Landslide Hazards and Mitigation

WSDOT Rail, Freight, and Ports Division
Washington State Department of Natural Resources
Clark County
BNSF Railway

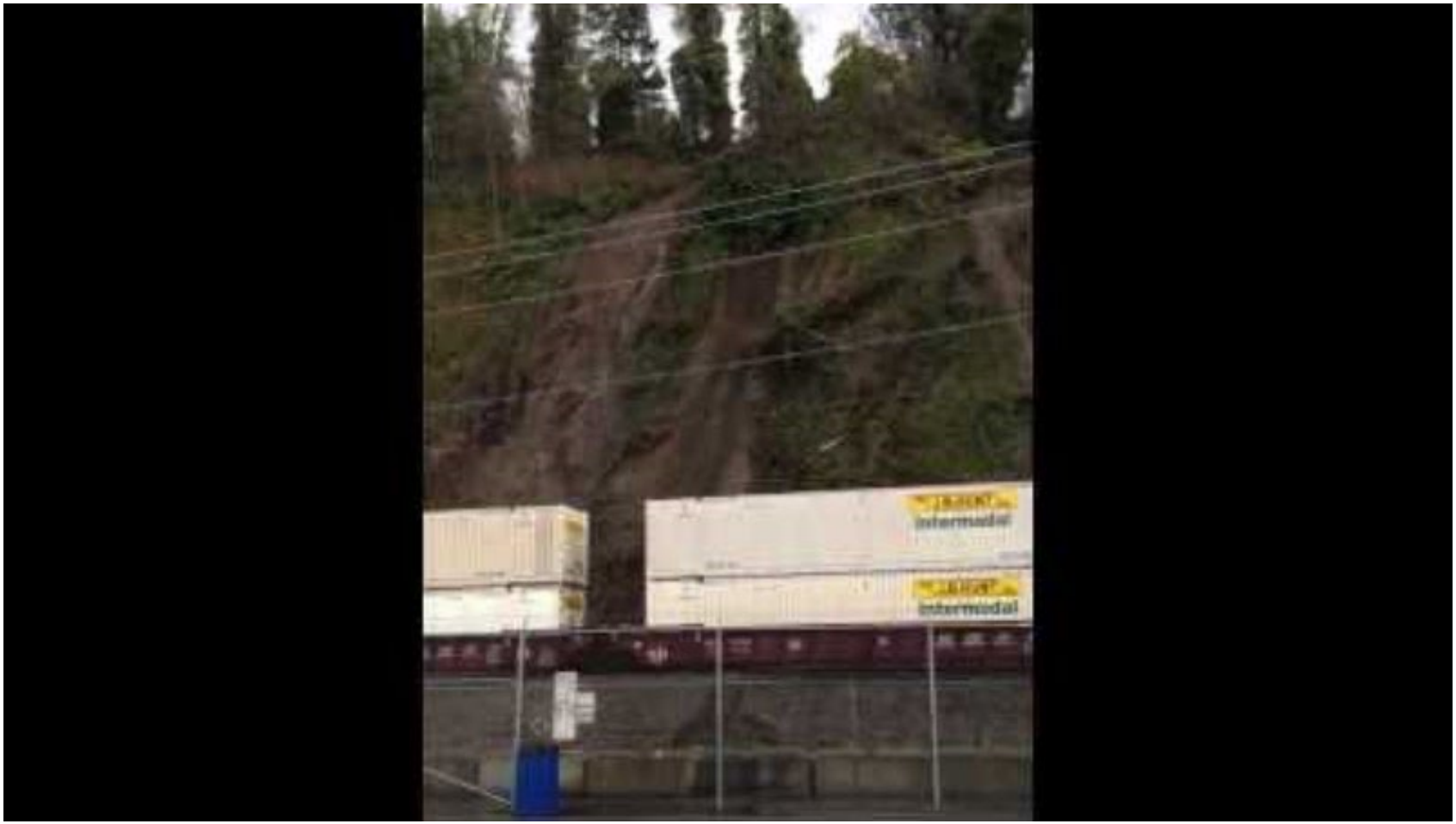
May 12, 2025

Agenda

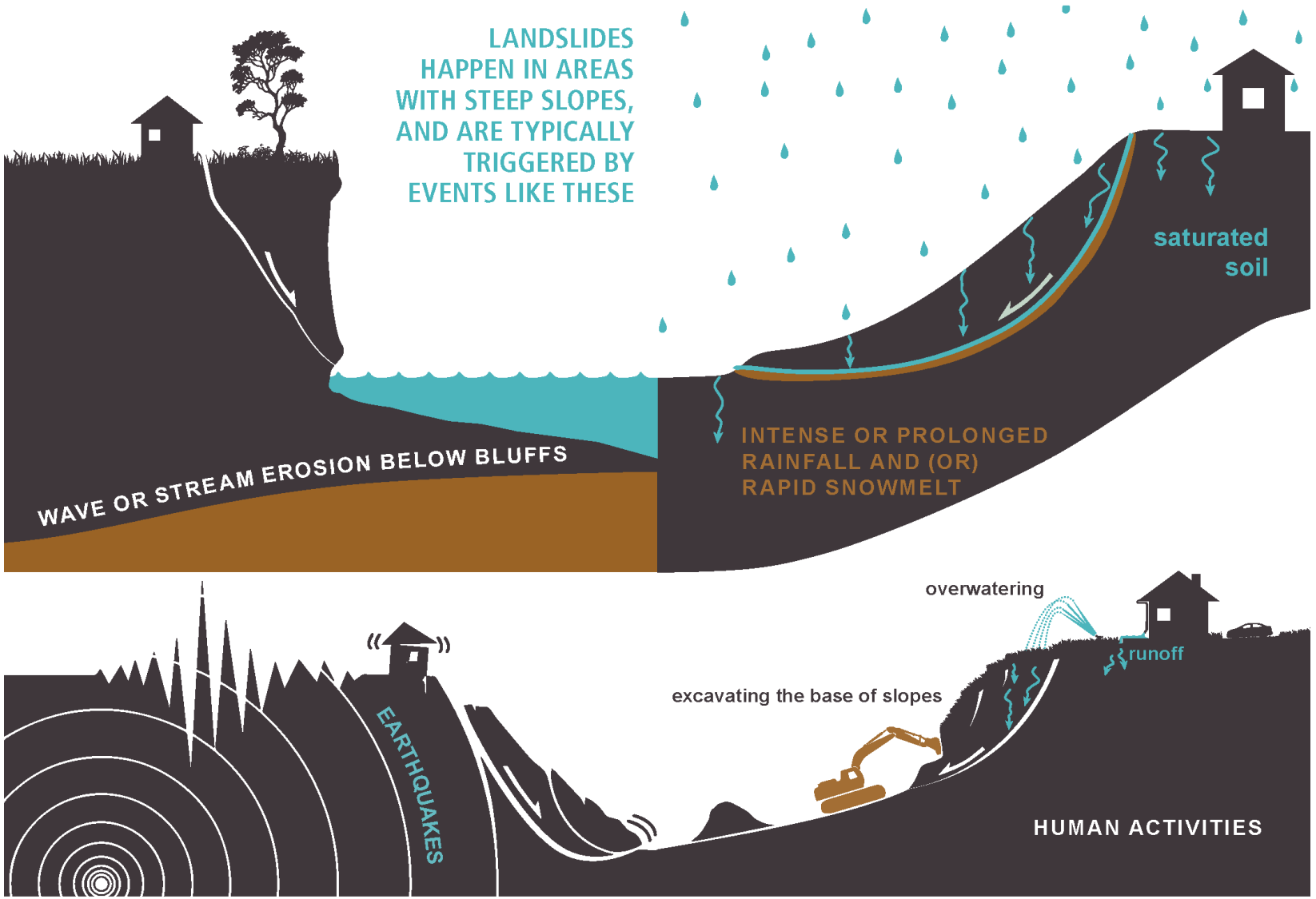
- Landslides can threaten your property!
- What causes landslides?
- How can you identify and prevent landslides?
  - Landslide mapping
- What are we doing to respond?
  - Landslide Mitigation Workgroup
  - Landslide mitigation construction projects
- How do landslides impact rail?
- Landslides in Clark County
- Contact us!

Landslides can threaten your property

Everett landslide derails train



Landslide triggers



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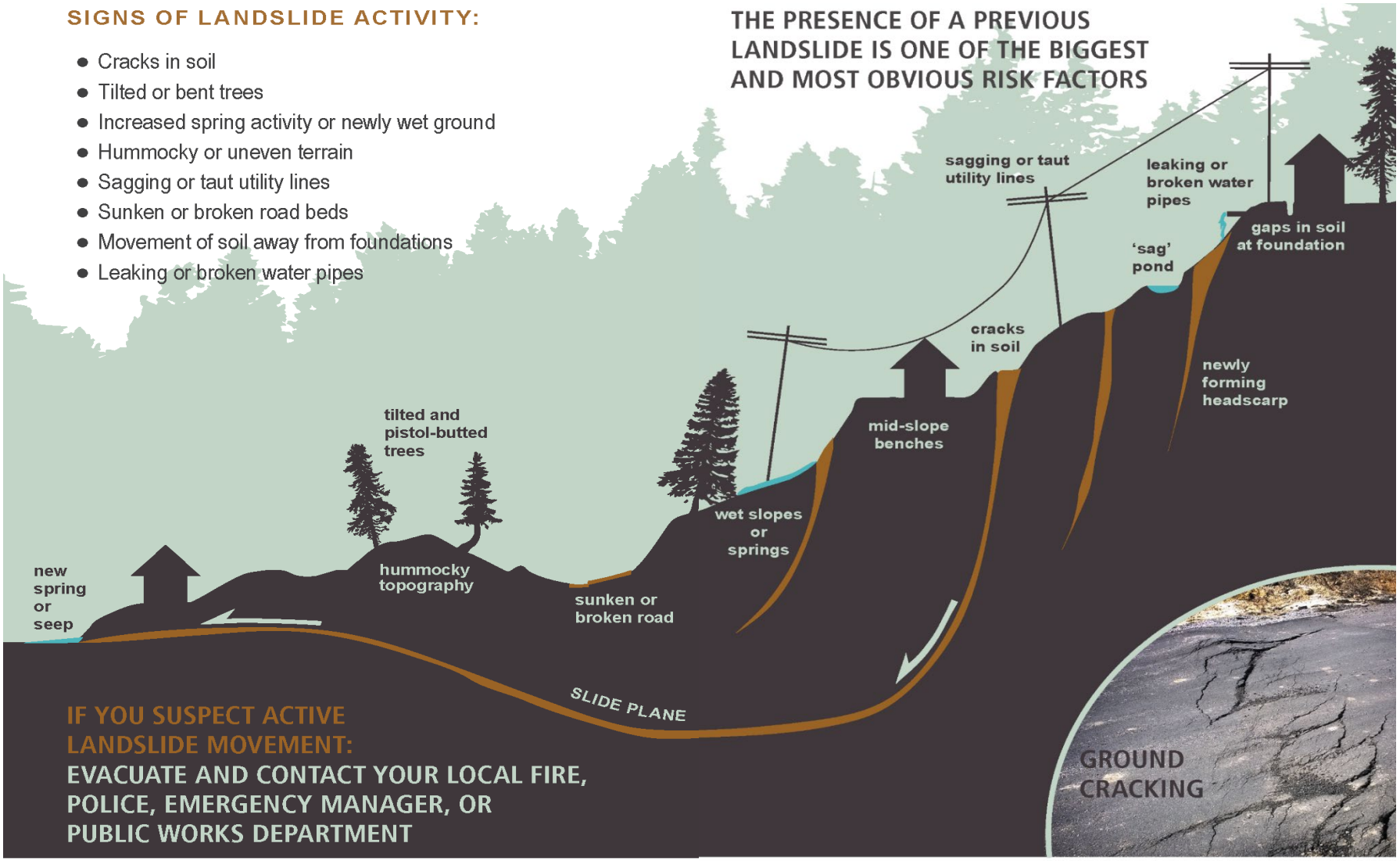
Landslide warning signs

SIGNS OF LANDSLIDE ACTIVITY:

- Cracks in soil
- Tilted or bent trees
- Increased spring activity or newly wet ground
- Hummocky or uneven terrain
- Sagging or taut utility lines
- Sunken or broken road beds
- Movement of soil away from foundations
- Leaking or broken water pipes



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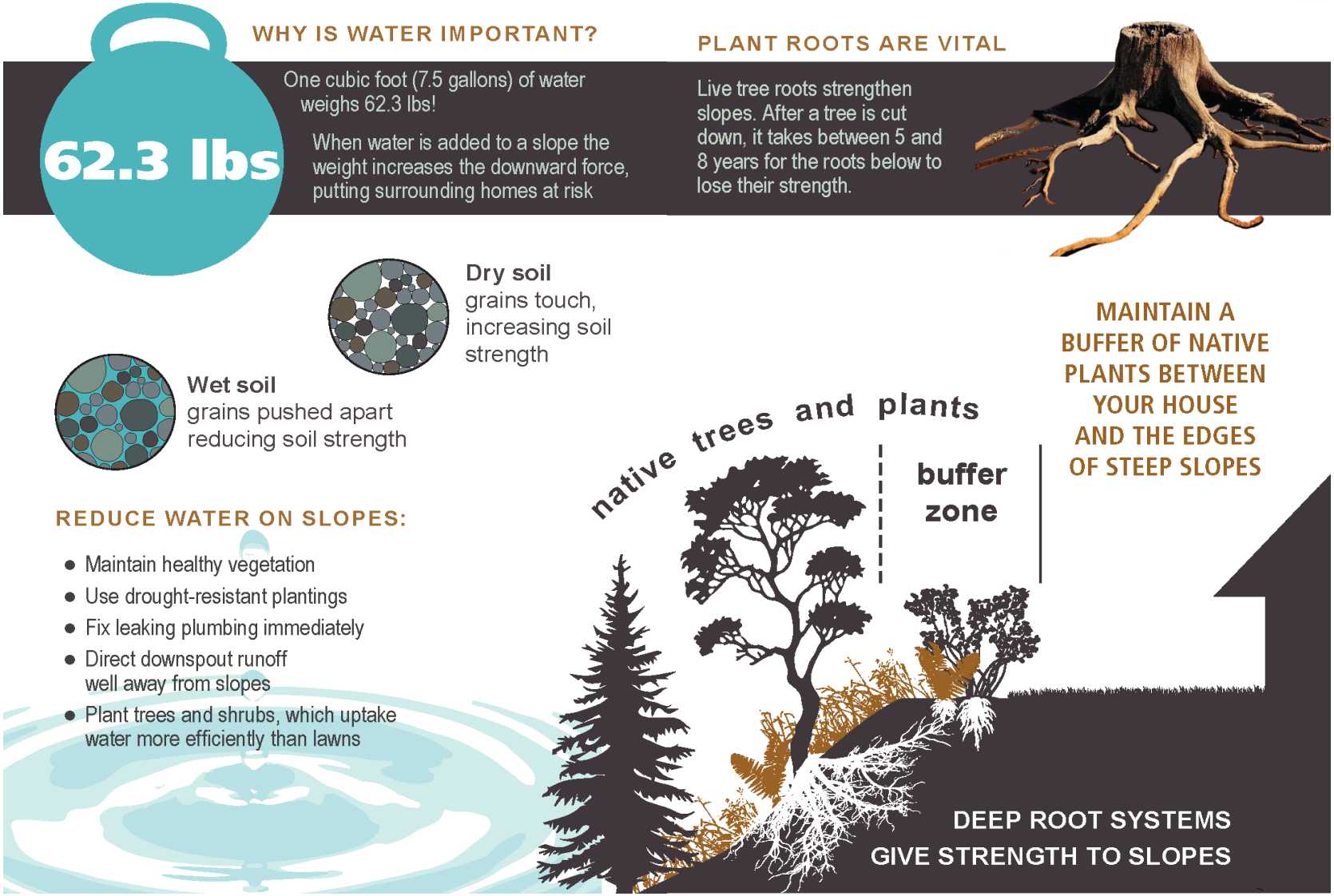
The role of water and plants



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Protect your property

THERE ARE ACTIONS YOU CAN TAKE AS A HOMEOWNER TO REDUCE THE CHANCES OF A LANDSLIDE AFFECTING YOUR PROPERTY:

DO

- Drain water from surface runoff, downspouts, and driveways well away from slopes
- Plant native ground cover on slopes
- Consult with a professional before significantly altering existing slopes uphill or downslope of your home
- If you suspect you are on a landslide, contact a licensed engineering geologist or a geotechnical engineer for an evaluation
- Check online maps, such as SLIDO (Oregon) or the Washington Geologic Information Portal to see if you might live in a landslide area

DO NOT

- Do not add water to steep slopes
- Avoid placing fill soil on or near steep slopes
- Avoid placing yard waste or debris on steep slopes
- Avoid excavating on or at the base of steep slopes

YOU AND YOUR NEIGHBORS SHARE MORE THAN FENCES. YOU ALL SHARE THE RESPONSIBILITY OF KEEPING YOUR SLOPES SAFE.

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LOOK FOR WARNING SIGNS ON YOUR PROPERTY

If you live on or near a steep slope, evaluate your property for signs of landslide movement. Many (but not all) signs of landslide activity are listed below. A high score may indicate the presence of a landslide.

INSIDE YOUR HOME:

- ☐ Cracks in walls
- ☐ Nails popping out of walls
- ☐ Bulging walls
- ☐ Separation of chimney from walls
- ☐ Creaking/popping noises
- ☐ Light switches coming out of walls
- ☐ Doors/windows hard to shut
- ☐ Twisted beams
- ☐ Cracks in floors
- ☐ Water seeping into basement

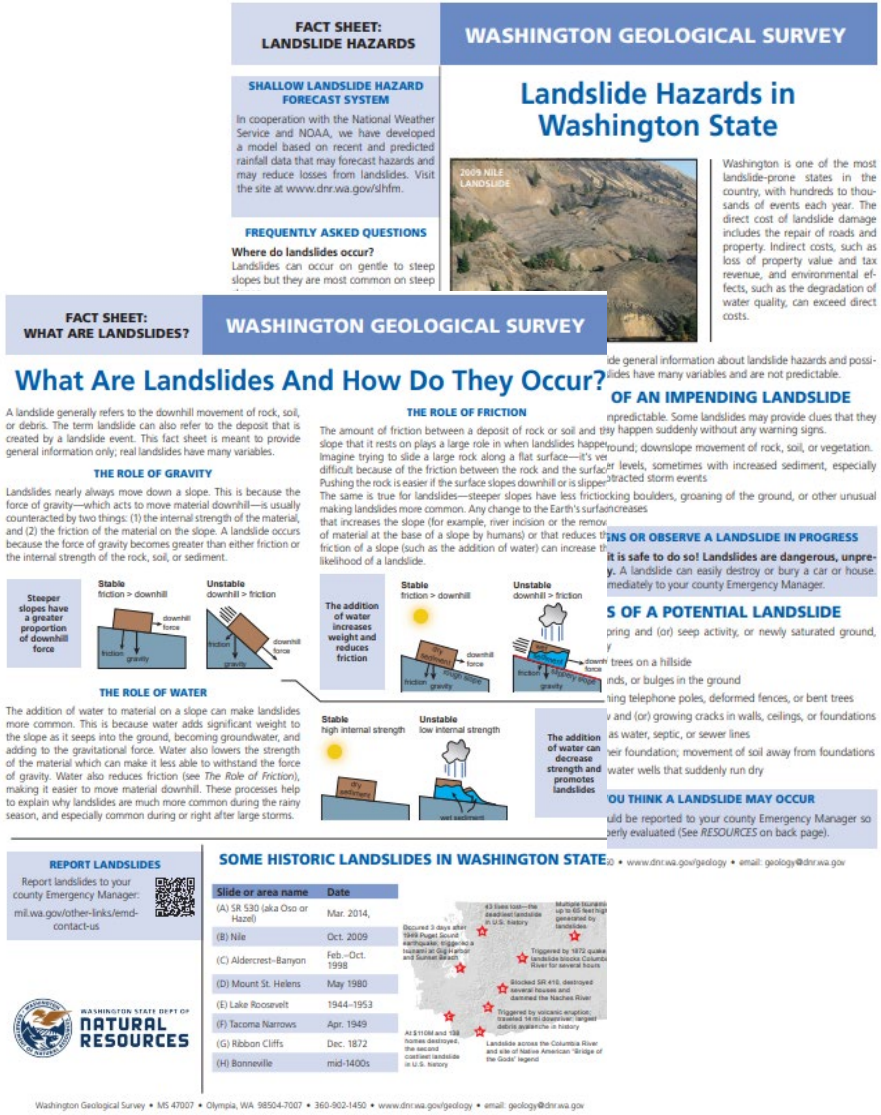
OUTSIDE YOUR HOME:

- ☐ Changes in surface drainage
- ☐ Bulges in retaining walls or tilting of walls
- ☐ Cracks developing in the soil
- ☐ Pistol-butted or bent trees
- ☐ Broken water, utility, or sewer lines
- ☐ Cracks in sidewalks or foundation
- ☐ Stretched or leaning utility lines

CONSULT A PROFESSIONAL BEFORE PURCHASING PROPERTY IN SLOPING AREAS

www.oregongeology.org

Resources



https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/landslides

DNR Landslide Mapping

NATURAL RESOURCES

PROTOCOL FOR LANDSLIDE INVENTORY MAPPING FROM LIDAR DATA IN WASHINGTON STATE

by Stephen L. Slaughter, L.E.G., William J. Burns, C.E.G., Katherine A. Mickelson, L.G., Kara E. Jacobacci, Alyssa Biel, and Trevor A. Contreras, L.E.G.

WASHINGTON GEOLOGICAL SURVEY

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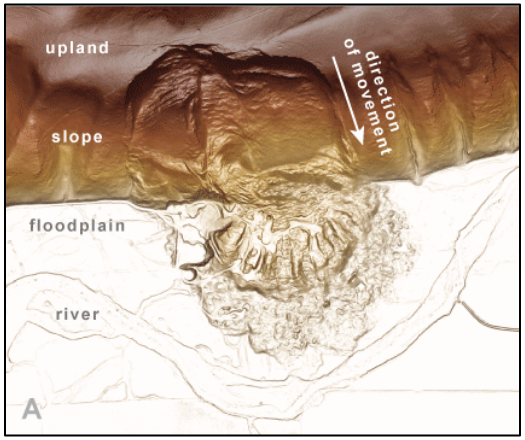
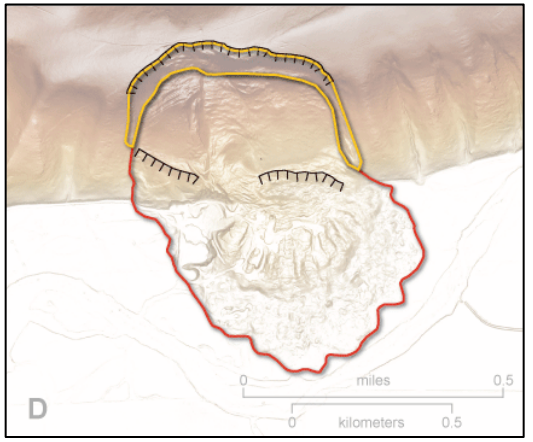
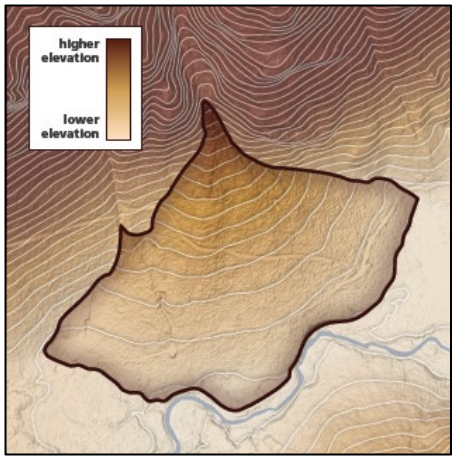
PEER REVIEWED

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

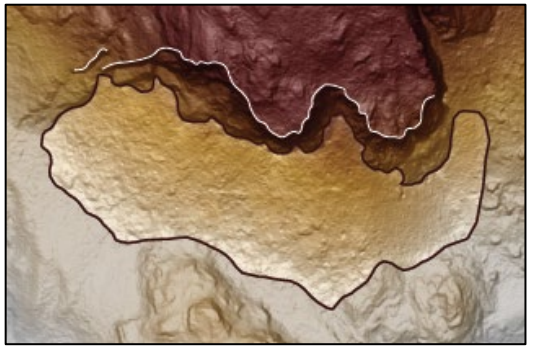
Landslides





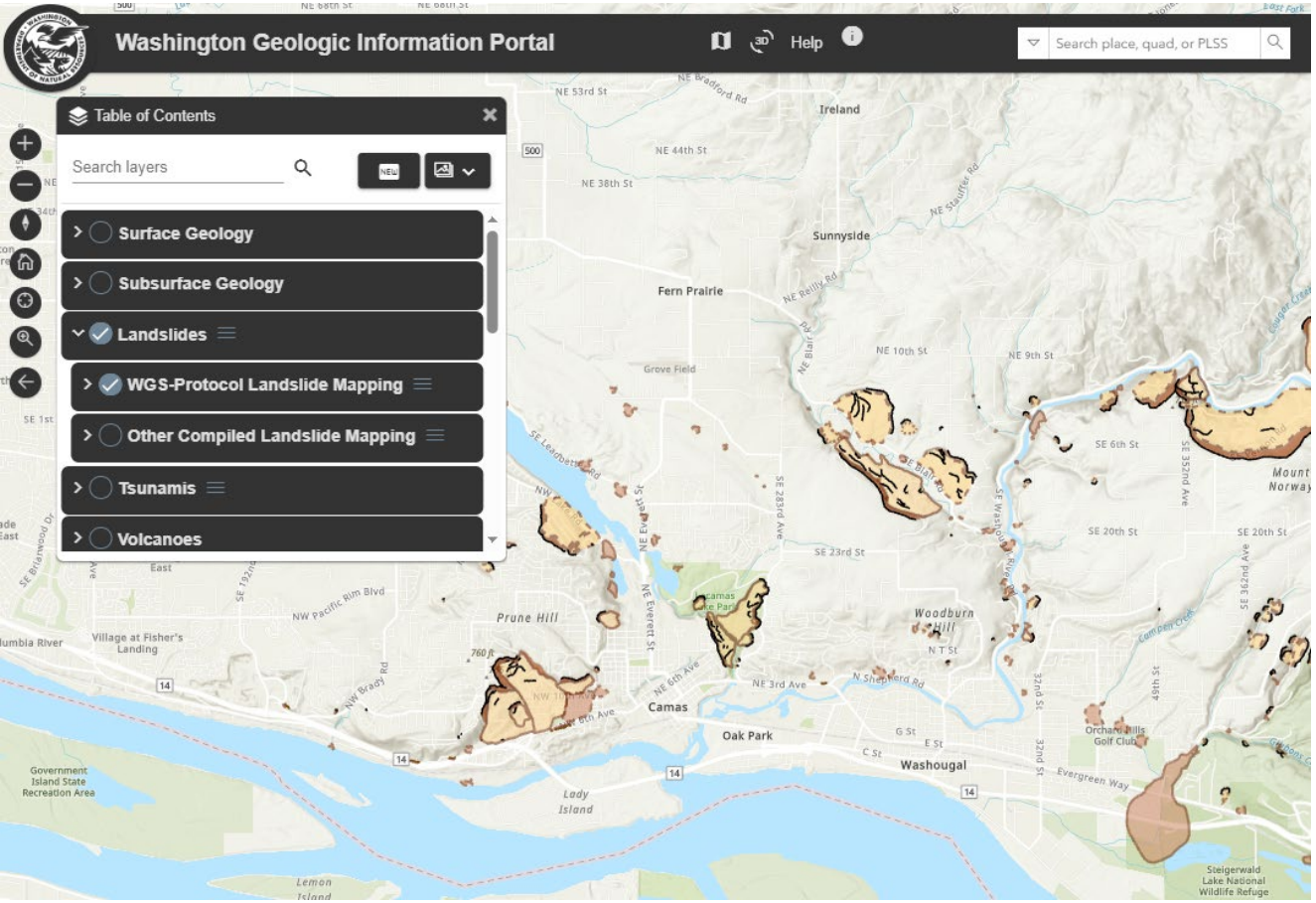


Fans



Rockfall

DNR Landslide Mapping



Landslide mapping for Clark County will be published December 2026

Landslide Mitigation Workgroup

Landslide Mitigation Team

- Washington State Department of Transportation (WSDOT)
- BNSF Railway
- Local municipalities (Clark County)
- Department of Natural Resources (DNR)
- YOU!

Landslides are **damaging** for homeowners, railroads, local governments, the local economy, and the traveling public.

Our **goal** is to prevent landslides on or near train tracks by educating the public about how human activities contribute to landslides and can damage your property.

Amtrak Cascades corridor

Amtrak Cascades:

- 18 stations from Vancouver, BC to Eugene, Oregon covering 461 miles with two daily roundtrips north of Seattle, six daily round trips south of Seattle
- WSDOT and ODOT contract with Amtrak to operate the service
- Amtrak operates on BNSF and Sound Transit tracks in Washington

Landslide History:

- More than 200 landslides occurred in the last 15 years along the Amtrak Cascades corridor in WA
- Human activities like slope management, stormwater discharge, and failing drainage systems are substantial contributors to landslides
- Landslides that reach the railroad tracks result in cancelled or disrupted passenger and freight trains each year
- Landslides are costly for landowners, possibly resulting in damage to the home, loss of property value, increased costs for insurance and repairs, increased liability, or damage to others' property

Host railroad coordination

- Tracks on the Amtrak corridors in Washington are primarily owned by BNSF Railway, a private freight railroad
  - Amtrak Cascades, Empire Builder and Coast Starlight passenger services operate on BNSF tracks
  - Sound Transit owns the tracks between Tacoma and Nisqually
- BNSF imposes a 48-hour moratorium on passenger rail service when landslides reach the train tracks

BNSF RAILWAY

Landslide mitigation construction projects

Landslide mitigation efforts between Seattle and Everett

- WSDOT awarded three separate CRISI grants from FRA
- Leveraged $4.5 million in state funding into more than $12 million total project funding through the federal grants and BNSF contributions
- WSDOT administers the grants, and BNSF constructs catchment walls and other forms of slope stabilization

BNSF's landslide mitigation policies and best practices

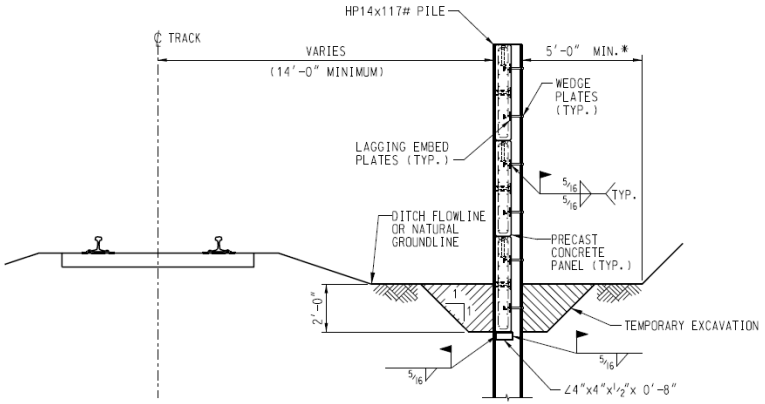
Stormwater policy

- Railroad ditches are not designed or intended for conveyance of public water
- Divert drainage away from railroad right-of-way via site plan design or by tying into existing stormwater infrastructure

Catchment wall program

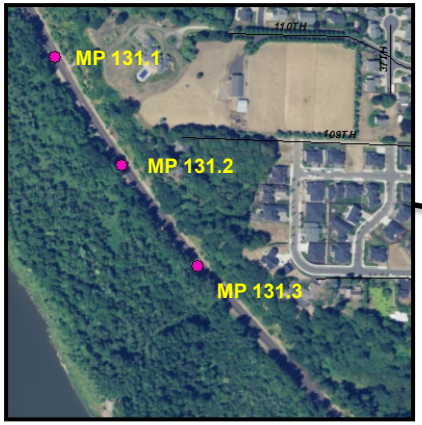
- Over 2 miles of catchment wall constructed since 2013 in partnership with WSDOT and federal agencies
- Over 12,000 CY of debris removed from behind catchment walls since 2018

Landslide behind catchment wall – Mukilteo, WA



PARTIAL WALL SECTION

Clark County landslides above railroad tracks



Landslides increase in Clark County

- Slides seen in Clark County, near Felida and Ridgefield
- New housing developments in Clark County
  - Properties near the bluffs are at higher risk of landslide activity
  - Important to talk about best practices for addressing vulnerable slopes

2009

2015

Clark County Permits/Reviews

- Clearing of natural/native vegetation on slopes may be regulated under the County's Geohazard (40.430), Wetlands and Fish and Wildlife Habitat Conservation Areas (40.445), Shoreline Master Program (40.460), and Forest Practices (40.260.080) codes.
- Areas beyond property lines may be BNSF right-of-way or owned by an HOA.
- Explore your property in MapsOnline.

Clark County Permits/Reviews

Building: structures, walls or retaining walls (4 ft.), fences (7 ft.)

Contact: permitservices@clark.wa.gov; 564.397.4078

Engineering: grading, stormwater/drainage, slope stabilization, geohazard

Contact: devengineer@clark.wa.gov; 564.397.4559

Protected Areas: wetlands, habitat, shoreline

Contact: WetlandHabitatReview@clark.wa.gov; 564.397.5855

Forestry

Contact: hunter.decker@clark.wa.gov; 564.397.4852

Contact Information

WSDOT Rail, Freight and Ports Division:

- Rail@wsdot.wa.gov
- 360-705-7900

WA Department of Natural Resources:

- Kate Mickelson, Landslide Hazards Program Manager, kate.mickelson@dnr.wa.gov and 360-810-0006
- Tricia R. Sears, Geologic Planning Liaison, tricia.sears@dnr.wa.gov and 360-628-2867

BNSF Railway:

- **Emergencies:** 1-800-832-5452

Q&A