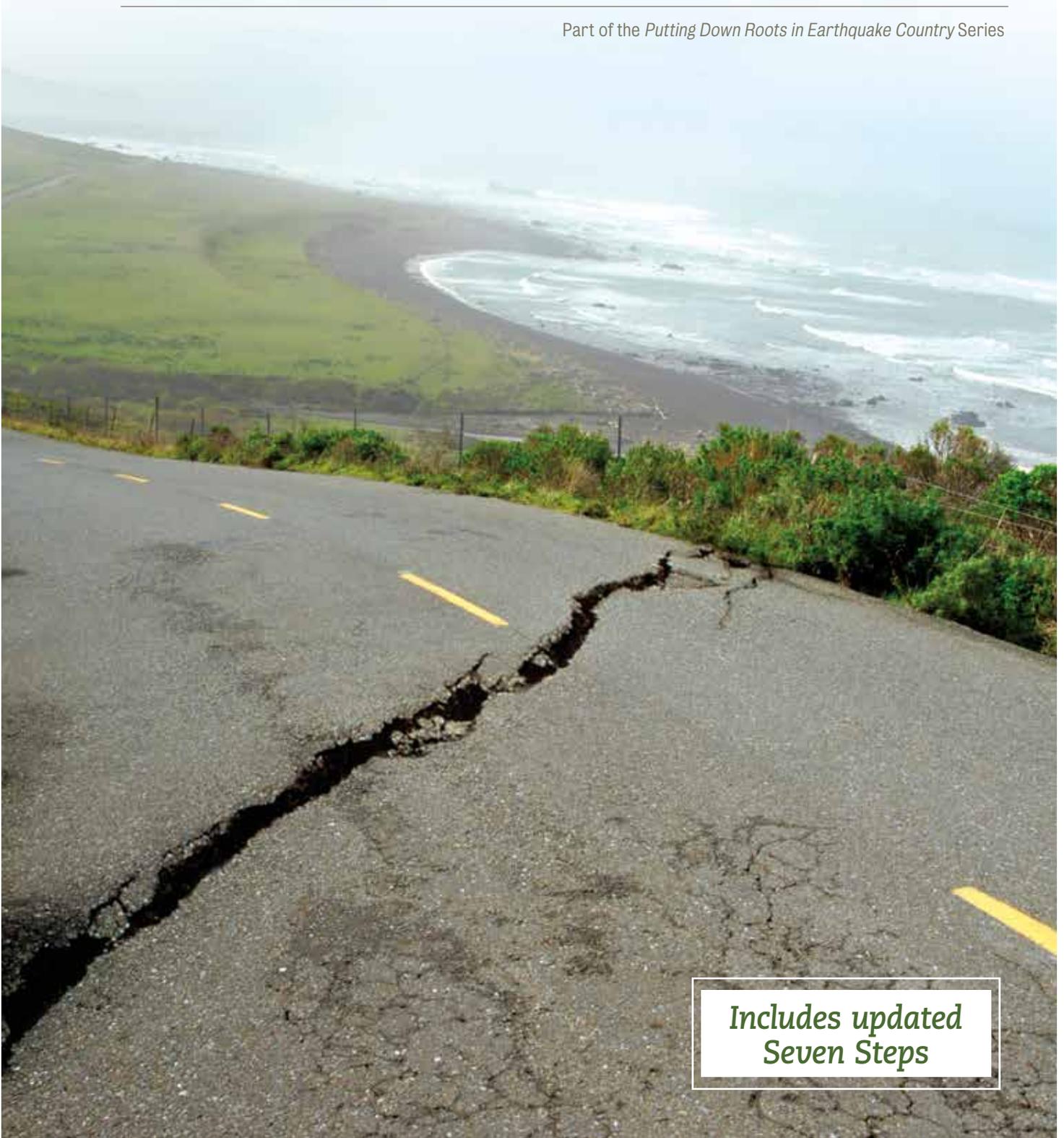


Living on

# SHAKY GROUND

HOW TO SURVIVE EARTHQUAKES AND TSUNAMIS IN NORTHERN CALIFORNIA

Part of the *Putting Down Roots in Earthquake Country* Series



*Includes updated  
Seven Steps*

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Prepared by the Humboldt Earthquake Education Center and the Redwood Coast Tsunami Work Group (RCTWG), in cooperation with the California Earthquake Authority (CEA), California Office of Emergency Services (Cal OES), Federal Emergency Management Agency (FEMA), California Geological Survey (CGS), Department of Interior United States Geological Survey (USGS), National Oceanographic and Atmospheric Administration (NOAA) National Weather Service, with contributions from many members of the Redwood Coast Tsunami Work Group. The Redwood Coast Tsunami Work Group is a member of the Earthquake Country Alliance, a statewide "alliance of alliances" linking the public information efforts of organizations and individuals that provide earthquake information and services in California.

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Special thanks to the Southern California Earthquake Center and members of the 1906 Earthquake Centennial Alliance for the Seven Steps to Earthquake Safety and additional materials adapted from the *Putting Down Roots in Earthquake Country* series.

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<sup>1</sup> Courtesy of the National Information Service for Earthquake Engineering, EERC, University of California, Berkeley

<sup>2</sup> Evacuation map based on relative hazard maps by Jay Patton and Lori Dengler

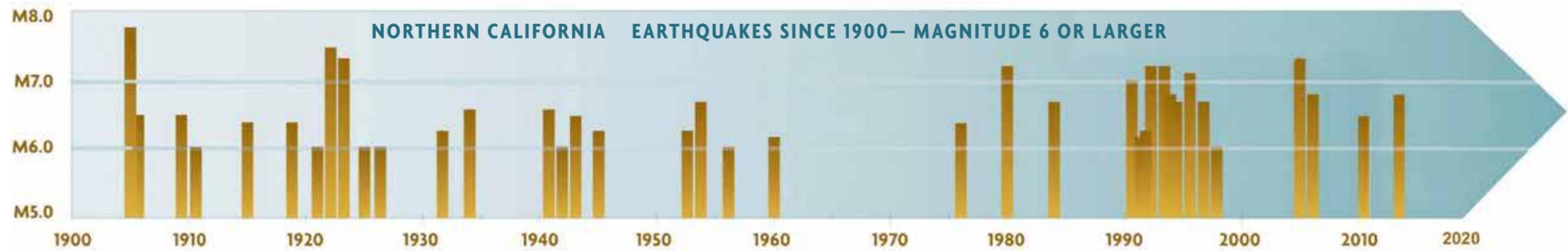
**Dedication** To the memory of Kathleen Sullivan Fairchild whose work promoting earthquake and tsunami preparedness has made North Coast Californians safer.

# You Can Prepare for the Next Quake or Tsunami

SOME PEOPLE THINK it is not worth preparing for an earthquake or a tsunami because whether you survive or not is up to chance. NOT SO! Most Northern California buildings will survive even a large earthquake, and so will you, especially if you follow the simple guidelines in this handbook and start preparing today. If you know how to recognize the warning signs of a tsunami and understand what to do, you will survive that too—but you need to know what to do ahead of time!

This handbook will help you prepare for earthquakes and tsunamis in Northern California. It explains how you can prepare for, survive, and recover from them. It also describes what you can do today to save lives, reduce injuries, and minimize damage.

Government agencies and other emergency organizations cannot protect you from the next earthquake or tsunami. Even under the best of circumstances, medical aid or fire and law enforcement officials may not be able to reach you for many hours, or even days. It is our responsibility as individuals, neighborhoods and communities to reduce risks, to prepare for the critical period immediately after the earthquake, and to make sure that planning for earthquakes and tsunamis has the high priority it deserves. By becoming informed, we can take actions to protect ourselves, reduce losses, and recover quickly.



Earthquakes of magnitude (M) 6 and larger since 1900 located in California north of Santa Rosa and in the adjacent off-shore area.



## What do I do?

### DURING AN EARTHQUAKE YOU SHOULD:

**If you are indoors, DROP** and take **COVER** under a sturdy table or other furniture. **HOLD ON** to it and stay put until the shaking stops.

**Stay clear of items that can fall and injure you**, such as windows, fireplaces and heavy furniture.

**Stay inside.** You may be injured by breaking glass and falling objects if you run outside.

**If you are at the coast, walk to higher ground** away from the ocean as soon as it is safe for you to move.

**If you are driving, move your car** as far out of the normal traffic pattern as possible **and stop** if it is safe. Stay away from structures or objects that could fall on you, such as bridges, overpasses, light posts, power lines or trees. Stay inside your car.

**If you are in the mountains**, or near unstable slopes, **be alert for falling rocks, trees, or landslides** that could be loosened by the earthquake.



### AFTER AN EARTHQUAKE YOU SHOULD:

**EVACUATE if you are in a TSUNAMI HAZARD ZONE.** Walk inland or to higher ground as soon as it is safe to do so. Do not wait for official notification. Stay away from the coast until officials permit you to return.

**Check for injuries.** Do not move seriously-injured persons unless they are in immediate danger.

**Check for hazards** such as fires, gas leaks, downed utility lines and fallen objects.

**Clean up** any potentially harmful material spills.

**Expect aftershocks.** Aftershocks following large earthquakes can be large and damaging.

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# Answer These Questions Before a Disaster

During an emergency you'll need immediate answers to many questions. Here are some questions you should answer long before a disaster strikes.

## Where will my family be and how will I reach them?

- Make sure your family disaster plan includes:
  - Children who may be away at school, day care, or at other activities.
  - Planning for pets or livestock if you are away from home.
  - An out-of-the area contact to convey information to other friends and family members.
- Discuss your safety and emergency plans with everyone in your family.

*Remember—Phone systems, such as land-based and cell phones, and Internet communications may be disrupted, or overwhelmed almost immediately. The road system may also be damaged making it difficult or impossible to travel.*

## Where will I get medical help?

- Take first aid and CPR classes to help you respond to medical emergencies.
- Plan for back-up power if members of your family require electricity for life-saving medical equipment.

*Remember—The 9-1-1 system will likely be overloaded or completely down, ambulances and emergency vehicles will be overwhelmed or have limited access and some medical facilities may not be operational.*

## Am I prepared to live without the essentials?

- Store water at home, work and in your car because drinking water will be in short supply.
- Keep at least one week's worth of food and medicine on hand for everyone in your family.
- Fill up your gas tank frequently and keep it at least half full because gasoline will be scarce.

*Remember—Utilities and water supplies may be disrupted for weeks.*

## How will I pay for things?

- Keep cash on hand because banks may be closed and credit cards unusable.

*Remember—ATMs are likely to be out of order.*

## How will I repair the damage to my home?

- Examine what your insurance covers and consider earthquake and/or flood insurance.
- Minimize losses by taking action to reduce your hazards.

*Remember—Construction materials and labor for repairs will be limited and costs may increase.*

## Do I live, work or visit in a tsunami hazard zone?

- If you are in a hazard area, determine your evacuation routes beforehand—you may have as little as ten minutes to reach a safe zone on foot after feeling an earthquake.
- If you are in a safe area, stay put. You will not have to evacuate.

*Remember—there will be no time for an official tsunami warning to reach you if the source of the tsunami is nearby.*

Follow the Seven Steps to Earthquake & Tsunami Safety for more information to help you to answer these questions—see pages 18 to 31.

### SUPPLIES FOR SEVEN DAYS

The California Office of Emergency Services recommends that you store enough food and water to survive on your own for a minimum of five days. In rural areas of Northern California, it may take longer for assistance to reach you—plan to be on your own for a week or longer.

# Who's Going to Save You?

WHO CAN YOU RELY ON to help you after a disaster? Who will provide you with food, water, shelter and medical care? You might be surprised by the answer: **you and your neighbors!**

A major earthquake or tsunami will likely overwhelm local law enforcement, fire, and emergency medical personnel and resources. In fact, it may take local, state and federal

agencies a week or more to provide the most basic relief. This is particularly true in the many remote locations on the North Coast and in the mountains of Northern California.

Start getting prepared today by identifying and mitigating hazards, readying supplies, and developing an emergency plan may make all the difference during a disaster.

## PREPARING FOR EARTHQUAKES AND TSUNAMIS WILL PREPARE YOU FOR ALL DISASTERS INCLUDING FIRE, WINTER STORMS, AND FLOODS



# You Live in Earthquake Country

NORTHERN CALIFORNIA IS one of the most beautiful places in the United States to live with its high mountains, rugged coast and dramatic vistas. The geologic forces that have made it a spectacular place to live also make it one of the most earthquake-prone spots in the continental United States. Forces deep within the earth have folded and broken great slabs of the earth's outer surface to create the Coast Ranges, the Trinity Alps, the Modoc Plateau and the High Cascade volcanoes.

How seriously you and your community are impacted and how quickly you recover from the next large Northern California earthquake is largely a matter of what you know and how well you prepare for the inevitable. This handbook will help you do precisely that.

California's most damaging earthquakes of the past 150 years, such as the 1906 "San Francisco" earthquake, have occurred on faults in the San Andreas fault system. While we are at risk of future San Andreas tremors, there are many other seismic zones, some capable of producing earthquakes as large or larger

as the one in 1906. North of the Mendocino triple junction lies the 700-mile long Cascadia subduction zone, believed capable of producing magnitude (M) 9 earthquakes. Faults in Northeastern California show evidence of past earthquakes in the M 7 range.

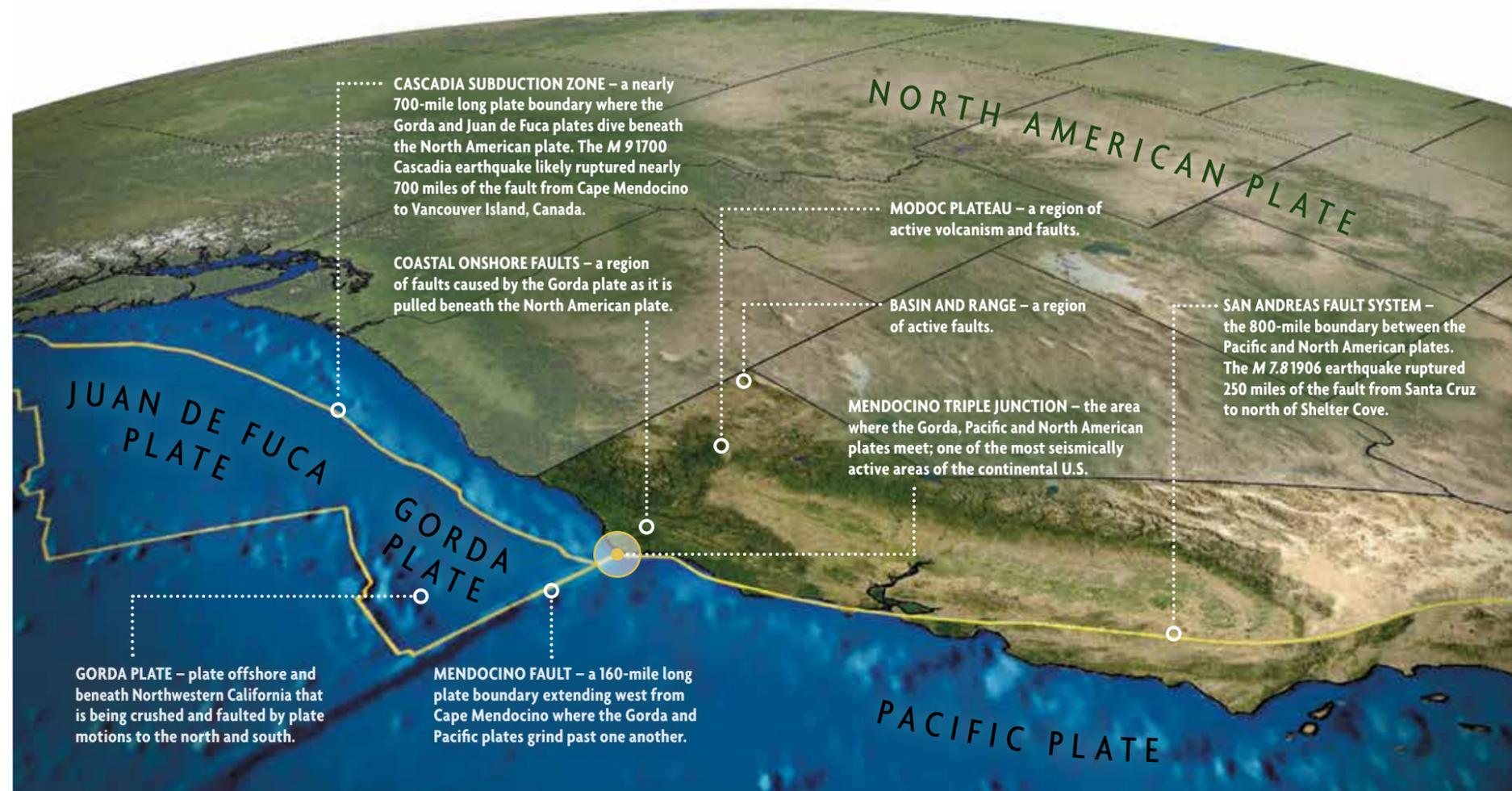
## PLATE TECTONICS

If our planet were the size of an egg, the earth's outermost layer would be about as thick as the eggshell. This shell is broken into several pieces called plates, which move about as fast as your fingernails grow. A plate boundary is where one plate meets another. A triple junction is an area where three plates or plate boundaries meet.

The vast majority of the world's earthquakes occur at or near the boundaries between plates. The most seismically active plate boundaries are convergent zones where one plate dives beneath an adjacent plate in a process known as subduction. Northwestern California is located on top of one of these zones known as the Cascadia subduction zone.

## PLATE MOTIONS LOAD THE FAULTS

Three plates meet on California's North Coast at the Mendocino triple junction. To the north of the triple junction, the Gorda plate is pulled to the northeast beneath the North American plate at a few inches per year. To the south of the triple junction, the Pacific plate grinds to the northwest past the North American plate at a similar speed.



## ALL AREAS OF NORTHERN CALIFORNIA HAVE EXPERIENCED EARTHQUAKES IN THE PAST AND WILL DO SO AGAIN IN THE FUTURE

### Myth #1 Invest in beachfront property in Nevada and Arizona

Despite Hollywood special effects, California will not fall into the ocean. Earthquakes actually help keep the land above sea level. If it weren't for the uplift associated with them, all of the continental land masses would have been leveled to sea level long ago. The 1992 Cape Mendocino earthquake uplifted a 15-mile stretch of coast about four feet.

## OUR FAULTS

Faults are weak zones in the earth's crust where the rock on one side has moved relative to the other side. Some faults, like the San Andreas, are vertical and the two sides move horizontally like cars on a freeway. Thrust faults slope like a ramp and the rock above the fault is pushed up and over the rock below. The largest faults on earth are thrust faults in subduction zones. An earthquake is caused when the rock miles below the earth's surface breaks along the fault and the two sides suddenly slip in a process called fault rupture. The larger the rupture area, the larger the earthquake. The rupture begins many miles beneath the earth's surface. The epicenter is the location on the ground surface directly above the point where the rupture starts.

# Where Earthquakes Have Occurred in the Past, They Will Happen Again

THE SIZE, LOCATION and how often earthquakes occur give an indication of what to expect in the future. Since the mid-1800s, more than 40 earthquakes of M 6 or larger have occurred in California north of Santa Rosa and in adjacent offshore areas.



Ferndale after the 1906 earthquake.

Not all earthquakes that affect Northern California are centered here. Great earthquakes like the 1964 M 9.2 Alaska earthquake may generate tsunamis that can hit our coast.



Bricks from the same building fell during the April 1992 earthquake. The building has now been replaced by a wooden structure.

## Notable earthquakes

**January 26, 1700 Cascadia subduction zone** – M 9 earthquake ruptured from Cape Mendocino to Vancouver Island—based on North American geology and Native American oral history. Japanese documents describe some of the ensuing tsunami's effects on the far side of the Pacific.

**April 18, 1906 San Andreas fault** – M 7.8 earthquake ruptured from Santa Cruz to Shelter Cove, the largest Northern California earthquake in the past 200 years. Often called the San Francisco earthquake, it caused major damage in the coastal counties as far north as Humboldt and was felt throughout the state.

**June 6, 1932 Gorda plate fault** – M 6.4 earthquake centered near Arcata caused severe damage in the Humboldt Bay region and killed a woman in Eureka when a chimney from a neighboring building collapsed on her home.

**December 21, 1954 Coastal onshore fault** – M 6.5 earthquake located between Blue Lake and Willow Creek caused damage in the Humboldt Bay region and killed a man in Korbel.

**November 8, 1980 Gorda plate fault** – M 7.2 earthquake located offshore of Trinidad caused a highway overpass to collapse, and seriously injured six people driving on the bridge. \$2 million in property damage; felt from Eugene, Oregon to San Francisco and Western Nevada.

**April 26-27, 1992 Mendocino triple junction area** – M 7.2, 6.7, 6.6 earthquakes caused hundreds of injuries, landslides, and major damage to buildings in Southern Humboldt County. The second earthquake caused a fire that destroyed Scotia's business district. Coastal uplift produced a small tsunami that was recorded as far away as Hawaii. \$66 million in damage; felt from Southern Oregon to Salinas and Redding.

**September 21, 1993 Basin and Range fault** – Two M 6 earthquakes centered near Klamath Falls in Southern Oregon damaged more than 1,000 buildings. Two people died, \$7.5 million in damage; felt throughout Southern Oregon and in Northern California.

**September 1, 1994 Mendocino fault** – M 7 centered 90 miles offshore of Cape Mendocino. No damage; felt from Southern Oregon to San Francisco and caused tall buildings to sway in Sacramento. A three-inch tsunami was recorded in Crescent City.

**January 9, 2010 Gorda plate fault** – M 6.5 centered 30 miles offshore of Eureka. The earthquake caused about \$20 million in damage to structures in Eureka and was felt from Eugene, Oregon to south of the San Francisco Bay Area.

# Types of Earthquakes

## Offshore earthquakes

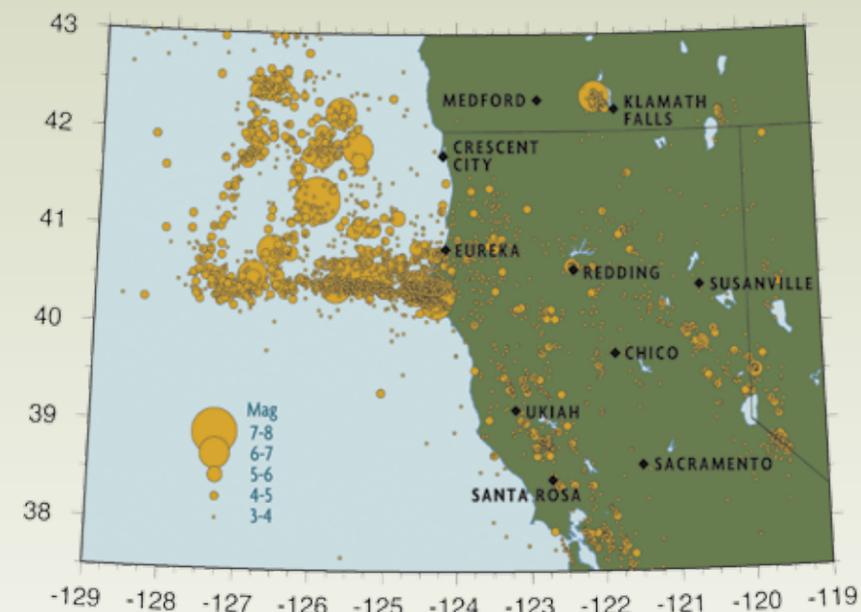
MORE THAN TWO-THIRDS of our large historic earthquakes have been located offshore on faults within the Gorda plate or along the Mendocino fault. Fortunately many of these earthquakes have been too far offshore to cause damage. However, more than 20 were close enough to the coast to knock down chimneys and damage buildings. For offshore earthquakes of M 7 or larger, tsunami warnings may be issued.

## Onshore earthquakes

The most damaging Northern California earthquakes in the past century were caused by faults onshore. Earthquakes as small as M 5 can cause damage if they are close to populated areas. There are many faults throughout the region that are capable of producing earthquakes in the M 7 range.

## The Big One – the Cascadia subduction zone

The world's largest faults are associated with subduction zones and have produced earthquakes in the M9 range! The last great earthquake on the Cascadia subduction zone occurred in 1700, a little over 300 years ago. Geologists have found evidence for at least 13 great Cascadia earthquakes during the past 7,000 years—and estimate they occur irregularly at intervals anywhere between 200 and 800 years. The next Cascadia earthquake may be similar to the M9 2011 Japan earthquake. It could cause strong ground shaking from Northern California to Southern Canada lasting for five minutes or longer. It will also produce a tsunami that could affect not only our coast, but other countries throughout the Pacific basin.



Northern California earthquakes between 1970 and 2009.

## RECENT EARTHQUAKES DON'T TELL THE WHOLE STORY

The first seismographs were installed in California just over 100 years ago and written records only go back as far as the mid-1800s. For evidence of earlier earthquakes, scientists look for geologic clues such as surface fault rupture and tsunami deposits, oral history of native peoples and written records from distant areas that were affected by a Northern California-generated tsunami. The study of ancient earthquakes is called paleoseismology.

## HOW BIG IS BIG?

Magnitude is one way to measure the size of an earthquake. Each unit of magnitude corresponds to about 32 times more energy released. An M 7 earthquake releases 32 times more energy than an M 6, and about 1000 times more than M 5. Both the area affected by the earthquake and how long the shaking lasts increase with magnitude. An M 4 will be felt only close to the epicenter and will last a few seconds. An M 7 will be felt by people hundreds of miles away and last 20 seconds or longer.

Intensity is another way to estimate earthquake size. It measures how strongly the ground shakes in a particular location. If you feel an earthquake, you can help determine the intensity by reporting your observations at [earthquake.usgs.gov/earthquakes/dyfi](http://earthquake.usgs.gov/earthquakes/dyfi)

## Myth #2

### Small Earthquakes Prevent Big Ones from Happening

Small earthquakes release very little energy compared to large ones. To equal the release of energy of an M 9 earthquake, we would need about 2,000 M5 earthquakes. This means about 5 moderate quakes every day for 500 years.

# Most Earthquake Damage is Caused by Shaking...

DAMAGE IN EARTHQUAKES is mainly due to shaking. How strongly the ground shakes in a particular location is a result of earthquake magnitude, the distance away from the earthquake source, the orientation and type of fault movement, and the type of ground material such as bedrock or soft soil. An area that did not shake strongly in one earthquake may be severely affected in another. All areas of Northern California have experienced strong ground shaking in the past and will again in the future.

Ground shaking can cause poorly-built structures to collapse. In California, where building codes have included seismic design requirements for more than 80 years, the most likely

result of ground shaking is falling items within homes and businesses. Lights, television sets, bookshelves, cupboard contents and other objects can topple over and injure you!

Your home or business may escape major damage in the next Northern California earthquake, but downed power lines, damaged bridges and broken water lines will disrupt infrastructure and could isolate you at home, at work or in your car. The actions you take now to plan and to strengthen your home will reduce your losses. Find out how you can prepare on pages 18-25.

## Earthquakes also cause damage in other ways...



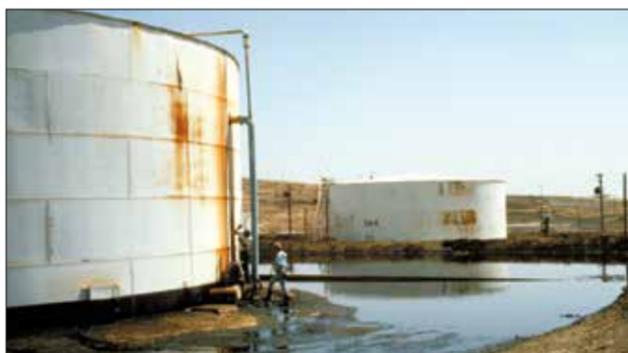
### Destructive Fires

Earthquakes and tsunamis are often followed by fires because gas lines may break, electrical shorts cause sparks, damaged water tanks and broken pipes limit water for fire fighting, and damaged roads prevent fire fighter access. The 1964 tsunami caused this fire in Crescent City that burned for three days.



### Landslides

Earthquakes can trigger landslides that damage roads, buildings, pipelines and other infrastructure. Northern California has steep slopes underlain by loose rock that is highly susceptible to landslides. Landslides may temporarily dam rivers and cause a destructive flood hazard when the rivers break through. The Navarro River in this photo was temporarily dammed by a landslide in 1995.



### Hazardous material releases

Chemicals, pesticides and other hazardous materials can be released when industrial plants, laboratories and other facilities are damaged in an earthquake. Oil was released when these tanks failed during the 1983 M 6.5 Coalinga earthquake.

### Damaged infrastructure

Earthquakes often damage roads, which can hinder rescue and recovery efforts and may cause accidents. Ruptured pipelines result in water loss and can cause "sinkholes" that undermine roads and buildings. Damage to gas and electrical systems can cause fires, as well as major service outages. This Highway 101 overpass south of Eureka collapsed in the November 1980 M 7.2 earthquake.



### Dam failures

Earthquake shaking and fault rupture can cause dams to fail, potentially causing catastrophic downstream flooding, reduced water supply and contamination. This photo shows the failure of the Shihkang Dam, the largest concrete gravity dam in Taiwan, caused by the 1999 M 7.6 Chi Chi, Taiwan earthquake.



### Liquefaction

Strong ground shaking can cause loose soil and fill to behave like a liquid. Liquefied ground loses its strength causing slumps and fractures that can disrupt roads and cause buried gas and water lines to break. This hazard is greatest in saturated low-lying areas of loose, sandy soils or poorly compacted fill. The photo was taken shortly after the 1906 earthquake and shows liquefaction-caused slope failures on the banks of the Eel River.



### Surface rupture

Fault movements can break the ground surface, damaging buildings and other structures and breaking pipe lines. This track at a high school in Taiwan was deformed when a thrust fault ruptured the ground in 1999.



### Myth #3

#### The Ground Will Crack Open and Swallow You Up

The opening of great, yawning chasms that may swallow houses and people only occurs in fiction. Though some fissures may be produced on earthquake-triggered landslides, the earth's pressure is too great to allow ground cracks associated with faulting to open up.

# What is a TSUNAMI?

A tsunami (soo-nah-me) is a series of waves or surges that is most often caused by earthquake fault movement beneath the sea floor.

TSUNAMIS CAN CAUSE great loss of life and property damage in coastal areas. Very large tsunamis can cause damage to coastal regions thousands of miles away from the earthquake that caused them.

Thirty-eight tsunamis have been recorded on the Northern California coast since 1933. Most were very small, but five caused damage. The most damage was caused by a tsunami generated by the M 9.2 1964 Alaska earthquake. It flooded 29 blocks of Crescent City's waterfront, damaged harbors and port facilities as far south as Santa Cruz, and caused 12 deaths in California.



1946 – HAWAII The tsunami surge approaching Coconut Island in Hilo, Hawaii looked like a sloping mountain of water.

2011 – JAPAN In Kesennuma, cars and other debris were swept away by tsunami waves.



2004 – THAILAND When the water rushed in, it looked like a river in flood.

2004 – THAILAND In Phuket, the tsunami began as a withdrawal of the ocean water that exposed hundreds of feet of the sea floor.

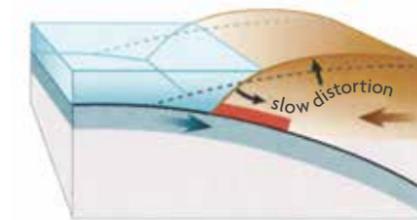
## Tsunami Facts

- Tsunamis most commonly are caused by earthquakes, but also may be triggered by landslides, submarine volcanic eruptions and, very rarely, meteor impacts.
- No two tsunamis are alike. Sometimes they look like sloping mountains of water and other times they rush ashore like a river in a flood, and are usually choked with debris.
- Large tsunamis may reach heights of 20 to 50 feet along the coast and, in isolated areas, even higher. The first tsunami surge is not the highest. In Northern California, the largest surge may occur hours after the initial wave.
- It is not unusual for tsunami surges to last 12 hours, and in some cases much longer. It is not safe to approach the coast until officials permit you to return.
- The time between wave surges may range from minutes to over an hour. It is not possible to predict how many surges or how much time will elapse between waves.
- The areas at greatest risk are on the beach and low-lying coastal areas. Only in large coastal rivers is a tsunami likely to penetrate farther than two miles inland.
- Sometimes the first sign of a tsunami is an unusual lowering of ocean water, exposing the sea floor. This “drawdown” always means that the water will surge back strongly. Not all tsunamis are preceded by water lowering—so if you feel ground shaking or hear that a tsunami warning has been issued, evacuate the coast immediately and do not wait to see the water pull back.

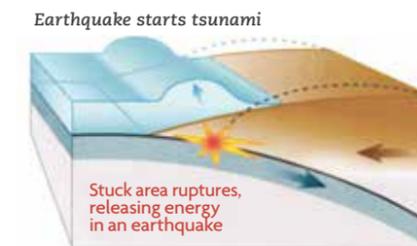
## HOW TSUNAMIS ARE FORMED



1 Gravity pulls the offshore Gorda and Juan de Fuca plates beneath the North American Plate. Most of the time the two plates are firmly stuck together along the boundary (red zone).

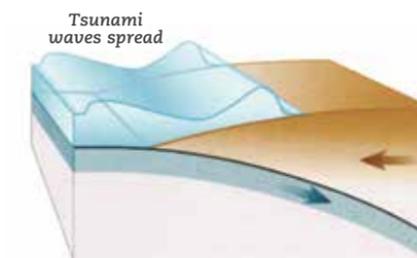


2 Over time, the North American plate is squeezed and bulges up as the Gorda plate slowly moves beneath it.



Earthquake starts tsunami

3 Eventually the stuck area can no longer resist the squeezing and breaks along the boundary, causing a large earthquake. Like a spring, the overriding North American Plate jumps upward and seaward, lifting the water above it. A tsunami is born.



Tsunami waves spread

4 The water bulge divides and sends waves both east towards the coast and west into the Pacific. The first waves reach nearby shores only minutes after the earthquake. The other set of waves may still be large enough to damage distant coastal areas many hours later.

# How Will I Know if a Tsunami is Coming?

You may find out that a tsunami is coming in two ways:

## Natural Warnings

GROUND SHAKING, a loud ocean roar, or the water receding unusually far exposing the sea floor are all nature's warnings that a tsunami may be coming. If you observe any of these warning signs, immediately walk to higher ground or inland. A tsunami may arrive within minutes and damaging surges are likely to occur for at least 12 hours and possibly longer. Stay away from coastal areas until officials permit you to return.

## Official Warnings

You may be notified that a Tsunami Warning has been issued via TV, radio stations, door-to-door contact by emergency responders, NOAA weather radios, or in some cases, by outdoor sirens and announcements from airplanes. Move away from the beach and seek more information **without using a phone**. Tune into local radio or television stations for more information. Follow the directions of emergency personnel who may ask you to evacuate low-lying coastal areas.

## How Do I Know if an Earthquake is Big Enough to Cause a Tsunami?

- If you are on the beach and feel an earthquake, no matter how small, move inland or to high ground immediately.
- In other low-lying areas, **COUNT** how long the earthquake lasts. If you count 20 seconds or more of ground shaking and are located in a tsunami hazard zone, evacuate as soon as it is safe to do so.
- **GO ON FOOT.** Roads and bridges may be damaged by strong ground shaking. Avoid downed power lines—some may retain a charge even when they are on the ground. If evacuation is impossible, go to the upper floor of a sturdy building or climb a tree—but only as a last resort.

**NATURAL AND OFFICIAL WARNINGS ARE EQUALLY IMPORTANT. RESPOND TO WHICHEVER YOU HEAR OR OBSERVE FIRST!**

**DON'T HEAD TOWARDS THE COAST IF YOU HAVE HEARD THAT A TSUNAMI WARNING HAS BEEN ISSUED.**

You will put yourself in danger and make it more difficult for the people who need to evacuate.

## OFFICIAL WARNINGS FROM TSUNAMI WARNING CENTERS

Tsunami warning systems detect earthquakes large enough to cause a tsunami and send warning bulletins before the waves arrive so that local authorities can evacuate vulnerable populations. The United States operates two tsunami warning centers: the Pacific Tsunami Warning Center in Hawaii covers Hawaii, the U.S. Pacific territories, and provides guidance to many other countries. The National Tsunami Warning Center (NTWC) has the responsibility of warning Canada and the rest of the United States, including California. NTWC has access to tide gauges, deep ocean water level sensors and a global network of seismographs that can locate and estimate the size of large earthquakes anywhere in the Pacific basin in less than 15 minutes.

Tsunami warnings are most effective when the tsunami source is more than 1000 miles away such as Alaska, Japan, or Chile. If the earthquake is located on a local fault such as the Cascadia subduction zone, there is too little time for NTWC to get a warning to you. Ground shaking that lasts a long time or other natural warning signs will be your only warning. Know what areas are hazardous and immediately head to high ground or inland away from the coast.

Based on earthquake size and location, the NTWC will issue bulletins corresponding to the relative tsunami threat:

- **Tsunami Warning:** A significant tsunami is considered imminent—the first waves are expected within three hours or less. If you hear that a Warning has been issued, leave the beach or harbor areas and get more information. Follow the instructions of local officials about what areas need to be evacuated.
- **Tsunami Watch:** A tsunami may have been generated but the threat is uncertain and the first wave arrival is at least three hours away. Stay alert for more information. A Watch may be upgraded to a Warning as more information becomes available.
- **Tsunami Advisory:** No significant flooding is expected but vulnerable harbor areas like Crescent City may be damaged by strong water currents. Authorities may request you to leave beaches and harbors.
- **Tsunami Information Statement:** There is no tsunami risk. The bulletin is issued for information purposes only. Relax—no action is needed. For more information, visit [tsunami.noaa.gov](http://tsunami.noaa.gov).

## Myth #4

### A Tsunami is a Surfer's Ultimate Big Wave

TSUNAMIS ARE NOT SURFABLE. If you're a surfer, you know how little control you have if your board is in whitewater. A tsunami has no face, so there's nothing for a surfboard to grip. The water isn't clean, but is filled with everything dredged up from the sea floor and the land the wave runs over, including garbage, parking meters, pieces of buildings, and dead animals. You can't dive beneath the wave because the entire water column is in motion, not just the top few feet. You can't exit the wave either, because the trough behind may be 100 or more miles away, and all that water is moving towards you. Big-wave riders should save their talents—and their lives—for big waves that are generated by large storms.

## What if I am Outside the Map Area?

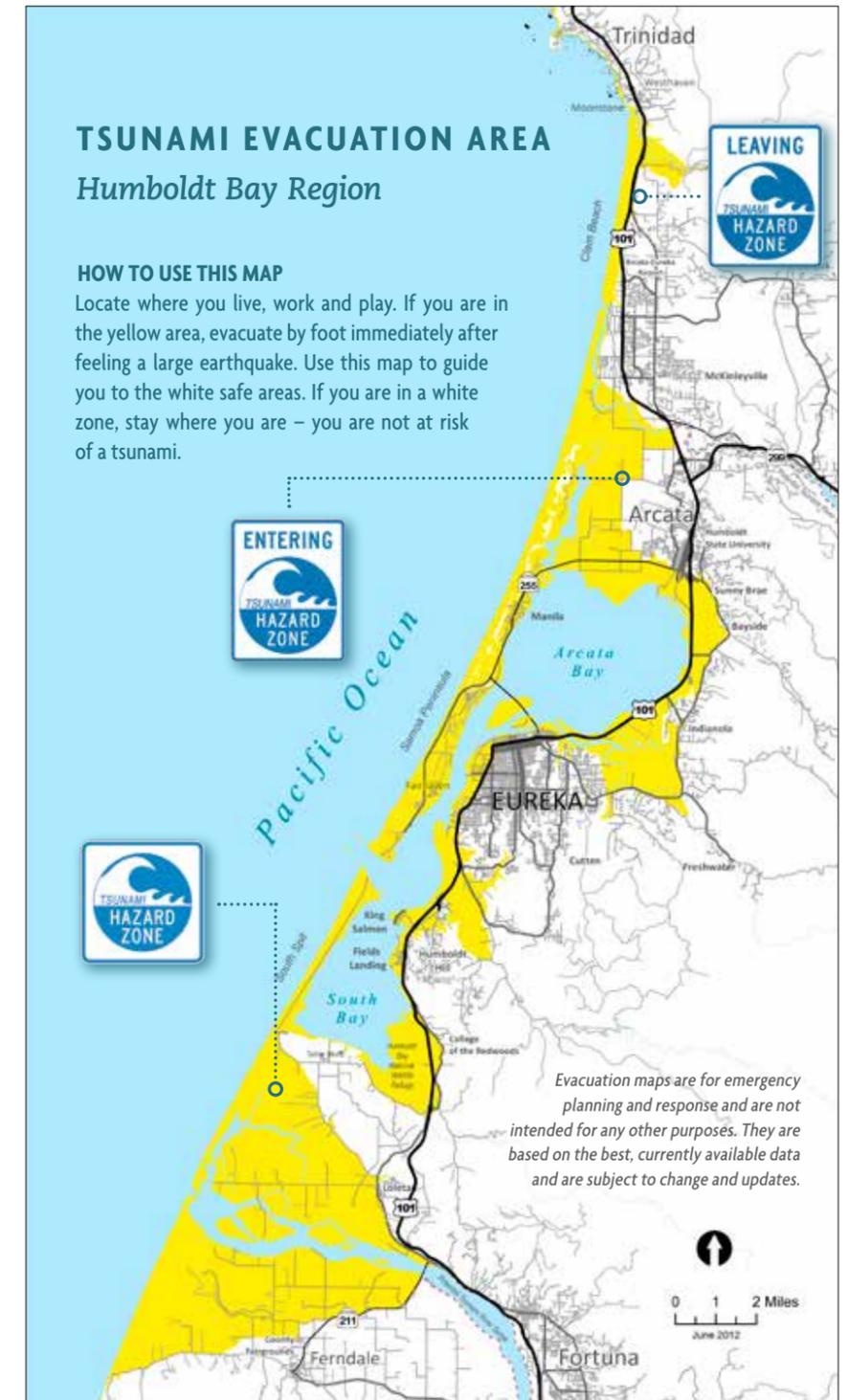
Go to an area 100 feet above sea level or two miles inland, away from the coast. If you cannot get this far, go as high as possible. Every foot inland or upwards can make a difference.



SAMOA, CA—Residents practice tsunami evacuation in an annual drill.

# Tsunami Evacuation Maps

All of California's coast is being mapped for tsunami hazards. Find out your tsunami threat at [myhazards.caloes.ca.gov](http://myhazards.caloes.ca.gov). Contact your county Office of Emergency Services to see what information is available for your area. The map below is an example from Humboldt County.



# The 2004 Indian Ocean Tsunami

THE GREAT INDONESIA earthquake of December 26, 2004 made the world aware of the destructive power of tsunamis. The M 9.2 earthquake that caused the tsunami ruptured more than 900 miles of the Sumatra-Andaman subduction zone. People in Indonesia felt at least five minutes of strong shaking. The first tsunami surges arrived at the closest land only eight minutes after the earthquake. It took 15 minutes for the first waves to hit Northern Sumatra, and about two hours to reach Sri Lanka and Thailand. The waves were still large enough to cause damage in Africa about seven hours after the earthquake. The tsunami ravaged the coastlines of 14 countries and killed at least 227,000 people. Few people in Indian Ocean countries were aware of tsunamis and their natural warning signs, and there was no tsunami warning system to warn populations far from the source region of the impending waves.

## Lessons from the Simeulue Islanders

Langi is a small village on Simeulue Island off the coast of Sumatra. The earthquake damaged many buildings in the town and the first tsunami surge arrived only eight minutes after the earthquake shaking began. The surges were over 30 feet high and destroyed every building in the town.

*Not a single man, woman or child in Langi was killed.*

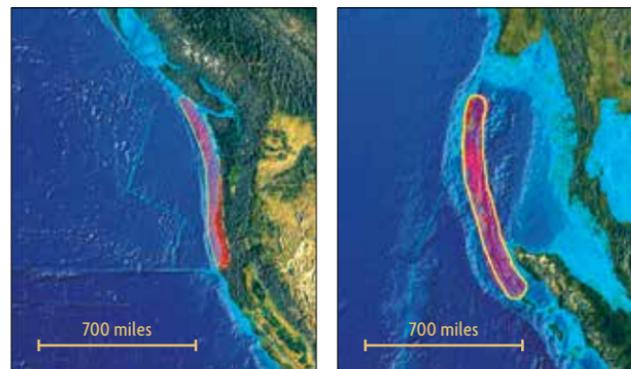
Why were there no casualties? Langi has no electricity, no Internet and no technological warning system. But the people on Simeulue have an oral history and have passed stories about the dangers of tsunamis from one generation to the next. If the ground shakes for a minute or more, everyone knows exactly what to do. Adults grab the children, and use carts to wheel the elderly and the sick up to their evacuation area about 90 feet above the village, where they have stashed supplies and temporary building materials. Great tsunamis are rare in Simeulue—the last deadly tsunami occurred in 1907. Large earthquakes are common in Indonesia and most don't produce tsunamis. Simeulue Islanders consider every earthquake an opportunity to practice their evacuation skills whether it produces a tsunami or not.



**2004 – SUMATRA** Above Langi village was completely destroyed by the 2004 tsunami. Below Four months later, a new house has been built on the damaged foundations.

## Why Northern Californians should be interested in the Indian Ocean tsunami:

- Northern California is located along a subduction zone—the same type of geologic setting as the Eastern Indian Ocean.
- The last great earthquake on the Cascadia subduction zone occurred on January 26, 1700, and was nearly the same size as the 2004 Indonesia earthquake. It produced a tsunami that affected native peoples from Northern California to Vancouver Island, Canada and caused damage in Japan more than 4,800 miles away.



Left Rupture zone of the 1700 Cascadia earthquake  
Right Rupture zone of the 2004 Indonesian earthquake



Ghost forests are caused by great subduction zone earthquakes when rupture causes land to abruptly drop down, exposing the tree roots to salt water. The trees above in Indonesia were killed by the 2004 earthquake which lowered the ground level several feet.

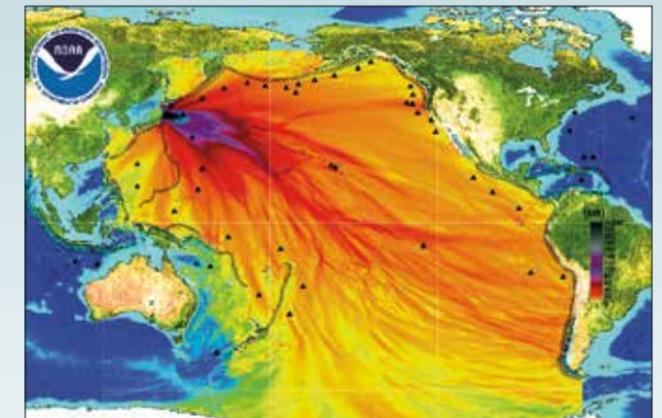


The Red Cedar trees along the Copalis River in Washington State met a similar fate over 300 years ago when the last great Cascadia earthquake occurred.

## THE 2011 JAPAN TSUNAMI IN CALIFORNIA

On March 11, 2011, an M 9.0 earthquake occurred off the Northeast Coast of Japan's main island of Honshu. The earthquake generated a great tsunami in Japan that also traveled outward from the source region and across the Pacific basin. More than eight hours after the earthquake, the first surge reached the West Coast of the United States. In California, this tsunami produced very little flooding on land but the extremely strong currents tore up docks and harbor structures and smashed boats. The cost to repair the damage exceeded \$80 million.

- The 2011 tsunami on the West Coast didn't look like a "wave." It looked like a turbulent rising and lowering of the tide with strong currents like a river in flood rushing through the harbor.
- All of the damage was caused by strong currents. The tsunami water height only barely exceeded the high tide level.
- The surges continued for five days in Crescent City's harbor! The largest surges occurred more than two hours after the first.



Above right Modeled peak water heights from the 2011 Japan tsunami. The shape of the sea floor focuses some of the energy at California's North Coast.

Below right All the damage to Crescent City Harbor's small boat basin was caused by strong currents and occurred more than two hours after the first tsunami wave arrived.



# Seven Steps That May Save Your Life

EARTHQUAKES AND TSUNAMIS are inevitable but the damage is not—even in a great earthquake on the Cascadia subduction zone. Most damage and loss can be reduced by steps you take before, during, and after. The seven steps that follow include actions to keep you and your loved ones safe, reduce potential damage and recover quickly. These steps should also be followed in schools, workplaces, and other facilities. By following them, countless casualties can be avoided and millions of dollars saved.

Preparation is the key to surviving a disaster—that much is clear—but where should you start? Start by talking—talk to your family, friends, neighbors and co-workers about what you’ve learned in this handbook about earthquakes and tsunamis in Northern California. Then discuss what you have done to prepare and together plan your next steps.

Many people are overwhelmed by the mere prospect of a natural disaster and, as a result, don’t prepare at all. Do not fall into that trap. You can start today by following these seven steps.

Visit [earthquakecountry.org](http://earthquakecountry.org) for instructions and resources.

## Start Here!

### PREPARE

1. Secure Your Space (see illustration below and page 20)
2. Plan to be Safe (page 22)
3. Organize Disaster Supplies (page 23)
4. Minimize Financial Hardships (page 24)

### SURVIVE

5. Drop, Cover and Hold On (page 26)
6. Improve Safety (page 27)

### RECOVER

7. Reconnect and Restore (page 28)

## THIRTY SUGGESTIONS TO MAKE YOUR HOME EARTHQUAKE SAFE

Connect these actions with their locations in the house below.

### STEP 1—SECURE YOUR SPACE

- 1 Know whether you live, work or play in a tsunami hazard zone.
- 2 Hang plants in lightweight pots with closed hooks, well secured to a joist or stud and far away from windows.
- 3 Store fire extinguisher (type ABC) in easily accessible location.
- 4 Install strong latches on kitchen cabinets.
- 5 Use flexible connections where gas lines meet appliances.
- 6 Remove or lock refrigerator wheels, secure to studs.
- 7 Keep several flashlights in easily accessible places around the house.
- 8 Secure valuable electronics items such as computers and televisions.
- 9 Keep breakables in low or secure cabinets with latches.
- 10 Move heavy plants and other large items to floor or low shelves.
- 11 Hang mirrors and pictures on closed hooks.
- 12 Secure free-standing woodstove or fireplace insert.
- 13 Keep heavy unstable objects away from doors and exit routes.
- 14 Place bed away from windows or items that may fall.
- 15 Secure knickknacks and other small valuables with museum putty.
- 16 Brace overhead light fixtures.
- 17 Place only light weight/soft items over bed.
- 18 Secure top-heavy furniture to studs.
- 19 Keep wrench or turn-off tool in water proof wrap near gas meter.
- 20 Know the location of your main electrical switch (fuse box or circuit breaker).
- 21 Secure water heater with metal straps attached to studs.
- 22 Trim hazardous tree limbs.

### STEP 2—PLAN TO BE SAFE

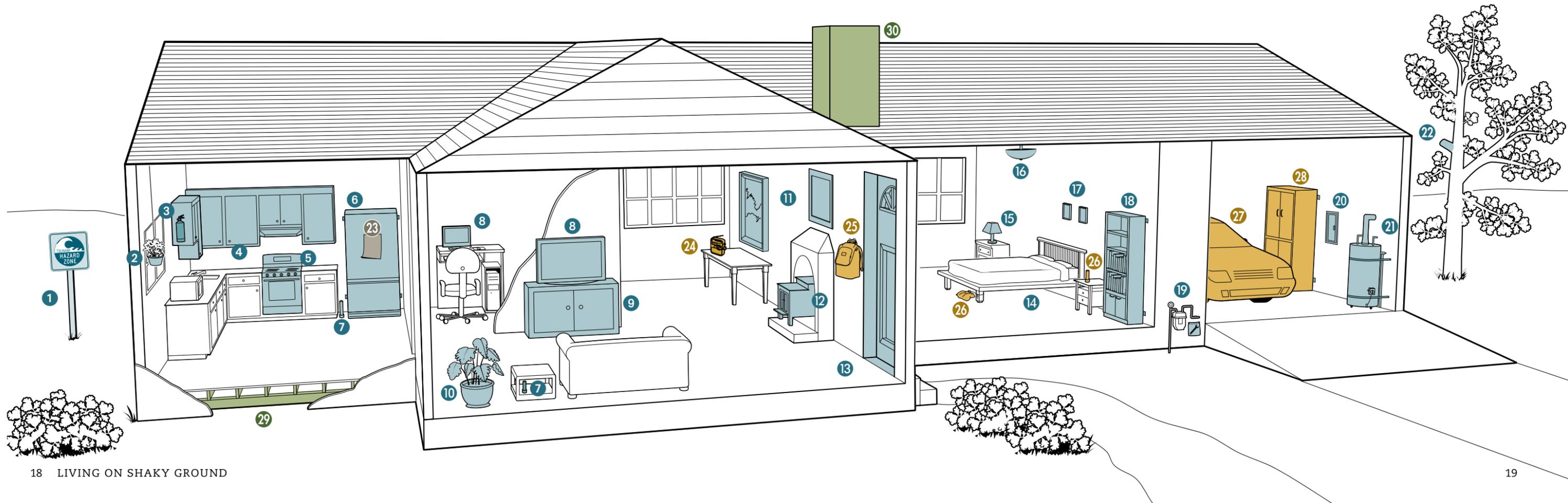
- 23 Have your emergency plan accessible and discuss with all family members.

### STEP 3—ORGANIZE DISASTER SUPPLIES

- 24 Obtain a NOAA Weather Radio with the Public Alert feature to notify you of tsunamis and other hazards.
- 25 Keep an emergency backpack with copies of important documents near the door to grab and go.
- 26 Keep flashlight, slippers and gloves next to beds.
- 27 Keep gas tank at least half full.
- 28 Store emergency food and water supplies in a dry accessible area. Include first aid kit, extra cash, portable radio, extra batteries, medications and other necessary supplies.

### STEP 4—MINIMIZE FINANCIAL HARDSHIP

- 29 Use anchor bolts every 4 to 6 feet to secure home to foundation.
- 30 Reinforce brick chimneys.



Step 1

## SECURE YOUR SPACE AND KNOW YOUR ZONE

THE FIRST STEP to earthquake and tsunami safety is to recognize your hazards. Look around your home and workplace and identify objects that might fall or shift during shaking. Additional information, including how-to instructions, is available at [earthquakecountry.org](http://earthquakecountry.org) and from your local American Red Cross office.

**START NOW** by identifying items that may fall, topple, or slide. Secure potentially hazardous and valuable items.

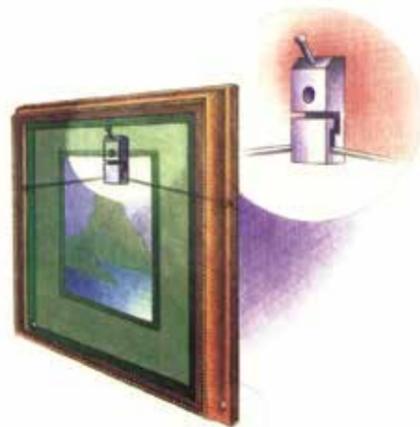


### KITCHENS

- Install strong latches on cabinet doors.
- Secure refrigerators and major appliances.

### HANGING OBJECTS

- Place only soft art above beds and sofas.
- Hang mirrors and pictures on closed hooks.
- Brace overhead light fixtures.

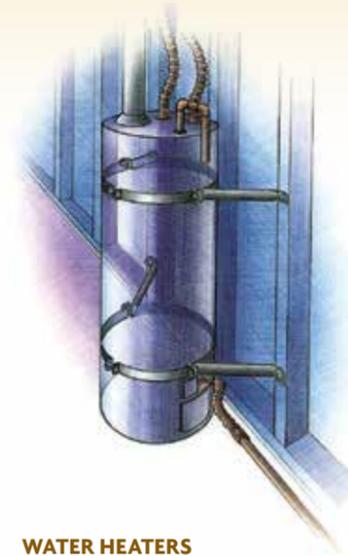


### OBJECTS ON OPEN SHELVES AND TABLETOPS

- Hold small valuables in place with removable putty, museum wax, or quake gel.
- Add lips to shelves to prevent costly items from sliding.
- Move heavy objects and breakables to lower shelves.

### WOOD STOVES

- Anchor stove feet by bolting to floor or creating brick and mortar bracing to keep stove from sliding. Note: anchors must not conduct heat.
- Brace stove pipes.



### WATER HEATERS

- Anchor to wall studs or masonry with metal straps and lag screws.
- Install flexible (corrugated) copper water connectors.



### FURNITURE

- Store heavy and breakable items on lower shelves.
- Secure tall furniture to wall studs with lag bolts.



### GARAGES AND UTILITY ROOMS

- Move flammable or hazardous material to low cabinets that are securely latched.
- Ensure that items stored above or beside vehicle cannot fall.

### WATER AND GAS PIPES

- Evaluate, replace and properly secure rusted or worn pipes.
- Replace rigid gas connections with flexible stainless steel gas connections.

### ABOVE GROUND PROPANE TANKS

- Propane tanks can be anchored by mounting the tank on a continuous concrete pad and bolting the four legs to the pad.



### HOME AND OFFICE ELECTRONICS

- Secure televisions, computers, sound systems and other electronics with flexible nylon straps and buckles.



**START NOW** by determining if you live, work or play in a tsunami hazard zone

Know your risk. Use signs and maps to find out which areas are hazardous. No signs or maps for your area? On the open coast areas 100 feet or more in elevation and low areas more than two miles inland are safe.

## Step 2 PLAN TO BE SAFE

WILL EVERYONE IN your household know what to do during the violent shaking of a strong earthquake or when a tsunami warning has been issued? Do you know how to get in touch with each other afterwards? Before the next earthquake or tsunami, talk to your family, housemates or co-workers and plan what each person will do before, during and after.

### PLAN NOW TO BE SAFE DURING AN EARTHQUAKE

- Practice DROP, COVER, and HOLD ON (see step 5, page 26).
- Identify safe spots in every room, such as under sturdy desks and tables.
- Learn how to protect yourself no matter where you are when an earthquake strikes.
- Be sure to include hazards unique to where you live or work in your planning. Are you in a tsunami zone? Could your home be isolated if a bridge failed or a landslide occurred?

### PLAN NOW TO RESPOND AFTER AN EARTHQUAKE OR TSUNAMI

- Get a fire extinguisher for your home and learn how to use it properly.
- Teach everyone in your household to use emergency whistles and to knock three times repeatedly if trapped.
- Identify family members or neighbors with special needs such as medications, special diets and wheelchairs.
- Take a Red Cross First Aid and cardiopulmonary resuscitation (CPR) class or refresher course.
- Know the location of utility shut-offs and keep needed tools nearby. Only turn off the gas if you smell or hear leaking gas. Only the gas company should turn the gas back on.
- Install smoke alarms and check them monthly. Change batteries once a year or whenever you hear a "chirping" sound.
- Work with your neighbors to identify people who have skills and resources useful in an emergency.
- Know the tsunami hazard zones in your community and how to get to safe areas.
- Recognize the **natural warning signs** of a tsunami—ground shaking, water receding unusually far, and/or a loud roar from the ocean—and make sure everyone in your family knows to immediately evacuate if they are in a hazard zone.
- Know how you may be notified if a tsunami warning is issued. Consider a NOAA Weather Radio with the Public Alert feature if you live or work in a tsunami hazard zone.
- If a tsunami warning is issued, get off the beach and tune in to your radio or television for further instructions on what to do.
- Consider becoming a part of Community Emergency Response Team (CERT) in your area. Contact the Regional Training Institute for more information at [fema.gov/community-emergency-response-teams](http://fema.gov/community-emergency-response-teams).

After the shaking stops or the waves recede, power, utilities, communication systems and roads may be out, fires and chemical spills may occur, or you may be separated from children, pets and other family members. By planning now, you will be ready. Planning for earthquakes and tsunamis will also prepare you for other more frequent emergencies such as storms, fires, and flooding.

### PLAN NOW TO COMMUNICATE AND RECOVER AFTER AN EARTHQUAKE OR TSUNAMI

- Select a safe place outside of your home to meet your family or housemates after the shaking stops.
- Identify an out-of-the area contact person to call who can relay information to other friends and family.
- Provide all family members with a current list of important contact telephone numbers.
- Determine where you might stay if your home cannot be occupied after an earthquake or tsunami.
- Ask about your children's school or day care emergency response plans. Keep emergency release information current.
- Talk to your insurance agent about your coverage for earthquake and tsunami losses.
- Make copies of important documents such as identification, deeds, insurance policies and financial records in a secure, waterproof container. Include a household inventory of your belongings.



## Step 3 ORGANIZE DISASTER SUPPLIES

EVERYONE SHOULD HAVE personal disaster supply kits. Keep them where you spend most of your time, so they can be reached even if your building is damaged or if you need

### PERSONAL/OFFICE DISASTER SUPPLY KIT

- Medications, prescription list, copies of medical cards, doctors' names and contact information
- Medical consent forms for dependents and copies of personal identification
- First aid kit and handbook
- Non-latex gloves, dust masks
- Spare eyeglasses or contact lenses and cleaning solution
- Whistle (to alert rescuers to your location)
- Sturdy shoes, change of clothes, blanket
- Emergency cash (ATMs require power and might not work)
- Local road maps
- List of emergency out-of-area contact phone numbers
- Bottled water, snack foods high in protein and calories
- Flashlight with extra batteries and light bulbs
- Comfort items such as games, crayons, writing materials, stuffed animals
- Toiletries and personal care supplies
- Extra keys for car, home, office, safe deposit box etc.



### Tip

A space blanket not only keeps you warm and dry, its reflective surface can be used to signal for help.



Store your items in "grab-and-go" backpacks or small duffle bags so you can take them with you if you need to evacuate. You could be stranded at work or in your office; keep a change of clothes and extra medicines there as well.

to quickly evacuate out of a tsunami hazard zone. Keep one kit in your home, another in your car, and a third kit at work.



Keep a flashlight and a pair of sturdy shoes secured to each person's bed.

### HOUSEHOLD DISASTER SUPPLY KIT—Supplies for at least seven days

Store in an easily-accessible location, preferably outdoors, in a large watertight, easily-moved container. Replace perishable items like water, food, medications and batteries on a yearly basis.

- Water (minimum one gallon a day for each person and pet)
- Wrenches or other special tools to turn off gas and water supplies
- Work gloves and protective goggles
- Heavy duty plastic bags for waste, and to serve as tarps, rain ponchos, etc. Include duct tape.
- Portable or hand-cranked radio with extra batteries
- Additional flashlights or light sticks
- Canned and packaged food
- Charcoal or propane for outdoor cooking and matches if needed
- Cooking utensils and a manual can opener
- Pet food, pet carrier and restraints
- Comfortable, warm clothing including extra socks
- Blankets and/or sleeping bags, and perhaps a tent
- Copies of vital documents (deeds, insurance, bank accounts etc.)

### CAR DISASTER SUPPLY KIT

Decide what items in your personal kit are absolute necessities and add:

- An additional 6-pack of water
- Tire repair kit, booster/jumper cables, pump and flares, white distress flag or silver space blanket
- Seasonal supplies: winter (blanket, hat, mittens, shovel, sand, chains, windshield scraper); summer (sunscreen and hat)

# Step 4 MINIMIZE FINANCIAL HARDSHIP

EARTHQUAKES MAY LAST only seconds but they can cause financial hardships that last for weeks, months or years. You can minimize losses by strengthening your home, organizing important documents, and considering insurance.

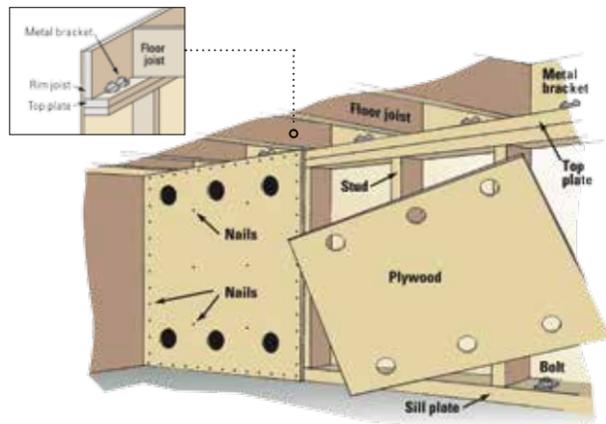
## Common building problems

Buildings are designed to withstand the downward pull of gravity, yet earthquakes shake a building in all directions—up and down, but most of all, from side to side. The following presents some common structural problems and how to recognize them.

**INADEQUATE FOUNDATIONS** Look under your house at your foundation. Look for bolts in the mudsills. They should be no more than six feet apart in a single story and four feet apart in a multistory building.

**UNBRACED CRIPPLE WALLS** Homes with a crawl space should have panels of plywood connecting the studs of the short “cripple” walls.

**SOFT FIRST STORIES** Look for large openings in the lower floor, such as a garage door or a house built on stilts. Consult a professional to determine if your building is adequately braced.



**UNREINFORCED MASONRY** The most typical type of unreinforced masonry in Northern California is brick. While there are few brick homes in our area, many older buildings have unreinforced brick chimneys. If your house has brick or blocks as a structural element, consult a professional to find what can be done and to determine if it is safe.

## If you live in a mobile home...

Mobile homes can easily slide off their foundations if not properly secured to resist side-to-side motion. Look under your home—if you only see a metal or wood “skirt” on the outside with concrete blocks or steel tripods/jacks support your home, you need to have an “earthquake-resistant bracing system” (ERBS) installed.

## For those who rent

As a renter, you have less control over the structural integrity of your building, but you do control which apartment or house you rent. When looking for housing, remember:

- Apartment buildings have to meet the same codes and structural requirements as houses.
- Avoid rental units made of unreinforced masonry or those with “tuck-under” parking spaces on the ground floor.
- Consider the safety of attached structures such as stairways and balconies, which can break during an earthquake.

Ask your landlord these questions:

- What retrofitting has been done on this building?
- Has the water heater been strapped to the wall studs?
- May I secure furniture to the walls?

## More Ways to Protect Yourself Financially

Identify your important documents and place them in a safe space. These include property deeds, insurance policies, vehicle titles, wills, bank accounts and stocks and bonds, credit cards and personal information such as passports, driver’s licenses and marriage/birth certificates. Consider scanning these documents and keeping them electronically or making paper copies. Take photos or a video of the interior and exterior of your home and your personal belongings to make an inventory for insurance purposes.

You can further protect your home with earthquake and flood insurance. Without insurance, you will be responsible for all costs to repair or rebuild your home and replace your personal property. Residential policies do not cover earthquake or flood damage. For more information, see page 30.

## SPECIAL CONSIDERATIONS

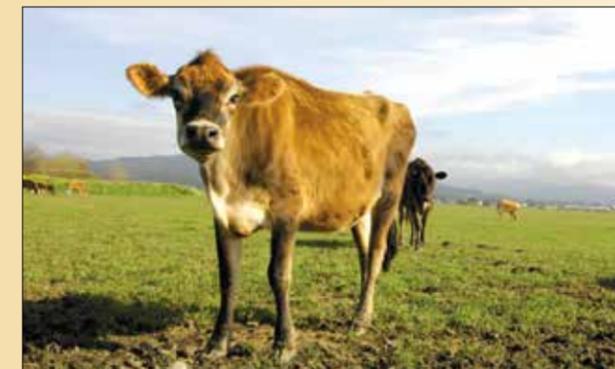
### Children

Earthquakes and tsunamis may be traumatic events for all of us. They are especially frightening for children who may not understand such events and feel anxious and confused. After an earthquake, a child fears reoccurrence and injuries, and being separated from other family members. Seeing a parent or other adult become frightened adds to a child’s anxiety. Repeated aftershocks can increase these fears. You can help to alleviate your child’s fears before the next earthquake.

- Talk with children about what might happen during an earthquake or tsunami. Let them ask questions.
- Involve children in reducing hazards, putting together an earthquake kit and in developing an earthquake plan. Include emergency information in your child’s back pack. Practice family earthquake drills.

### AFTER THE EARTHQUAKE

- Keep the family together.
- Limit media coverage of the disaster. Repeated exposure to disturbing images and sounds will increase children’s fears.
- Encourage children to talk or draw pictures about their experience.
- Include children in earthquake cleanup and safety activities whenever possible and age appropriate.
- Take particular care at bedtime. Children may have difficulty sleeping, may wake up frequently and/or have nightmares for weeks or months afterwards. Allowing a child to share a room with another child or parents may alleviate these fears.



### Fragile, Elderly and Disabled

Persons with any special considerations need to take extra precautions.

- Realistically assess your own special needs and those of family members and write them down. Include medications and special equipment such as ventilators and oxygen tanks.
- Keep medications, duplicate prescriptions, glasses and any special equipment in a safe place where they can be easily reached.
- Keep a notebook, pencils, a whistle and flashlight in several locations if you have difficulty in communicating.

- Include supplies for seeing eye, hearing, or companion dogs.

### DURING AND AFTER AN EARTHQUAKE

- If you are in a wheelchair, lock the wheels of the chair once you are in a safe and protected position.
- If unable to move safely and quickly, stay where you are, even in bed, and cover your head and body with your arms, pillows and blankets.
- Use your whistle to call for help and signal others if you need it.

To find out more about how children and adults react to emergencies and how you can help, contact your local mental health department.

### Pets and Livestock

Don’t forget your pets in your earthquake and tsunami plan.

- Include extra pet food and medications in your disaster kits.
- Consider implanting your pet with an identification microchip so that if you and your pet are separated, you can be easily reunited.
- Many emergency shelters don’t allow pets. Prepare a list of family, friends and other locations that could shelter your pets in an emergency. Emergency preparedness is particularly important for livestock owners because of their food and shelter needs and difficulties in transporting large or numerous animals.
- Make sure every animal has durable and visible identification.
- Identify alternate water and power sources. A generator with a safely-stored supply of fuel may be essential if you have electrical equipment necessary to the well being of your animals.
- If you use heat lamps or other electrical machinery, make sure the wiring is safe and that any heat source is clear of flammable debris.

More tips for livestock owners at: [humanesociety.org/issues/animal\\_rescue/tips/disaster\\_preparedness\\_for\\_livestock.html](http://humanesociety.org/issues/animal_rescue/tips/disaster_preparedness_for_livestock.html).

## STRENGTHENING YOUR “PIER AND POST” FOUNDATION

“Pier and post” or “post and beam” foundations consist of wooden posts on isolated concrete footings, which support the entire structure. Many homes in rural Northern California use this foundation system. This type is particularly vulnerable to the strong side-to-side shaking from earthquakes. There is no question that the best foundation to resist earthquake shaking is a continuous perimeter foundation, but for many Northern California residents, the cost of installing such a foundation is prohibitive.

It is possible, however, to strengthen your pier and post foundation at relatively low cost. The bracing system pictured here will increase resistance to lateral forces for your home. The bracing should be installed around the perimeter of the structure and, at a minimum, every second line of interior posts. This type of strengthening should be considered adequate for short term stabilization until you are able to install a permanent, concrete, perimeter system.

Find out more at [earthquakecountry.org](http://earthquakecountry.org).



## Step 5 DROP, COVER, AND HOLD ON

The previous steps have concentrated on getting ready for the next earthquake or tsunami. What should you do while the ground is shaking?

### INDOORS

#### Drop, cover, and hold on

- Drop down to the floor and take cover under a sturdy desk, table or other furniture.
- Hold on to the table or desk and be prepared to move with it—hold the position until the ground stops shaking and it is safe to move.

#### If there is no nearby table or desk:

- Sit on the floor against an inside wall, away from windows, tall furniture or bookcases.
- Protect your head and neck with your arms.
- If you are elderly or have mobility impairment, remain where you are, bracing yourself in place.
- Avoid exterior walls, windows, hanging objects, mirrors, tall furniture, large appliances, and cabinets with heavy objects or glass.

DO NOT GO OUTSIDE WHILE THE GROUND IS SHAKING!



**IN BED** If you are in bed, stay there, hold on and protect your head with a pillow.

**IN A MULTISTORY BUILDING** Drop, cover, and hold on. Do not use elevators. Do not be surprised if sprinkler systems or fire alarms activate.

**IF YOU ARE OUTSIDE** Move to a clear area if you can safely do so; avoid power lines, trees, signs, buildings, vehicles and other hazards.

### Tip How will I know if an earthquake is big enough to cause a tsunami?

Get into the habit of COUNTING how long the earthquake lasts. If you count 20 seconds or more of shaking and are in a tsunami hazard zone, evacuate to a safe area as soon as you can safely walk. Even if you aren't in a tsunami zone, counting is a good idea—it will help to keep you calm.

**DRIVING** Pull over to the side of the road, stop and set the parking brake. Avoid overpasses, bridges, powerlines, signs and other hazards. Stay inside the vehicle until the shaking is over. If power lines fall on your vehicle, stay inside until a trained person removes them.

**IF YOU ARE IN A THEATER OR STADIUM** Stay at your seat. Duck down and protect your head and neck with your arms. If you can't duck under the seat, at least put your head and upper body under the seat. Don't try to leave until the shaking stops. Then exit slowly, watching for fallen debris or for anything that could fall on you in the aftershocks. Stay calm and encourage others to do likewise.

**IF YOU ARE IN THE MOUNTAINS** Avoid unstable slopes or cliffs and watch for falling rock and debris.

### Myth #5

#### The 'Triangle of Life' is the Best Way to Protect Yourself Inside a Building

**NOT TRUE.** The best survival method inside a building is to **drop, cover, and hold on**. The triangle of life advocates that you get next to a large object rather than crouch beneath a desk or table. This will expose you to lacerations and crushing injuries from falling objects and debris. Many reputable scientific, government and relief organizations have examined the triangle of life and are unanimous in recommending that you drop, cover, and hold on. Find out more at [earthquakecountry.org/dropcoverholdon](http://earthquakecountry.org/dropcoverholdon).

## Step 6 IMPROVE SAFETY

### EVACUATE if you are in a TSUNAMI HAZARD ZONE

For a large local earthquake, feeling ground shaking may be the only warning you will get that a tsunami is on its way. Use tsunami hazard maps and posted hazard zone signs to identify safe evacuation areas. Refer to page 15 for more information about tsunamis.

**IF YOU ARE AT THE BEACH** Move to higher ground immediately—no matter how small the earthquake.

**IF YOU ARE IN A TSUNAMI HAZARD ZONE AND THE EARTHQUAKE LASTS A LONG TIME** Immediately gather your family members, grab your tsunami disaster kit, and WALK to a safe area.

**IF EVACUATION IS IMPOSSIBLE** Go to the upper floor of a sturdy building or climb a tree. This should only be a last resort.

### DO NOT WAIT FOR AN OFFICIAL WARNING

IF YOU ARE NOT IN A TSUNAMI HAZARD ZONE, STAY WHERE YOU ARE. YOU ARE NOT AT RISK OF A TSUNAMI. Unnecessary evacuation will put you at risk and hamper the evacuation of people who really need to get away from danger.

### Once you are in a safe area, CHECK FOR INJURIES AND DAMAGE

First take care of your own situation—check yourself for injuries so you can help others. Remember your emergency plans. Aftershocks may cause additional damage, so get to a safe location and take your disaster supply kit with you. Once you are safe, help others and check for damage. Protect yourself by wearing sturdy shoes and work gloves, to avoid injury from broken glass and debris. Wear a dust mask and eye protection if you have them.

If you are trapped under debris, protect your mouth, nose and eyes from dust. If you are bleeding, put pressure on the wound and elevate the injured part. Signal for help with your emergency whistle, a cell phone, or tap on pipe or wall, three times every few minutes, so rescuers can locate you. Don't shout—shouting will wear you out and can cause you to inhale dangerous amounts of dust.

### Check for injuries

- Use your first aid kit or the front pages of your telephone book for detailed instructions on first aid measures such as stopping bleeding, rescue breathing and CPR (cardiopulmonary resuscitation).
- Do not move seriously-injured persons unless they are in immediate danger of further injuries.
- Cover injured persons with blankets or additional clothing to keep them warm.

### Check for damage

**FIRE** If possible, put out small fires in your home or neighborhood immediately. Call for help, but don't wait for the fire department.

**GAS LEAKS** Shut off the main gas valve only if a leak is suspected or identified by the odor of natural gas. Wait for the utility company to turn it back on once the damage is repaired.



**DAMAGED ELECTRICAL WIRING** Shut off power at the breaker box. Leave the power off until damage is repaired.

**UNPLUG BROKEN LIGHTS AND APPLIANCES** They could cause fires when power is restored.

**DOWNED POWER LINES** Consider all downed lines as potentially hazardous and stay well away from them. Never touch downed lines or any objects in contact with them even if you think they may be dead.

**FALLEN ITEMS** Beware of items tumbling off shelves when you open closet and cupboard doors. Wear gloves before handling broken items. Replace your telephone on its receiver. Telephones off the hook tie up the telephone network.

**SPILLS** Clean up any spilled medicines, drugs or other non-toxic substances. Potentially harmful materials such as bleach, lye, paint, garden chemicals, and gasoline should be isolated or covered with an absorbent such as dirt or cat litter. When in doubt, leave your home.

**DOWNED OR DAMAGED CHIMNEYS** Stay away from chimneys and walls made of brick. They may be weakened and could topple during an aftershock. Don't use a fireplace until it is inspected by an expert – it could start a fire or let poisonous gasses into your home.

## Step 7 RECONNECT AND RESTORE

The first few hours and days after an earthquake or tsunami...

Once you have met your and your family's immediate needs, continue to follow the plan you prepared in advance (see Step 2, page 22).

### Tsunamis

Stay away from the coast until officials reopen the area for you to return.

- The first surge is almost never the largest. The largest waves may arrive hours after the first.
- Successive surges will arrive at irregular intervals spaced minutes to tens of minutes apart. The danger period may last 10 hours or longer.
- Never go to the coast to watch a tsunami. Tsunamis move faster than a person can run. Incoming traffic hampers safe and timely evacuation of coastal areas.

#### BE IN COMMUNICATION

Listen to your NOAA Weather Radio for updates on the hazard and for instructions on what to do.

### Earthquakes

You may be safest staying in your home even if the power is off and some items have been damaged. Shelters may be overcrowded and initially lack many services. Use the information you put together in your disaster plan and the supplies you organized in your disaster kits.

- Do not use open flames (candles, matches, lighters or grills) or operate any device that could generate a spark such as light switches, generators, motor vehicles until you are sure there are no gas leaks.
- Never use a camp stove, gas lantern or heater, gas or charcoal grill, or gas generator indoors.

#### BE IN COMMUNICATION

- Use your portable, car, or NOAA Weather Radio for updates and safety advisories. Scan channels to find one that is on air and broadcasting safety information.
- Call your out-of-area contact and tell them your status, then stay off the phone. Emergency responders need the phone lines for life-saving communications.
- Check on the condition of your neighbors.

### FOOD AND WATER

- If the power is off, plan meals to use up refrigerated and frozen foods first. With the door closed, food in the freezer may last several days.
- If your water is off or unsafe, you can drink from water heaters, melted ice cubes, or canned vegetables. Avoid drinking water from swimming pools or spas.
- Do not eat or drink anything from open containers that are near shattered glass.



### The first weeks after the earthquake...

This is a time of transition. Aftershocks may continue for many months, but it is time to work toward getting your life, your home and family, and your routines back in order. Emotional care and recovery are just as important as healing physical injuries and rebuilding a home.

- Make sure your home is safe to occupy and not in danger of collapse in an aftershock.
- If your gas was turned off, you will need to arrange for the gas company to turn it back on.
- If the electricity went off and came back on, check your appliances and electronic equipment for damage.

#### Tip Join a Community Emergency Response Team (CERT)

CERT programs will educate you about the hazards in your area and will train you in basic disaster response skills. Contact the Regional Training Institute to find out about CERT teams in your area or go to [californiavolunteers.org/index.php/CERT](http://californiavolunteers.org/index.php/CERT).

- If water lines broke, look for water damage.
- Have a professional inspect your fireplace or wood burning stove before you use them after an earthquake. The damage may not be easy to see and could cause a chimney fire or poisonous gas release.
- Locate and/or replace critical documents that may have been misplaced, damaged or destroyed.
- Contact your insurance agent right away to begin your claims process. Take pictures of the damage both of your building and contents.

### If you cannot stay in your home...

If your home is in a tsunami hazard zone, is structurally unsafe, or threatened by a fire or other hazard, you need to evacuate.

If you evacuate, tell a neighbor and your out-of-area contact where you are going. Set up an alternative mailing address with the post office as soon as possible. Take the following, if possible, when you evacuate:

- Personal disaster supply kits
- Supply of food, water and snacks
- Blanket/pillow/air mattress or sleeping pad
- Change of clothing and a jacket
- Towel and washcloth
- Comfort items such as family pictures, games, books
- Personal identification and copies of household and health insurance information
- Special needs items such as medicines, eyewear, infant supplies (diapers, bottles, baby food), and supplies for elderly and disabled persons



#### Do not take to a shelter:

- Pets—have a plan for your pets in advance (service animals for people with disabilities are allowed but you must bring food for them)
- Large quantities of unnecessary clothing or other personal items—space is very limited
- Valuables that might be lost, stolen, or take up needed space

If a major disaster has been declared by the President, the Federal Emergency Management Agency (FEMA) may activate the Individuals and Households Program. This program may include home-repair cash grants, rental assistance and/or temporary housing.

Find out more by visiting [fema.gov/disaster-process-disaster-aid-programs](http://fema.gov/disaster-process-disaster-aid-programs).



# Insuring Against Earthquake and Tsunami Damage in California

## Earthquake Insurance

IF YOU OWN your home, it is probably your biggest single asset. In seconds, an earthquake can cause major damage to both the structure and its contents. Following the steps in this handbook will help to protect your family from injuries and reduce your losses, but you may still have some level of damage and will need to repair or replace belongings. One option for managing these potential costs is to buy earthquake insurance.

Most standard homeowners', mobile homeowners', condominium, and renters' insurance policies do not cover earthquake damage; it is generally a separate policy you can purchase when buying homeowners insurance. All insurance companies that sell residential property insurance in California are required by law to offer earthquake insurance to homeowners when the policy is first sold and every two years thereafter.

Most of the companies that sell residential property insurance in California participate in the California Earthquake Authority (CEA) and offer CEA's residential earthquake policies. The cost of the earthquake policy is based on a number of factors including location, age, construction type and home value.

CEA policies cover a policyholder's dwelling, while excluding coverage for nonessential items such as swimming pools, patios, and detached structures. The insured value of your home is the same as the amount of coverage specified in your homeowners insurance policy. CEA policies provide:

- Home repair or replacement
- Additional living expenses
- Replace personal property
- Emergency repairs
- Building code upgrades
- Land—costs to replace, stabilize or restore the land that supports the home

Optional coverage is available to lower the deductible, increase personal property coverage, increase additional living expenses, and increase building code and land upgrades. You may purchase a CEA policy only through the CEA's participating insurers. A complete list is on the CEA web site at [earthquakeauthority.com](http://earthquakeauthority.com) which has an online premium calculator.

## Tsunami Flood Insurance

Flood insurance is not included on homeowner's policies and cannot be purchased through residential insurance companies. A separate flood insurance policy issued through the National Flood Insurance Program (NFIP) covers damages due to tsunamis as well as other flooding events and includes:

- Losses that result from flood-related erosion
- Damage due to mudflows if caused by flooding
- Flood damage to the building itself— foundation elements, posts, pilings, piers or other support systems in elevated buildings

Flood insurance does not cover buildings that are entirely over water (like a boat house), and structures other than buildings (like fences, retaining walls, swimming pools, walkways, decks, driveways, etc.)

You can find out about your flood risk by entering your property address information at [floodsmart.gov](http://floodsmart.gov).

### Myth #6

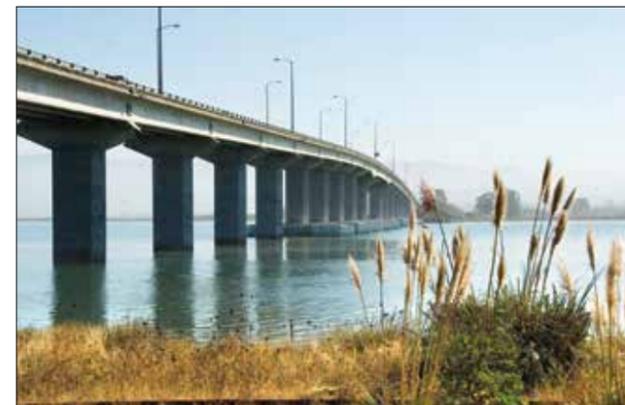
#### Homeowner's Insurance Will Cover Any Damage to My Home or Belongings Caused by an Earthquake or Tsunami

Most residential property insurance policies do not cover earthquake or tsunami damage. A separate earthquake insurance policy is one way to protect your home and the investments you have made in personal belongings. The National Flood Insurance program is the only organization that offers policies to cover flood damages related to storms or tsunamis. Investigate your options carefully to ensure that your assets are sufficiently protected.

# Recovering From a Big One

## Resilient infrastructure

TO BOUNCE BACK quickly from a disaster, communities need to become resilient. Community resilience depends on how many individuals, businesses, schools, agencies and organizations are prepared. While taking the actions suggested in this handbook will help protect your family and reduce your personal losses, your actions alone can't protect your community and restore the regional economy. Studies of past disasters show that the key to economic recovery is infrastructure—the essential facilities like roads, bridges, hospitals and dams and the lifelines that supply water,



power, gas, and communications. The more damage there is to infrastructure, the slower the recovery. Building resilient infrastructure requires public-private partnerships and a long-term perspective on the health and viability of the region. You can help by letting public officials know that seismic safety is a high priority and must be included in long-term planning for all California communities. The process is similar to voting, where personal decisions and actions can affect everyone:

- Learn about the issues—earthquake impacts and risk reduction strategies.
- Decide which efforts will best protect your loved ones and your financial security.
- Take action—talk to friends and neighbors and let candidates and public officials know which efforts are important to you.

If enough people “vote” the same way, they will have a winning platform and be on the path to a resilient community.

## Small business recovery

Small businesses are particularly vulnerable to the economic disruption caused by major disasters. Many small businesses have very narrow profit margins and even a small disruption can make a big difference in the bottom line. There are steps you can take, similar to the steps in this handbook, to protect your business and employees.

Find out more information—download or request free copies of “Seven Steps to an Earthquake Resilient Business” at [earthquakecountry.org/roots](http://earthquakecountry.org/roots).



**Tip** Don't forget your earthquake and tsunami readiness when you are traveling or on holiday. Thirty-nine Americans died in the 2004 Indian Ocean tsunami, most of whom were on vacation in Thailand and Sri Lanka.

# THE SEVEN **7** STEPS FOR EARTHQUAKE & TSUNAMI SAFETY

Tear off this page and put it on your refrigerator, bulletin board or other prominent place. Make copies for other family members.

## PREPARE

### 1 Secure Your Space (pg 20)

- Identify items that may fall, topple or slide
- Secure potentially hazardous and valuable items
- Determine if you live, work or play in a tsunami hazard zone

### 2 Plan to be Safe (pg 22)

- Practice “Drop, Cover, and Hold On” drills
- Collect critical supplies
- Choose a meeting place and an out-of-area contact
- Recognize the natural and official warnings of a tsunami and know how to respond

### 3 Organize Disaster Supplies (pg 23)

- Create kits for home, work and car
- Be prepared to be isolated for at least a week

### 4 Minimize Financial Hardships (pg 24)

- Identify weaknesses in your building and fix them
- Consider earthquake and/or flood insurance

## SURVIVE

### 5 Drop, Cover, and Hold On (pg 26)

- **DROP** to the floor
- **TAKE COVER** under a sturdy table or desk
- **HOLD ON** until the shaking stops

### 6 Improve Safety (pg 27)

- If you are in a tsunami hazard zone, immediately **WALK** to higher ground or inland away from coast
- Check for injuries and damage

## RECOVER

### 7 Reconnect and Restore (pg 28)

- If you evacuated coastal areas—stay away until officials permit you to return
- Be in communication—use your radio for info
- Expect aftershocks—some may be large enough to do additional damage

## IMPORTANT INFORMATION

Out-of-Area Contact Name _____	Phone _____	
Email _____	Phone _____	
Neighborhood Meeting Place _____	Phone _____	
Regional Meeting Place _____	Phone _____	
Doctor/Office _____	Account No. _____	Phone _____
Medical Insurance _____	Policy No. _____	Phone _____
Pharmacist _____	Account No. _____	Phone _____
R <sub>x</sub> No. _____	R <sub>x</sub> No. _____	R <sub>x</sub> No. _____
Home/Rental Insurance _____	Policy No. _____	Phone _____
Veterinarian/Kennel _____	Account No. _____	Phone _____

Call the **HEEC Earthquake Hotline** for a daily recording of earthquake activity locally and around the globe: **(707) 826-6020**

Shake Out  
[shakeout.org](http://shakeout.org)

Living on Shaky Ground  
[humboldt.edu/shakyground](http://humboldt.edu/shakyground)

US Geological Survey Earthquake Preparedness  
[earthquake.usgs.gov/learn/preparedness.php](http://earthquake.usgs.gov/learn/preparedness.php)

Geologic Hazards  
[myhazards.caloes.ca.gov](http://myhazards.caloes.ca.gov)

Earthquake Country Alliance  
[earthquakecountry.org](http://earthquakecountry.org)

NOAA Tsunami Preparedness  
[tsunami.noaa.gov/prepare.html](http://tsunami.noaa.gov/prepare.html)

