

# Planning for Critical Areas: Geologically Hazardous Areas

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Washington Geological Survey



WASHINGTON STATE DEPT OF  
**NATURAL  
RESOURCES**  
WASHINGTON  
GEOLOGICAL SURVEY

Passport to 2044 Webinar Series: Planning for Critical Areas, November 30, 2022

# The Washington Geological Survey (WGS)

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## MISSION

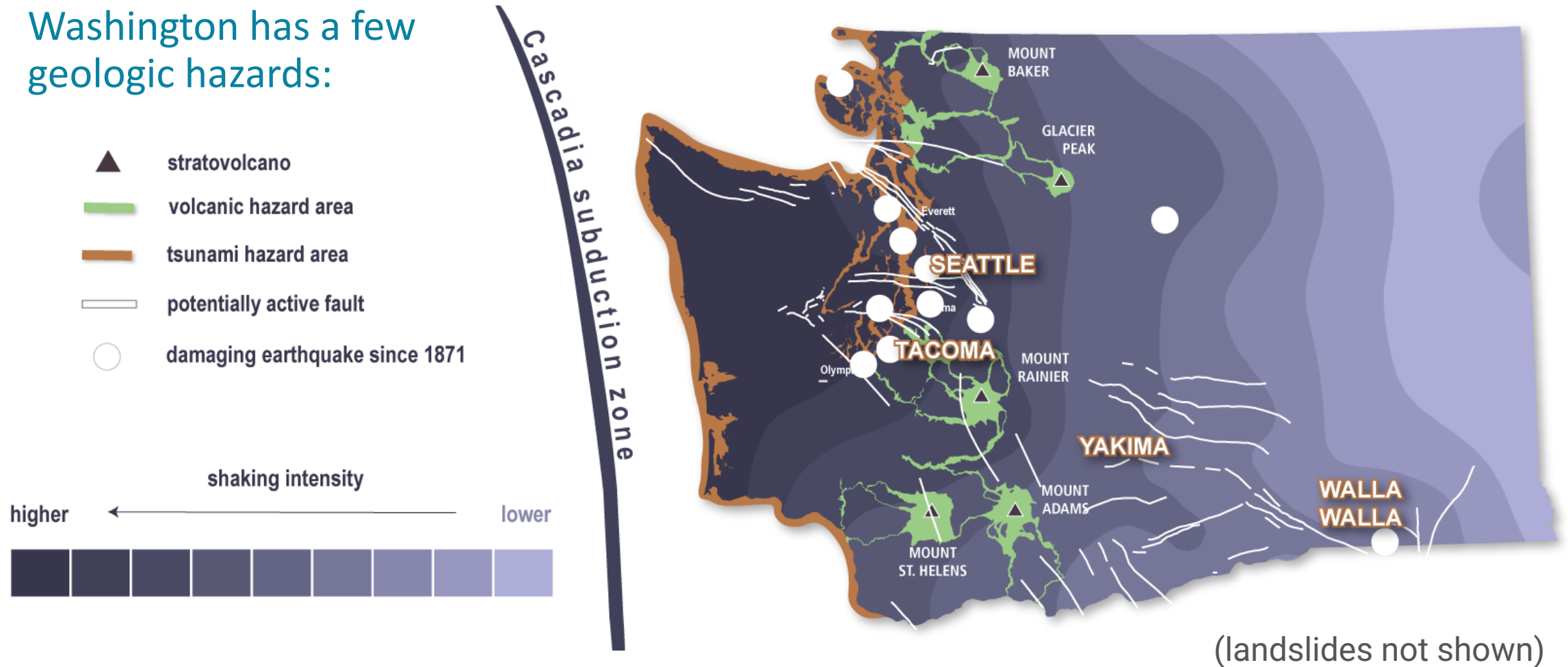
To collect, develop, use, distribute, and preserve geologic information to promote the safety, health, and welfare of the citizens of Washington, protect the environment, and support its economy.

## VISION

Fostering a safer, more productive and resilient society that incorporates geology into its regular thought and decision-making processes.

# Geologic Hazards

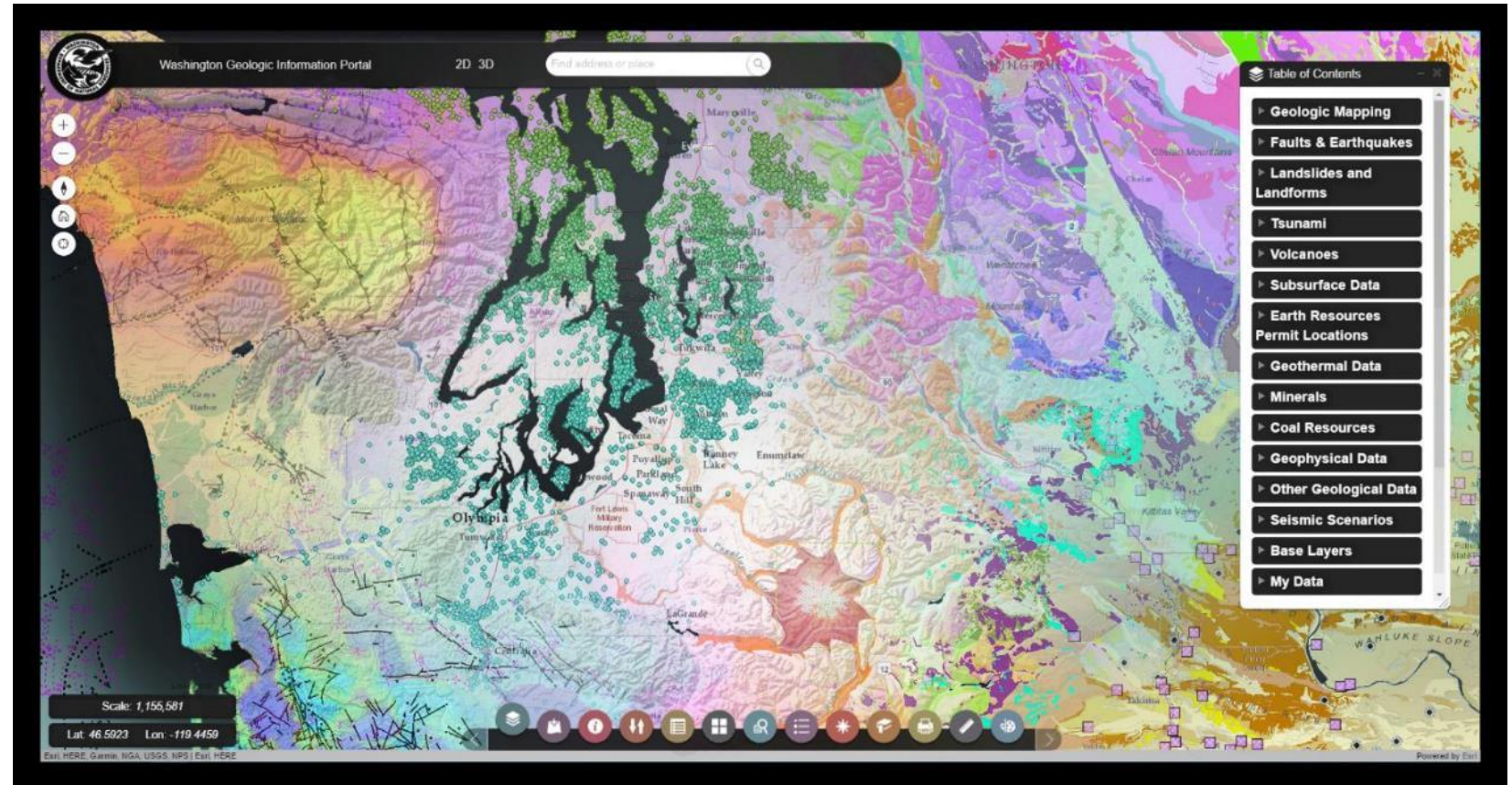
Washington has a few geologic hazards:





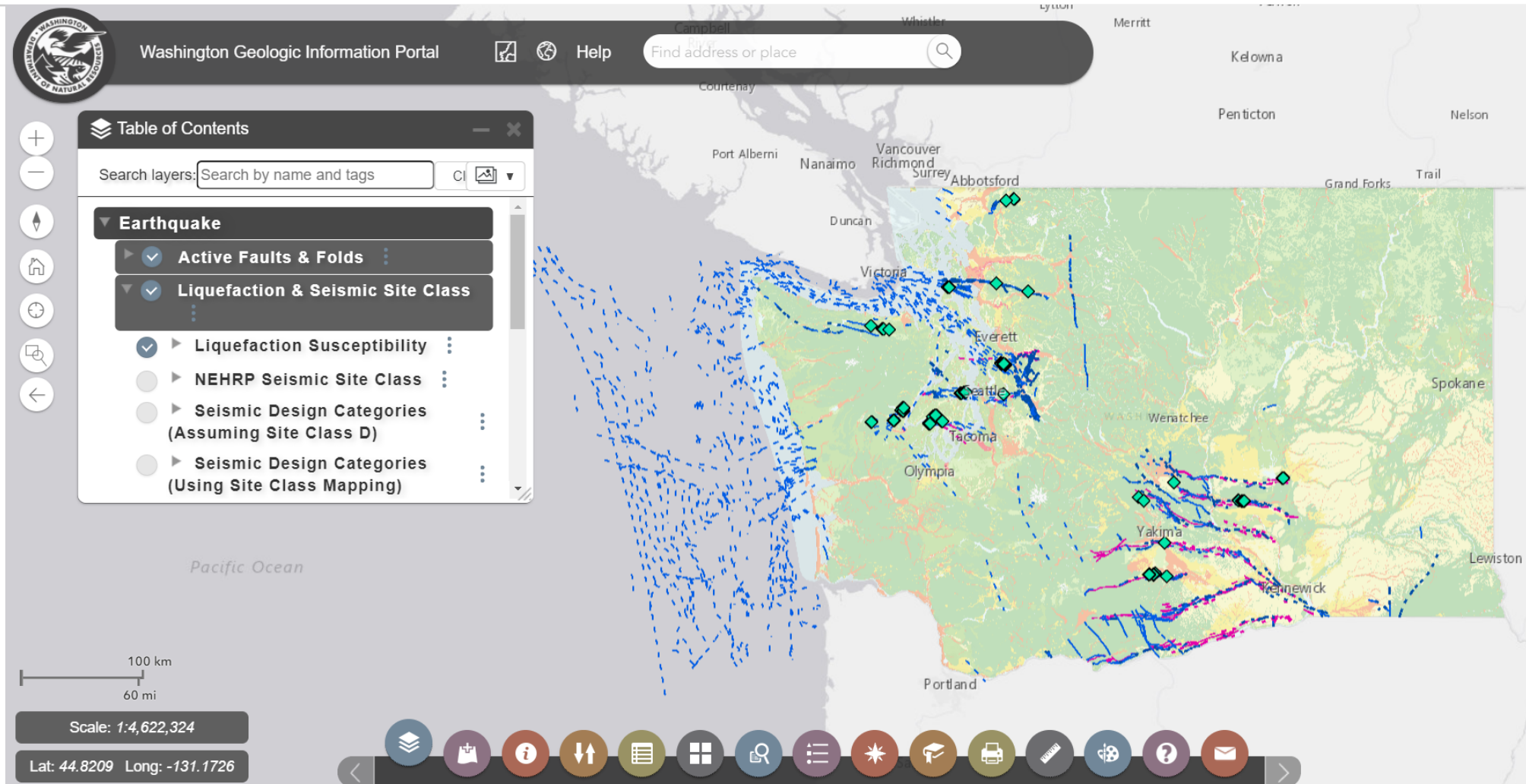
# Washington Geologic Information Portal

- View all geologic hazard data
  - Identify features
  - Print maps
  - Add your own data
- Download data for use in GIS



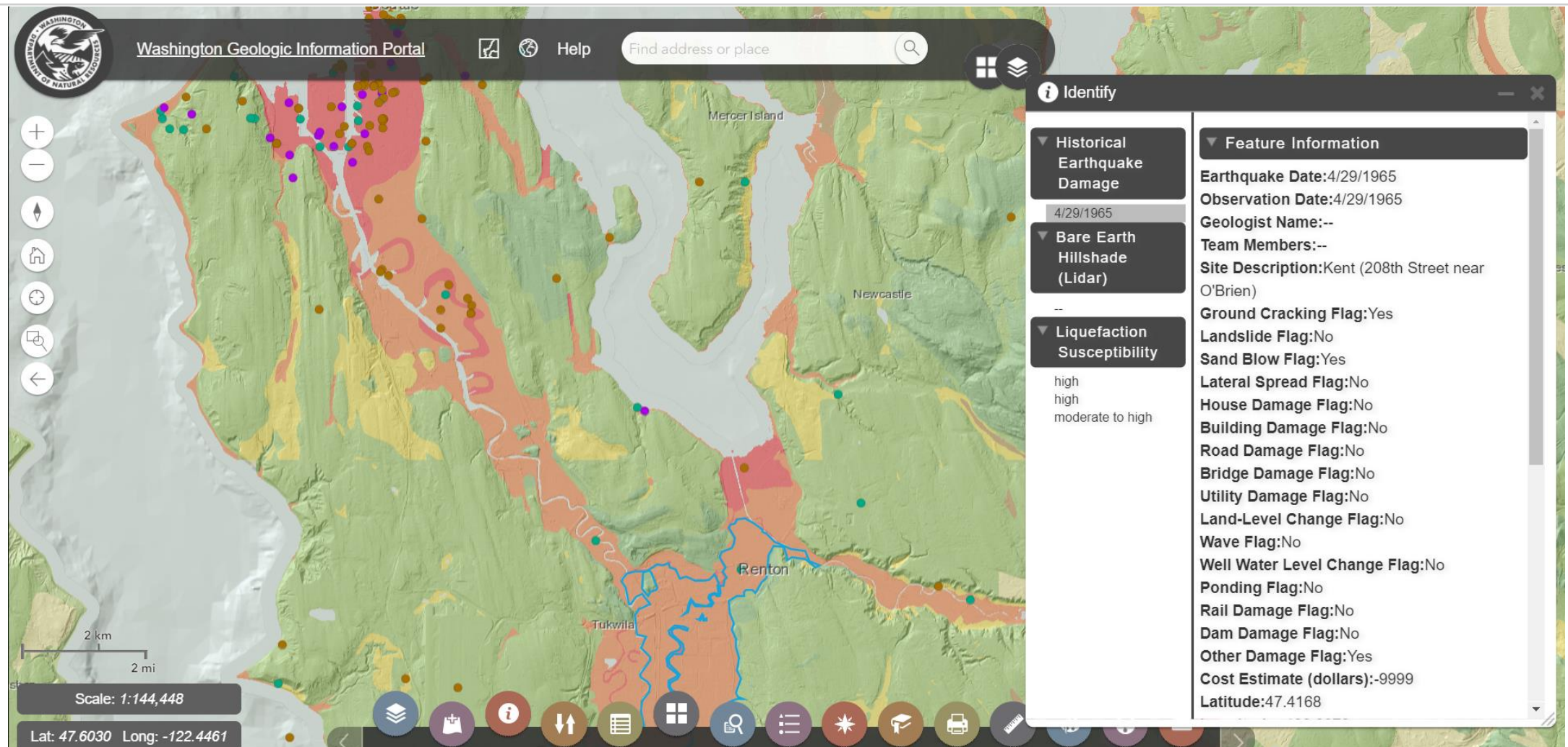
<https://www.dnr.wa.gov/geologyportal>

# Earthquake Hazards





# Earthquake Hazards



# Seismic Scenario Catalog

- 20 shaking scenarios of different earthquakes across WA
  - Damage to structures and infrastructure
  - Injuries and fatalities
  - Economic losses
  - Debris and loss of water access
  - Geologic summary reports
- Available on [dnr.wa.gov/seismic-scenarios](https://dnr.wa.gov/seismic-scenarios)

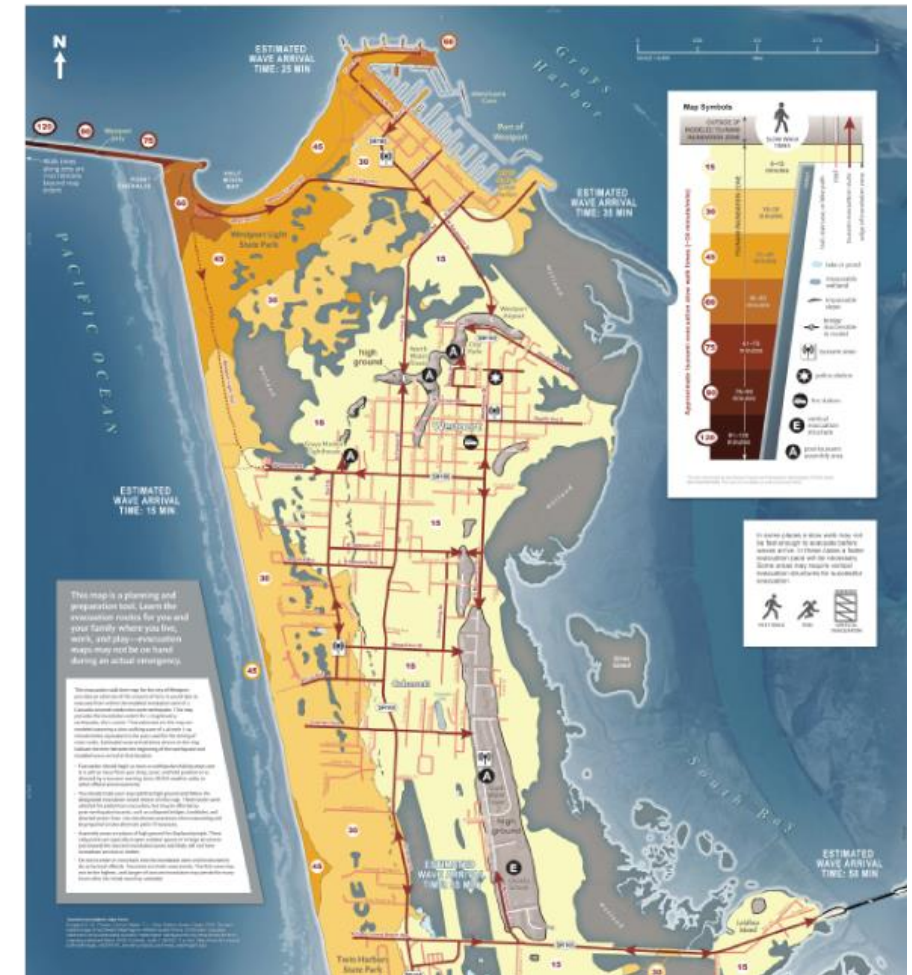


Predicted earthquake shaking intensity distribution for a M9.0 Cascadia subduction zone earthquake event.



# Tsunamis

- WGS produces **tsunami hazard maps** that show modeled tsunami inundation and current velocity
- WGS also produces **tsunami walk time maps** that show how long it takes to walk to safe areas from hazard zones





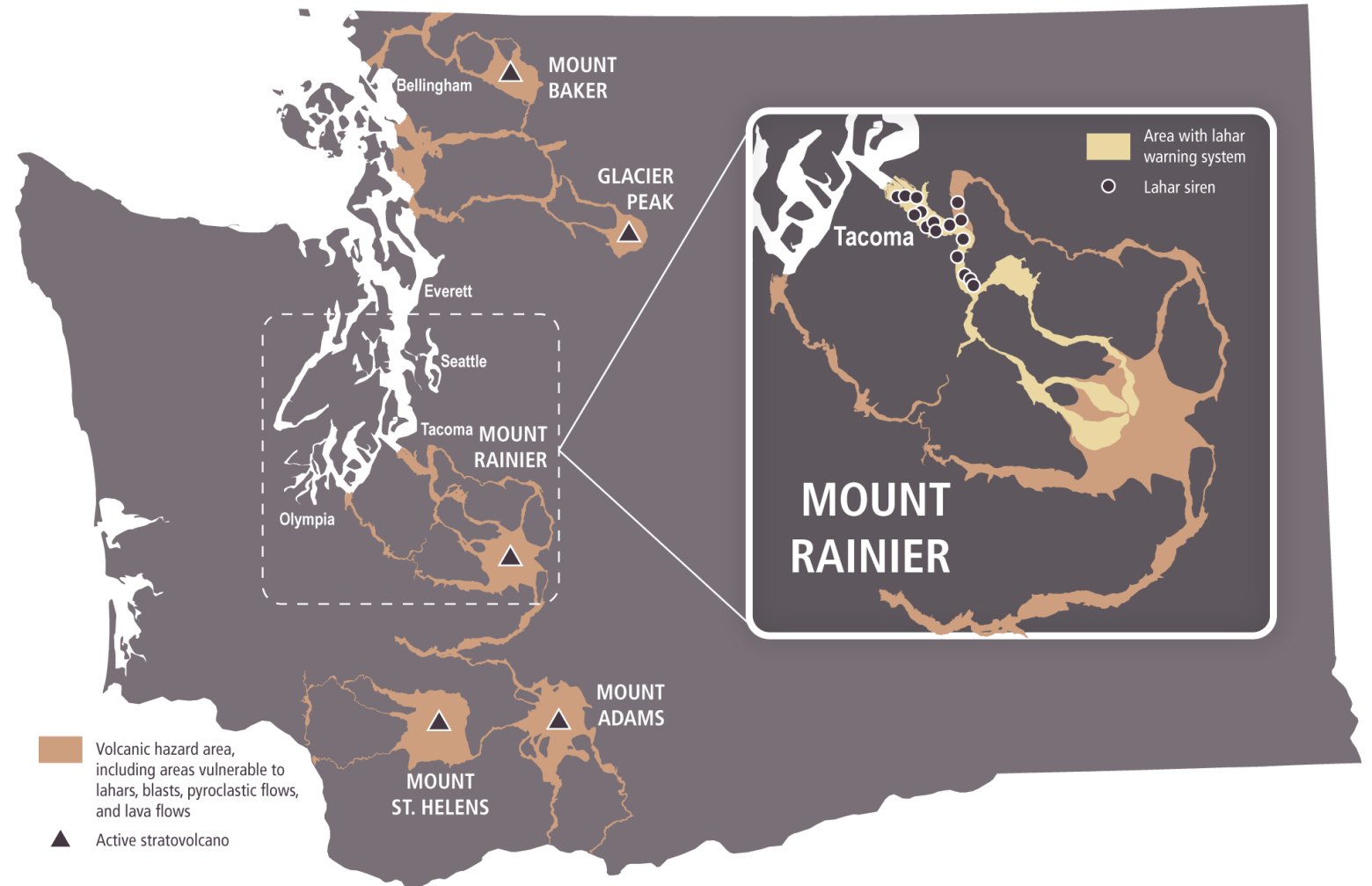
# Tsunamis

- As of adoption of the 2018 Washington Building Code, new construction of Risk Category III and IV (critical) facilities within the **Tsunami Design Zone** must be constructed to withstand loads from tsunamis.
- **Tsunami Design Zone = tsunami inundation zone**
- **Tsunami Design Zone mapping** is available at [dnr.wa.gov/wa-tdz](http://dnr.wa.gov/wa-tdz)
- The new **Auntie Lee tsunami vertical evacuation** structure in Tokeland, WA, built for the Shoalwater Bay Tribe is a Risk Category IV structure that used the new building code design. →



# Volcanic Hazards

- Washington has five active stratovolcanoes
- Several of these volcanoes are considered a high threat
- **Volcano hazards:**
  - Lahars (volcanic mudflows)
  - Debris avalanches
  - Lava flows
  - Pyroclastic flows
  - Ash fall
- Many communities lie on their slopes or downstream from them





# Volcanic Hazards

The screenshot displays the Washington Geologic Information Portal interface. The main map shows the Mount Rainier area with red outlines indicating volcanic hazards. The left sidebar contains an 'Identify' panel with a 'Volcanic Hazards (USGS)' section. The 'Feature Information' panel provides details about Mount Rainier, including its hazard type (Lahars), a description, a hyperlink to a document, and four take actions. The right sidebar shows a 'Table of Contents' with a search bar and a list of layers, including 'Volcanic Hazards (USGS)'. The bottom of the screen features a scale bar, coordinates, and a toolbar with various map navigation icons.

**Washington Geologic Information Portal**

Find address or place

**Identify**

- Volcanic Hazards (USGS)
  - Tephra (ash)
  - Lahars

**Feature Information**

**Volcano:** Mount Rainier  
**Hazard Type:** Lahars  
**Description:** Potentially far-travelled in valleys draining volcano  
**Hyperlink:** [Document link](#)  
**Definition:** Lahars are hot or cold mixtures of water, from melted snow, ice, and rock fragments that flow down the slopes of a volcano and typically enter river valleys. A moving lahar looks like a roiling slurry of wet concrete, and as it rushes downstream, the size, speed, and amount of material carried can constantly change.  
**Take Action 1:** Listen carefully to official reports via emergency broadcasts.  
**Take Action 2:** If officials warn of an approaching lahar, seek high ground off the valley floor as quickly as possible, such as moving up a hillside. Then, seek shelter.  
**Take Action 3:** Stay out of valleys and low-lying areas that lead away from the mountain.  
**Take Action 4:** Evacuate if necessary.

**Table of Contents**

Search layers: Search by name and tags

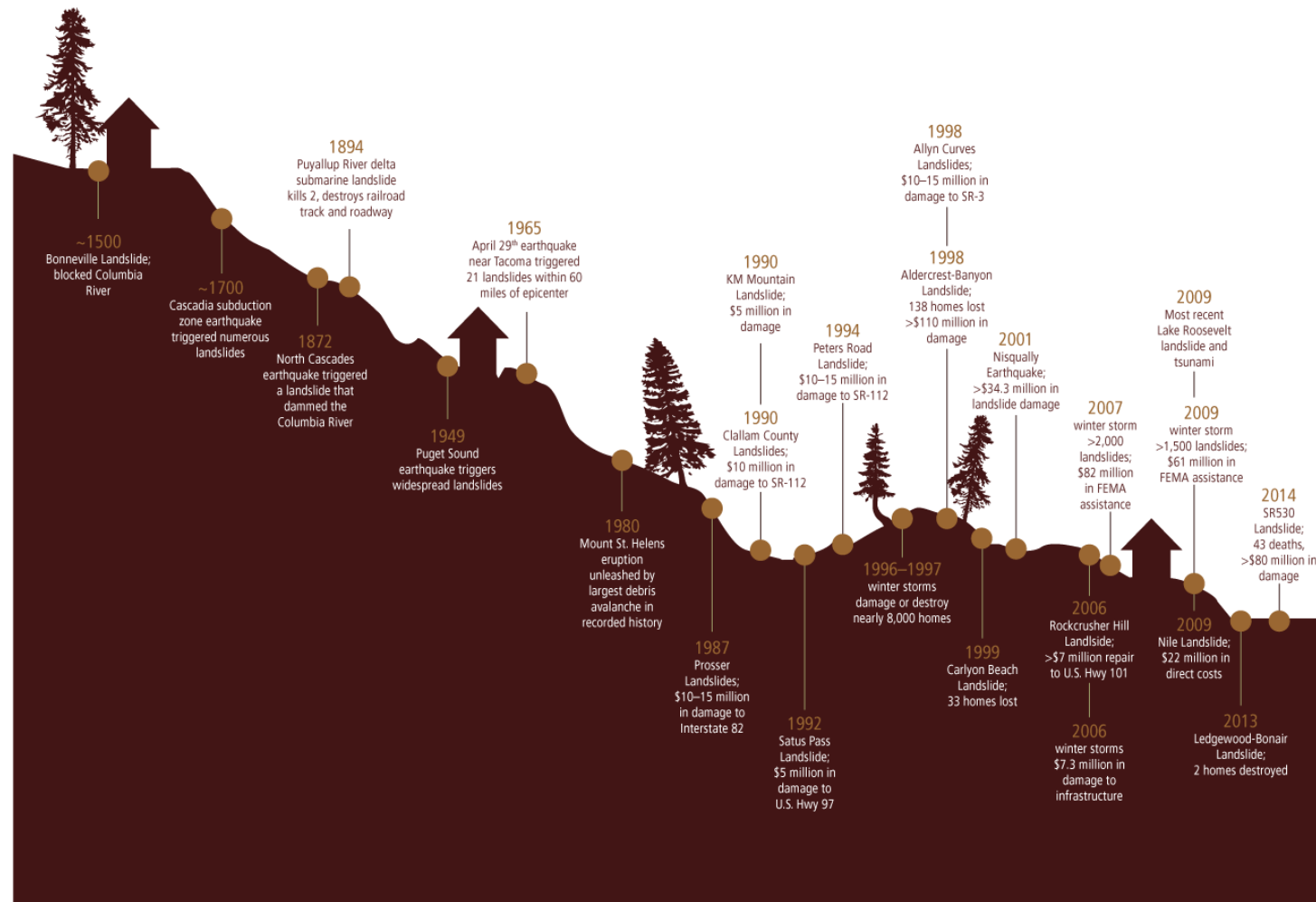
Clear

- Volcanoes
  - Volcanic Vents
  - Volcanic Hazards (USGS)
- Minerals

Scale: 1:1,155,581

Lat: 46.4941 Long: -122.3651

# Landslides are Frequent and Expensive





# Landslide Data We Offer

## Washington State Landslide Inventory Database

- Two types of information inside the database
  - Detailed Inventory aka WGS-Protocol Landslide Mapping
  - Compilation
- **WGS-Protocol Landslide Mapping**
  - Follows a peer-reviewed protocol
  - Requires high-quality lidar
  - Done on a county-by-county basis
  - This mapping is reviewed by qualified professionals



# Landslide Data We Offer

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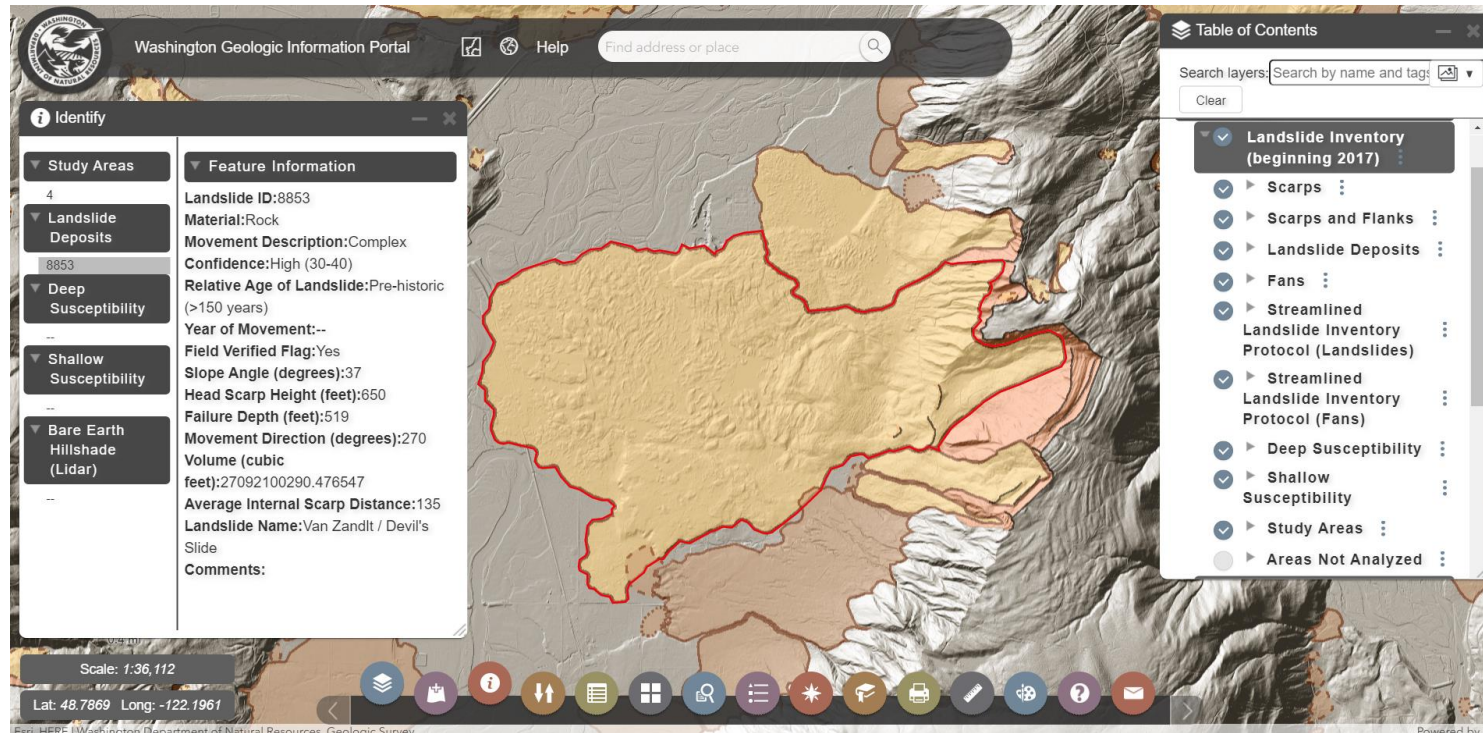
- Detailed Inventory aka WGS-Protocol Landslide Mapping
- **Compilation**
  - Multiple datasets make it appear to be a complete, statewide, inventory. It is not. The absence of a mapped landslide does not indicate an absence of hazard!
  - It includes:
    - 24K (not statewide) and 100K (statewide) geologic mapping
    - Reconnaissance studies from large storm events
    - Landslide Hazard Zonation projects
    - Miscellaneous projects
  - Mapped by multiple authors with varying background and expertise for various purposes
  - Mapped with or without lidar



View of the 2009 Nile Valley Landslide covering State Route 410.

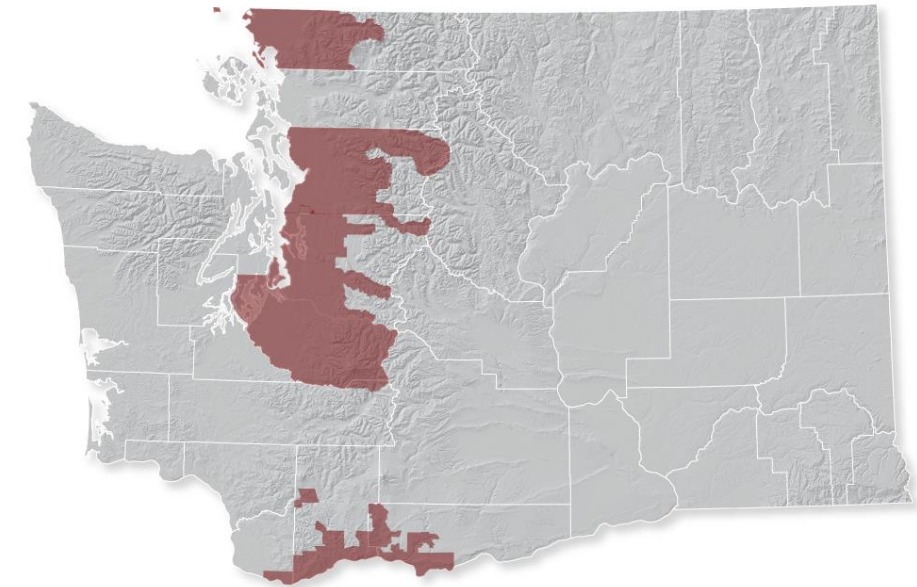


# Landslide Data We Offer



## Detailed landslide inventory status map:

- Red: published inventory
- Orange: alluvial fan mapping
- Yellow: planned alluvial fan mapping



# Wildfire-Associated Debris Flow Hazards

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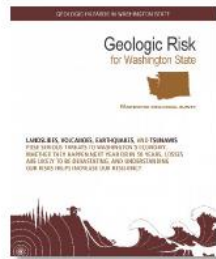
- After a wildfire, our **WALERT team** rapidly assesses debris flow potential that may impact local communities.
- **Alluvial fans** are great indicators of where debris flow hazards exist, with or without wildfire.
- We are working to map these features more completely, especially in the wildland-urban interface.



# Resources

## General Resources

### Geologic Risk Booklet



### Geologic Information Portal



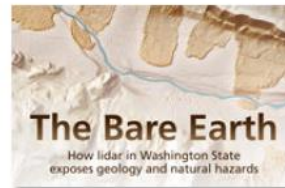
### Geologic Information Portal Fact Sheet



### RiskMAP



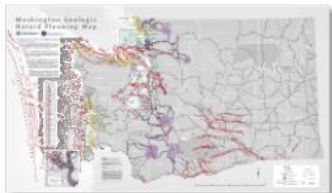
### Bare Earth Story Map



### GIS Data Webpage



### Washington Geologic Hazard Planning Map



## Lidar Resources

### Lidar Fact Sheet



### Washington Lidar Portal



### Washington State Lidar Plan





# Resources

## Landslide Hazard Resources

### Landslide Inventory Publications



### WGS Landslides Webpage



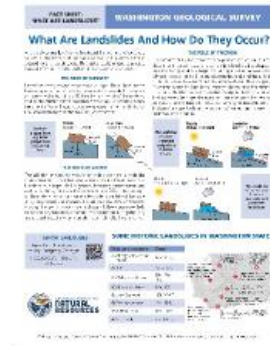
### Wildfire-Associated Debris Flows



### Wildfire Debris Flows Fact Sheet



### What are Landslides and How Do They Occur?



### Landslide Hazards in Washington State



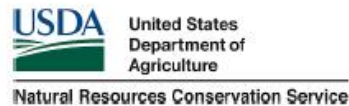
### WA Dept. of Ecology Puget Sound Landslide Webpage



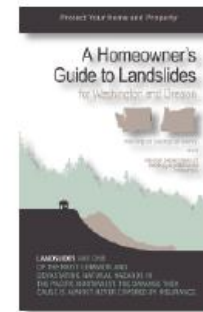
### USGS Landslide Hazards Webpage



### USDA Soils Data



### Homeowners Guide to Landslides



### Oregon Land Use Guide



# Resources

## Seismic Hazards Resources

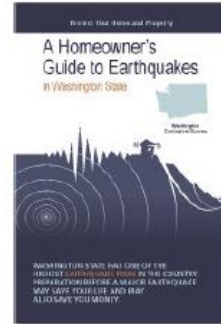
### WGS Earthquakes & Faults Webpage



### Faults & Earthquakes in Washington



### Homeowner's Guide to Earthquakes in Washington



### WA Seismic Design Category Maps



### U.S. National Seismic Hazard Maps



### Seismic Scenario Catalog



## Tsunami Hazards Resources

### WGS Tsunami Webpage



### Tsunami Hazard Maps



### Tsunami Evacuation Maps



### Tsunami Simulations



[https://fortress.wa.gov/dnr/geologydata/hazards/wa\\_geologic\\_hazards\\_resources.pdf](https://fortress.wa.gov/dnr/geologydata/hazards/wa_geologic_hazards_resources.pdf)

# Thank you!

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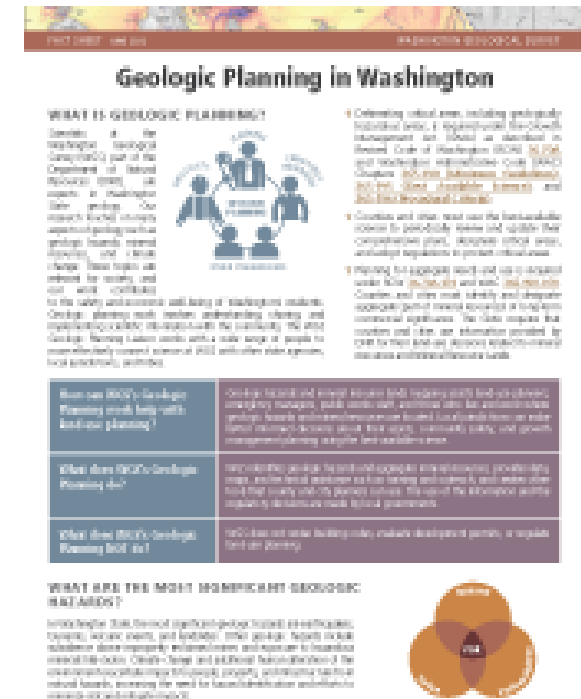
360-810-0006

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For more information on integration of geologic hazards into land use planning, see our WGS webpage, [Geologic Planning | WA – DNR](#).