

## Landslides: An Introduction

What are landslides?

How may landslides affect me?

Why should I care now?

What can I do about it?

Where can I learn more about landslides in Washington?

**Landslides may occur on steep slopes such as coastal bluffs, especially when water has seeped into the ground.**

Sea level rise will cause erosion, which can increase landslide risk for bluffs.

**Landslide-prone coastal bluffs may not be next to the shoreline today, since many shoreline areas have been filled for buildings and towns.**

Landslides affect areas above and below the slide, and the weight of this material can move or crush buildings.

**Prepare for landslides:**

- Build structures away from the top or base of a slope,
- Preserve natural slopes and vegetation,
- Attend local planning meetings to ensure that local development considers landslides.

### What are landslides?\*

A landslide (<https://www.dnr.wa.gov/publications/ger fs landslide processes.pdf?3nrk1o>) generally refers to the downhill movement of rock, soil, or debris. The term landslide can also refer to the deposit that is created by a landslide event. Landslides can be large or small. They can happen suddenly or move very slowly over days, months or even years. Geologists refer to landslides as “mass wasting.” Three main processes play a role in landslides:

1. Gravity – the force of gravity acts to move material and debris downhill.
2. Water – adds significant weight to the slope as it seeps into the ground, becoming groundwater, and adding to the gravitational force.
3. Friction – the force between a deposit of rock or soil and the slope that it rests on. Typically, on steeper slopes, there is less friction, which can make landslides more common.

Shallow landslides commonly occur along Puget Sound and Pacific Coast shorelines, as well as upland areas. These are smaller landslides that typically involve a thin layer (1-2 meters) of soil and vegetation. However, larger landslides like the 2014 Oso landslide in 2014 can occasionally occur. Both types of landslides can be caused by heavy rainfall. As sea levels rise, erosion will increase. This can cause slopes to fail, leading to landslides.

Water is an important trigger, but not a trigger for every landslide. Triggers for landslides include wave or stream erosion below bluffs, heavy rainfall or snowmelt, earthquakes, or human activities like excavating at the base of a slope, overwatering vegetation, or removing vegetation.

\*the majority of this information comes from Washington State Department of Natural Resources’ Landslides website. (<https://www.dnr.wa.gov/publications/ger fs landslide processes.pdf?3nrk1o>)



*A 1949 landslide from the Tacoma/Puyallup region. (Source: Puyallup Tribes)*

### How may landslides affect me?

Washington is one of the most landslide-prone states in the country, with hundreds to thousands of landslide events each year. Landslides can damage roads and other infrastructure, destroy personal property and cause the loss of life. Indirect impacts include lost property value, lost tax revenues and the degradation of water quality.



*Landslide along Highway 12 in Aberdeen (source: MyNorthwest.com)*

### What are signs of a potential landslide?

- Be Aware of the Signs of a Landslide:
  - Cracks growing in the ground; downslope movement of rock, soil, or vegetation.
  - Sudden changes in creek water levels, sometimes with increased sediment, especially during or right after large or protracted storm events.
  - Sounds of cracking wood, knocking boulders, groaning of the ground, or other unusual sounds, especially if the sound increases.
  - Pistol-butted or bent trees.
  - Stretched or leaning utility lines.
  - Broken water, utility, or sewer lines.
- During a Dangerous Weather Event please consider:
  - Seek out advisories and warnings before, during, and after intense rainfall events. Check the NOAA Weather Radio, your local TV stations, and the Shallow Landslide Hazard Forecast website.
  - Don't assume that highways are safe—watch for collapsed pavement, mud, fallen rock, or other debris on the roadway. Check the Washington Department of Transportation website for road closures.
  - Listen for loud or unusual sounds. These can be indicators of an imminent landslide. If you think there is danger, evacuate immediately.
  - Keep away from landslide-prone areas.



*A devastating landslide near Oso, Washington on March 22, 2014. While this event was not coastal, it points to the impacts that landslides can have. (Source: Mark Reid, USGS)*

### Why should I care now?

Landslides occur frequently throughout Washington already. As more hazard-prone land is developed and as sea level rise increases erosion, landslides may increase in frequency. Planning and preparing for landslides now can potentially save lives and prevent property damage.



*1997 Rolling Bay Landslide – As a result, a family home was destroyed and a family of 4 passed away. (Source: Washington Department of Ecology)*

## What can I do about landslides?

### Educate yourself:

- Learn about your risk. Areas with previous landslides may be at higher risk of another landslide. Washington Geologic Information Portal ([https://geologyportal.dnr.wa.gov/#natural\\_hazards](https://geologyportal.dnr.wa.gov/#natural_hazards)) contains information of previous landslides and other hazards.
- Learn more about common landslides triggers: rainfall, earthquakes, water-level changes, human activities (removal of vegetation, mining, etc.), and geology. Check out Washington's Department of Natural Resources page on landslide warnings and triggers. (<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides#landslide-warning-signs-and-triggers.2>)
- Learn about the latest coastal hazards science and risks via the Washington Coastal Hazards Resilience Network (this website!). (<https://wacoastalnetwork.com/>)
- Visit the links in "Where can I learn more about landslides in Washington?" (<https://wacoastalnetwork.com/chn/coastal-hazards/landslide/>)
- Plan and Prepare:
  - Plan ahead – Have several days of emergency supplies, food, and water.
  - Have an evacuation route – Ensure that your route is away from streams that may carry landslides or debris flow. Do not assume that highways will always be safe.
  - Contact local planners, planning commissions or Marine Resource Committees to share experiences, voice concerns, recommend that public projects account for sea level rise or attend a public meeting. (<https://wacoastalnetwork.com/events/>)
  - Engage with local Shoreline Master Program (<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-Master-Programs>) or Comprehensive Plan (Growth Management Act) (<https://www.commerce.wa.gov/serving-communities/growth-management/periodic-update/>) updates to encourage wise planning for the future.
- Mitigate:
  - Avoid living, working, and recreating in hazardous areas, especially when there is a storm event. Areas above, on, or below steep slopes are more likely to experience landslides. Areas known to have frequent landslides in the past are also more likely to have landslides in the future.
  - Consider consulting a professional such as a licensed engineering geologist to assess your site or location.
  - Visit the Washington Coastal Hazards Risk Reduction Project Mapper (<https://waecy.maps.arcgis.com/apps/Shortlist/index.html?appid=58bac8d897ea48559d624eb06836a0d2>) to see how other people in Washington have adapted to coastal hazards or connect to an expert via the Washington Coastal Hazards Resilience Network. (<https://wacoastalnetwork.com/chn/other-projects/connect-with-a-chn-member/>)

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