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TO: Thurston County Planning Commission

FROM: Claire Swearingen, Associate Planner

DATE: June 17, 2025

SUBJECT: Geologically Hazardous Areas Gap Analysis

Introduction

This memo provides background on geologic hazard areas to support the Planning Commission's upcoming work sessions. Geologic hazard areas are locations where the conditions or structure of the soil or earth create a potential hazard for people and property. They are one of five categories of critical areas that the County regulates in its Critical Areas Ordinance (CAO). These areas may be at risk for landslides, erosion, volcanic lahar flows, or seismic soil liquefaction. Some development is allowed in volcanic and seismic hazard areas, but it is limited and conditioned in order to protect human safety. Development in areas made potentially hazardous by mining activity requires technical reports and must meet additional requirements to ensure safety. Development near marine bluffs and other landslide hazard areas is protected by preserving an undisturbed vegetated buffer to ensure slope stability. RCW 365-190-03 defines geologically hazardous areas as follows:

> *"'Geologically hazardous areas' are areas that because of their susceptibility to erosion, sliding, earthquake, or other geological events, are not suited to siting commercial, residential, or industrial development consistent with public health or safety concerns."*
>
> *"'Landslide hazard areas' are areas at risk of mass movement due to a combination of geologic, topographic, and hydrologic factors."*
>
> *"'Mine hazard areas' are those areas directly underlain by, adjacent to, or affected by mine workings such as adits, tunnels, drifts, or air shafts."*
>
> *"'Seismic hazard areas' are areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, debris flows, lahars, or tsunamis."*
>
> *"'Volcanic hazard areas' shall include areas subject to pyroclastic flows, lava flows, and inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity."*

"'Erosion hazard areas' are those areas containing soils which, according to the United States Department of Agriculture Natural Resources Conservation Service Soil Survey Program, may experience significant erosion. Erosion hazard areas also include coastal erosion-prone areas and channel migration zones."

The Washington Department of Natural Resources (WA DNR) is the primary source of state guidance for geologically hazardous areas. Other agencies, such as the US Geological Survey (USGS) and Thurston Regional Planning Council (TRPC) also publish relevant documents. Many of the most important publications for geologically hazardous areas are in the form of GIS mapping resources, but other studies and hazard or resiliency plans are also important.

For these areas, regulating development through the CAO is one piece of a larger natural hazards mitigation effort to protect people from landslides, earthquakes, mine hazards, and volcanic hazards. Newly published mapping resources from DNR include a LiDAR-based landslide map, which displays areas previously affected by landslides or at risk for future landslides with a very high level of accuracy and precision. Because regulating geologically hazardous areas relies so heavily on GIS mapping, it's important that the CAO refer to the most accurate and precise mapping resources available.

The CAO should also reflect hazard mitigation efforts, such as TRPCs *Hazard Mitigation Plan for the Thurston Region,* which includes hazard assessments for earthquakes, landslides, and volcanic lahar events. Another important aspect for regulating geologic hazards is planning for the effects of climate change. The severity and frequency of landslides can be affected by sea level rise, intense heavy rainfall events, and wildfires, all of which are natural events connected to climate change. This issue is reflected in WA DNR's *Plan for Climate Resilience,* and by ensuring that the CAO reflect the most up-to-date mapping and risk assessments from WA DNR, we can ensure improved safety for Thurston County residents at risk of adverse effects from climate change.

Functions and Values Provided by Geologic Hazard Areas

Erosion and Environmental Factors

Many erosion hazard areas, landslide hazard areas, and coastal bluffs overlap with riparian areas, or areas of interface between land and water. These areas have a strong impact on the quality of aquatic habitats, and there are many biological and ecological processes that these areas contribute to. Erosion is a natural process that plays an important role in shaping the landscape and provides necessary sediment to streams and nearshore marine environments. It can, however, be disrupted by human activity, causing unwanted or high-intensity erosion events which threaten stream health and soil stability. The impacts of erosion on soil stability can threaten human life and safety, and the safety of structures and property. Increased erosion due to landscape disturbance, vegetation removal, and increased impervious areas can threaten the quality of aquatic habitat, including necessary habitat for salmonids. Many marine bluffs also act as feeder bluffs, providing necessary sand and gravel to beaches. Feeder bluffs can be protected by avoiding development nearby, and encouraging the landward relocation of existing structures. It's important to note that many marine bluffs and other areas near bodies of water fall under the jurisdiction of the Shoreline Master Program (SMP).

Vegetation quality and cover is one of the most important landscape features for mitigating risk and impacts associated with erosion hazards. Vegetation can assist with healthy infiltration of surface stormwater into the ground, slowing the movement of stormwater runoff while stabilizing soils that may otherwise be prone to erosion. When vegetation is removed, stormwater can move quickly over exposed soil, picking up sediment and forming rills and gulleys. Vegetation also enhances slope stability to decrease the risks of hazardous erosion and landslide events. Many slope areas also provide habitat areas to a variety of species.

Protection Strategies and Permitting

Human Life, Safety, and Property

Nearly all geologically hazardous areas present a risk to human life, safety, and property. Erosion, marine bluff, mine, and landslide hazard areas are all at risk of dangerous ground failure or slide events. Seismic hazard areas become a risk in an earthquake event, when the soils could be destabilized or liquefied by the movement of an earthquake. Lahar hazard areas represent the potential paths for a lahar flow (a river of molten rock and mud) from an eruption event on Mt. Rainier (Mt. Tahoma). Scientific information, including soil inventories, LiDAR maps, and case studies of other hazard events such as the 2014 Oso landslide, can be used to mitigate the risks presented by these types of hazards. New LiDAR-based landslide maps from WA DNR provide precise information about the location of landslide risks. This data can help County make better determinations about permitting requirements on a given parcel.

Protection Strategies

Protection strategies for geologically hazard areas include applying resources and data at the site-specific level to avoid or mitigate hazards. For some areas, especially landslide hazard areas, this may mean avoiding placing development in high-risk locations identified by mapping resources or by a geotechnical professional. Maintaining or establishing a vegetated buffer near the top and toe of a slope can help prevent loss of life or property in a slide event. In some cases, such as lahar and seismic hazard areas, education and awareness are more appropriate tools. One option may be to require applicants to sign a recorded acknowledgement that the property is in a hazard area, and to educate people on hazard preparedness and mitigation. To avoid loss of important infrastructure, certain critical facilities should not be placed in hazard-prone areas.

A primary concern for permitting near erosion, landslide and coastal bluff hazard areas is determining the level of geological investigation needed to ensure the construction won't have negative safety or environmental impacts. To ensure consistency and transparency, code and policy should provide a clear path for incoming applicants, so that applicants know what to expect and can plan to submit the correct reports. One solution, which could reduce expenses to applicants and improve permitting timelines, is to allow reconnaissance-level geotechnical reports if the proposed development is outside of a set standard buffer for a given geologically hazardous area, and to make use of the new WA DNR landslide hazard mapping to determine when and where higher levels of geological investigation are necessary.

Climate Change Impacts

Climate change may impact geologically hazardous areas in many ways. An increased frequency of intense rainfall events can worsen the risk presented by landslide hazard areas, and make slide events more likely. Coastal bluffs can face increased erosion risk due to sea level rise, and slopes near rivers and streams may be eroded by channel migration, which is affected by a variety of climatological changes. More frequent and intense wildfires create greater erosion and landslide risk due to vegetation loss. A priority recommendation from DNR's Plan for Climate Resilience is the use of improved, LiDAR-based data, which is now available for Thurston County.

Gap Analysis

Code Section	Title	Recommendations	Reason
24.15.013	Geologic Hazards Designated	Add designation criteria to chapter	Usability and accessibility
24.15.013	Geologic Hazards Designated	Update references to NRCS soil data	Consistency with most recent data

		erodibility classifications	
24.15.013	Geologic Hazards Designated	Ensure consistency with WAC designations	Consistency with state law
24.15.013	Geologic Hazards Designated	Designate channel migration zones as erosion hazard areas	Best Available Science
24.15.015	Standard buffer for landslide hazard areas and marine bluff hazard areas	Create clarity and flexibility by establishing review distance and standard buffers	Usability and accessibility
24.15.015	Standard buffer for landslide hazard areas and marine bluff hazard areas	Leverage new landslide hazard map data from WA DNR	Best Available Science
24.15.020	Special hazard overlay districts	Include additional known special hazard areas	Best Available Science, staff expert recommendation
24.15.023	Site Assessment Standards	Outline clear standards for geotechnical reporting	Usability and accessibility
Table 24.15-3	Erosion Prone Soils of Thurston County	Remove tables containing outdated soil classifications	Consistency with most recent data
Chapters 24.16-24.18	Seismic Hazard Areas, Volcanic Hazard Areas, Mine Hazard Areas	Minor language revisions for clarity and appropriateness	Usability and accessibility

24.15.013 Geologic Hazards Designated

Specific designation criteria should be added to the main chapter to support clarity, usability and accessibility. Designation criteria should reflect current, up-to-date, publicly available maps and data sources and should align with designations and definitions provided in the WAC and RCW. Channel migration zones and associated erosion or landslide hazards should be considered based on BAS, especially climate change BAS which indicates that stream and river morphology may be impacted by climate change.

24.15.015 Standard buffer for landslide hazard areas and marine bluff hazard areas.

Standard buffer calculation methods should be easy to understand, review, and implement. Standard review distances should be implemented for clarity in the permitting process. Staff expert review of code language should ensure consistency with standard practices in geological reporting. Where it would not cause a loss of ecological function or a safety hazard, flexibility in site design should be allowed with appropriate reports by qualified professionals. New best available science, such as the new Washington Geological Survey Landslide Protocol maps, should also be incorporated as a tool to improve the efficiency and effectiveness of screening for potential critical areas.

24.25.020 Special hazard overlay districts

At the recommendation of staff experts, other known areas of historic failures of special geological hazards should be considered. If additional areas of special hazard are designated, publicly available maps should be updated for accessibility and transparency.

24.15.023 Site assessment standards

Based on public feedback and input from permit review staff, updates to geotechnical site assessment requirements should be made more clear, specific, and accessible. Updates should also consider allowing for different levels of reporting, which are appropriate for different projects, in order to save both applicant and staff resources. This change is also supported by a recently adopted updated definition for “qualified professionals.”

Table 24.15-3 Erosion Prone Soils of Thurston County

In order to ensure that GeoData maps can be updated easily if new data is released without causing a conflict with development codes, tables containing outdated information, or information that could be subject to change, should be removed. Instead, code should allow for maps to be kept up-to-date, while identifying the specific site characteristics that are identified when screening for potential critical areas.

Chapters 24.16-24.18 Seismic Hazard Areas, Volcanic Hazard Areas, Mine Hazard Areas

Few changes are necessary in these chapters, as the critical areas regulated do not often change. Generally, development is allowed in these critical areas with some use restrictions and design or performance standards. Language has been updated as needed for clarity, accuracy, or appropriateness, i.e. removing outdated terminology.

Best Available Science Resources

Bash, J., Berman, C., & Bolton, S. (n.d.). *Effects of Turbidity and Suspended Solids on Salmonids* (No. 42; T1803). Center for Streamside Studies.

Booth, D. B. (1990). Stream-channel incision following drainage-basin urbanization. *Water Resources Bulletin*, *26*(3). https://faculty.washington.edu/dbooth/Booth_1990_WRB.PDF

Booth, D. B. (1991). *Urbanization and the Natural Drainage System—Impacts, Solutions, and Prognoses*. http://hdl.handle.net/1773/17032

Booth, D. B. (2007). *Forest Cover, Impervious-Surface Area, and the Mitigation of Urbanization Impacts in King County, Washington*. University of Washington Department of Civil and Environmental Engineering. http://hdl.handle.net/1773/19552

Chleboard, A., Baum, R., & Godt, J. (2006). *Rainfall thresholds for forecasting landslides ine the Seattle, Washington, area—Exceedance and probability* (Open-File Report) [Open-File Report]. https://pubs.usgs.gov/publication/ofr20061064

Crosson, R. S., & Jacobson (compiler), M. L. (1983). Proceedings of Workshop XIV: Earthquake hazards of the Puget Sound region, Washington. In *Open-File Report* (Nos. 83–19). U.S. Geological Survey. https://doi.org/10.3133/ofr8319

Geologic Hazards and the Environment | Department of Natural Resources. (n.d.). Retrieved November 24, 2025, from https://dnr.wa.gov/washington-geological-survey/geologic-hazards-and-environment

Geologic Planning | Department of Natural Resources. (n.d.). Retrieved November 24, 2025, from https://dnr.wa.gov/washington-geological-survey/geologic-planning

Iverson, R. M., George, G. L., Allstadt, K., Reid, M. E., Collins, B. D., Vallance, J. W., Schilling, S. P., Godt, J. W., Cannon, C. M., Magirl, C. S., Baum, R. L., Coe, J. A., Schulz, W. H., & Bower, J. B. (2015). Landslide mobility and hazards: Implications of the 2014 Oso disaster. *Earth and Planetary Science Letters*, *412*, 197–208. https://doi.org/10.1016/j.epsl.2014.12.020

Keaton, J. R., Wartman, J., DeLaChapelle, J., Anderson, S., Benoît, J., Gilbert, R., & Montgomery, D. (2014). *The 22 March 2014 Oso Landslide, Snohomish County, Washington*. Geotechnical Extreme Events Reconnaissance.

Mauger, G. (n.d.). *Global Climate Model Projections for the PNW* [Dataset]. Retrieved January 28, 2026, from https://cig.uw.edu/datasets/downscaled-global-climate-model-projections-for-the-pnw/

Mauger, G., Casola, J., Morgan, H., Strauch, R., Jones, B., Curry, B., Busch Isaken, T., Whitely Binter, L., Krosby, M., & Snover, A. (2015). *State of Knowledge: Climate change in Puget Sound*. University of Washington Climate Impacts Group. https://data.cig.uw.edu/picea/mauger/ps-sok/PS-SoK_2015.pdf

Mauger, G., Morgan, H., & Won, J. (n.d.). *Projected Changes in Extreme Precipitation Web Tool*. Retrieved January 9, 2026, from https://data.cig.uw.edu/picea/stormwater/pub/viz/

Mote, P. W., & Salathé, E. P. (2010). Future climate in the Pacific Northwest. *Climatic Change*, *102*(1–2), 29–50. https://doi.org/10.1007/s10584-010-9848-z

Naiman, R. J., & Decamps, H. (1997). The Ecology of Interfaces: Riparian Zones. *ResearchGate*. https://doi.org/10.1146/annurev.ecolsys.28.1.621

Newman, T., Kuhta, S., Andrade, C., Dial, G., Whittaker, K., Folkerts, K., Chase, C., Blair, M., Sears, T., & Ballash, H. (n.d.). *Critical Areas Handbook*. Washington State Department of

Commerce. Retrieved January 28, 2026, from https://deptofcommerce.app.box.com/s/rlysjrfvrxpxwnm9jvbcd3lc7ji19ntp

Puget Sound feeder bluff—Washington State Department of Ecology. (n.d.). Retrieved November 24, 2025, from https://ecology.wa.gov/research-data/monitoring-assessment/coastal-monitoring-assessment/projects/puget-sound-feeder-bluff

Puget Sound Nearshore Ecosystem Restoration Project | Washington Department of Fish & Wildlife. (n.d.). Retrieved November 24, 2025, from https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp

Shipman, H., MacLennan, A., & Johannessen, J. (2014). *Puget Sound Feeder Bluffs* (Nos. 14-06–016). Washington State Department of Ecology.

Taylor, K. E., Stouffer, R. J., & Meehl, G. A. (2012). An Overview of CMIP5 and the Experiment Design. *Bulletin of the American Meteorological Society*, *93*(4), 485–498. https://doi.org/10.1175/BAMS-D-11-00094.1

WA DNR. (2020). *Safeguarding our lands, waters, and communities: DNR's plan for climate resilience*. Washington State Department of Natural Resources. https://dnr.wa.gov/sites/default/files/2025-03/em_climaterresilienceplan_feb2020.pdf

Washington Geologic Information Portal. (2025). [Map]. Washington Department of Natural Resources. https://geologyportal.dnr.wa.gov/2d-view#natural_hazards?-13730376,-13613581,5875248,5931658?Surface_Geology,500k_Surface_Geology,Map_Units