Welcome

YOU ARE IN THE RIGHT SPOT. WE WILL START AT 9:00 AM.

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Geologically Hazardous Areas

FEBRUARY 3, 2021

Washington Department of FISH and WILDLIFE

Washington State Department of Commerce

DEPARTMENT OF ECOLOGY State of Washington

2021 Critical Areas and Shoreline Monitoring & Adaptive Management Online Workshops

Welcome to

Geologically Hazardous Areas

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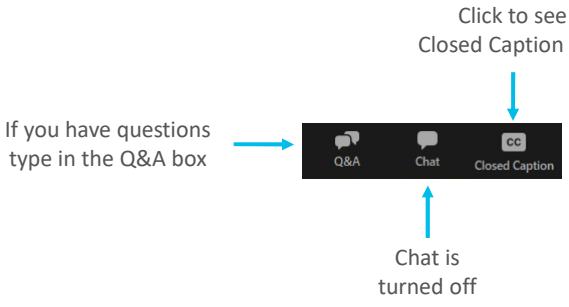
2021 Critical Areas and Shoreline Monitoring & Adaptive Management Online Workshops



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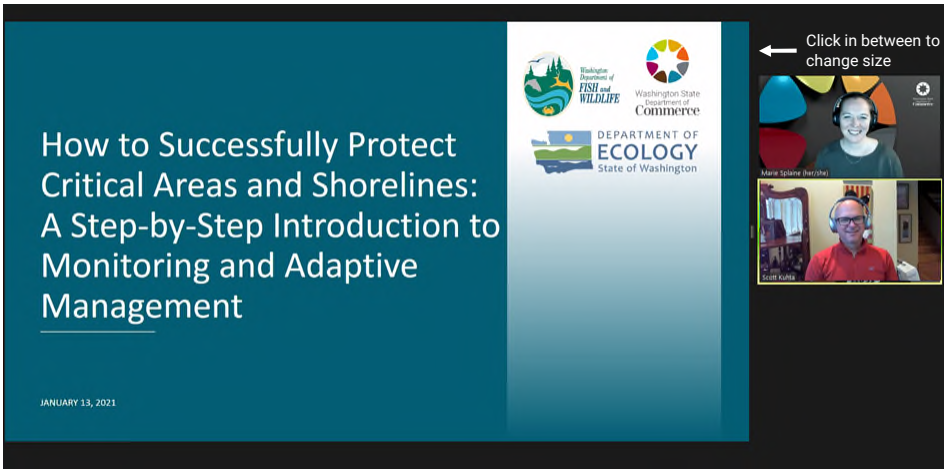
2021 Critical Areas and Shoreline Monitoring & Adaptive Management Online Workshops



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Visit Project Website for More Information

https://www.ezview.wa.gov/site/alias__1992/37576/overview.aspx

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2021 Critical Areas and Shoreline Monitoring & Adaptive Management Online Workshops

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement PC-01J2230116-05251 through the Washington Department of Fish and Wildlife.

Workshop Wednesday Series Lineup

Register using Zoom.

January 13 - 9:00 a.m. - 11:00 a.m.
How to Successfully Protect Critical Areas and Shorelines: A Step-by-Step Introduction to Monitoring and Adaptive Management

January 20 - 9:00 a.m. - 11:00 a.m.
Setting the Stage: Successful adaptive management and critical areas monitoring program basics

January 27 - 9:00 a.m. - 11:00 a.m.
Wetlands

February 3 - 9:00 a.m. - 11:00 a.m.
Geologically Hazardous Areas

February 10 - 9:00 a.m. - 11:00 a.m.
Fish and Wildlife Habitat Conservation Areas

February 17 - 9:00 a.m. - 11:00 a.m.
Frequently Flooded Areas

February 24 - 9:00 a.m. - 11:00 a.m.
Critical Aquifer Recharge Areas (CARAs)

March 3 - 9:00 a.m. - 11:00 a.m.
Shorelines

March 10 - 9:00 a.m. - 11:00 a.m.
Permit Implementation Monitoring Tools

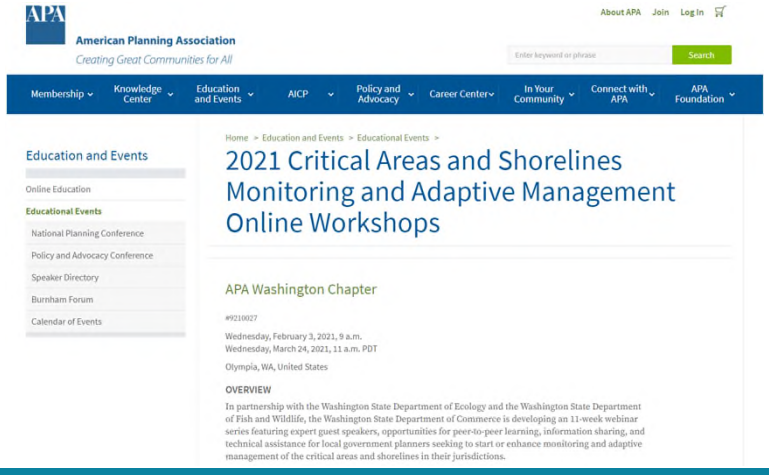
March 17 - 9:00 a.m. - 11:00 a.m.
CAO Performance Indicators

March 24 - 9:00 a.m. - 11:00 a.m.
Adaptive Management Interactive Workshop

Note: Workshop names may change but topic will stay the same.

American Planning Association Education Credit

GO TO: [HTTPS://PLANNING.ORG/EVENTS/EVENTMULTI/9210027/](https://planning.org/events/eventmulti/9210027/)



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Land Acknowledgment

Discover which tribal lands you reside on text your zip code to (907) 312-5085.

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Poll

Question:

What size jurisdiction do you work with?

What is your role?

How long have you worked on critical areas?

11

Poll

Question:

In your estimation, how often are Geologically Hazard Areas found on project sites in your jurisdiction?

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Meet Your Presenters

Scott is a Senior Planner for the Washington Department of Commerce. He has over 20 years of planning experience, including time with Kootenai County, Spokane County and the City of Spokane Valley. He has worked in all aspects of planning, including comprehensive plans, floodplains, shorelines, code enforcement and current planning.

Scott's technical focus is water resources and critical areas. He is also the agency liaison for the Voluntary Stewardship Program.

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The Role of Local Governments in Geologically Hazardous Areas

Growth Management Act - RCWs

- RCW 36.70A.030 - Definitions
  - (12) "Geologically hazardous areas" means areas that because of their susceptibility to erosion, sliding, earthquake, or other geological events, are not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns.
- RCW 36.70A.050 - Guidelines to classify….critical areas
- RCW 36.70A.060 - Natural resource lands and critical areas – Development Regulations

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Growth Management Act - WACs

WAC 365-190-120 – Geologically Hazardous Areas

(1) Geologically hazardous areas. Geologically hazardous areas include areas susceptible to erosion, sliding, earthquake, or other geological events. **They pose a threat to the health and safety of citizens when incompatible commercial, residential, or industrial development is sited in areas of significant hazard.**

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Growth Management Act - WACs

WAC 365-190-120 – Geologically Hazardous Areas

(2) Some geological hazards can be reduced or mitigated by engineering, design, or modified construction or mining practices so that risks to public health and safety are minimized. **When technology cannot reduce risks to acceptable levels, building in geologically hazardous areas must be avoided.** The distinction between avoidance and compensatory mitigation should be considered by counties and cities that do not currently classify geological hazards, as they develop their classification scheme.

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Growth Management Act - WACs

WAC 365-190-120 – Geologically Hazardous Areas

Counties and cities should assess the risks and classify geologically hazardous areas as either:

(a) Known or suspected risk;

(b) No known risk; or

(c) Risk unknown - data are not available to determine the presence or absence of risk.

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Geohazards are DIFFERENT!

- Critical Areas Protection Standard is No Net Loss
- Not "protecting" Geohazards
- Protecting life and property
  - Statutory standard for protecting critical areas is No Net Loss
- Focus on avoidance and risk minimization

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Erosion Hazards

- Bluffs
- Steep Slopes
- Areas with unconsolidated soils

Dept. of Ecology

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Landslide Hazards

Combination of bedrock, soil, slope, slope aspect, structure, hydrology, other factors

Ice Age Flood Institute

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Seismic Hazards

- Shaking
- Slope Failure
- Settlement
- Liquefaction
- Surface Faulting
- Tsunamis

Washington Military Dept.

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Other Geologically Hazardous Areas

Volcanic areas subject to pyroclastic flows, lava flows, debris avalanche, or inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity

NASA

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Roles

- Local Governments regulate and educate
  - Comprehensive Plan Policies
  - Critical Areas Regulations
  - Building Codes
  - Escape/Evacuation Routes
- Resource Agencies and Research Institutions
  - Provide maps, data, training

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High Resolution Change Detection (HRCD)

- Spatial Mapping Tools like HRCD
- Terrific Resource to visualize landscape changes
  - Evaluate Mapped Geohazard Areas
  - Locate Unknown/Unmapped Landslides

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Hearings Board Decisions

SNO-KING ENVIRONMENTAL ALLIANCE, ET AL. V. SNOHOMISH COUNTY, ET AL.

- County retains full discretion in what methods it utilizes and what degree of protection it affords designated landslide hazard areas. Less susceptible lands can be treated differently than more susceptible lands and the nature of the development can be taken into account.

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Hearings Board Decisions

FRIENDS OF PIERCE COUNTY, et al., CITY OF BONNEY LAKE, and MARILYN SANDERS, et al., Petitioners, v. PIERCE COUNTY

- The GMA requires that critical areas be designated and that regulations to protect their "functions and values" be enacted applying best available science. **However, there is no GMA directive that prohibits development because of geological risks**.
- While hazard areas are defined as areas that are not suited to development consistent with public health and safety, the **GMA definition by itself does not impose an independent duty upon the County to protect life and property by prohibiting development**.

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Hearings Board Decisions

FRIENDS OF THE SAN JUANS et al, v. SAN JUAN COUNTY

- Petitioners argue that allowing development in geohazard areas or frequently flooded areas ignores BAS Synthesis.
- The GMA does not impose an independent duty to protect life and property.

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Hearings Board Decisions

FUTUREWISE, PILCHUCK AUDUBON SOCIETY, AND THE TULALIP TRIBES, Petitioners, v. SNOHOMISH COUNTY

- Public health and safety concerns lie within the purview of the County's legislative authority. Here, Snohomish County exercised its discretion. It adopted landslide hazard area regulations by which it sought to balance the protection of people and property with restrictions on the use of land.

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Let's Keep a few things in Mind!!

- How can the resources be used for M and AM?
- Comp Plan Policies
- Regulations
- Feedback Loop

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Q&A

TYPE YOUR QUESTIONS IN THE Q&A BOX IN YOUR TOOLBAR

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Poll

Question:

How well do you feel the Geo Hazard Areas section of your code is functioning?

If you feel your Geo Hazard Areas code needs updates, would updating local hazard maps be a component of the code update?

Does your jurisdiction know where to find mapping resources for the Geo Hazard Areas you regulate?

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Meet Your Presenter

Jessica Czajkowski is the Assistant Director of Science and Research with the Washington Geological Survey, part of the Washington Department of Natural Resources. As an Assistant Director, Jessica helps guide the science, research, public outreach, and budget of the Survey. In her 11 years with the Survey, she has also served as its Editor in Chief, and has performed geothermal research, fault trenching, mapping, aggregate resource mapping, and has compiled numerous statewide digital datasets for the Survey. Prior to joining the Survey, she worked as a landslide geologist in southern California.

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Department of Natural Resources tool and resource overview

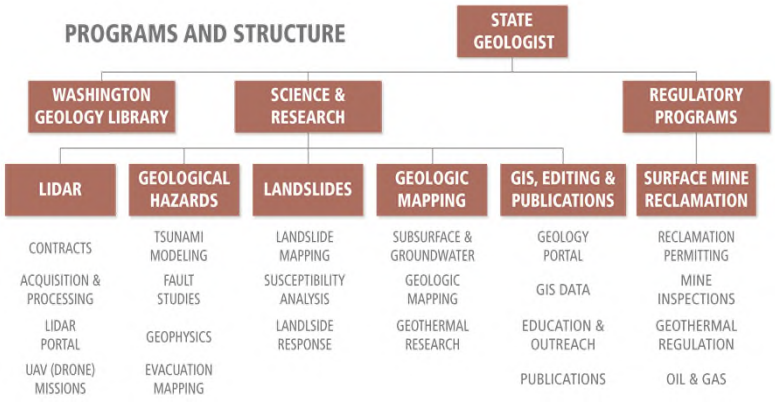
The Washington Geological Survey (WGS)

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.

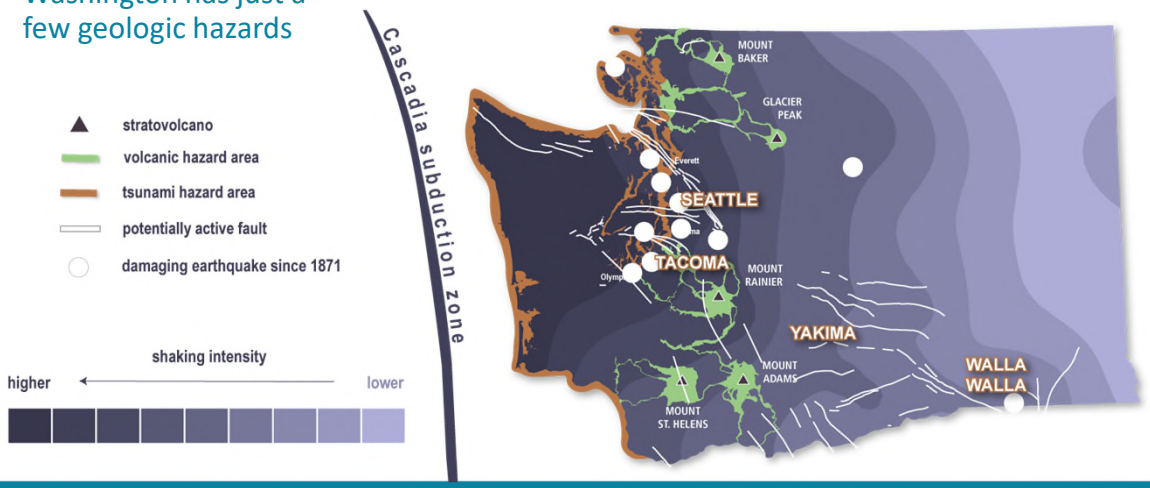
VISION

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



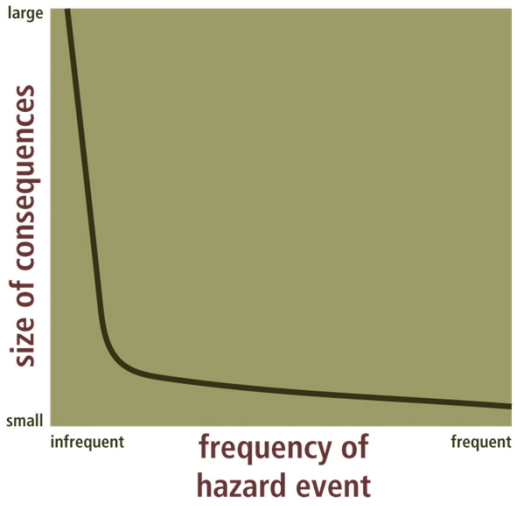
Geologic Hazards

Washington has just a few geologic hazards



Geologic Hazards

- Geologists look at the geologic record to determine how often each hazard is likely to occur.
- Small geologic events happen frequently.
- However, every few hundred years, we can expect one or more disastrous events. These large events leave indelible marks on the landscape and our lives.



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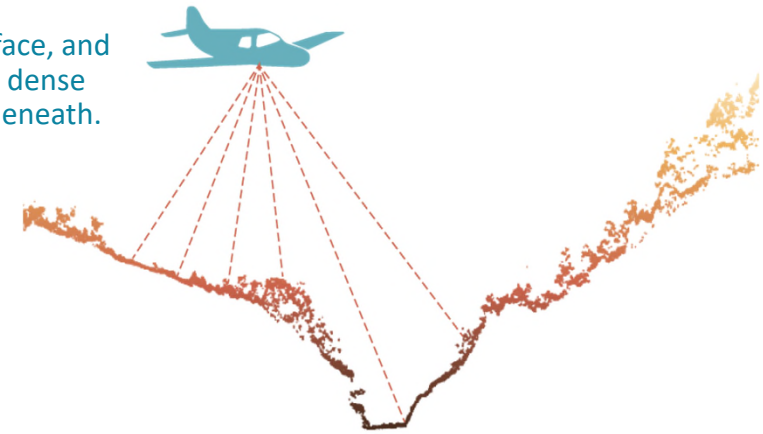
Lidar—one of the best tools ever!

Lidar is a technology that collects high-resolution topographic information of the Earth's surface, and can see through Washington's dense vegetation to the bare earth beneath.



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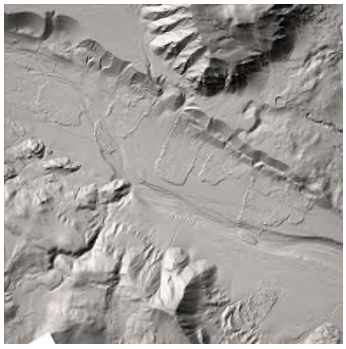
Lidar—one of the best tools ever!

This level of detail is game changing! We can see beneath the trees to identify landslides, undiscovered faults, and other never-before seen geology.



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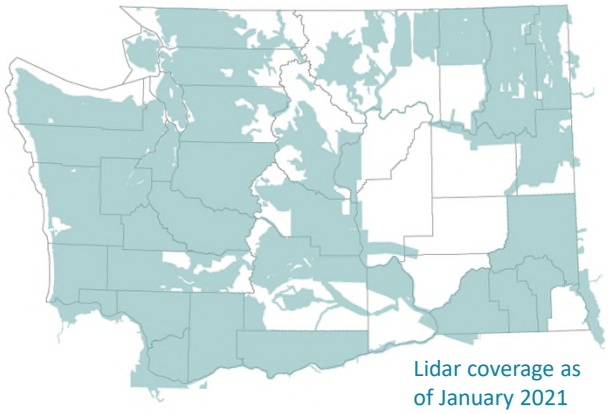
Lidar—one of the best tools ever!

- Used for:
  - All geologic hazard mapping
  - Wildfire
  - Flood mapping
  - Shoreline mapping
  - Agriculture
  - Forestry, silviculture
- 75% coverage in Washington



Lidar coverage as of January 2021

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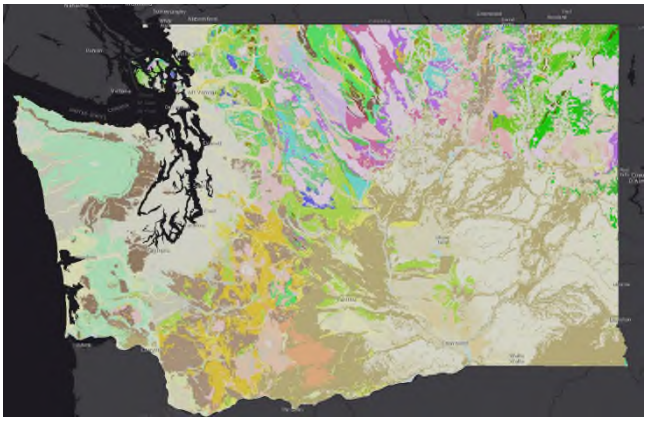
Washington Geologic Information Portal

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



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

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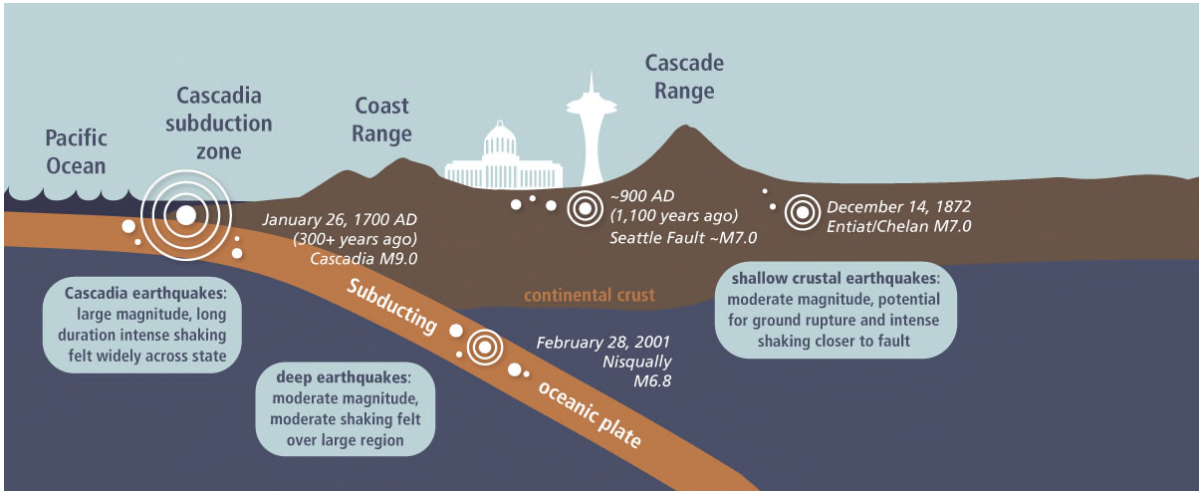
Seismic Hazards



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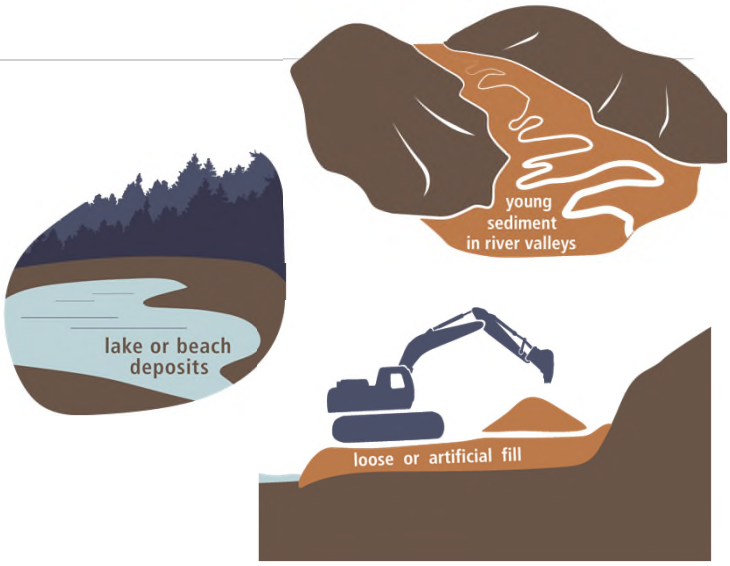
Seismic Hazards

- Aside from violent earthquake shaking, other effects can be just as damaging
- Liquefaction is a widespread effect of earthquake shaking
- Certain types of earth materials behave like liquids during shaking
  - Differential settlement
  - Cracked foundation
  - Collapse



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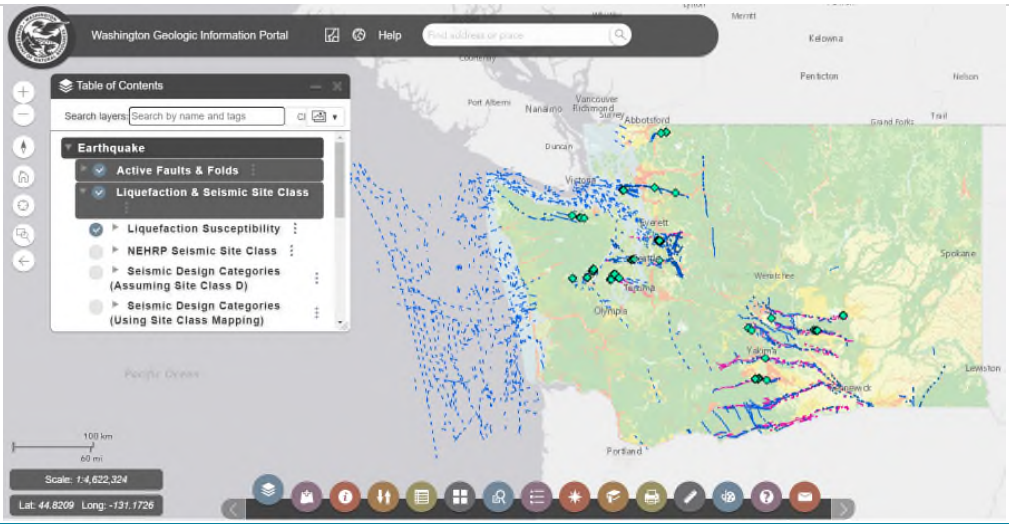
Seismic Hazards



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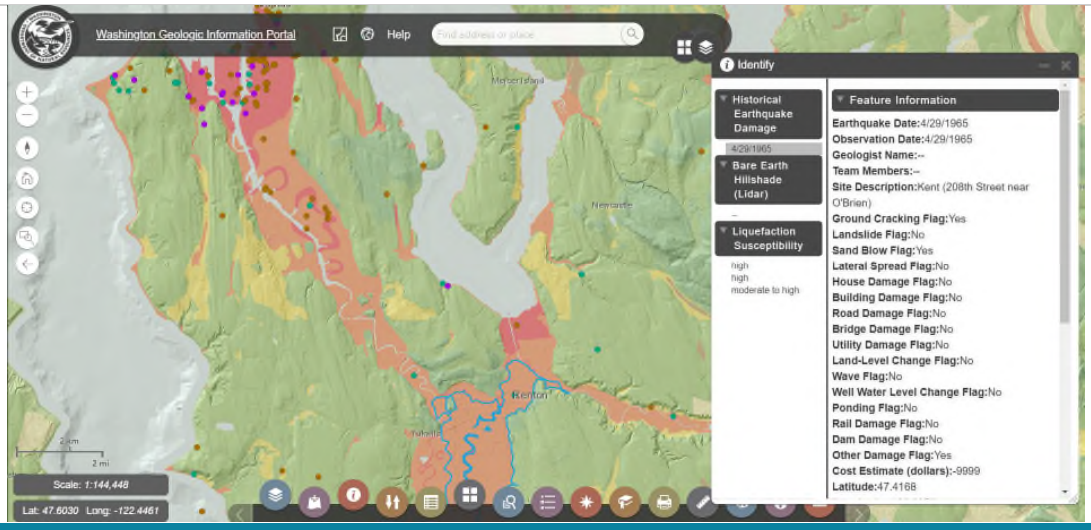
Seismic Hazards



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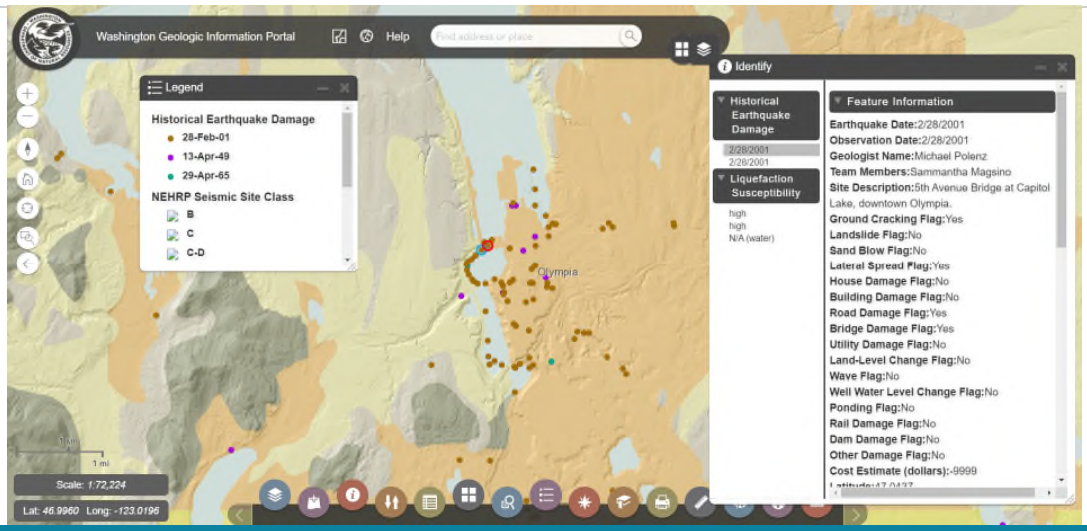
Seismic Hazards



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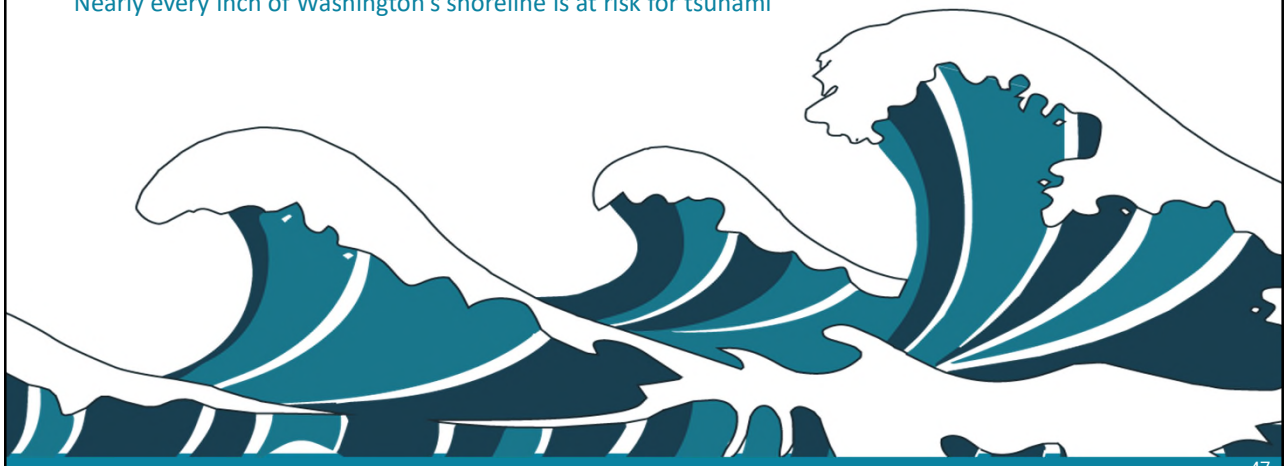
Tsunamis

Nearly every inch of Washington's shoreline is at risk for tsunami



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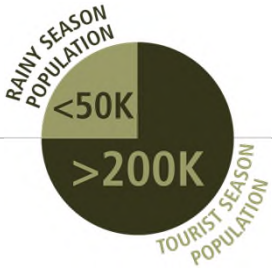
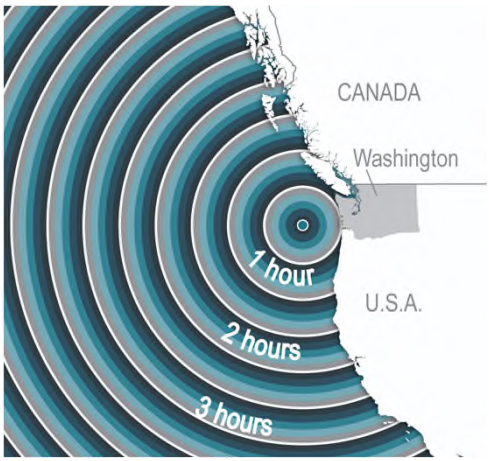
Tsunamis



- The greatest hazard is from an earthquake on the Cascadia subduction zone. They occur regularly between 300 and 800 years.
- A local earthquake on the CSZ means very little time for evacuation from tsunami
- Washington is also susceptible to tsunamis generated from earthquakes anywhere in the Pacific, and we'd have much more time to evacuate



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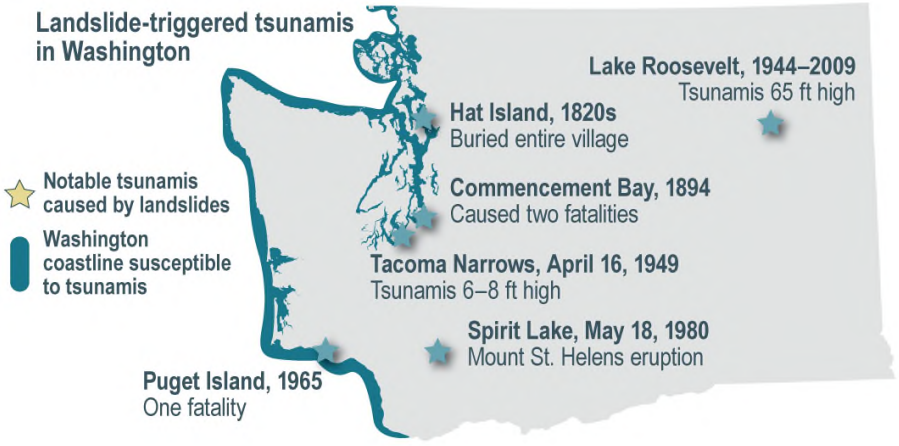
Tsunamis

- Washington's coastline is at risk, but so are all waters
- Landslides have cause several deaths from tsunamis in Washington, even on the east side of the Cascades!



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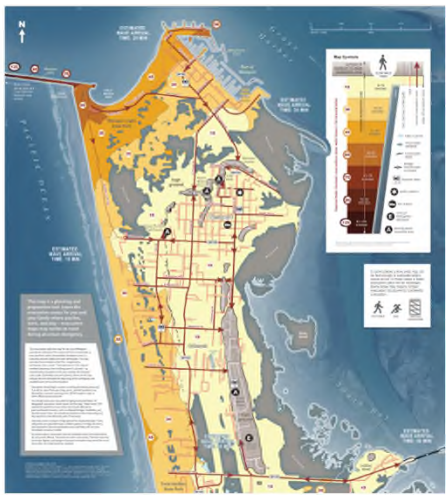
Tsunamis

- 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



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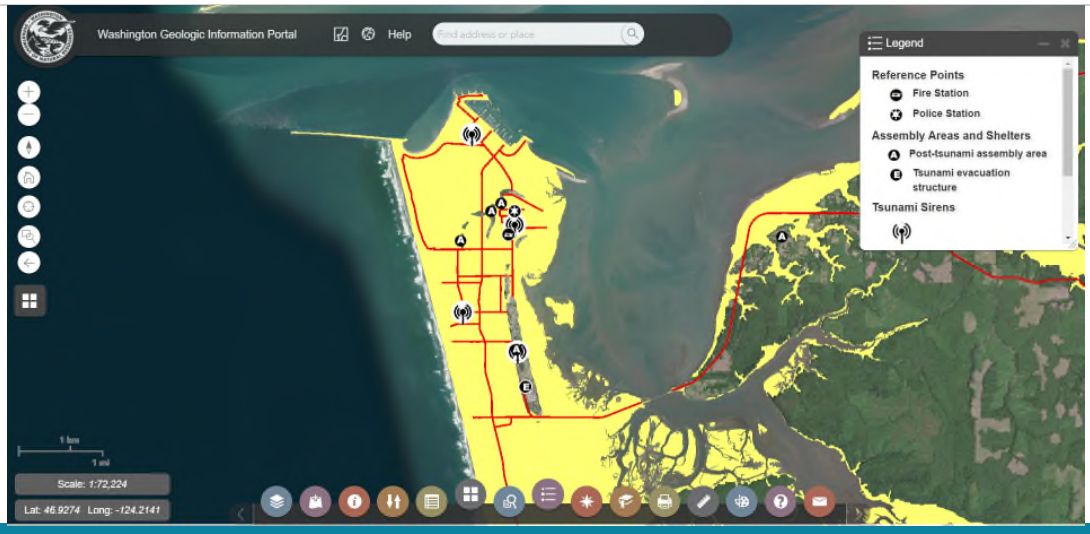
Tsunamis



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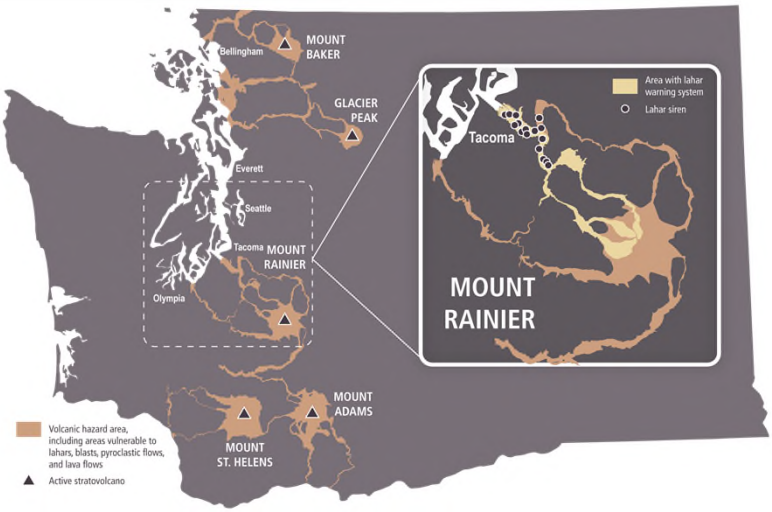
Volcanic Hazards

- Washington has five major stratovolcanoes
  - Avalanches
  - Lava flows
  - Pyroclastic flows
  - Ash fall
  - Lahars
- Many communities lie on their slopes
- Several of these volcanoes are considered a high threat



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Volcanic Hazards

- Most common hazards associated with volcanoes:
  - Ash
  - Lahars
- Areas affected by ash are determined by prevailing winds
- Lahars (volcanic mudflows) affect valleys immediately downslope of volcanoes

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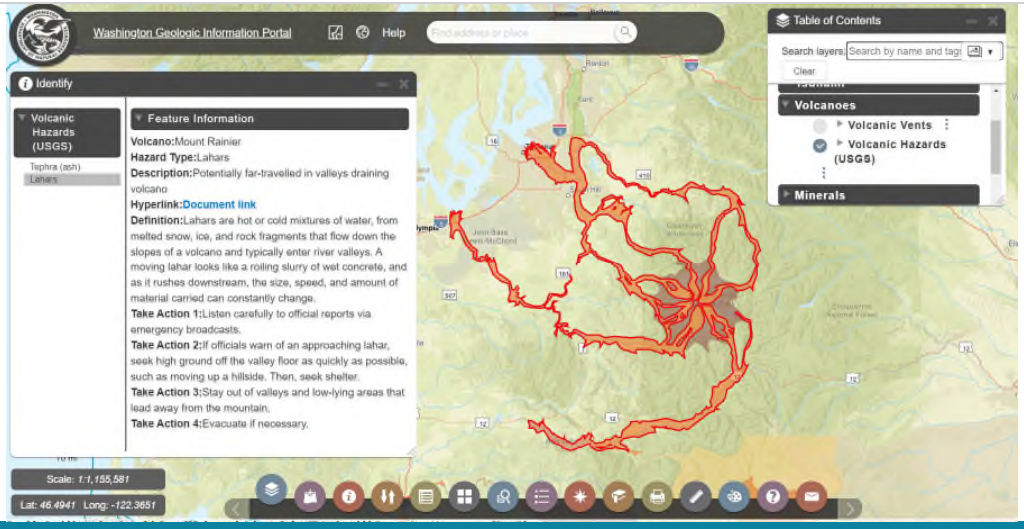
Volcanic Hazards



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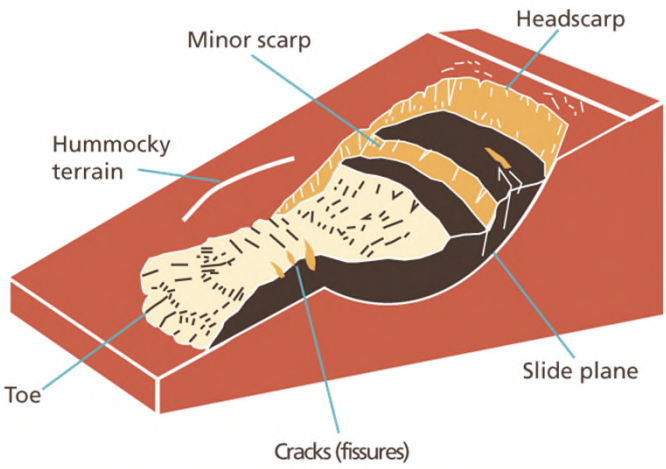
Landslides



- Landslides vary
  - Shallow and rapid
  - Deep and slow-moving
- Areas on, above, and below landslides are hazardous
- A few inches of movement can destroy a house
- Once there's a landslide, it's nearly always considered a hazard without mitigation

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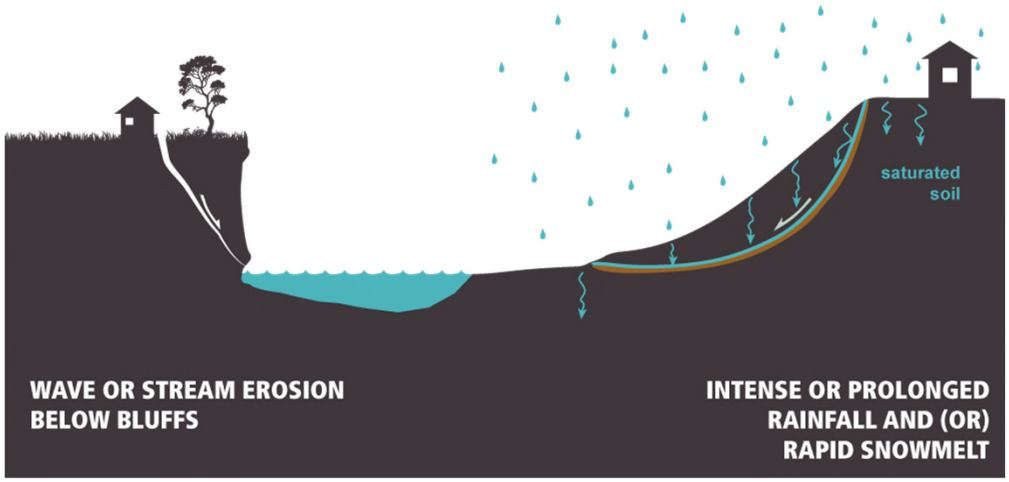
Landslide Triggers



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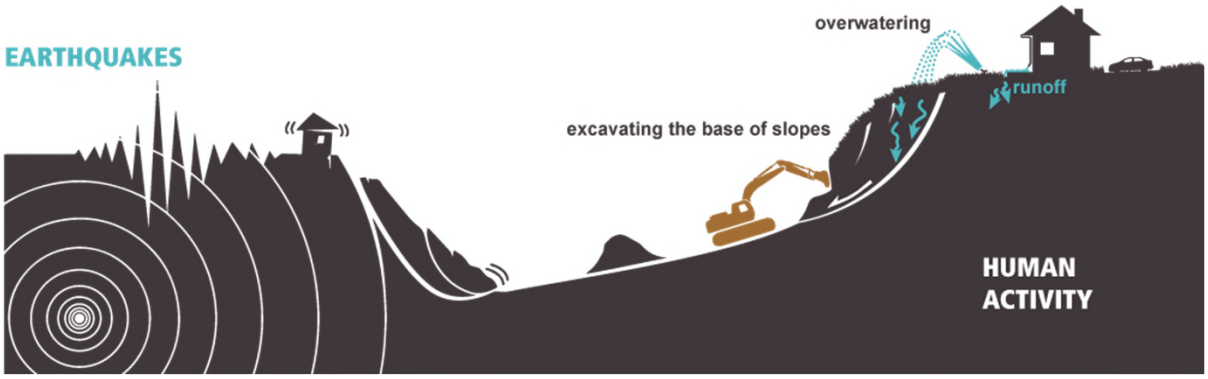
Landslide Triggers



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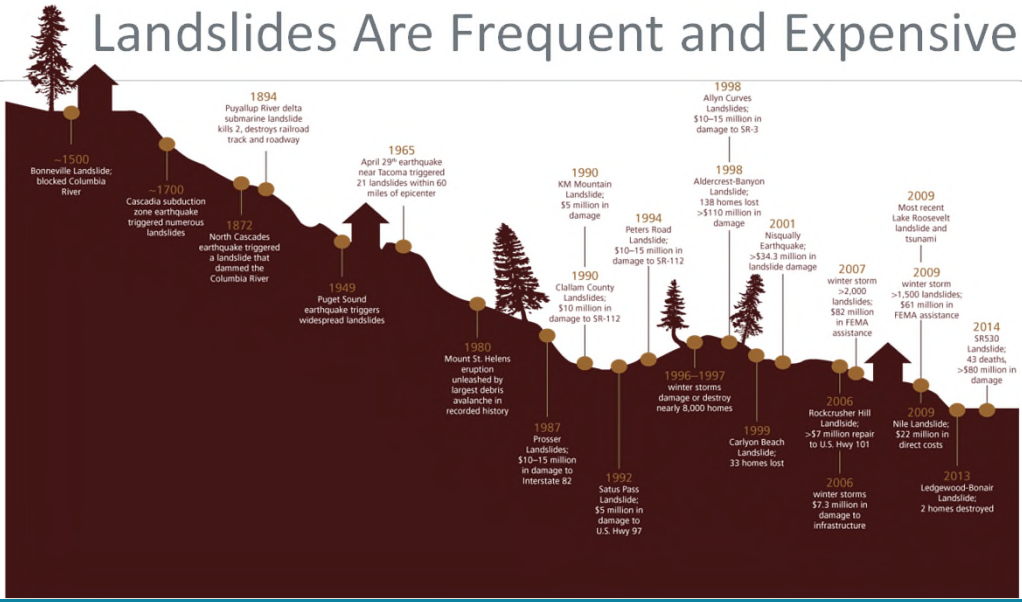
Landslides Are Frequent and Expensive



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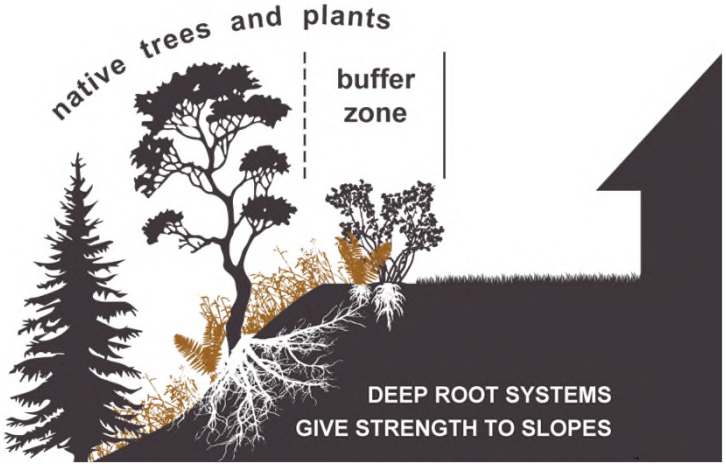
Landslides

- Management Strategy
  - Encourage native vegetation and limit removal of vegetation on slopes
  - Avoid building on, above, or below steep slopes
  - Know where landslides are



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Landslide Data We Offer

- Landslide Compilation
  - Compilation of numerous studies, and has many caveats
    - 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
    - Mapped with or without lidar
    - Mapped for various purposes
    - Mostly deep-seated landslides, not shallow landslides
    - It's way better than nothing!

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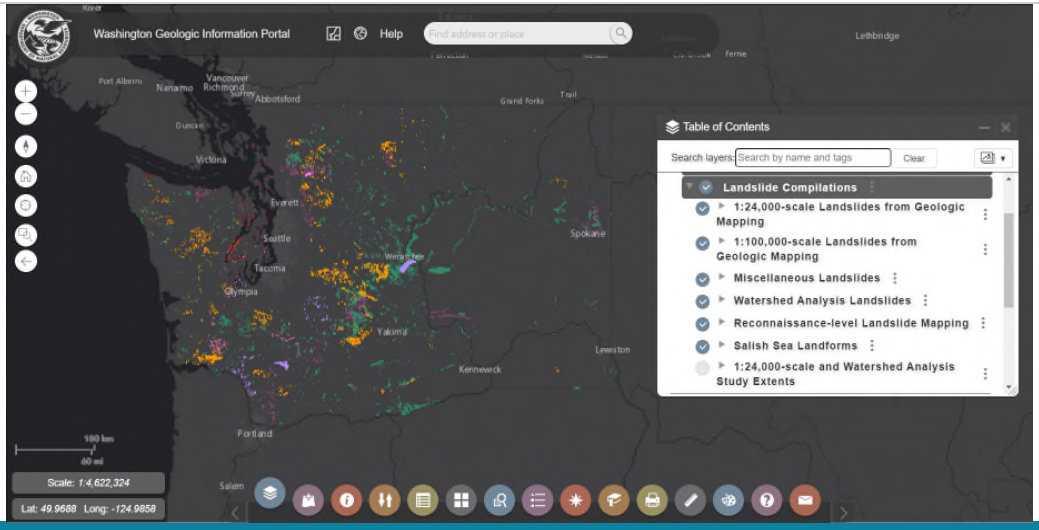
Landslide Data We Offer



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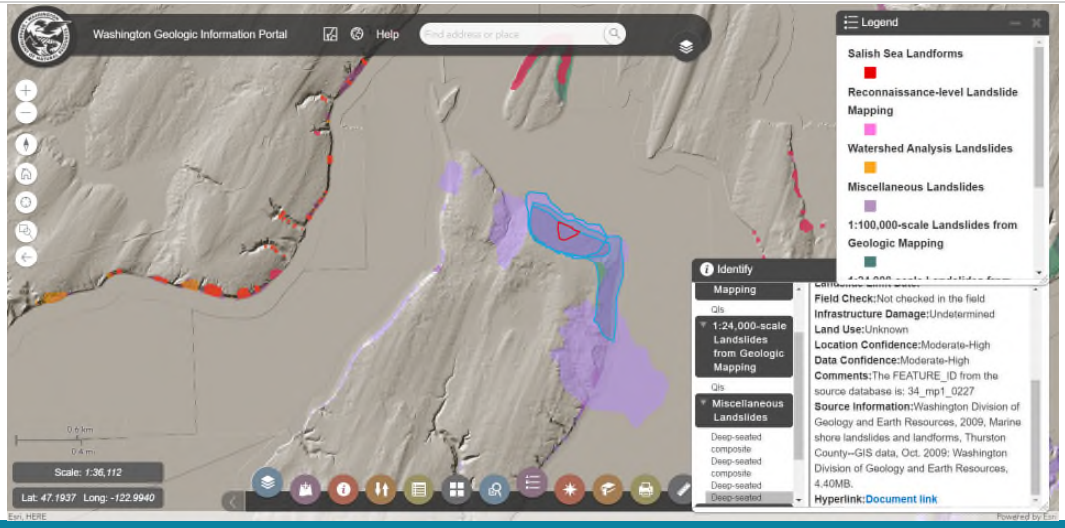
Landslide Data We Offer



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Landslide Data We Offer

- Landslide Compilation
- New Landslide Inventory (beginning in 2017)
  - Follows a peer-reviewed protocol
  - Requires high-quality lidar
  - Done on a county-by-county basis
  - Some have susceptibility analysis or alluvial fan mapping, some do not
  - So far, rockfalls are not included, but this is planned.
  - Where we have inventory mapping, we stamp out the compilation data, although it is still available when downloaded.

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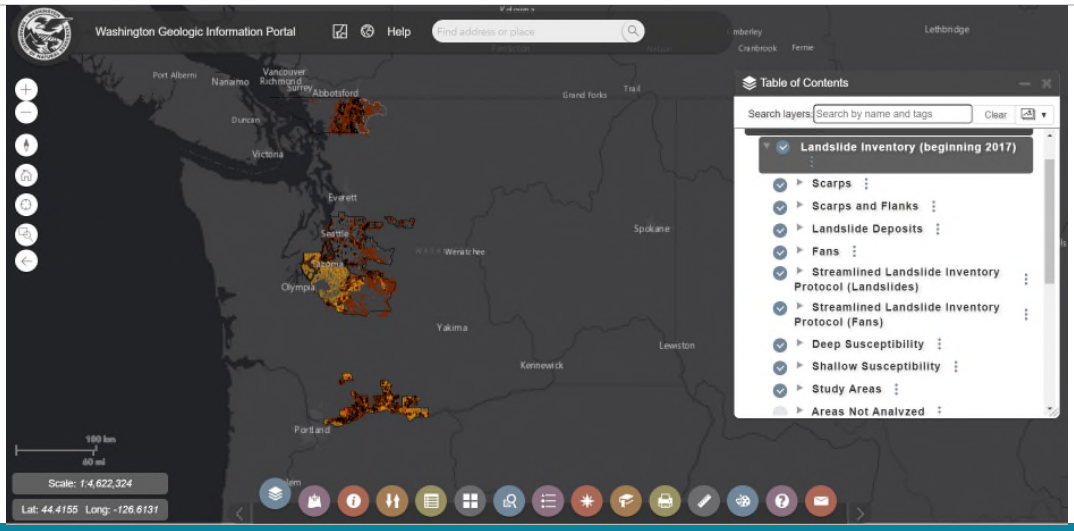
Landslide Data We Offer



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Landslide Data We Offer

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Wildfire-Associated Debris Flow Hazards

- 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.

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RiskMAP

Risk Mapping, Assessment, and Planning

- Important part of hazard mitigation planning and FEMA participation
- Determines potential loss estimation from exposure to multiple hazards
- Interactive Storymap
- State Risk Map Coordinator: Jerry Franklin, WA Dept. of Ecology

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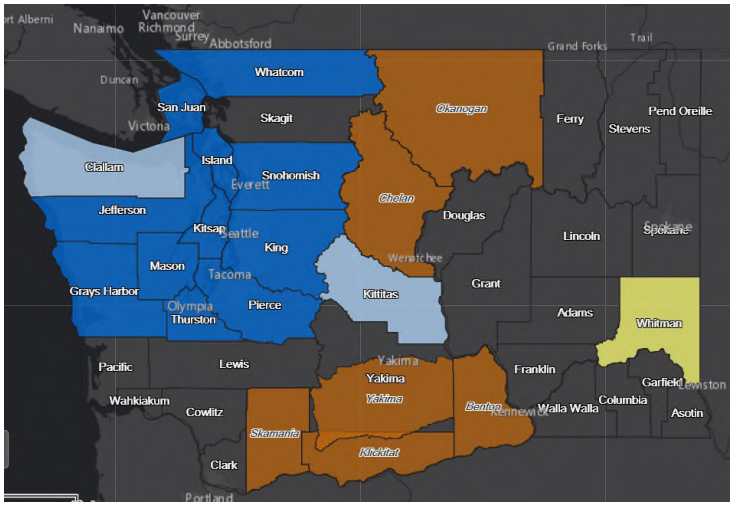
RiskMAP

Multiple counties complete or in progress



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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

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Resources

Landslide Hazard Resources

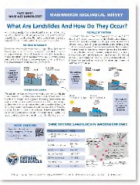
Landslide Inventory Publications

WGS Landslides Webpage

Wildfire-Associated Debris Flows

Wildfire Debris Flows Fact Sheet

What are Landslides and How Do They Occur?



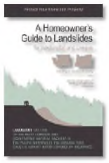
Landslide Hazards in Washington State

WA Dept. of Ecology Puget Sound Landslide Webpage

USGS Landslide Hazards Webpage

USDA Soils Data

Homeowners Guide to Landslides



Oregon Land Use Guide

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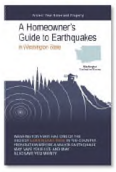
Resources

Seismic Hazards Resources

WGS Earthquakes & Faults Webpage

Faults & Earthquakes in Washington

Homeowner's Guide to Earthquakes in Washington

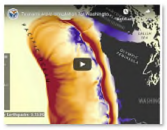


WA Seismic Design Category Maps

U.S National Seismic Hazard Maps

Seismic Scenario Catalog

Tsunami Simulations



Tsunami Hazards Resources

WGS Tsunami Webpage

Tsunami Hazard Maps

Tsunami Evacuation Maps

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Resources

Volcanic Hazards Resources

WGS Volcano Webpage

USGS Cascades Volcano Observatory Webpage

Volcanic Hazards Brochure

Link to Geologic Hazards Resources of Washington State Handout

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Q&A

TYPE YOUR QUESTIONS IN THE Q&A BOX IN YOUR TOOLBAR

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Poll

Question:

Does your code have standard setbacks from Geo Hazard Areas?

If your jurisdiction has standard setbacks, how often would you estimate the setback is changed based on recommendations from a geotechnical report?

Does your jurisdiction seek additional/third party review of geotechnical reports?

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Meet Your Presenter

Andy Wiser is a Washington State Licensed Engineering Geologist working with Whatcom County Planning and Development Services as a Geohazard Specialist, Surface Mining Program Administrator and Planner. In this role Mr. Wiser is responsible for review and administration of development permits for hazardous geologic conditions regulated by the Whatcom County Critical Areas Ordinance and Shoreline Management Program. His duties include review of technical reports for conformance with code requirements and industry-standards, as well as determination of potential threats to life-safety and property damage. His work also includes review of potential impacts to Critical Aquifer Recharge Areas, as well as erosion hazards associated with Frequently Flooded and Coastal Erosion Hazard Areas. Mr. Wiser is also the administrator of the Whatcom County Surface Mining Program, and frequently reviews WDNR Forest Practice Applications with the potential to impact County-regulated lands. Prior to working with the County, Mr. Wiser spent 7 years as a consulting geologist preparing geotechnical engineering and geologic hazard reports, often tailored to satisfy Critical Area requirements in Counties across the Pacific Northwest.

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Local government perspective on management of Geologically Hazardous Areas

Whatcom County Planning and Development Services

Geologically Hazard Areas

Implementation of Local Regulations

Andy Wiser, L.E.G., Whatcom County PDS
awiser@whatcomcounty.us – 360.778-5945

Debris Flow - Unnamed Creek above Nelson Road – 2009

- Whatcom County Geologist – since 2014
  - Technical Administrator of Article 3
    - CAO, SMP, Current- and Long-Range Planning
    - CARA, Frequently Flooded
  - Surface Mining Program Administrator
  - Assist Public Works and Department of EM
  - Work with WWU Geology Department
  - Participate in Forest Practice Application review

Presentation Outline

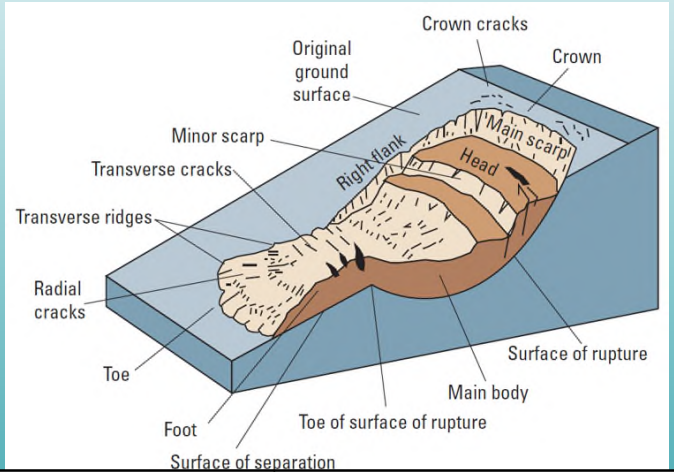
1. WC CAO Review Process
2. Regulated GHA's
   a) Define and screen for hazards
   b) Code Requirements
3. Administration of GHA
   a) Protective Measures, Reporting Requirements, Interplay between other CAO regs
4. SMP
   a) Briefly discuss and touch on key geotechnical issues
5. Current- and Long-range Planning Functions
6. Other Responsibilities
   a) Work w/ Public Works and WC Emergency Management

Natural Resource Assessment

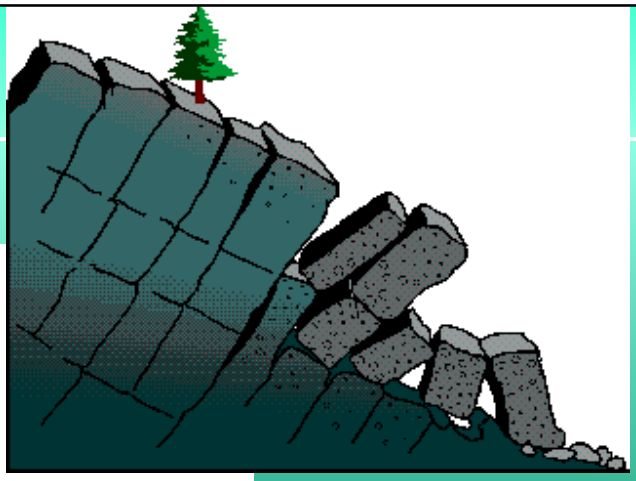
- NR review delayed building permit issuance.
- Site plan review required prior to building permit submittal.
- Allows zoning, fire, and NR approval prior to building and architectural design costs.

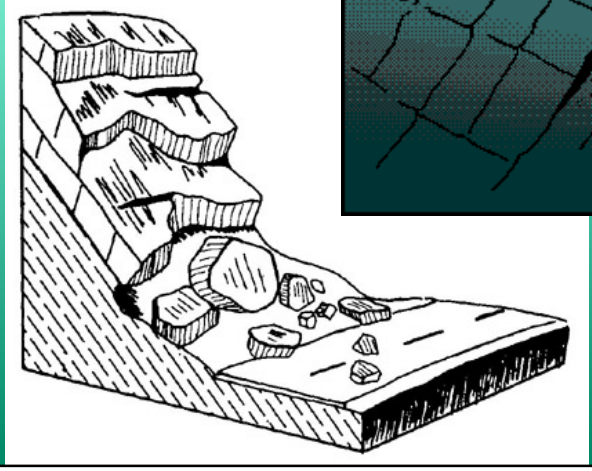
Regulated Landslide Hazard Areas

- WCC 16.16.310 – Definitions
  - Describes a semi-exhaustive list of landslide criteria.
  - Distinguishes between Potential and Active L.S.



Rock Falls, Slides and Topples





Shallow Translational Soil Failure-
2009 Hillside Road Debris Avalanche

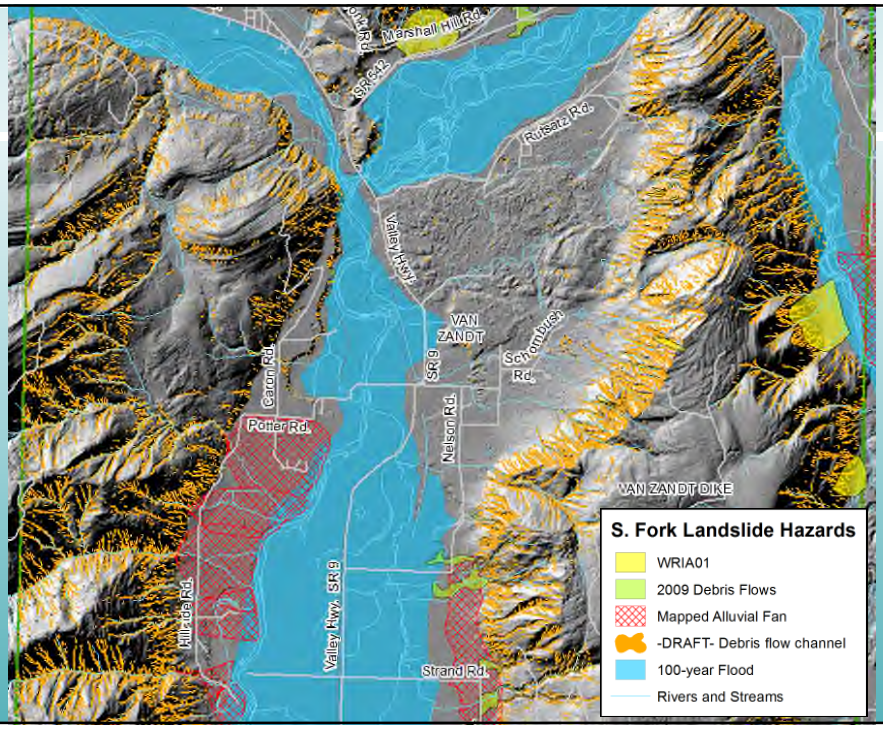
Photo Credit: Doug Goldthorp, Former WC PDS Geologist

2009 Nelson Rd. Debris Flow

Photo Credit: Paul Pittman

Landslide Hazard Screening Tools

- Slope percent map (<40%)
- DNR Mass Wasting Inventory
- 2019 DNR Landslide Inventory
- Lidar Imagery
- DOE Coastal Atlas

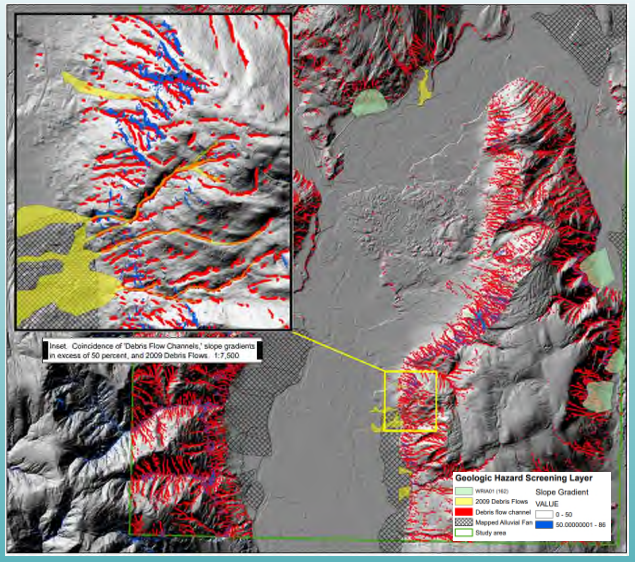


Alluvial Fan Hazard Areas

- Regulates range of alluvial fan processes
- Uses limited to reasonable use, infrastructure and SFR
- 500-yr Debris Flow or Max. Credible Event
- Typical Investigation methodologies/mitigation

Alluvial Fan Screening Tools

- Geologic Maps
- Lidar imagery
  - Slope percent map
  - Lobate contour lines
- DNR Landslide Inventory



Tsunami Hazard Areas

- Shoreline areas susceptible to inundation
- Defined by DNR's 2004 inundation model
- Inundation depth similar to coastal flooding, but increased velocity
- Hazard assessments
  - Depth and velocity
  - Elevated F.F. and increased embedment
  - Evacuation routes and Hazard Warning Systems

Erosion Hazard Areas

- Coastal and Riverine
- Setbacks required
  - Channel Migration Zone
  - 100-year design life
- In concert w/ SMP
- Prevent the need for armoring.
- 2014 MSDG

EHA Screening Tools

- Channel Migration Zone Mapping
  - DOE 2003 (#03-06-027) and 2014 (14-06-025)
- DOE Coastal Atlas
  - ~Decadal shoreline aerial photography
  - Shoreline process mapping
    - Drift cell direction
    - Coastal Landform mapping after
- Lidar Imagery
- FEMA-defined coastal floodplains

Volcanic Hazard Areas

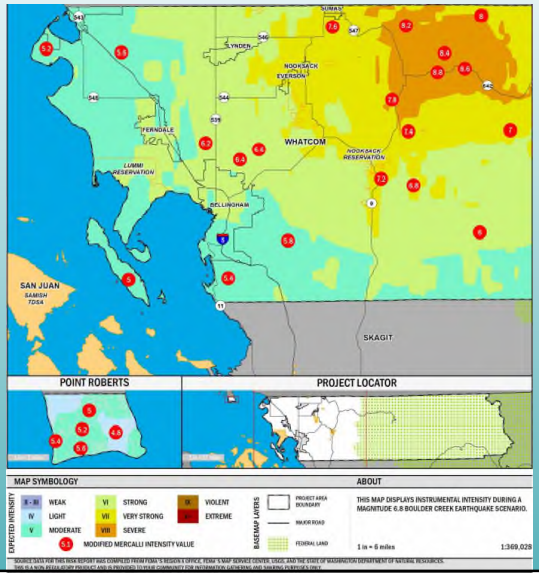
- Regulations specific to lahar hazards
- Updated w/ most recent CAO adoption
- All uses allowed, but emergency plan required when lahar arrival time > 60 min.

Seismic Hazard Areas

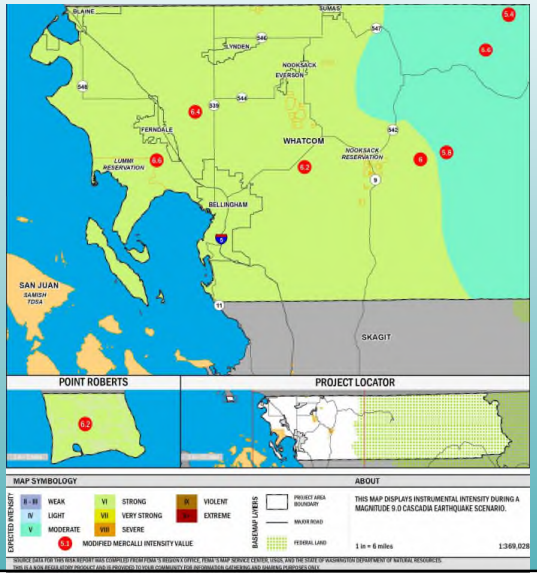
- Regulated pursuant to IBC and AASHTO
- Structural Engineer addresses in foundation design.
- Land subdivision allowed, buy may require avoidance or site-specific mitigation
- Site Class D-E and E may require site-specific analysis depending on use
- WA DNR Seismic Site Class and Liquefaction Susceptibility Mapping

ShakeMap output from Whatcom Count RISK Map Report

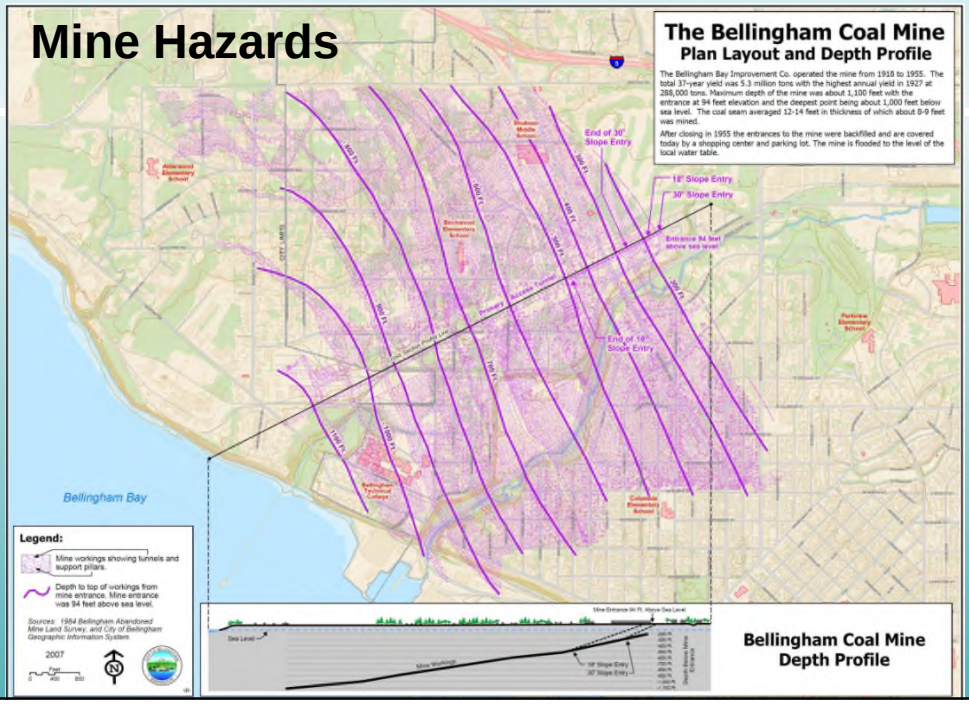
Boulder Creek Fault – M6.8



Cascadia Subduction Zone– M9.0



Mine Hazards



Shoreline Management Program

- CAO adopted by reference
- Shoreline stabilization
- Bluff crest setback
  100-year design life
- Non-conforming development

Supporting Regulations

- Protective Measures
  - Notice on Title
  - Conservation Easements
  - Release and Indemnification
- CAO Interplay
  - Extended Wetland or HCA Buffer
  - Flood and tsunami Requirements

Reporting Requirements

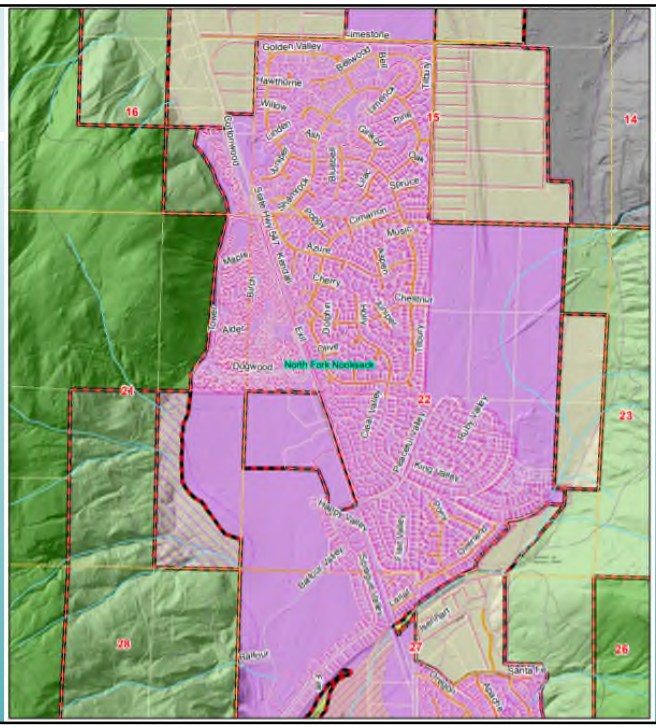
- Reporting Requirements
  - Hazard specificity
  - Scale of investigation
  - Licensure Requirements
    - DOL – Guidelines for Preparing Engineering Geology Reports in Washington State
    - Licensure nuance – LG versus LEG versus PE (Geotechnical Engineer)
- General Standards

Current Planning

- Review of all land use and planning.
- Current Planning
  - General standards apply
  - No subdivision if fully encumbered in GHA
  - BLA's reviewed similarily
  - Define buildable area outside of hazard

Long Range

- Existing Development
- Comp Plan language
- Urban Growth Areas
- Sea-level Rise



WC Public Works

- Alluvial Fan Hazard Assessments
  - Canyon, Jones, Swift and Glacier Creeks
  - Defined code standards
  - Property Buy-outs
  - Not intended to entirely mitigate hazard

WC Emergency Management

- Natural Hazard Mitigation Plan
- Emergency Notification and Evacuation Routes
- Annual Community Hazard Meetings
- Coordination of hazard response resources
- Hazard Scenarios

Q&A

TYPE YOUR QUESTIONS IN THE Q&A BOX IN YOUR TOOLBAR

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Thank you!

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