

## Tsunami (soo-NAH-mee)

Tsunamis (Japanese translation “harbour wave”) are waves with a great distance between crests, and are caused by any widespread, sudden movement of large volumes of water. The tsunami grows tall as the ocean shallows, such as in a harbour. In ancient Japan, the people often witnessed the wave rise directly out of the harbor and coined the term tsunami. Tsunamis are most prevalent in the Pacific Ocean, but are known to occur in all ocean basins.

## What is a tsunami?

A tsunami is a natural hazard consisting of a series of long surge-like waves generated when a large volume of ocean water is rapidly displaced. Tsunamis are known for their capacity to violently flood coastlines, causing devastating property damage, injuries, and loss of life.

Major submarine or coastal earthquakes where there is significant displacement of the ocean floor or coast are the cause of most tsunamis. They also cause some of the biggest tsunamis, in terms of wave height at shore and the size of the inundation area. The inundation area is the area that will be subject to flooding.

Coastal and submarine landslides, and volcanic eruptions, can occasionally cause tsunamis too, but

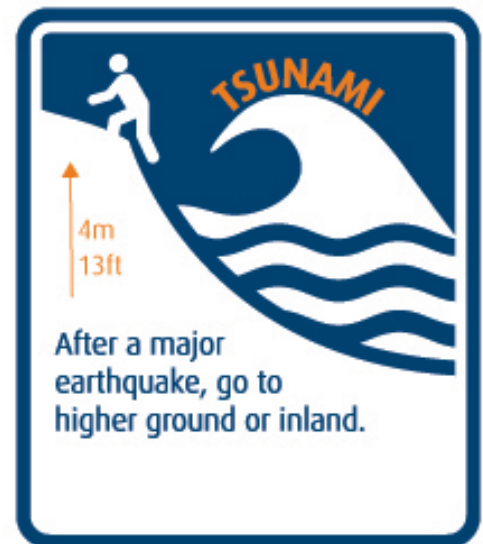
these affect a much smaller length of coast and are infrequent. Some landslides and eruptions are not associated with trembling of the earth: you should always evacuate if the ocean recedes or there’s roaring like a jet engine from the ocean.

There are two types of tsunamis: local and distant. A local tsunami will be associated with a “felt” earthquake, while a distant tsunami will happen far away and you will be notified by officials if any actions are necessary.

Tsunami waves differ from ordinary coastal waves in that the entire column of water from the ocean floor to the surface is affected. Tsunami waves contain considerable energy; they travel further inland compared to ordinary coastal waves. A tsunami may not look like a wave at all, but will have very strong ocean currents under the surface.

**A tsunami is a series of waves. The first wave to arrive is often not the largest, and each wave may be separated by up to an hour or more.** Waves may continue for many hours – stay away from the shore until local government officials tell you it is safe to return.

**There is no way to predict if a tsunami may occur.**



## Capital Regional District Tsunami Frequently Asked Questions (FAQ's)

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## FAQs for tsunamis in the Capital Region

### 1. What kind of an earthquake may cause a tsunami?

The most dangerous tsunami threat to the BC coast will follow a major, "megathrust" earthquake along the *Cascadia subduction zone (CSZ)*, located about 100 km off Vancouver Island. Such an earthquake is commonly called "The Big One". The shaking will be so strong it will be difficult to stand in many places. The best available science suggests that residents along any BC coastline plan for tsunami flooding. Since the elevation differs in each area, however, check with [www.prepareyourslf.ca](http://www.prepareyourslf.ca) to see what the recommended evacuation distances are for your work, home, school and recreational areas.

The main tsunami threat the Capital region comes from a subduction earthquake off the West Coast. At most, a tsunami created elsewhere in the Pacific Basin would affect low lying coastal areas in Greater Victoria, similar to large winter storms. Like large winter storms, tsunami waves can threaten people on beaches because of the strong currents involved.

### 2. What is a major earthquake?

A major earthquake will have shaking motion that makes it difficult to stand. Always "Drop, Cover and Hold On" until the shaking stops to protect yourself, and then head to higher ground or inland immediately.

### 3. Why shouldn't I wait for an official warning if I feel a major earthquake that makes it difficult to stand?

**Strong shaking IS your warning!** When an earthquake makes it difficult to stand move away from beaches and low-lying areas and seek higher ground immediately. Do not count on official notices to warn you to evacuate because the earthquake may damage communication systems and officials may not have enough time to get to coastal areas at risk.

### 4. Is a tsunami just one big wave?

A tsunami consists of a series of waves that may last for hours. A tsunami may not look like a big wave, but more like a rapid rise and fall in the ocean level. The first wave from a Cascadia Subduction Zone (CSZ) earthquake could arrive in the Port Renfrew area in 35 minutes, and Greater Victoria in 75 minutes, but the largest wave may not arrive until later. It is important to stay away from coastal and low-lying areas until your local government officials to tell you it is safe to return.

## 5. Is it safe after the first wave?

Since a tsunami consists of a series of waves, and the largest wave may arrive much later, it is not safe to go back to coastal or low-lying areas until instructed to do so by your local government officials.

## 6. How long after a local or major Cascadia Subduction Zone (CSZ) earthquake will a tsunami arrive?

Based on modelling of a major 9.0 CSZ earthquake scenario, the first wave could arrive at the Port of Renfrew in 35 minutes, and Greater Victoria in approximately 75 minutes.

### Projected Local Tsunami Arrival Times

| Location                                       | Tsunami Arrival Time (min) | Time to Maximum Water level (min) | Maximum Water level (m) / (ft) |
|--|----------------------------|-----------------------------------|--------------------------------|
| Port Renfrew (entrance)                        | 35                         | 50                                | 3.5 / 11.5                     |
| Sooke Harbour (entrance)                       | 60                         | 75                                | 2.5 / 8.2                      |
| Esquimalt Harbour (entrance)                   | 77                         | 96                                | 2.7 / 8.9                      |
| Victoria Harbour and Gorge Waterway (Entrance) | 76                         | 95                                | 2.5 / 8.2                      |
| Cadboro Bay                                    | 90                         | 160                               | 2.0 / 6.6                      |
| Sidney   | 110                        | 150                               | 2.0 / 6.6                      |

## 7. How fast will the waves and currents be?

Tsunamis can generate very strong currents in harbours and waterways even when there is only a small amount of inundation or flooding on land. These currents can impact navigation and damage docks and boats. Speeds may be fast enough to be dangerous so be sure to listen to local media and stay away from coastal areas until you are instructed by local government officials that it is safe to return.

## 8. How will I know if a tsunami is coming after a distant earthquake?

Your local emergency program and Emergency Management British Columbia (EMBC) monitor a number of channels to be notified of distant tsunamis including the West Coast Alaska Tsunami Warning Centre (WCATWC). WCATWC will issue one of three alerts - a Watch, an Advisory, or a Warning, and EMBC will do the same. Emergency management personnel will notify you if any action is required via local and social media and other channels. You can sign up for direct alerts by following NWS\_WCATWC on Twitter.

## 9. What is the difference between a tsunami Watch, Advisory, and Warning?

### Warning

A “Warning” is the highest level of tsunami alert. Warnings are issued 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.

### Advisory

An “Advisory” is the second highest level of tsunami alert. Advisories are issued due to the threat of a tsunami that has the potential to produce strong currents dangerous to those in or near the water. Significant inundation is not expected for areas under an Advisory but coastal zones may be at risk due to strong currents. Appropriate actions by local emergency management personnel may include closing beaches and evacuating harbours and marinas.

### Watch

A “Watch” is the third highest level of tsunami alert. Watches are based on seismic information, without confirmation that a destructive tsunami is underway. There is a potential threat to a zone under a tsunami Watch but communities have time to prepare. Emergency management personnel and coastal residents should prepare to take action in case the Watch is upgraded.

## 10. What other tsunami alerts may be issued by authorities?

### Information Statement

An “Information Statement” is issued when an earthquake has occurred and there is no threat of a destructive tsunami affecting Coastal BC. Information Statements may be used to prevent unnecessary concern when an earthquake has occurred but there is no tsunami threat.

### Cancellation

A “Cancellation” cancels any previously issued tsunami messages. It is issued when there is no longer observed evidence of tsunami waves at tide gauge stations. Local conditions may differ from those at tide gauge stations and local authorities should determine the safety of coastlines. Once a cancellation has been issued for a tsunami event, EMBC will no longer issue tsunami messages.

For further information regarding the WCATWC tsunami alert levels, visit the WCATWC website at: <http://wcatwc.arh.noaa.gov/Products/msgdefs.htm>

## 11. What's the difference between tsunami notification zones used by Emergency Management British Columbia (EMBC) and West Coast Alaska Tsunami Warning Centre (WCATWC)?

WCATWC issues alerts based on three breakpoints in BC (BC/AK border, North Tip of Vancouver Island and BC/WA border), while EMBC divides BC into five notification zones for a BC-Specific alert. Since coastal BC is such a large area with different levels of risk, there are some areas of the coast that may not be affected by a tsunami. For example, Zone C may be impacted by a distant tsunami, while Zones D (Southern Vancouver Island) and Zone E (Strait of Georgia) will not be impacted. EMBC consults with federal scientists to determine whether to include Zones D and E into the BC-specific alert. The first alert notification from EMBC will likely be a repeat of the WCATWC information while a determination of a BC-specific notification is assessed. It is important to stay tuned to media and follow instructions from local government officials.

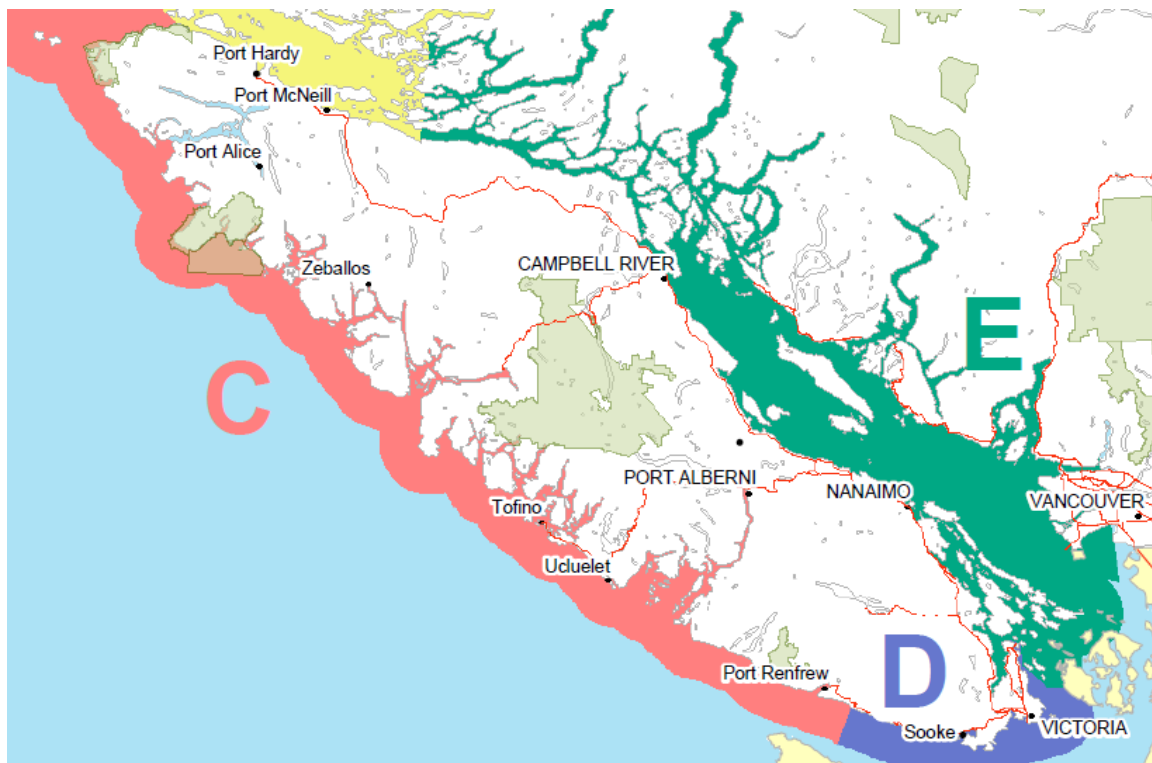
## 12. What BC tsunami notification zone am I located in?

**Residents of the Capital Region may be located in zones C, D, or E.**

**Zone C:** The outer West Coast of Vancouver Island from Cape Scott to Port Renfrew.

**Zone D:** The Juan de Fuca Strait from Jordan River to Greater Victoria, including the Saanich Peninsula.

**Zone E:** The Strait of Georgia including the Gulf Islands, Greater Vancouver, and Johnstone Strait.



### **13. What is the tsunami hazard line?**

The tsunami hazard line is the projected limit or run up of water on shore due to tsunami in the event of a major 9.0 Cascadia Subduction Zone (CSZ) earthquake based on recent modelling. Anything below this line is considered to be a tsunami hazard area and is used for emergency planning purposes.

### **14. What is a tsunami hazard area?**

A tsunami hazard area is an area that may be affected by flooding due to tsunami. Evacuation is recommended if you are in one of these areas during a major earthquake that makes it difficult to stand. Check with your local emergency program to see if you are located in a tsunami hazard area.

### **15. Where can I go to find out if I am in a tsunami hazard area?**

The Tsunami Hazard Line Map can be found at <http://www.prepareyourself.ca/>.

This map is based upon recent scientific modelling which suggests that land in the Greater Victoria area approximately 4 meters or 13 feet above the high tide line is not likely to be affected by tsunami. This map depicts areas below the projected tsunami line that may be subject to a tsunami hazard in the event of a major 9.0 Cascadia Subduction zone (CSZ) earthquake. Anything below this line is considered to be a tsunami hazard area.

The map is intended only as a general guide for emergency preparedness, and your local emergency program may have evacuation zones that are further away from the shore than the hazard line. You should contact your local emergency program to find out if you are located in an evacuation zone.

### **16. When should I evacuate?**

If you feel a major earthquake and you're in tsunami hazard area (refer to map) you should evacuate immediately!

There are other natural signs of an arriving tsunami: You might notice something strange like the ocean receding, a sudden rise or fall of ocean level, or hear roaring like a jet engine from the ocean. Evacuate to higher ground immediately if you experience any of these signs.

You may be asked by emergency officials to evacuate if you are in a tsunami hazard area – follow their instructions and be sure to take your emergency kit with you.

## 17. From where should I evacuate?

You should move away from beaches, harbours, marinas, and low lying areas if you feel a strong earthquake. You can also check in advance on the map located on [PrepareYourself.ca](http://PrepareYourself.ca) to see if you work, live, or play in a potential tsunami hazard area. If you do, make sure you have an emergency kit for each of these places to be prepared.

## 18. Where should evacuate to?

If you experience a major earthquake that makes it difficult to stand, move to a tsunami-safe area in your community. Monitor local media for information.

## 19. How far inland or high up do I go to evacuate?

You should check the tsunami hazard map for the areas where you live, work, go to school and play to find the nearest area that is safe. In the Capital Region area you do not usually need to go far; in most areas of the CRD, 4 metres or 13 feet above high tide is a safe elevation above the water. It is NOT necessary to go to the highest point in the area, just out of the hazard area. You can go to [PrepareYourself.ca](http://PrepareYourself.ca) to view the map.

## 20. How should I evacuate?

You should evacuate immediately on foot or by bicycle to an area outside the tsunami hazard areas. Only use a car if absolutely necessary as roads may be blocked or congested, and emergency response personnel will need to use them. If you must use your car keep driving inland to make way for others evacuating along the same route.

## 21. How much time do I have to evacuate?

If you are near the coast and feel a major earthquake that makes it difficult to stand, you should **drop, cover, and hold on**, and then evacuate to higher ground or inland. The first wave could be in Port Renfrew within 35 minutes and Victoria in 75 minutes. Please refer to the table under item Q6.

## 22. How long do I evacuate for?

Only return to the evacuated area once you have received notification from local government authorities. Tsunami waves can take many hours to arrive and the largest wave can land/break many hours after the first wave. Large aftershocks can generate their own new waves.

## 23. How can I help during a tsunami?

Knowing your neighbours and others on your street that might need additional assistance is a great way to be of assistance during a tsunami and other potential hazards. Make connections with these people and community groups as a way to increase your community's resilience. Make sure you plan for evacuations with your family and neighbours before a tsunami strikes.



## 24. What if I'm in a boat in a harbour during a tsunami?

If there is a local tsunami resulting from a major earthquake that makes it difficult to stand, and you are moored in a harbour, **abandon your boat or float home immediately and go to higher ground or inland.**

## 25. How is this map different from the previous tsunami hazard map in 2004?

The tsunami planning maps published in 2004 were created using best available data at the time. The new map is based on an updated numerical model called NEOWAVE, which won the 2009 tsunami model challenge at Oregon State University. NeoWave is the official model for tsunami inundation mapping in Hawaii, American Samoa, the U.S. Gulf coast states, and Chile. In addition to meeting the National Tsunami Hazard Mapping Program (NTHMP) benchmarks, it has been validated with measurements from the 2009 Samoa tsunami, 2010 Chile tsunami, 2010 Mentawai tsunami, and 2011 Tohoku tsunami with publications in many journals. The new map does not differ largely from the original, but confirms the tsunami planning zones already in place.

## 26. How accurate is the computer modelling?

The modelling is based on many variables, and looks at maximum probable results. Science is constantly changing, and additional modelling may be done at a later date as the science evolves. The map and associated hazard line were created using the NEOWAVE model which has been tested against actual events and has been used in several other projects in North America and the world. The model is intended to provide a guideline for emergency planning and to help the public understand where safe areas are.

## 27. Why was a 9.0 Cascadia Subduction Zone (CSZ) earthquake scenario used to develop the model?

A 9.0 CSZ earthquake scenario was used as it is the most probable tsunami-producing scenario to occur in our region. This does not mean that a 9.0 CSZ earthquake is the only type of earthquake that may occur.

## 28. Where can I go for more information?

To learn more about emergency preparedness and hazards in the capital region visit [www.PrepareYourself.ca](http://www.PrepareYourself.ca).