a GOES satellite link to ground stations, which demodulate the signals for immediate dissemination to NOAA's Tsunami Warning Centers, NDBC, and PMEL. The moored system is shown in the accompanying figure.

Distant Source Tsunami (teletsunami) - A tsunami that is caused by an event, such as an earthquake, several thousands of miles from the North Coast. Generally, the warning time for a distant source tsunami is much greater than that of a local source tsunami.

Earthquake Magnitude - A logarithmic scale for indicating the size of earthquakes. For tsunami warning purposes the moment magnitude scale (based on seismic P waves, surface waves, or both) will be used to size potentially

tsunamigenic earthquakes. Other magnitude scales such as Ms, mb, and ml can be used as appropriate to size smaller non-tsunamigenic earthquakes and as a supplement to the moment magnitude scale for larger earthquakes.

International Tsunami Warning Center – ITWC is responsible for tsunami warning to the member nations in the Pacific Ocean Basin. http://www.tsunamiwave.info/

Local Source Tsunami – A tsunami caused by an earthquake or underground landslide that occurs near the coastline, such as along the North Coast of California. The arrival time of the first wave from a local source tsunami may be only a mater of minutes. The only warning that may precede the first surge of water is a heavy ground shaking. If the ground shakes, people must get to high ground (over 100+ feet above sea level) immediately. Official notification may not occur until after the tsunami strikes!

Pacific Marine Environmental Laboratory - PMEL carries out interdisciplinary scientific investigations in oceanography and atmospheric science. PMEL programs focus on open ocean observations in support of long-term monitoring and prediction of the ocean environment on time scales from minutes to decades. http://www.pmel.noaa.gov/

NOAA/National Oceanic and Atmospheric Administration is a federal agency under the Department of Commerce, focused on the condition of the oceans and the atmosphere. The National Weather Service is under NOAA. http://www.noaa.gov

NOAA/National Weather Service - The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community. http://weather.gov

NOAA/National Weather Service Eureka - Eureka Weather Forecast Office 300 Startare Drive Eureka, California 95501 Tel: (707) 443-6484. The Eureka National Weather Service provides tsunami warnings and education to residents of the North Coast of California http://weather.gov/eureka

Pacific Tsunami Warning Center - The Pacific Tsunami Warning Center is operated by the National Oceanic and Atmospheric Administration (NOAA). The Pacific Tsunami Warning Center (PTWC) is located in Ewa Beach, Hawaii, and provides warnings for teletsunamis to most countries in the Pacific Basin as well as to Hawaii and all other US interests in the Pacific outside of Alaska and the US West Coast. Alaska and the US West Coast are served by the West Coast /

Alaska Tsunami Warning Center located in Palmer, Alaska. http://www.prh.noaa.gov/ptwc/

Seismometer – A seismometer is the internal part of the seismograph, which may be a pendulum or a mass mounted on a spring; however, it is often used synonymously with "seismograph". Seismographs are instruments used to record the motion of the ground during an earthquake installed in the ground throughout the world and operate as seismographic network. http://interactive2.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=193

Teletsunamis - A teletsunami is a non-local tsunami that occurs far away from a country and crosses open water. The 1964 tsunami that struck Crescent City and Klamath was a teletsunami that was generated from an earthquake in Alaska.

Tide Gauge - An instrument that measures the alternate rising and falling of the waters of the ocean, and of bays, rivers, etc., connected therewith. The tide ebbs and flows twice in each lunar day, or the space of a little more than twenty-four hours.

TsunamiReady - The TsunamiReady program is designed to educate local emergency management officials and their constituents and to promote a well-designed tsunami emergency response plan for each community. TsunamiReady promotes tsunami hazard preparedness as an active collaboration among federal, state, and local emergency management agencies. This collaboration supports greater and more consistent tsunami awareness http://wcatwc.arh.noaa.gov/tsunamiready/tready.htm

Tsunami Advisory - The third highest level of tsunami alert. Advisories are issued by the TWCs to coastal populations within areas not currently in either warning or watch status when a tsunami warning has been issued for another region of the same ocean. An Advisory indicates that an area is either outside the current warning and watch regions or that the tsunami poses no danger to that area. The TWC(s) issuing the Advisory will continue to monitor the event, issuing updates at least hourly. As conditions warrant, the Advisory will either be continued, upgraded to a watch or warning, or ended.

Tsunami Information Bulletin (TIB) - A text product issued to inform that an earthquake has occurred and to advise regarding its potential to generate a tsunami. In most cases, a TIB indicates there is no threat of a destructive tsunami affecting the issuing TWC's AOR, and are used to prevent unnecessary evacuations as the earthquake may have been felt in coastal areas. A TIB may, in appropriate situations, caution about the possibility of a destructive local tsunami. A supplemental TIB may be issued if important additional information is received such as a sea level reading showing a tsunami signal. A TIB may also

be upgraded to a Watch or Warning if appropriate. Further, the TIB may be used to recommend a Warning when protocols agreed to by emergency management authorities within an AOR so specify.

Tsunami Safe Areas -

Tsunami Warning Cancellation - A final text product indicating the end of the damaging tsunami threat. A cancellation is usually issued after an evaluation of sea level data confirms that a destructive tsunami will not impact the warned area.

Tsunami Warning - The highest level of tsunami alert. Warnings are issued by the TWCs due to the imminent threat of a tsunami from a large undersea earthquake or following confirmation that a potentially destructive tsunami is underway. They may initially be based only on seismic information as a means of providing the earliest possible alert. Warnings advise that appropriate actions be taken in response to the tsunami threat. Such actions could include the evacuation of low-lying coastal areas and the movement of boats and ships out of harbors to deep water. Warnings are updated at least hourly or as conditions warrant to continue, expand, restrict, or end the Warning.

Tsunami Final Warning Supplement - A final text product issued following a damaging or potentially damaging tsunami within a TWC's AOR that may pose a continuing threat. The supplement provides guidance to local officials regarding when they can consider the threat to have ceased. The cancellation or all clear decision must be made by local emergency officials.

Tsunami Information Statement - The same product as a Tsunami Information Bulletin.

Tsunami Warning Center (TWC) - A center that monitors and analyses observational data (e.g. seismic, tide/sea-level) and issues tsunami warnings as necessary. Tsunami Warning Centers can serve local, national, international, and/or global Tsunami Warning Systems.

Wavelength - Is defined as the distance between two identical points on a wave (i.e. between wave crests or wave troughs). Normal ocean waves have wavelengths of about 100 meters. Tsunami have much longer wavelengths, usually measured in kilometers and up to 500 kilometers.

Wave Height - Refers to the distance between the trough of the wave and the crest or peak of the wave.

Wave Amplitude - Refers to the height of the wave above the still water line, usually this is equal to 1/2 the wave height. Tsunami can have variable wave height and amplitude that depends on water depth as we shall see in a moment

Wave Frequency or Period - Is the amount of time it takes for one full wavelength to pass a stationary point.

Wave Velocity is the speed of the wave. Velocities of normal ocean waves are about 90 km/hr while tsunami have velocities up to 950 km/hr (about as fast as jet airplanes), and thus move much more rapidly across ocean basins. The velocity of any wave is equal to the wavelength divided by the wave period.

West Coast/Alaska Tsunami Warning Center – The West Coast/Alaska Tsunami Warning Center is operated by the National Oceanic and Atmospheric Administration and is responsible for tsunami monitoring and warning in the coastal waters of the West Coast and Alaska, including California, Oregon and Washington. The WCATWC is located at 910 S. Felton Street, Palmer, Alaska 99645 (907) 745-4212 and FAX: (907) 745-6071. http://wcatwc.arh.noaa.gov/

Important Facts to Know about Tsunamis

The expected impacts from a tsunami are difficult to predict, even by professionals, it is always better to error on the side of caution when responding to a threat from a tsunami.

Tsunamis can occur at any time, day or night.

Tsunamis that strike coastal locations in the Pacific Ocean Basin are most always caused by earthquakes. These earthquakes might occur far away (teletsunami) or near where you live (local tsunami).

Some tsunamis can be very large. In coastal areas their height can be as great as 30 feet or more (100+ feet in extreme cases), and they can move inland several hundred feet on land, or several miles by river.

All low-lying coastal areas can be struck by tsunamis.

Tsunamis can travel up rivers, tributaries, and streams that lead to the ocean.

A tsunami consists of a series of waves. Often, the first wave may not be the largest.

The danger from a tsunami can last for several hours after the arrival of the first wave.

Tsunamis can move faster than a person can run (in excess of 30 miles per hour on land).

It is not safe to drive a vehicle during a tsunami, since even a foot of water can move a vehicle, causing it to be swept away and drowning the occupants.

Sometimes a tsunami causes the water near the shoreline to recede exposing the ocean floor.

The force of some tsunamis is enormous. Large rocks weighing several tons along with boats and other debris can be moved inland hundreds of feet by tsunami wave activity. Homes and other buildings can be destroyed. Trees can be uprooted. All this material and water moves with great force killing and injuring people.

Tsunamis generated in distant locations (teletsunamis) will generally give people enough time to move to higher ground, provided they heed warnings to evacuate.

For locally-generated tsunamis, where you might feel the ground shake, you may only minutes to move to higher ground. The earthquake may be your only warning followed by the first wave.

If you are at the beach or near the ocean and you feel the earth shake, move immediately to higher ground, DO NOT wait for a tsunami warning to be announced. Do not stop and gather your belongs.

Stay away from rivers and streams that lead to the ocean if you feel a strong earthquake or if there is a tsunami threat or warning.

A regional tsunami from a local earthquake could strike some areas before a tsunami warning can be announced by public officials.

If you are in a boat on the Klamath River, immediately go to shore and get to high ground (over 100+ feet above sea level). Damaging wave activity, unpredictable currents, debris filled surges and receding waters in the river may cause you and your boat to overturn into the river and/or swept out to sea.

Boaters are advised to wear a life jacket at all times.

If you find yourself swept into the river or ocean, your best chance of survival is to climb onto a log or other floating debris until you can get safely out of the water.

If you are at home or work and hear that there is a tsunami warning, you should

- Make sure your entire family and/or co-workers are aware of the warning.
- Evacuate your house or workplace if you live or work in a tsunami evacuation zone and proceed to high ground immediately.
- Move in an orderly, calm and safe manner to a designated evacuation site or to any safe place outside the evacuation zone (100+ feet above sea level or 2 miles inland away from the river and its tributaries).

Follow the advice of local emergency and law enforcement authorities.

Ensure that your family and co-workers know in advance how and where to evacuate in the event of a tsunami warning and evacuation. It may not be possible to telephone them during the emergency.

Other areas along the coast-line may pose a threat during a tsunami. Several areas along US Highway 101 to the north and south of Klamath are within a 100 feet of sea level and could be unsafe during a tsunami.

After a tsunami warning is issued, residents in Crescent City and Orick will be evacuating to safe zones. An influx of people evacuating from Klamath will only exasperate the evacuation of these communities.

During an actual tsunami warning, the California Highway Patrol will shut down US Highway 101 to travelers to the North and South of Klamath. It may be several hours before an all clear is issued and you will again be allowed to travel along US Highway 101.

During a tsunami warning or event, telephone and cell phone communication lines will quickly be overwhelmed shutting down local telephone communication.

Select someone outside of the area as a family contact person. Often, outside telephone lines are the only communication lines accessible when local telephone lines become jammed.

Never go down to the shoreline or river banks to observe a tsunami or to photograph or film a tsunami. Make sure you stay at least 100+ feet above sea level at all times.

Do not go back into a tsunami inundation area until an all-clear is issued by public emergency officials.

It may be several hours, or even days, before an all clear is issued by public emergency officials to return to impacted areas due to the devastating effects of the tsunami and earthquake on infrastructure, such as, utilities, roads and bridges.

General Information

Tsunami Mitigation Planning

Equipped with safety information, and with the possibility of warning time from tsunami monitoring systems, the next step in preparedness is emergency response planning at local, regional and national levels – called tsunami mitigation. The need to increase emergency preparedness planning, awareness campaigns and education, and the development of the operational capabilities to act in an emergency are essential to truly becoming prepared.

Tsunami warnings need to be accompanied by highly effective communication channels if they are to reach the people they are supposed to save. Once people get the message, they need to know where danger zones are, and where they will be safe. It is the responsibility of governments to ensure that emergency services and plans are in place. The media, as well as schools, local authorities, community groups and businesses can all play key roles in disseminating disaster response information.

Planning for tsunamis

- ✓ Establishing a culture of prevention: natural disasters cannot be eradicated, but their impact can be reduced.
- ✓ Promoting effective measures against disasters, and incorporating disaster reduction into government initiatives.
- ✓ Investing in disaster reduction.
- ✓ Information as a key to reducing the damage of disasters.
- ✓ Passing on experiences to the next generation to improve disaster reduction capability.
- ✓ Strengthening partnerships.
- ✓ Building a network and strengthening cooperation.

What is a tsunami?

A tsunami is a series of ocean waves, or surges of incoming water, which are sometimes generated at the same time as an earthquake occurring beneath the sea floor. Tsunami waves may be spaced minutes or hours apart as they hit the shoreline. The first waves are almost never the largest. Damage from a tsunami can last over eight hours.

A tsunami is not a tidal wave. A tsunami has nothing to do with tides, or the weather, and tsunami surges can act quite differently from ordinary waves.

What causes a tsunami?

Tsunamis may be generated from all of the following sources:

- Earthquakes
- Volcanic Eruptions
- Landslides
- Meteor Impacts

A tsunami can be generated by ANY disturbance that displaces a large water mass from its equilibrium position. Submarine landslides, which often occur during a large earthquake, can also create a tsunami. During a submarine landslide, the equilibrium sea level is altered by sediment moving along the sea floor. A violent marine volcanic eruption can create a force that displaces a water column and generates a tsunami. Above water landslides and space born objects can disturb the water from above the surface. The falling debris displaces the water from its equilibrium position and produces a tsunami. Unlike ocean-wide tsunamis caused by some earthquakes, tsunamis generated by non-seismic mechanisms usually dissipate quickly and rarely affect coastlines far from the source area.

What areas may be impacted by a tsunami?

Tsunamis may hit along coastlines, lakes and inland seas. Large tsunamis may cause a tidal bore to travel for miles up large river channels and tributaries. Extensive flooding and high velocity water surges may occur in coastal areas and along the Lower Klamath River and its tributaries. During periods of high water, such as during heavy rain events or high tides, the impacts of a coastal tsunami and tidal bore may be much greater than the impacts expected during more average tides or river levels. Due to these many variables, it is difficult to predict the extent of impact that would occur from a mega-tsunami striking the Klamath area.

How many waves are there in a tsunami?

A tsunami generally consists of a series of waves, often referred to as the tsunami wave train. The amount of time between successive waves, known as the wave period, is only a few minutes; in some instances, waves are over an hour apart and can last for several hours. Many people have lost their lives after

returning to home or work in between the waves of a tsunami, thinking that the waves had stopped and danger has passed. It is important to remain in a safe zone, outside of potential run-up areas, until an all clear has been issued.

Anatomy of a tsunami

In deep water, the wave height is no more than a few feet and may be scarcely noticed, even when the tsunami passes under a boat in the open sea. Successive wave crescents may be hundreds of miles apart.

In the open sea, waves can travel at the speeds in excess of 500 miles per hour. As the seashore shallows, the tsunami slows down, causing the water to build up in height. Waves then begin to bunch together. When the tsunami hits the coastline, it slows down to approximately 20-35 miles per hour.

A tsunami generated by an earthquake may reach 25 feet or higher. A tsunami generated by the impact of a meteor, volcanic eruption or landslide can generate a much greater wave height. A rockslide into Vaiont Reservoir, Italy, created a tsunami that killed 3,000 people. In 1958, a landslide-generated tsunami in Lituya Bay, Alaska produced a 525 meter (1722 ft) wave.

A tsunami has a longer wave length and higher wave speed than a storm wave. The water from a tsunami wave has more momentum and penetrates further onto shore. Subsequently, a 15-foot tsunami will cause more damage than a 25 foot storm wave.

As a tsunami leaves the deep water of the open sea and moves into more shallow waters near the coast, it undergoes a transformation. Since the speed of the tsunami is related to the water depth, as the depth of the water decreases, the speed of the tsunami diminishes. The change of total energy of the tsunami remains constant. Therefore, the speed of the tsunami decreases as it enters shallower water and the height of the wave grows. Because of this "shoaling" effect, a tsunami that was unnoticeable in deep water may grow to several feet or more when it reaches the shore.

When a tsunami finally reaches the shore, it may appear as a rapidly rising or falling tide, a series of breaking waves, or even a bore. Reefs, bays, entrances to rivers, undersea features and the slope of the beach all help to modify the tsunami as it approaches the shore. Tsunamis rarely become great, towering breaking waves. Sometimes the tsunami may break far offshore. Or it may form into a bore: a step-like wave with a steep breaking front. A bore can happen if the tsunami moves from deep water into a shallow bay or river. The water level on shore can rise many feet. In extreme cases, water level can rise to more than 50 feet (15 m) for tsunamis of distant origin and over 100 feet (30 m) for tsunami generated near the earthquake's epicenter. The first wave may not be the

largest in the series of waves. One coastal area may see no damaging wave activity while in another area destructive waves can be large and violent.

The flooding can extend inland by 1000 feet (305 m) or more, covering large expanses of land with water and debris. Tsunamis may reach a maximum vertical height onshore above sea level, called a run-up height, of 30 meters (98 ft). Flooding from tsunami waves can carry loose objects, animals and people out to sea when waves retreat. When subsequent waves come in they carry back in dangerous debris flows.

How do tsunamis cause damage?

Tsunamis can cause damage by:

- Creating water surges capable of drowning people and animals
- Creating debris flows
- Bashing buildings and people with debris
- Lifting buildings off their foundations
- Starting fires by damaging propane, gas and electrical lines
- Causing flooding along the coastline, the river and its tributaries
- Depositing sand and debris
- Creating scours and erosion as the waters recede

What is run-up and inundation?

When a tsunami approaches a coastline, the wave begins to slow down and increase in height, depending on the topography of the sea floor. Often the first signs of a tsunami are a receding water level caused by the trough of the wave. In some instances though, a small rise in the water level just before the recession is observed. Regardless, the incoming wave approaches much like the incoming tide though on a much faster scale. The maximum vertical height to which the water is observed with reference to sea level is called the *run-up*. The maximum horizontal distance that is reached by a tsunami is referred to as *inundation*.

What is a distant source tsunami?

An earthquake, or other tsunami-causing event that occurs several thousands of miles away in the Pacific Ocean, can create a distant source tsunami that can strike the North Coast of California. After a distant source earthquake, or other tsunami-causing event strikes, it may be several hours before a tsunami reaches the California coastline. Emergency responders must closely examine tsunami

bulletins issued by the NOAA West Coast & Alaska Tsunami Warning Center to determine projected arrivals times of the first wave and begin the evacuation process. NOAA tsunami warning bulletins can be found on-line at http://www.nws.noaa.gov or by tuning into a NOAA All Hazard Weather Radio for current broadcasts.

At 5:36 p.m. on March 27, 1964, a magnitude 8.6 earthquake struck 5 miles beneath Alaska's Prince William Sound releasing the energy of 12,000 Hiroshima atomic bombs. The earth rumbled for three minutes. Four and a half hours later, the tsunami reached the north coast of California, killing 12 individuals and causing millions of dollars in property damage. A 1960 magnitude 9.5 earthquake in Chile caused a tsunami that struck the north coast of California several hours after the initial earthquake.

What is a local source tsunami?

A local source tsunami is created by a tsunami-causing event that occurs off the North Coast of California. The most likely origin of a local source tsunami in the Klamath area is an earthquake occurring along the Cascadia Subduction Zone.

The Cascadia Subduction Zone, located 75 miles off of the Klamath coastline, is the largest earthquake fault in North America. An earthquake along the Cascadia Subduction Zone is capable of generating a tsunami of the scale and magnitude that caused the deaths of over 200,000 people during the 2004 Asian tsunami.

A tsunami generated by an earthquake along the Cascadia Subduction Zone or on other California North Coast faults will arrive at the coastline of Klamath just minutes after the initial earthquake shock. The lack of warning time and the potentially larger waves may result in higher causalities than if the tsunami were from a distant source. Increased public awareness and understanding of the tsunami hazard and adequate evacuation exercises are essential to saving lives during a local source tsunami.

In low lying areas along the coastline or near the Klamath River and its tributaries, strong ground shaking should be taken as a warning that a tsunami may be arriving within minutes.

Do not wait for a warning from officials or warning sirens. Individuals should immediately move to higher ground at least 100+ feet above sea level or at least two miles inland and away from the river or low-lying ground.

Do all earthquakes cause tsunamis?

Not all earthquakes will result in a tsunami occurring. Never the less, anyone who is near a low-lying coastal area or the Klamath River shore-line must immediately assume that a tsunami may have been generated. Proactive action must be taken immediately until the Pacific Tsunami Warning Center has ruled out a tsunami.

Subduction zone earthquakes often cause a vertical movement of the sea floor which can cause a tsunami. One plate is pulled by gravity beneath another plate. The plate on top is suppressed like a spring. An earthquake occurs and rapidly releases stored energy. Elastic rebound causes the compressed land to spring back. Deformation of the sea floor causes tsunami sea waves to travel out in all directions from the earthquake source.

What is the tsunami risk to Klamath?

Tsunamis are a low risk, high impact disaster. The Pacific Northwest states of Alaska, Washington, Oregon, and California are all vulnerable to tsunamis due to the Cascadia Subduction Zone that is located approximately 75 miles off the Klamath coastline.

Since 1900, tsunami events affecting the U.S. and its territories have been responsible for 470 fatalities and hundreds of millions of dollars in property damage. Twelve of those deaths occurred in Del Norte County, California and one death occurred in Klamath, California.

On March 27, 1964 a devastating tsunami struck Del Norte County. The tsunami was caused by an 8.6 earthquake off the Alaskan coastline. One death occurred in Klamath. Two men were eeling during the night at the mouth of the Klamath River. Their only warning of the impending tsunami was a loud roar they heard just before the first debris filled surge of water knocked them into the Klamath River. The men were carried several miles up the Klamath River clinging to debris. As the water receded, one man managed to swim to shore near the Requa Resort. The other man was swept out to sea and drowned.

Northern California – Locally Generated Tsunami Events

Date	*Earthquake Magnitude*	*Maximum Water Height*	*Number of Run-ups*
1700, January 27	8.7 to 9.2		43
1854, October 4		.03	1
1856, February 15	5.5	.60	1
1865, October 8	6.3		1
1868, October 21	6.8	4.50	4
1869, June 1			1
1873, November	6.7	3.00	1
1906, April 18	7.9	.10	2
1927, November 4	7.5	1.80	8
1989, October 18	6.9	.40	3
2005, June 15	7.2	.13	5

Source: NOAA – National Geophysical Data Center

How does a Tsunami Cause Damage?

Tsunamis have three main means of destruction – inundation, erosion and wave impact on structures. Inundation is the distance inland that a tsunami wave floods. The greater the inundation, the greater the destructive force of a tsunami is likely to be.

Strong tsunami-induced currents lead to the erosion of foundations and the collapse of bridges and seawalls. Flotation and drag forces rip houses apart and overturn vehicles and train carriages. Considerable damage is caused by floating debris, including boats and cars that become dangerous projectiles that can crash into buildings, break power lines and start fires. Fires from damaged ships in port, or ruptured oil storage tanks and refineries can cause destruction greater than that inflicted directly by the tsunami.

How does the Tsunami Warning System work?

Here is how the basic tsunami warning system works in the Pacific Northwest area. First, a key concept - there are two sources of tsunami for California coastal waters - a distant source and a local source.

A local source - If you feel violent shaking for several minutes, head for higher ground immediately. The earthquake is your warning. Do not wait for a warning from an official sources, such as, an announcement from a NOAA All-Hazard radio, a tsunami siren, public official, fire or law enforcement or friends and family members. The most likely source for a violent earthquake of this magnitude is the Cascadia Subduction Zone just off our coast. The last earthquake that resulted in a mega-tsunami was estimated to be 9.0 in magnitude on Jan 26, 1700, and was similar to the Dec 26, 2004 Sumatra 9.0 magnitude earthquake and subsequent Indian Ocean Basin tsunami.

Simulations show that the initial tsunami wave from the 1700 tsunami event reached the North Coast in 20 to 30 minutes - so time is limited. Geologic history showed waves with this event were as high as 30 feet. It is recommended that you climb to at least 100 feet above sea level to remain safe.

The earthquake may cause coastal areas to permanently subside as much as six feet, meaning the ground and roadways will likely be very uneven. After the earthquake, areas that were previously above sea level may be now under sea level. Since roadways and bridges may be cracked and broken away in areas, evacuation must be on foot. Another form of evacuation is vertical evacuation into a sturdy building of at least three stories. Evacuate by climbing to at least the third story. Expect that telephone and radio communications will be interrupted for long periods. Other area earthquake faults could produce strong violent quakes. Yet, the most likely source for a local tsunami is the Cascadia Subduction Zone off our coast.

A distant source (teletsunami) - The perimeter of the Pacific Ocean Basin, nicknamed the *Ring of Fire*, has a number of earthquake sources that can produce strong earthquakes of 7.0 magnitude or greater. During the 20th century, there have been three 9.0 magnitude or greater quakes, the last was the 1964 Alaskan earthquake of 9.2 magnitude that produced a tsunami throughout the Pacific Basin. These distant earthquakes permit a lead time of several hours before a resulting tsunami reaches the California coastline. Tsunamis from distant locations like Japan or Chile will take anywhere from six to eight hours to get to the North Coast of California. A tsunami from Alaska may take only three to six hours to reach the North Coast of California.

Tsunamis generated from either local or distant source tsunamis can penetrate several miles up coastal rivers, harbors and bays, but lose energy as they move further inland.

What is the difference between a Tsunami Watch and a Tsunami Warning?

A ***Tsunami Watch*** is automatically declared by the warning center for any earthquake having a magnitude of 7.5 or larger on the Richter scale (7.0 or larger in the Aleutian Islands) and located in an area where a tsunami can be generated. Notification of the local National Weather Service and state and county emergency management agencies begins immediately, followed by limited public announcements by the local media. Data from tidal gauge stations is awaited for confirmation of the actual existence of a tsunami.

Reports on wave activity from the tide-gauging stations nearest to the earthquake epicenter are requested by the warning center. If the stations report that there is no observed tsunami activity, the ***Tsunami Watch*** is cancelled. If the stations report that a tsunami has been generated, then a ***Tsunami Warning*** is issued for areas that may be impacted within the next hour. The public is then informed of the ensuing danger by the emergency broadcast system. Evacuation procedures are implemented, and sea going vessels are advised to head out to sea, where in deep waters they will not be affected by the tsunami.

What is a Tsunami Advisory?

A ***Tsunami Advisory*** is issued when any earthquake has occurred in the Pacific basin, which might generate a tsunami. The West Coast & Alaska Tsunami Warning Center and the Pacific Tsunami Warning Center will then begin issuing hourly bulletins advising of the situation.

Where can I find Tsunami Bulletins?

The numbered bulletins can be found on NOAA website.

1. Go to *NOAA.gov*
2. Click on *Current Watches and Warnings*
3. A map will appear, click on *Tsunami Warnings*

4. A numbered *Tsunami Bulletin* will appear indicating either an Advisory, Watch or Warning.
5. *Advisories* will be upgraded to *Watch* and then *Warning* or cancelled as additional information becomes more readily available.

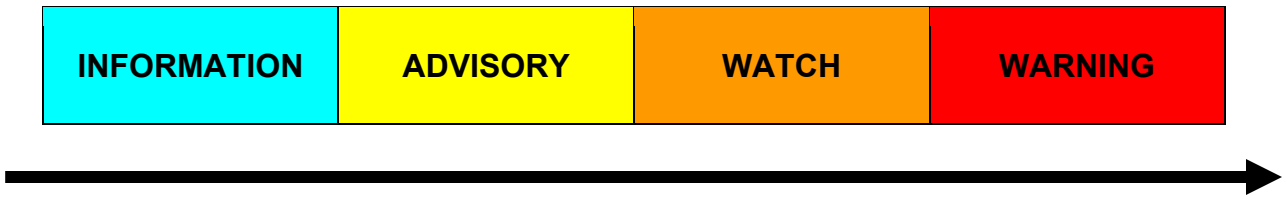
Tsunami Standard Operating Procedures

If a strong ground shaking occurs, then immediately get to high ground. Do not hesitate. There may be only minutes before the first wave arrives.

If the tsunami notice does not follow a large ground shaking, then the next step is to check with the National Weather Service to determine the Upon receipt of tsunami watches and warnings, coastal the National Weather Service (NWS) offices in Eureka will activate the Emergency Alert System (EAS) via NOAA Weather Radio. All broadcasters (TV, AM/FM radio, cable TV) receive the tsunami EAS message simultaneously as well as those with weather radio receivers in homes, tribal offices, businesses, schools, health care facilities, etc. NOAA Weather Radio also activates the All-Hazard Alert Broadcast (AHAB) units located in remote coastal areas, alerting people in those isolated locations.

Upon receipt of tsunami watch or warning messages, Del Norte County OES and Humboldt County OES emergency management officials can decide to activate the Emergency Alert System (EAS) to evacuate low-lying coastal areas in advance of the initial tsunami wave. Their EAS messages are also received by broadcasters, weather radio receivers and All Hazard Alert Broadcasts (AHABs) to help provide widespread dissemination of these messages.

The West Coast and Alaska Tsunami Warning Center (C/ATWC) and Pacific Tsunami Warning Center (PTWC) issues the following bulletins:



- **INFORMATION**: A message with information about an earthquake that is not expected to generate a tsunami. Usually only one bulletin is issued.
- **ADVISORY:** An earthquake has occurred in the Pacific basin, which might generate a tsunami. WC/ATWC and PTWC will issue hourly bulletins advising of the situation.

- **WATCH:** A tsunami was or may have been generated, but is at least two hours travel time to the area in watch status. Local officials should prepare for possible evacuation if their area is upgraded to a warning.
- **WARNING:** A tsunami was or may have been generated, which could cause damage; therefore, **people in the warned area are strongly advised to evacuate.**

NOAA Tsunami Warning Centers

A Tsunami Warning System has been put into place to help minimize loss of life and property. The NOAA West Coast/Alaska Tsunami Warning Center in Palmer, Alaska monitors for earthquakes and subsequent tsunami events. If a tsunami is generated, the West Coast/Alaska Tsunami Warning Center issues tsunami watches and warnings, as well as tsunami information bulletins for Alaska, British Columbia and Washington, Oregon and California.

The Pacific Tsunami Warning Center in Ewa Beach, Hawaii provides the same service for the Aloha state as well as all other American territories in the Pacific. They also serve as the International Tsunami Warning Center for 25 other member countries in the Pacific Ocean Basin.

The tsunami warning centers use earthquake information, tide gauges and now a new tool from NOAA - tsunami detection buoys, developed by NOAA's Pacific Marine Environmental Laboratory. Six of these buoys are now deployed in the north Pacific to help scientists determine whether a tsunami has been generated and is moving across the Pacific Ocean before reaching North American coastlines. Another duty of the tsunami warning centers is to help avoid any false alarms. More of these buoys would help detection as well as provide backup to each other since the buoys suffer outages in the harsh North Pacific Ocean.

Tsunami warnings

When the West Coast Tsunami Warning Center has determined that there is a potential or actual tsunami hazard, it informs emergency authorities in the threatened areas, as well as, representatives with local National Weather Service offices. Initial tsunami bulletins are issued within 10 minutes of a potentially tsunami-generating earthquake, based on the magnitude and location of the earthquake. The warning indicates that a tsunami may be imminent and the coasts in the warned area should prepare. Projected tsunami wave arrival times are estimated for key coastal cities. The closest cities to Klamath that are identified in the WCTWC bulletins are Crescent City to the north and Eureka to the south. The Klamath area can expect wave arrival times that are several minutes plus or minus these estimates.

After a tsunami has been monitored with sea level gauges and where possible with deep level sensors, and a more accurate picture of its threat and movements are obtained, a tsunami warning will either be cancelled, restricted or expanded in subsequent bulletins. A tsunami watch is an alert that is issued to areas outside the warned area. The size of the watch area is based on the magnitude of the earthquake and tsunami travel times. A watch can either be upgraded to a warning in subsequent bulletins, or cancelled. Both tsunami

warnings and watches include estimated wave arrival times for key coastal locations in the warned or watch area.

Getting the message across

The story is different in many Pacific Ocean rim countries that have experienced destructive tsunamis regularly down the years. In Japan – one of the most frequently struck countries – earthquake warnings are broadcast on television within 30 seconds of a tremor and tsunami warnings follow very rapidly.

In the Pacific, a number of countries have developed Standard Operating Procedures (SOP) that include tsunami evacuation procedures that emergency services and the public know how to follow when a warning is received. If available, sirens are activated and radio and television announcements warn residents. In Hawaii, which has also been hit hard by tsunamis, authorities hold annual evacuation and training drills and public awareness events. In Hawaii, tsunami evacuation maps are printed on the front of the local telephone directory, showing people what areas are threatened by tsunami flooding and what evacuation routes to follow to move inland to higher ground. In the event of a nearby tsunami that arrives too soon for a warning, people are well versed through continuing public education on what to do with the time available. Still, the challenge remains to sustain the high levels of awareness and preparedness forever, both for local tsunamis that strike within minutes and require everyone to recognize natural warning signs and immediately respond, and for distant tsunamis that will not be felt and take hours to arrive, but for which warning centers have time to issue warnings to enable coastline evacuations.

In 1996 NOAA, FEMA and the US Geological Survey developed a Tsunami Hazard Mitigation Implementation Plan for Alaska, California, Hawaii, Oregon and Washington. It identified four primary issues for the US National Tsunami Hazard Mitigation Program that ought to be of concern to high-risk states. The needs to:

- Quickly confirm potentially destructive tsunamis and reduce false alarms.
- Address local tsunami mitigation and the needs of coastal residents.
- Improve coordination and exchange of information to better utilize existing resources.
- Sustain support at state and local level for long-term tsunami hazard. It made four recommendations that were considered essential to the development of effective plans prove the awareness and preparedness of communities for tsunamis.
- Raise the awareness of affected populations.
- Supply tsunami evacuation maps.

- □ Improve tsunami warning systems.
- □ Incorporate tsunami planning into state and federal all-hazards mitigation program.

Klamath Tsunami Warnings

Tsunami warnings to the Klamath area will be accomplished through a variety of means:

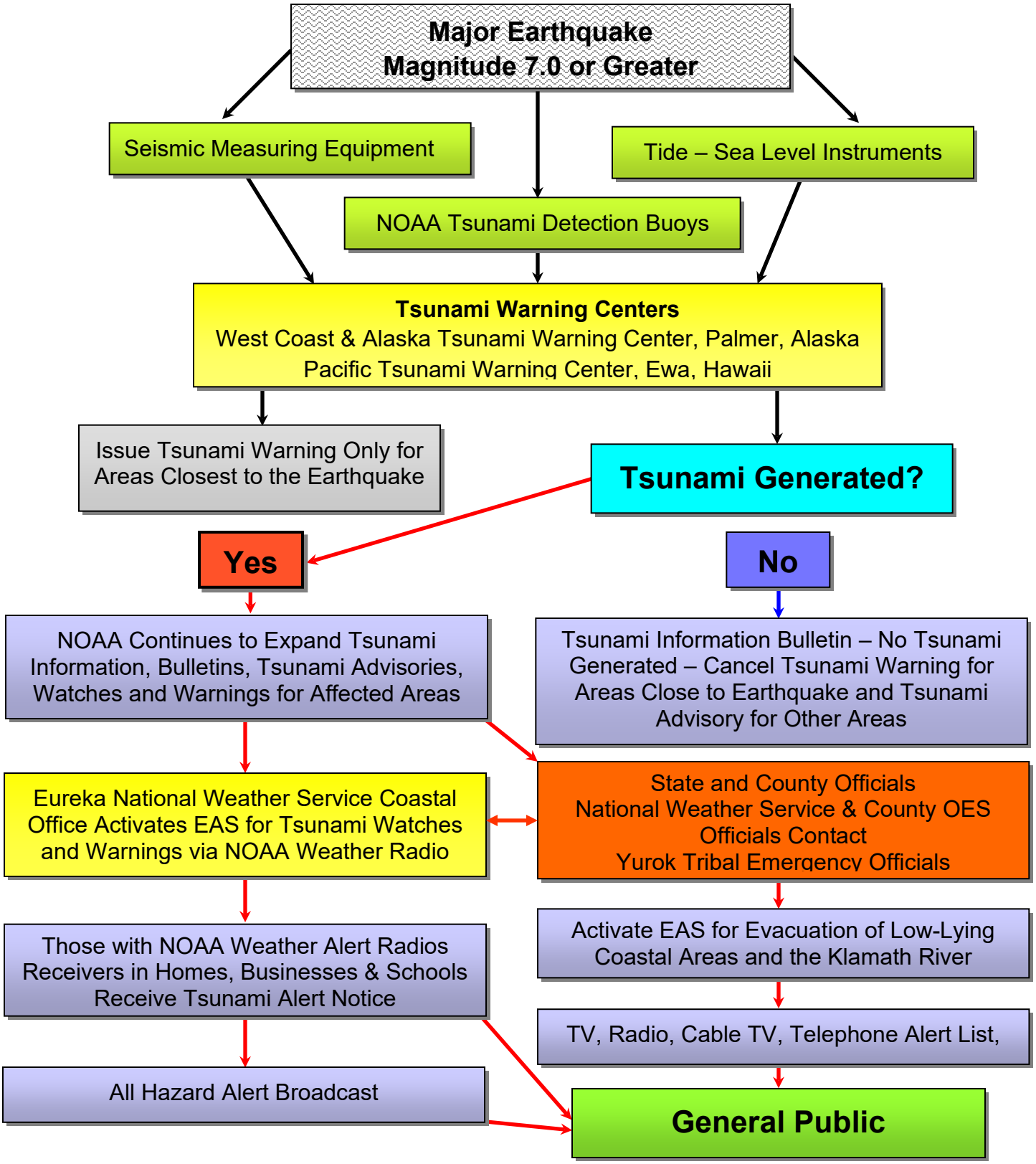
Non-Local Tsunami

- Those with NOAA weather alert radios receivers in homes, businesses and schools should receive a Tsunami alert notice on their radios.
- Tsunami Warning Sirens located at the Requa Resort, Klamath town site and Klamath Glen will be activated via NOAA radio alert.
- Public media radio and television announcements.
- The National Weather Service office in Eureka will attempt to contact the Yurok Office of Emergency Services and Yurok Public Safety through emergency numbers provided to them.
- Yurok Public Safety, Yurok Office of Emergency Services, Del Norte County Sheriff's Department and Klamath Volunteer Fire Department dissemination of warnings to the community and area businesses.

Local Tsunami

Strong ground shaking may be the only warning that a tsunami may be arriving within minutes. All individuals must get to high ground (over 100 feet) immediately. Do not expect to receive any other warnings before the first wave arrives.

A Tsunami Warning Flow Chart



Thunder wants people to have enough to eat. He thinks they will if prairies can be made into ocean. He asks Earthquake for help. Earthquake runs about land, land sinks, and prairies become ocean teeming with salmon, seals, and whales. – Ann of Espeu

Local Tsunami Procedures

In the event that a local off-shore earthquake precipitates a tsunami threat, the procedures outlines in this document are likely to be accelerated to the **Tsunami Warning stage immediately**, with the expected tsunami arrival time estimated to be in 5 to 30 minutes. Officials may not have time to activate or provide adequate warning. Under these circumstances, the local earthquake is the warning sign and staff and citizens should immediately move to high ground. It is anticipated that damage to roadways, bridges, buildings and infrastructure from a large scale earthquake may be significant. There may be multiple injuries and causalities.

If you feel a strong ground shaking earthquake along the coast:

- □ Protect yourself from the earthquake until it is over.
- □ Then quickly move inland and to higher ground.
- □ Go on foot if at all possible.
- □ Do not wait for official warning.
- □ Do not pack or delay.
- □ Do not return to the shore, river or tributaries.
- □ A tsunami may be coming in a matter of minutes.
- □ Additional waves may continue for several hours.
- □ Wait for an “All Clear” from local officials before returning to low-lying areas.

Distant Earthquake Procedures

In the event of a tsunami created by distant earthquake, up to several hours of advance notice may be available. The West Coast Tsunami Warning Center will contact the California State Office of Emergency Services (State OES) who will in turn contact both Del Norte County and Humboldt County Office of Emergency Services. Contact to the Yurok Public Safety and Yurok Office of Emergency services should come through Del Norte County Sheriff’s Department.

Tsunami Watch Procedures

Upon receipt of a **Tsunami Watch** alert, the Yurok Director of Emergency Services will place Klamath under an increased readiness alert status. Tsunami Bulletins will be monitored every fifteen minutes for predicted wave arrival time and changes in the emergency status.

- □ Monitor NOAA Tsunami Bulletins at NOAA.gov at 15 minute intervals
- □ Monitor All Hazard Radio Alerts
- □ Place all Department Directors on tsunami watch/warning alert.
- □ Begin planning preparations incase Tsunami Watch is upgraded to Tsunami Warning level.
- □ Review Klamath Tsunami Readiness Plan and Inundation and Evacuation Map.

Tsunami Warning Procedures

If a Tsunami Watch is upgraded to a **Tsunami Warning**, evacuation decisions will be made by the Chief of Public Safety/Director of Emergency Services, then public warning notifications shall begin in accordance with the Klamath Tsunami Readiness Plan.

Tsunami Warning Checklist

- □ One long continuous siren blast to alert the public to tune to local radio stations for specific warning information;
- □ Local radio station announcements;
- □ Public address announcements via police and fire vehicles patrolling threatened areas;
- □ Door to door notifications where possible and practical;
- □ Door to door notifications for Special Needs Persons;
- □ Send Public Safety Officer to Margaret Keating Elementary School, Klamath Headstart & Childcare, and Klamath Early College of the Redwoods to:
    - Alert school official of the Tsunami Warning and expected arrival time;
    - Advise school to cancel all field trips to river or coastal areas;
    - Advise school to follow all evacuation and emergency plans;
    - Advise school to monitor emergency radio alerts;
    - Provide assistance as needed to safeguard children and staff

- □ Contact employees who are scheduled to travel to work assignments along coastal routes, such as S.R. 101, and advise them to stay inland and on higher ground.

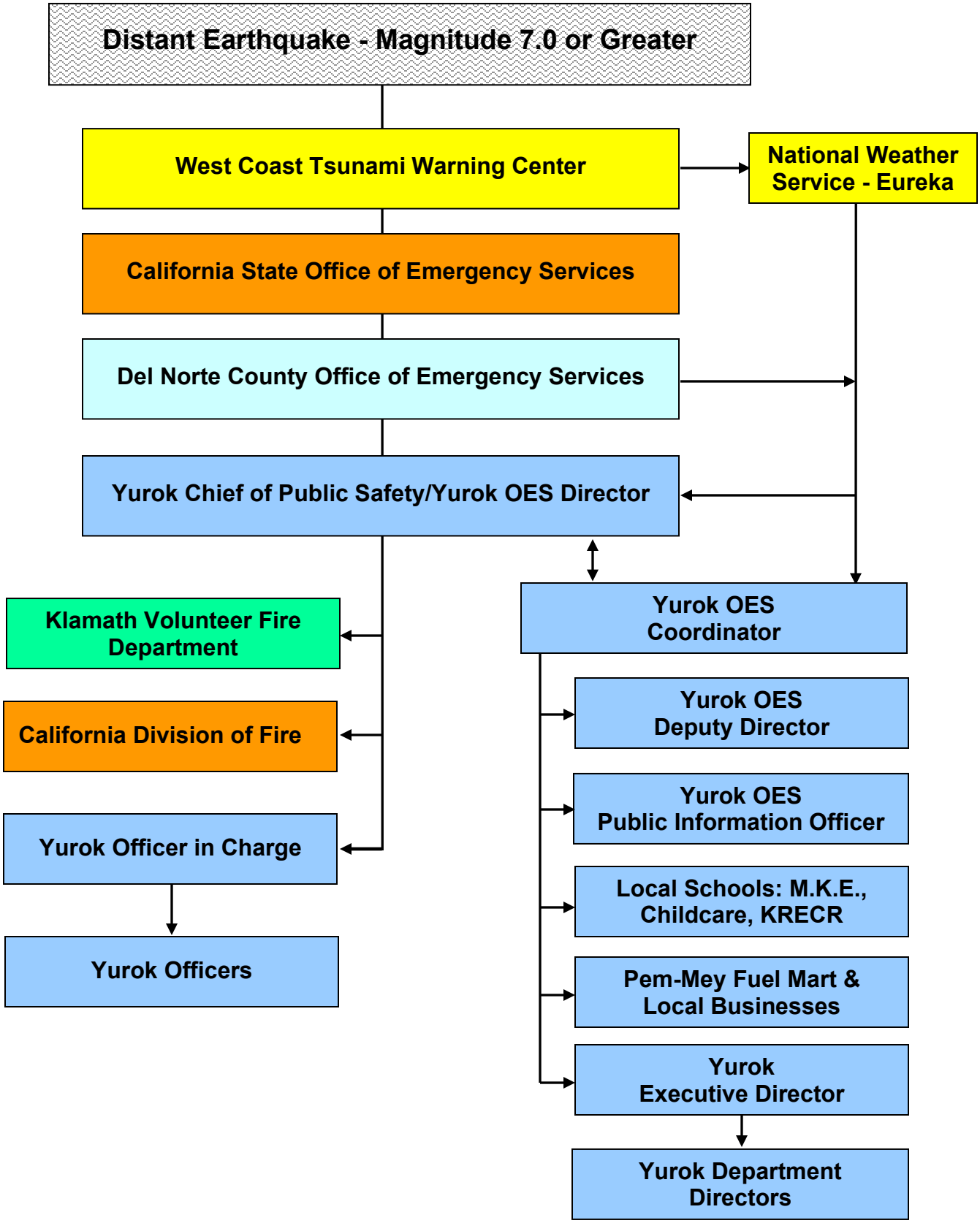
- □ Contact employees who may have assignments on the Klamath River and its tributaries and advise them to stay away from coastal areas, the Klamath River and tributaries.
- □ Move tribal equipment, boats and vehicles to high ground.
- □ Release non-essential employees. Advise employees against traveling along coastal roadways, such as S.R. 101, within 60 minutes of expected arrival time of first wave.
- □ Engage CERT and other volunteers to contact area businesses;
- □ Notify fisherman and tourists on the river and in local campgrounds of the Tsunami Warning.
- □ Thirty (30) minutes before the arrival time of the first wave, emergency responders will evacuate emergency personnel, vehicles and boats to:

    - United Methodist Church parking lot
      126 Redwood Drive, Klamath.

Example Script of Announcements

This is a Tsunami Warning Announcement.
You must evacuate inland and to higher ground immediately.
Do not go near coastal areas or the Klamath River or its tributaries.
Tune to your local radio station for more information.
Check with neighbors to identify those who cannot evacuate themselves.
Hang a sheet outside a front window to identify those who need help.
This is a Tsunami Warning Announcement.

Distant Earthquake Contact List



INSERT EVACUATION MAP

Department Actions Upon Receipt of a "Tsunami Warning" Alert

Yurok Office of Emergency Services

Yurok Director of Emergency Services (Chief of Public Safety)

- □ Director of Emergency Services (Chief of Public Safety) will make an assessment of the situation based upon the estimated time of arrival of the tsunami, the anticipated severity of the situation, and the evacuation tasks at hand.

- □ Make public evacuation decisions.

- □ Immediately notify the following persons and or agencies of the *Tsunami Warning* alert and begin plans for the staging of resources, public notification and evacuation:
  - Yurok OES Coordinator
  - Yurok Officer in Charge (OIC)
  - California Division of Fire (Klamath Station)
  - Klamath Volunteer Fire Department

- □ Initiate the Incident Command System (ICS) if the situation.
- □ Notify the Tribal Council if an Emergency Declaration is required.

Yurok OES Coordinator

- □ Immediately notify:
  - Yurok OES Deputy Director
  - Yurok Executive Director & Deputy Director
  - Yurok Chairperson
  - Local Schools
    - □ Margaret Keating Elementary Schools
    - □ Klamath Early College of the Redwoods
    - □ Klamath Headstart
  - Pem-Mey Fuel Mart
  - Yurok Indian Housing Authority

- □ Immediately begin monitoring NOAA bulletins and provide updates at least once every fifteen minutes to the Director of Emergency Services.

Yurok Public Information Officer

- □ Prepare written public announcements.
- □ Coordinate the printing and dissemination of public announcements, including a statement of the nature of the emergency, evacuation instructions, and safe zones, procedures for the safety of pets and animals, and instructions for special needs persons.
- □ Establish a Tsunami Hot-Line with pre-recorded information to callers.
- □ Select an individual to be the **Official Recorder** of the event. The Official Recorder will be staged at the Requa Hill Look-Out in Redwood National Park to record the arrival time of the first wave and to video record the initial wave impact and subsequent waves. Under no circumstances will the Official Recorder be allowed to go into affected areas until after an all-clear has been issued.

Yurok Public Safety

Yurok Chief of Public Safety

- □ Immediately recall all department personnel, advising them of the alert received and requiring that they report for duty to the _____.
- □ Instruct Yurok Public Safety personnel to assemble key department assets for evacuation to _____.
    - **Key Assets Evacuation List**:
        - Laptop Computers
        - External Hard Drives & Computer Back-ups
        - Evidence Boxes & Logs
        - Firearms
        - Ammunition
        - Case Files
        - Rescue Boats
        - Police Vehicles & Quads
        - Generators
- □ Coordinate notification and evacuation of:
        - Coastal Areas
        - Boaters on the Klamath River
        - Tourists and Fishermen at the mouth of the Klamath River

- Campgrounds, Trailer Parks & Residences along the Klamath River.
- Special Needs Persons
- Klamath Town Site Businesses

- □ Coordinate Public Address announcements via police and fire vehicles patrolling threat areas.
- □ Coordinate other Door-to-Door notifications where possible and practical.
- □ Recall all officers, fire personnel and others employed in the field at least 30 minutes prior to the expected tsunami arrival time.
- □ Establish road blocks at least 30 minutes before the expected arrival time of the first tsunami wave at the following locations:

Yurok Administration Department

Executive Director

- □ The Yurok Executive Director shall contact Department Directors and ensure that all departments are properly advised of the estimated time of arrival of the first tsunami wave, the anticipated severity of the situation, and the need to evacuate all staff within the potentially affected areas.
- □ Initiate a roll-call of all employees within each department to account for all employees.
- □ Advise all employees who may be working along the Klamath River, tributaries, streams, coastal areas or other affected will to relocate to a safe area.
- □ Instruct all department personnel, to assemble key department assets for evacuation to safe areas:

    - **Key Asset Evacuation List:**
        - □ Server
        - □ Laptops
        - □ External Hard Drives & Backups
        - □ Vehicles
        - □ Boats
        - □ Archival Items

- □ Release all non-essential employees, not required to assist in the Incident Command from work duty, no later than three (3) hours before the estimated arrival time of the first wave. Released employees are to be advised regarding the danger of traveling along coastal routes and other areas that will be evacuating, such as Orick and Crescent City.

- If the arrival of the first wave is expected to occur outside of normal work hours, employees should be advised against traveling to the Klamath area.

Yurok Council Support

- Chairperson shall notify other Council Members of the emergency.