**CITY OF KIRKLAND**
**City Manager's Office**
**123 Fifth Avenue, Kirkland, WA 98033 425.587.3001**
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**MEMORANDUM**

**To:** Kurt Triplett, City Manager

**From:** Marilynne Beard, Deputy City Manager

**Date:** February 18, 2015

**Subject:** HAZARDOUS SLOPES

The 2014 Oso landslide created a new level of awareness and concern about the risk of landslides and the potential for significant loss of life and property. Since the Oso incident, state and local government agencies have studied both the Oso incident and the risk potential and existing regulatory environment in Washington communities. In December 2014, the Governor's SR530 Landslide Commission submitted their report. A copy of the report is included as Attachment B and discussed later in this memo.

The purpose of this memo is to describe how the City of Kirkland identifies and manages landslide risk, how it regulates development on hazardous slopes, how information is communicated to the public, and how it plans for and mitigates against landslide hazards. It concludes with a summary and analysis of the strengths and weaknesses of the City's existing regulations and processes and provides recommendations on a series of actions for Council consideration.

## I. Understanding Landslides

Landslides occur when the stress of gravity exceeds the strength of rock and soil.[1]
They can be generated by a variety of triggers, generally categorized into those caused by humans or by nature[2].

Natural causes can include:

- Elevation of pore water pressure by saturation of slope material caused by prolonged rainfall and seepage
- Vibrations from earthquakes
- Waves of water that undercut banks or cause river erosion
- Volcanic eruptions
- Previous/historical landslides both at the location and in the vicinity

Human causes can include:

- Removal of vegetation
- Interference with, or changes to, natural drainage
- Leaking pipes such as water and sewer or other pipes

[1] Landslides 101 http://landslides.usgs.gov/learn/ls101.php (accessed 6/25/14)
[2] http://www.ga.gov.au/hazards/landslide/landslide-basics/causes.html (accessed 6/25/14)

- Irrigation systems
- Modification of slopes by construction (roads, buildings, etc.)
- Overloading slopes
- Mining and quarrying activities
- Vibrations from heavy traffic, construction, blasting, etc.
- Excavation or displacement of rocks

Landslides are frequently the consequence of more than one of the causes described above interacting and such causes do not always trigger a landslide immediately.

**Impact[3]**

Social, environmental, and economic elements of a community will feel the effects of a landslide incident. Many of these can last for decades.

Landslides distress communities severely by impacting people, public gathering places, and a sense of neighborhood. The most severe impacts are injury, death, and post-traumatic stress. Immediately after landslides there can be fear of additional incidents, loss of informal and formal support systems, and social unrest.

Natural resources impacted can include the biodiversity of fish and wildlife, waterway use, forests, and roadways. The quality, quantity, and availability of water can be affected by landslides.

Landslides account for more than $1 billion in property damage each year in the United States. Direct costs include repairs to public infrastructure such as water supplies, sewage disposal systems, homes and businesses, loss of property value, disruption of transportation routes, and medical costs of injuries. Indirect costs include loss of tourism, business relocation, and access to natural resources such as parks and waterways. The geotechnical studies and engineering projects involved in hazard mitigation of landslide site assessment and stabilization can also be costly. Landslides come in many sizes and can occur in many timeframes – slowly shifting earth can for example cause a foundation to crack.

Sudden catastrophic slides are the most noticeable, but also may be rare compared to slow slides that could actually cause more damage. Communities can be economically affected for years after a slide event because they are labeled and associated as "the place the landslide happened."

## II. Identifying Hazards that may Contribute to Landslides

Many types of surfaces developed by people may modify drainage, water retention, or erosion. Pavement materials, soil types and community development all have consequences on sloping. Collecting and providing data on types of surfaces provides information for risk analysis and hazard mitigation for both the City and the public.

[3] http://www.scribd.com/doc/36273555/Effects-of-Landslides

**Landslide-related data maintained by the City of Kirkland**

The City's Geographic Information System (GIS) captures, manages, analyzes and displays information. It provides data for users to visualize, understand, and analyze patterns and trends for risk analysis and hazard mitigation. Data is used in successive layers to evaluate the level of hazard and the regulations that may apply.

**Steep Slopes** – Any parcel having a slope greater than 40% is considered a steep slope and subject to development review as a "geologic hazard."

**Landslide Hazards** – Parcels that have conditions that increase the likelihood of landslides are considered a "potential landslide area."

**Landslide Risks** – "Risk mapping" provides information about additional factors that identify the level of risk associated with the parcel including groundwater levels and soils analysis. If the initial risk assessment for a proposed development identifies factors that create a potential landslide hazard, the developer will be required to do more detailed testing.

Each land parcel is unique and the variability of conditions from one parcel to the next requires each parcel to be evaluated independently (although landslide risk assessment applicable to each parcel can involve factors or features of adjacent or nearby parcels as well). This level of detailed evaluation is generally only conducted when development or redevelopment is proposed, particularly as these development activities can increase the risk of landslides.

The City's existing Landslide Hazard GIS data layer comes from two sources. Mapping for pre-annexation Kirkland (excludes annexation areas of Juanita, Finn Hill, and Kingsgate) originated from a joint King County-Kirkland effort in 1991 in which the County's Sensitive Area Ordinance (SAO) mapping was reviewed and augmented by a geologist working with City staff, primarily investigating steep slopes, soils, and groundwater conditions. From this analysis, landslide hazard polygons were mapped in high-risk and medium-risk categories, and subsequently became codified in Chapter 85 of the Kirkland Zoning Code. For the areas annexed on June 1, 2011, landslide data were merely copied from the King County GIS Center's published data layer, which again is based on early-1990s SAO mapping. The annexation area data are more dated and less detailed than the 2001 data collected for incorporated Kirkland.

GIS Layers that are currently available include the following list. Data for the first four categories (landslides, liquefaction, seismic and soils) in the annexation area are more dated and generalized:

- Landslides – A map showing landslide and seismic hazard areas within the City intended for use with Chapter 85 of the City's Zoning Code regulating development on slopes.
- Liquefaction – Shows areas prone to liquefaction which is the process by which water-saturated land temporarily loses strength and acts as a fluid.
- Seismic – Data related to earthquakes and vibrations.
- Soils – Information about soil texture and depth that impact its drainage characteristics.
- Impervious surfaces – Identification of land coverings, such as pavement, that drain, but don't absorb water.

- Geology – Describes the layers of earth, their formation and characteristics. Bore holes up to 100 feet deep provide data that describe each layer beneath the surface. As a recommendation of the 2005 Surface Water Master Plan, the geologic map of pre-annexation Kirkland was updated using borehole information and field work as managed by GeoMap Northwest, a project of the University of Washington Department of Earth and Space Sciences.
- Lakes – Bodies of water in natural depressions fed by streams.
- Streams – The flow of water in a channel having a bed or bank.
- Slope – Rising or falling surfaces.
- Elevation Data – Spot heights of the ground surface from surveys and/or multiple aerial mapping sources.
- Contours – Terrain lines of constant elevation; for example, 2-foot vertical contour interval
- Tax Parcels and King County Assessment Tables – Information about how communities are organized and valuated by governments.
- 3-inch-pixel resolution color orthophotography – Aerial photography that can be used like a map.
- Light Detection and Ranging (LiDAR) – A remote sensing technology that collects 3-dimensional elevation data that penetrates vegetation and helps to identify land surface features indicative of landslides.

LiDAR elevation data for Kirkland were developed in a regional program in about 2001 and are available for pre- and post-annexation Kirkland. The City's GIS orthophotography was last produced in April 2012, and is expected to be reproduced in spring 2015. Another potential regional project would produce updated LiDAR maps but the status of that project is not confirmed with King County at this time. Regional participation in LiDAR mapping will significantly reduce the cost compared to the City completing the work itself.
The citywide GIS uses the existing data to create standard maps and to perform spatial analysis. This data are used along with other environmentally sensitive area information during the development review process as noted above. Maps can provide important indicators of landslide risk; however, maps cannot predict landslides. Landslides themselves cannot be managed or mitigated, however, landslide risks may be mitigated through management of human cause such as development regulation and installation and maintenance of surface water systems on both public and private lands.

Given the age of the data and the discrepancy between the quality and type of data for the pre- and post-annexation areas, staff is recommending that all data be updated to inform the Geologically Hazardous ordinance update and programs recommended in the Draft Surface Water Master Plan. A service package was approved in the 2015-2016 Budget that will update basic data such as steep slopes and geology for the annexation area, and that will provide risk mapping that goes beyond slope to include factors such as groundwater levels, previous slide history and soil composition. The SR 530 Landslide Commission report recommends a statewide mapping projects and King County has approached King County cities about participating in a regional effort. Participation in a regional effort is recommended if available, provided it meets the timing needs of the City's critical areas ordinance update

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## III. Regulation of Development in Potential Hazard Areas

When permit applications to develop and/or subdivide land on a steep slope within the City of Kirkland are received, the planner assigned to review the application may request a geotechnical report for the parcel or parcels proposed for development. The developer (or property owner) must obtain the report and both the Planning and Building Departments rely on the geotechnical report developed by a certified engineer to determine what, if any, municipal codes or other regulations apply to the development of a given property. The report will also aid in determining if geotechnical work is required prior to commencing the intended development.

Most parcels could potentially be developed if sufficient mitigation is provided during construction to address the factors contributing to the property's hazards, including both pre-existing factors and new factors introduced by the development or redevelopment. Improvements to mitigate landslide hazards and surface water run-off issues can reduce the likelihood of slides for both the developing property and adjacent properties which were developed before strict regulations were in place. A more detailed description of the pertinent rules and regulations is provided in the following section.

### Existing Regulations Related to Development near Steep Slopes

The Zoning Code, Building Code, and Public Works Standards each contain regulations related to development near steep slopes. Development Services Staff use the mapped landslide areas within our geographic information system (GIS) as a guide to determine if a development is on or near a steep slope. If a development is on or near a steep slope, the following regulations may apply.

**Zoning Code:** The provisions of Chapter 85 apply when development activity is located in a seismic, moderate or high landslide area. The assigned planner refers to the Zoning Code to determine which provisions are required for the proposed project based on the nature and extent of the development. Planners might also require mitigation for compliance with the State Environmental Protection Act (SEPA), however, most provisions of the Act are duplicated in the City Code.

If the project is located on a shoreline or in the Holmes Point Overlay zone, additional requirements may apply beyond those contained in Chapter 85. Following is a description of the regulations that may apply.

Geologically Hazardous Areas (Chapter 85 KZC) – applicable citywide

If a property is in a high or moderate landslide hazard or seismic hazard area as shown on the City's Sensitive Areas map, the City may require some or all of the following with a development permit:

1. A topographic survey.
2. Geotechnical recommendations for special engineering or mitigation techniques and an analysis of how these will affect the subject and adjacent properties.
3. A civil engineer on site during grading.
4. A final report from the geotechnical engineer regarding retention of vegetation.

5. That development be limited or restricted if it would impact slope stability or drainage patterns on the subject property or adjacent property or cause hazards on the subject property or adjacent property.
6. The dedication of a greenbelt.
7. A bond or perpetual landscape maintenance agreement to ensure compliance.
8. The dedication of development rights, air space, or an open space easement.
9. Signing and recording a hold-harmless agreement to protect the City from liability.

Holmes Point Overlay Zone (Chapter 70 KZC)

The Holmes Pont Overlay Zone was created by King County prior to the 2011 annexation and was retained under the City's Zoning Code. The purpose of the Holmes Point Overlay Zone is to allow for development while providing an increased level of environmental protection in an area characterized by a predominance of sensitive environmental features including steep slopes, landslide hazard areas and erosion hazard areas. These standards, in part, are designed to protect a high proportion of the undisturbed soils, vegetation, and tree cover, and require an inspection of each site and the area proposed to be cleared, graded and built on prior to issuance of a building permit. Within this area the City requires the following with a development permit:

1. That the intended action demonstrates no significant adverse impact on properties located downhill or downstream from the proposed development.
2. That lot coverage be limited beyond normal requirements.[4]
3. That 25 percent of the total lot area be a Protected Natural Area in perpetuity.
4. That modifications be made to normal road standards.
5. That tree removal only be allowed if the trees are hazardous or a nuisance (as opposed to the two trees per-year allowance that is the standard elsewhere in the City).

Shorelines (Chapter 83 KZC)

For development within geologically hazardous areas and within the shoreline jurisdiction the City may:

1. Require a geotechnical report as specified in KZC 83.80.54 (includes more information than required through Chapter 85).
2. Not allow development that will result in a net loss of ecological functions, nor cause risk to people or improvements (KZC 83.520).

Drainage Basins - Sensitive Areas Maps and Other Resources (KZC 90.25)

These maps can be used to identify sensitive areas such as wetlands, streams, and 100-year floodplains. Other resources include topographic maps, soils maps, and air photos. These resources may be referenced during the permitting process to determine what, if

any, regulations should apply to the development of a particular parcel of land. The maps have also been adopted into the Kirkland Municipal Code (24.02.080 KMC).

**International Building Code:** The International Building Code (IBC) may require structures to be up to 15 feet away from the bottom of a slope and up to 40 feet away from the top of a slope. These setback distances can be reduced if justified by an approved geotechnical report which is required by the Kirkland Zoning Code as a condition of building near a slope.

**Kirkland Municipal Code:** Section 21.06.275 of the KMC allows the building official to require a geotechnical report, prepared by a civil engineer, where there are steep slopes or suspected unstable soils.

**Public Works Standards:** The City has adopted the 2009 King County Surface Water Design Manual. This manual is used by staff to address temporary and permanent storm drainage design in landslide areas. It provides design requirements for erosion control and setbacks of surface water facilities near steep slopes. The Surface Water Design Standards will be updated as a requirement of the Phase II Municipal Stormwater Permit.

The upcoming Critical Areas and Geological Hazards Ordinances update and implementation of the Surface Water Master Plan will include a review of all of these regulations.

## How other Cities Regulate Landslide Hazards

All cities use the International Building Code and cities and counties in Western Washington all follow surface water design regulations as dictated by the Western Washington NPDES Municipal Storm Water Permits. Although the event in Oso has brought landslide information to the forefront, we are unaware of any cities in Washington State that have changed regulations, although other jurisdictions are working to better understand and identify landslide hazards in their communities. Research indicated the following:

- Bellevue: Bellevue has a Critical Areas Overlay District to recognize the existence of natural conditions which affect the use and development of property. Landslide hazards, steep slopes and coal mine hazard areas are examples of geologic hazards in Bellevue. Along with an underlying permit, a Critical Areas Land Use Permit might be required for development within an Overlay District. Bellevue prohibits development on some parcels.

- Redmond: Redmond's Technical Committee classifies geologically hazardous areas. The Redmond code provides for minimum landslide hazard area buffers which may be increased by the Technical Committee. The City also sent letters to people who live in landslide prone areas identifying the need for hazard mitigation awareness.

## How the City's Plan Updates Address Landslide Hazards

The Natural Environment Element of the Kirkland Comprehensive Plan includes a map of Landslide and Seismic Hazard Areas (Figure NE-2) and a goal and policies section addressing soils and geology (Goal NE-4). The goal states that the City will "[m]anage the natural and built environment to maintain or improve soils/geologic resources and to minimize risk to life and

property."[5] To this end, the Plan describes policies that would introduce standards and programs to promote sound soil management practices, that would consider updates to policies and regulations for geologic hazard areas in light of the new watershed conservation plan, and which would help retain vegetation where needed to stabilize slopes. As part of the Comprehensive Plan update, a review of Goal NE-4 is being conducted to determine if it, or any of the policies, should be revised.

In addition, the adopted 2014-2016 Planning Work Program calls for an update to the critical area regulations for streams and wetlands (Chapter 90) and geologically hazardous areas (Chapter 85) in the Kirkland Zoning Code (this would occur beginning in 2015). Specialized consulting services (both environmental and geotechnical) will be necessary to ensure that the City is working with the best available science and industry standards.

The 2014 Surface Water Master Plan (SWMP), includes discussion of the interaction between landslides and surface water management. Programs are proposed in the SWMP that attempt to balance the need to infiltrate more stormwater to support stream health through low impact development stormwater facilities with a recognition that certain geologic conditions may make this hazardous and thus infeasible. Also as noted in the SMWP, the City will be required per the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit to adopt updated surface water design regulations that require increased geotechnical evaluation when infiltration is proposed near steep slopes.

The question of whether the City should be doing anything more or differently about landslide hazards and, if so, what, is part of a larger discussion about geologic hazards. The Governor's SR 530 Landslide Commission report suggests changes in the State's regulatory approach which will have implications for local government regulations. Additional layers of regulation such as requiring peer review of developer geotechnical studies, notification requirements for surrounding properties and increased buffers surrounding high landslide hazard parcels may be considered during the critical areas ordinance update.

## IV. Risk Management Practices Related to Private Development and Public Improvements

The attached map shows City-owned property (parks, right of way, open space, surface water facilities) in landslide hazard areas. Citizen inquiries about City properties that they believe pose a hazard to their adjacent property are investigated and resolved in cooperation with the private property owner. The City cannot make improvements to or perform work on private property without the consent of the owner.

As shown on the attached map (Attachment A), many of the City-owned properties in or near landslide hazardous areas are park properties. The use of these properties for park purposes is generally passive in nature and results in a low level of impact. In natural areas, park restoration projects, such as those spearheaded by the Green Kirkland Partnership, help maintain and improve vegetation critical for stabilizing slopes, as well as restoring healthy and diverse forests.

[5] Goal NE-4, Kirkland Comprehensive Plan, Sec. V: Natural Environment, September 2011, p. V-3.

Potential City liability exposure related to landslides comes from two sources: regulation of development and ownership and management of property. The City wants to reduce its liability but also wants to address risk to all owners and entities within the City where possible. The City's exposure in landslide cases for properties that slide and/or properties located in the path of a slide would likely be the same for both instances. Generally, in cases involving slope instability, the City is protected by the public duty doctrine. Under the public duty doctrine, when a duty is owed to the public at large (such as for administration of permitting), an individual who is injured by a breach of that duty has no valid claim against the City. There are certain exceptions; e.g., in cases where a special relationship is created (such as when an employee makes direct assurances to a member of the public under circumstances where the person justifiably relies on those assurances); or where an employee knows about an inherently dangerous condition, has a duty to correct it, and fails to perform that duty.

A potential policy discussion relates to mitigation on undeveloped City-owned property that has been identified as a landslide risk. Owners of undeveloped properties (including the City) are not required to take steps to mitigate natural hazards unless the property is developed. The City can pro-actively manage public lands to minimize landslide risk such as planting native vegetation to stabilize slopes or channel surface waters around or through hazardous areas. While the City is not legally bound to mitigate natural hazards, an inventory and assessment of City-owned properties would be needed to better inform the City Council of the level of investment needed and the degree to which it would prevent a landslide.

The City is a member of the Washington Cities Insurance Authority (WCIA), a self-insured municipal risk pool. WCIA's coverage document would provide defense and indemnity for any subsidence (earth movement) claims alleging negligence against the City, subject to the terms and conditions of the document.

Courts have generally allowed land use regulations that substantially advance legitimate state interests, do not deny owners economically viable use of their land, and do not unduly burden individuals. To avoid being subjected to "taking" claims, landslide-related land use regulations should clearly serve legitimate state interests, be supported by scientific data and not substantially reduce the value of land.

Hold harmless agreements are required of developers working on hazardous slopes. Such waivers releasing local governments from harm caused by identified or obvious pre-existing conditions of the property, as a condition of granting development permits, are valid and have been upheld by the Washington Courts. A covenant that releases a government entity from its own future negligence is not permitted and the City's Geologically Hazard Areas Covenant does not attempt to do this.

Some of the larger jurisdictions, such as Seattle, have applied considerable resources to these issues. Seattle has geotechnical experts on retainer to review the work of geotechnical engineers hired by permit applicants to analyze surface and subsurface conditions on a site.

Council has likely seen or heard articles about Snohomish County considering an emergency development moratorium in areas within one-half mile of mapped landslide areas. Ultimately, the County Council imposed a moratorium on the SR 530 landslide impact area and interim controls on development within the SR 530 flood impact area.

## V. Public Communications, Landslide Outreach Information, and the Office of Emergency Management

The City maps geology and assesses landslide potential on a citywide (as opposed to a parcel-level) basis and assists in identifying risk. The City also has a role in educating the public about steps they can take on private property to manage that risk. General information provided to all residents in Kirkland could include identifying the facts, warning signs, and cost of landslides as well as presenting simple tips for managing drainage, irrigation and other mitigation efforts members of the community can take regarding risk.

There has been little increase in public inquiry about landslide risk directed at the City, post-Oso; although the *Kirkland Reporter* has published an article about landslides and the role of volunteers from the community. The Finn Hill Neighborhood Association organized its own meeting to address landslide risk in late June 2014. The members of the group invited subject matter experts to speak to the issue. City of Kirkland employees attended the meeting to listen and address follow-up questions as requested.

The Office of Emergency Management (OEM) constructs response and recovery plans for all hazard types found in the City. The City's *Comprehensive Emergency Management Plan* (CEMP) has no landslide-specific annex, perhaps because it was constructed before the 2011 annexation which incorporated the Finn Hill neighborhood, territory that has significantly higher landslide risk. Landslide is covered as a part of the category All-Hazards. This is typical for city plans in King County.

The *King County Hazard Mitigation Plan* contains a *City of Kirkland Annex* that was written in 2013. Utilizing the *Hazard Risk Ranking* system constructed by King County, landslides are rated fifth of the ten hazard types (it follows: earthquakes, severe weather, severe winter weather, and flooding; it precedes wildfire, volcano, avalanche, dam failure, and tsunamis). As noted above, while geological conditions have remained more consistent in the past 24 years than human development in the Puget Sound, the expanding population and impervious surfaces that come with it have likely impacted the risk of landslides in Kirkland. Data utilized by King County Office of Emergency Management to assess landslide risk were gathered in the 1990's.[6] The County states that it understands its data set is old, but since geological conditions don't change rapidly, still has value. As noted earlier, the County is in discussions with surrounding jurisdictions about a joint effort to update regional LiDAR data that would assist in the delineation of geologic hazards.

## V. Report of the Governor's SR 530 Landslide Commission

The Governor's Commission was formed in July 2014 to review the landslide incident and the response of the various governmental agencies, volunteers, businesses and the community. The Commission was composed of twelve individuals representing emergency responders, scientists, land use professionals and elected officials. They acknowledged the enormity of the event but also noted the unique characteristics of the geography and its history of slides as well

[6] King County memo titled *Landslide Mapping Summary for City Managers* handed out at the July 2, 2014 meeting of the City Managers and City Administrators – Renton City Hall, Renton WA. "Although the hazard maps were last updated in the 1990's, they still have value. (Geological conditions don't change that rapidly)."

as the steady soaking rain that was a significant factor in the slide. The report does not attempt to evaluate the allowed land use but focuses on the response, notes lessons learned and provides a series of recommendations going forward. Some of the recommendations parallel those provided at the end of this memo and some reinforce many of Kirkland's existing regulations and practices. The Commission recommended the following "Critical First Steps" along with 17 additional recommendations based on lessons learned:

- Support a statewide landslide hazard and risk mapping program
- Integrate and sustainably fund Washington's Emergency Management System
- Clarify State fire service mobilization laws to support front line responders at non-fire emergencies

Of particular note is the recommendation to fund a statewide mapping effort since this is consistent with the Kirkland staff's primary recommendation to the Kirkland City Council. It will be important to coordinate with King County and the State's efforts to realize efficiencies and consistency. However, it is not known whether the Commission's recommendations will be funded and Kirkland may want to proceed as planned with its own mapping project as it is needed for the Critical Areas and Geologically Hazardous Ordinance updates.

An additional resource regarding the Oso landslide is a program aired on PBS by Nova titled "Killer Landslide." The video is available through the link provided below.

http://www.pbs.org/wgbh/nova/search/results/page/1/include-education/only/include-all/Y/include-teachers/N?q=landslide&x=0&y=0

**VI. Summary, Recommendations and Next Steps**

The City of Kirkland has strength in its approach to landslide assessment and risk. GIS mapping and technical interpretation of the data are sound although updated data are needed. The City has a comprehensive set of regulations regarding development on hazardous slopes that involve multiple departments as well as a number of tools available to use in addressing landslides such as information/mapping, risk assessment, notification and education of property owners, management of publicly-owned property and response once landslides have occurred.

Staff recommends the following actions to improve information and better inform the City Council and community about landslide risks in Kirkland:

1. Acquire updated GIS data and participate in regional and/or state efforts to collect data if they are consistent with Kirkland's timing need for the data. Otherwise, proceed with the Kirkland mapping and as approved in the 2015-2016 Budget.

2. Consider changes to the geologically hazardous area regulations as part of the ordinance update. Through this process, the City will identify changes to current regulations, policies and processes for regulating development on hazardous slopes with an eye toward life safety and preservation of the built and natural environment.

3. Conduct an inventory of City-owned properties that are on or near steep slopes and develop recommendations for mitigations and/or management strategies (if any) that

are needed.

4. Once updated data are available, make information available to the public about how to access information through the City's public GIS portal and provide information about steps individual property owners can take to maintain or improve the stability of slopes on their properties. In the meantime, provide this report through the City's communication channels and look for opportunities to educate the public about programs they can use to mitigate risk. The SR 530 Landslide Commission's report strongly encourages a robust public education effort coupled with making landslide hazard maps available to the public to foster a more informed and safe public.

The recommendations contained in the Surface Water Master Plan can contribute to both effective surface water management and risk management. Policy direction questions remain regarding the relationship between nature, property owners, and the City. The proposed GIS data update and risk assessment and the Critical Areas Ordinance are appropriate venues to consider whether regulations should change and how the City can best inform the public of potential risks and how they can manage risks as property owners.

This memo was made possible through the contributions of a number of City staff. Their expertise, input and collaboration are greatly appreciated:

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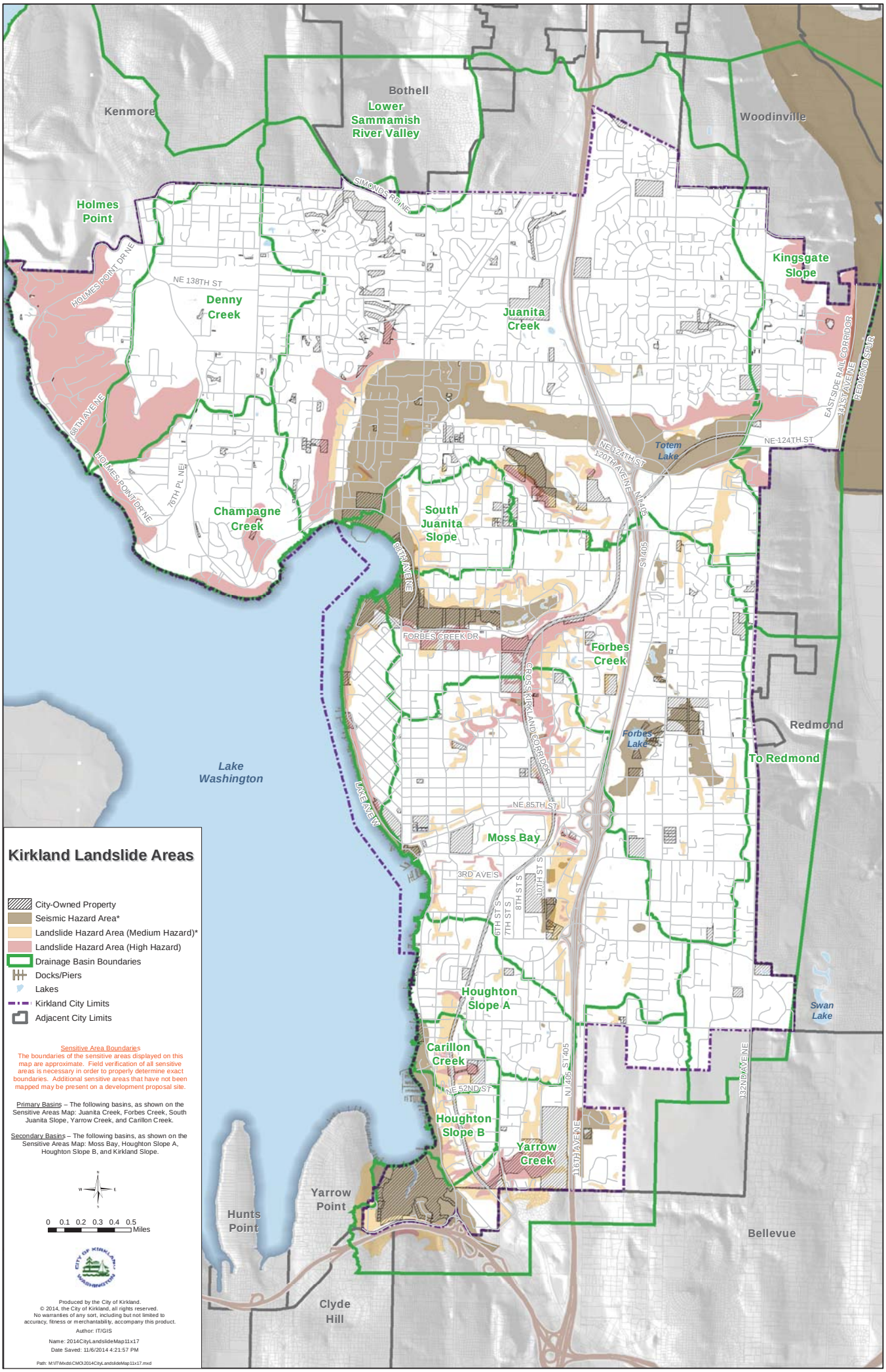
Jenny Gaus, Surface Water Engineering Supervisor
Frank Reinart, Senior Project Engineer
Robin Jenkinson, City Attorney
Oskar Rey, Assistant City Attorney
Nancy Cox, Development Review Manager
Tom Phillips, Building Services Manager
James Lopez, Director of Human Resources and Performance Management
Brenda Cooper, Chief Information Officer
Xiaoning Jiang, GIS Administrator
Karl Johansen, GIS Consultant
Kathy Joyner, Safety/Risk Management Analyst


Kirkland Landslide Areas
City-Owned Property
Seismic Hazard Area*
Landslide Hazard Area (Medium Hazard)*
Landslide Hazard Area (High Hazard)
Drainage Basin Boundaries
Docks/Piers
Lakes
Kirkland City Limits
Adjacent City Limits
Sensitive Area Boundaries
The boundaries of the sensitive areas displayed on this map are approximate. Field verification of all sensitive areas is necessary in order to properly determine exact boundaries. Additional sensitive areas that have not been mapped may be present on a development proposal site.
Primary Basins – The following basins, as shown on the Sensitive Areas Map: Juanita Creek, Forbes Creek, South Juanita Slope, Yarrow Creek, and Carillon Creek.
Secondary Basins – The following basins, as shown on the Sensitive Areas Map: Moss Bay, Houghton Slope A, Houghton Slope B, and Kirkland Slope.
0 0.1 0.2 0.3 0.4 0.5 Miles
Produced by the City of Kirkland.
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Author: IT/GIS
Name: 2014CityLandslideMap11x17
Date Saved: 11/6/2014 4:21:57 PM
Path: M:\IT\Mxds\CMO\2014CityLandslideMap11x17.mxd
Kenmore
Bothell
Lower Sammamish River Valley
Woodinville
Holmes Point
Denny Creek
Juanita Creek
Kingsgate Slope
Champagne Creek
South Juanita Slope
Forbes Creek
Totem Lake
Forbes Lake
Redmond
To Redmond
Lake Washington
Moss Bay
Houghton Slope A
Carillon Creek
Houghton Slope B
Yarrow Creek
Yarrow Point
Hunts Point
Clyde Hill
Bellevue
Swan Lake
SIMONDS RD NE
NE 138TH ST
HOLMES POINT DR NE
98TH AVE NE
76TH PL NE
68TH AVE NE
FORBES CREEK DR
CROSS KIRKLAND CORRIDOR
LAKE AVE W
NE 85TH ST
3RD AVE S
6TH ST S
7TH ST S
8TH ST S
10TH ST S
NE 52ND ST
116TH AVE NE
132ND AVE NE
NE 124TH ST
120TH AVE NE
NI 405
SI 405
EASTSIDE RAIL CORRIDOR
REDMOND SPUR
141ST AVE NE

# The SR 530 Landslide Commission

December 15, 2014

Governor Jay Inslee
Office of the Governor
PO Box 40002
Olympia, WA 98504-0002

Executive John Lovick
Snohomish County
3000 Rockefeller Ave. M/S 407
Everett, WA 98201

**Re: The SR 530 Landslide Commission Final Report**

Dear Governor Inslee and Executive Lovick,

The members of the SR 530 Landslide Commission are pleased to submit this final report to you, your staff, and to the people of Washington State. The Commission has endeavored to meet the underlying intent of its charter: to better understand the collective response and inform recommendations for the future that will guide policy makers as well as to improve planning and response for similar events. The Commission spoke and listened to survivors, victims' families, professional and volunteer first responders, local volunteers including loggers, contractors, mill workers and others, formal and informal community representatives, and representatives of the broad array of emergency management professionals. By no means "all inclusive", the Commission reviewed the myriad and sometimes conflicting information and perspectives to better understand the complexity of this disaster and the response. Through transparent and committed efforts, the Commission identified key lessons learned and has translated those lessons into 17 recommendations. Key among these recommendations are three critical first steps: *Support a Statewide Landslide Hazard and Risk Mapping Program; Integrate and Sustainably Fund Washington's Emergency Management System; and Clarify State Fire Service Mobilization Laws to Support Front Line Responders at Non-Fire Emergencies.*

Since one of government's key roles is to promote public safety, it is critical for the public to understand the risks posed by potential natural disasters and to mitigate or minimize their impact. Our preparedness for future catastrophic or unimaginable disasters depends largely on the lessons learned from this and other disasters, and the shared willingness to plan, prepare, and budget for natural disasters. The profound lessons learned from the SR 530 Landslide must be swiftly leveraged into meaningful and practical actions if we hope to make the people of Washington State safer. In a future catastrophic event, our emergency management systems will require the skills and innovation witnessed during this disaster and it would be important to proactively embed these assets into our statewide response capabilities.

The SR 530 Landslide had a far-reaching and lasting impact on the lives of many. The Commission salutes the courage and perseverance of the Stillaguamish Valley communities and others that came together, against the odds, to respond to the event, rescue those who could be rescued, and ultimately recover the 43 people that died in this catastrophe. It is on their behalf and on behalf of all of the people of Washington State that the SR 530 Landslide Commission submits to you our final report.

Sincerely,

**Kathy Lombardo**
Director, SR 530 Landslide Commission

**JoAnn Boggs**
Deputy Director,Pend Oreille County Emergency Management
Past-President,Washington State Emergency Management Association

**Hon. Jill Boudreau**
Mayor, City of Mount Vernon

**Paul Chiles**
Owner/President, Chiles & Company, Inc Real Estate
Former Chair, Urban League of Metropolitan Seattle

**John Erickson**
Former Director of Emergency Preparedness,
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**Wendy Gerstel**
Licensed Hydrogeologist
Principal at QWG Applied Geology

**David Montgomery**
Professor, Earth and Space Sciences, University of Washington

**Lee Shipman**
Emergency Management Director, Shoalwater Bay Tribe

**Renee Radcliff-Sinclair**
Former State Representative
Former Snohomish County Planning Commissioner

**Chief Steve Strachan**
City of Bremerton Police Chief
Former King County Sheriff

**Diane Sugimura**
Director, Department of Planning and Development, City of Seattle

**Bill Trimm**
Owner/Bill Trimm,FAICP - Town Planning and Economic Development

# SR 530 LANDSLIDE COMMISSION FINAL REPORT

*December 15, 2014*

# The SR 530 Landslide Commission

# Final Report

December 15, 2014

The members of the SR 530 Landslide Commission are pleased to submit this final report to Governor Jay Inslee and Snohomish County Executive John Lovick. The Commission has endeavored to understand the multitude of perspectives regarding the collective response to the SR 530 Landslide, identify lessons to be learned, and to translate those lessons into recommendations. Each Commissioner expresses his or her heartfelt sadness for the 43 family members whose lives were lost in this catastrophic event. The Commission also salutes the courage and perseverance of the Stillaguamish Valley communities and others that came together, against the odds, to respond to the event, rescue those who could be rescued, and ultimately recover all 43 fatalities.

**Cover Photo: Search and rescue teams on site**
Flickr/GovInslee - CC:BY-ND 2.0
https://www.flickr.com/photos/govinslee/13572341165/in/set-72157642811787053

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# Acknowledgments

This report presents lessons learned and recommendations derived by the SR 530 Landslide Commission from a review of existing reports and presentations, and from a broad range of people, each with a unique perspective on the incident and events which followed. Their input was obtained either through one-on-one interviews, in small groups or because they were presenters at eight of the eleven Commission meetings. The Commission spoke with and listened to: survivors, victims' families, professional and volunteer first responders, local volunteers including loggers, contractors, mill workers and others, formal and informal community representatives, and representatives of the broad array of emergency management professionals. Contributors to this effort include:

The survivors of the landslide, their families, and the families of the 43 individuals who perished in the landslide

Governor Jay Inslee and Snohomish County Executive John Lovick

The Communities of Arlington, Darrington, and Oso

Community Volunteers and Volunteer Organizations

The Darrington Community Center

The Everett Community Resources Center, Operated by the Everett School District

The Everett Herald

Federal, Tribal, State, and Local Emergency Management, Fire, Search, Rescue & Recovery Personnel

Local Leaders and Representatives

The Oso Fire Station

Participants, Speakers, and Public Commenters at the Commission's Meetings

The Sauk-Suiattle Indian Tribe

The Stillaguamish Tribe of Indians

The Tulalip Tribes

The William D. Ruckelshaus Center, University of Washington and Washington State University

# Executive Summary

In July 2014, Washington State Governor Jay Inslee and Snohomish County Executive John Lovick appointed a joint commission in response to the SR 530 Landslide. The SR 530 Landslide Commission (Commission) was tasked with reviewing the landslide and the collective response to it, including the initial emergency search and rescue, recovery of victims, community efforts, incident management, and coordination among local, county, state, tribal and federal governments. By no means 'all inclusive', the Commission has reviewed the myriad and sometimes conflicting information and perspectives to identify lessons to be learned and translate those lessons into the recommendations provided in this report. Preparedness for future catastrophic or unimaginable disasters depends largely on the lessons learned from this and other disasters, and the shared willingness to plan, prepare, and budget for emergency events. These lessons must be swiftly leveraged into meaningful and practical actions if we hope to make the people of Washington State safer.

The state of Washington contains some of the most rugged, beautiful, and dynamic landscapes in the United States. However, those same landscapes present hazards from natural disasters, including earthquakes, small and larger landslides, annual flooding, and wild land fires. On February 28, 2001, the Nisqually Earthquake, registering 6.8 on the Richter scale, triggered a number of landslides in King County, toppled and damaged brick masonry buildings in Seattle's Pioneer Square, and caused considerable damage to the Alaskan Way Viaduct. That earthquake triggered many more landslides in Pierce, Thurston, and Mason counties. A 9.0 earthquake off the Washington coast will cause significant and widespread damage to people, communities, and infrastructure. Such a catastrophe will demand a much broader emergency response than the one experienced in the Stillaguamish Valley.

## Lessons Learned

There are profound lessons to be learned from the SR 530 Landslide that must be acted upon to enhance public safety statewide. The formal emergency response, while hampered by both logistics and the need for unique skillsets, was remarkable. There were many successes associated with the response that can be attributed both to the professional responders who applied their skills and training under the most difficult circumstances, and to the many skilled loggers, contractors, scientists, and community volunteers who filled resource gaps through innovation, adaptation, and sheer willpower. In a catastrophic event, our emergency management systems will require the skills and innovations witnessed during this disaster and it would be prudent to proactively embed these assets into response capabilities.

The initial stages of an emergency event are often the most chaotic. Clarity of leadership and rapid reinforcement of the front line command and control elements is critical. It was an extraordinary confluence of regional capacity and coincidental operations that made reinforcements from the air available within one hour of the initial landslide. These airborne responders teamed with first responders and local volunteers to rescue fifteen people by helicopter. Airborne capacities cannot be relied on in future incidents without attention to the availability and mechanisms to deploy such resources.

Each after action report and presentation given to the Commission highlighted the power of the bonds that exist within specific responder communities, between individuals, and across jurisdictions. These bonds are often informal and ad-hoc, and in this case, were at least as important as formal linkages. Small, rural communities depend on volunteer local fire districts and law enforcement to respond immediately to disasters. These front-line entities need robust mutual aid agreements, strong relationships with county and regional assets, and joint training to adequately respond to overwhelming needs during a disaster.

In the state of Washington, knowledge and understanding of landslide hazards is not well developed and there is a need to refine and expand geologic and geohazard mapping throughout the state. This knowledge coupled with increased public understanding will benefit public policy decisions and the ability to plan for these hazards.

The magnitude of the SR530 Landslide was not fully comprehended for several hours. Even with helicopters in the air within an hour, those 'eyes in the sky' were immediately dedicated to rescuing survivors and could not communicate to others the gravity of the situation. Flooding of the Stillaguamish River and efforts to mitigate the risk of flooding up- and downstream of the landslide also detracted from the rapid development of overall situational awareness. Improved mechanisms to quickly establish and communicate situational awareness regarding the magnitude and resource demands of emergency events need to be identified and deployed.

An important take-away is that because not all landslides behave the same, it should not be assumed that all of the rescues and recoveries from future landslides will be found in distal or far end areas, as was the case with the SR 530 Landslide. Therefore, it is critical that geologic experts be brought in as soon as possible to characterize a landslide and predict where rescues and recoveries are likely to be located.

If one of government's preeminent roles is to promote public safety then it is imperative to understand the risks posed by potential natural disasters, mitigate or minimize their impact, and to employ a robust and sustainably funded emergency response system when catastrophic events do occur. To better understand the risks posed from potential natural disasters and to enhance capacity across the state to respond to such events, the SR 530 Commission provides both lessons learned and recommendations, summarized in the table below. Key among these recommendations are the following critical first steps towards making the people of Washington safer in the future.

## Critical First Steps

### *Support a Statewide Landslide Hazard and Risk Mapping Program*

The Commission recommends that the Legislature significantly expand data collection and landslide mapping efforts, which will provide the foundation for sound public and private land-use planning and decision-making. The SR 530 Landslide highlights the need to incorporate landslide hazard, risk, and vulnerability assessments into land-use planning, and to expand and refine geologic and geohazard mapping throughout the State. The lack of current, high-quality data seriously hampers efforts under the Growth Management Act

(RCW 36.70A) and other regulatory programs to account and plan for these hazards. Use lidar (Light Detection and Ranging) mapping to target high priority areas hazardous to people or property. Ensure that landslide hazard and risk mapping occur in the highest priority areas first, including transportation corridors, such as the Everett-Seattle rail line and the trans-Cascades highways, residential areas, urban growth areas, emergency evacuation routes, and forest lands where the State has regulatory authority over forest practices (i.e., RCW 76.09..020(15)).

### *Integrate and Sustainably Fund Washington's Emergency Management System*

The Commission recognizes the need for further study of the State's emergency management system. The SR 530 Landslide involved all levels of government in multiple jurisdictions and disciplines. The Commission recommends the Governor convene a funded task force, charged with affecting change and include participation from the Governor's office, the Legislature, tribes, county and municipal government, first responders, transportation agencies, non-government support agencies, the private sector, and members of the public.

The task force, at a minimum, should understand and evaluate: regional and statewide threats and hazards; existing State emergency management programs including funding and statutory authority; other examples of nationwide emergency management innovations including Emergency Management Accreditation Standards; integration of the emergency management principles and practice into government across the state; and strategies to implement state-sponsored cross-jurisdictional joint training and exercises.

The task force should report to the Governor by December 2016 with recommendations to build a more robust and innovative system of response and to secure an adequate, sustainably funded emergency management system across the state.

### *Clarify State Fire Service Mobilization Laws to Support Front Line Responders at Non-Fire Emergencies*

The Commission recommends the State Legislature clarify the definition of "all-hazards" mobilization and establish adequate funding in the disaster response account. Fire service mobilization was requested in response to the landslide, but refused because it was a non-fire emergency. The Commission concludes that state fire service mobilization is a significant tool to use in emergency incidents such as the SR 530 Landslide. State fire service mobilization is the only intrastate plan that has been used and exercised many times, and is a well-tested plan that has earned the faith and confidence of fire emergency responders. An all-hazard state mobilization would have provided improved command and control by allowing for a Type 2 Incident Management Team to arrive sooner and provide resources for first responders – technical rescue relief teams and equipment.

| Lessons Learned | Recommendations |
|---|---|
| *There were many successes associated with the response* | |
| *Sufficient, sustainable funding and cross-jurisdictional coordination for emergency management efforts is vital* | ❖ **Integrate and Fund Washington's Emergency Management System** |
| *Washington State has few adequate landslide hazard, risk, or vulnerability maps* | ❖ **Support a Statewide Landslide Hazard and Risk Mapping Program**<br>❖ **Establish a Geologic Hazards Resilience Institute** |
| *Clear parameters are needed for activating all-hazards mobilization* | ❖ **Provide Legislative Clarity for the Definition of "All-Hazards" Mobilization**<br>❖ **Establish Adequate Funding in the Disaster Response Account**<br>❖ **Pro-Active Preparations** |
| *Command and control must operate and transition smoothly from one phase of the response to the next – so that leadership and management are seamless among and across responding organizations* | ❖ **Activate Washington's Command and Control Structure for Catastrophic Events**<br>❖ **Develop a Standardized Process for Requesting, Tracking, Mobilizing, and Demobilizing Resources** |
| *Continue to study and monitor the SR 530 landslide and adjacent landslides* | ❖ **Conduct Landslide Investigations** |
| *Large incidents with multiple fatalities can overwhelm the capacity of local coroners and medical examiners* | ❖ **Prioritize Mass Fatality Management Planning Statewide** |
| *Local residents, loggers, contractors, business owners, officials, and many more were invaluable to the rescue effort* | ❖ **Improve Volunteer Process** |
| *It is important to coordinate with tribes prior to and during an emergency* | ❖ **Deploy Liaisons to Coordinate with Each Impacted Tribe** |
| *In emergency events, effective communication is challenging. Issues fall into the categories of infrastructure, interoperability, content, and strategy* | ❖ **Activate the First Responder Network Authority**<br>❖ **Update the State Communication Interoperability Plan** |
| *Washington Administrative Code guidelines for designating geological hazard areas and assessing risk are permissive, due in part to the lack of statewide geologic and geohazard mapping* | ❖ **Update the WACs Related to Critical Area Regulations** |
| *Disaster assistance after an event needs a "one stop shop" in order to help families navigate the various aid systems* | ❖ **Develop a Navigator Program for Emergency Management** |
| *Public awareness of the potential negative impacts to property caused by the existence of geologic hazards is important in ensuring the protection of the general public* | ❖ **Advance Public Awareness of Geologic Hazards** |

# I. Introduction

On Saturday, March 22, 2014, at 10:37 a.m. a historic landslide, one of the largest in state history occurred between the towns of Arlington and Darrington near the community of Oso in Snohomish County, Washington. Mud and debris slid down into the North Fork Stillaguamish River valley, covering an area of approximately one square mile in less than one minute.[1] The landslide inundated State Route 530, isolating the community of Darrington and blocked the flow of the North Fork of the Stillaguamish River. Forty-three people died and more than 40 homes and structures were destroyed.

Rescue operations were initiated within the first few hours. Fifteen people were rescued by helicopter. On March 22nd, Snohomish County Executive John Lovick proclaimed an emergency and Washington State Governor Jay Inslee proclaimed a State of Emergency that same date. The Washington State Emergency Operations Center (EOC) was activated for 38 days, the longest activation in at least the last 30 years. On April 2nd, President Barack Obama issued a declaration of a "major disaster" under the Stafford Act, making federal disaster aid available to supplement state, tribal, and local recovery efforts in the area. This assistance was in addition to the support provided under the Presidential Emergency Declaration granted on March 24, 2014.[2] More than 900 local, state and federal personnel and trained and untrained volunteers, contractors, families and neighbors were involved in the search, rescue, and recovery operations.[3]

**Aerial photo of the mudslide and backup of Stillaguamish River.**
Flickr/GovInslee - CC: BY-ND 2.0 https://www.flickr.com/photos/govinslee/13384148714/in/set-72157642811787053

1 Norman presentation to Commission September 30, 2014
2 http://www.fema.gov/news-release/2014/04/02/president-declares-disaster-washington
3 Ezelle Presentation to the Commission 9.10.14

In July 2014, Washington Governor Jay Inslee and Snohomish County Executive John Lovick appointed a joint commission in response to the SR 530 Landslide. The Governor and Executive agreed the SR 530 Landslide Commission (Commission) would operate independently from the state and county executive branches to review the incident, the collective response, and to provide recommendations to help plan and prepare for, mitigate, and respond to similar events. The Governor and Snohomish County Executive jointly appointed the members of the Commission and asked regional business leader Kathy Lombardo to serve as the Commission's Executive Director. The Governor and Snohomish County Executive also asked the William D. Ruckelshaus Center to support and facilitate the operations of the Commission.[4]

The Commission's Charter is provided in Appendix A. Copies of the Commission's meeting materials, including meeting summaries and audio recordings can be found at www.bit.ly/sr530commission.

**The SR 530 Landslide Commission**

## Report Structure

This report is divided into three sections, with additional information provided in appendices. The first section provides a brief overview of the SR 530 Landslide. The overview is not intended to be an exhaustive review of the landslide, its impacts, or the response. Rather, the Commission would like the reader to develop a sense of the power and the devastation of the landslide, as well as the extent of the response in order to more fully appreciate the lessons learned and recommendations in this report. The second section discusses these lessons learned and recommendations, as identified by the Commission. Finally, the Commission posts a "call to action" that identifies critical first steps to be taken and a matrix of the Commission's recommendations, identifying responsible parties to take action.

4 The William D. Ruckelshaus Center is a neutral resource for collaborative problem solving in the state of Washington and the Pacific Northwest, providing expertise to improve the quality and availability of voluntary collaborative approaches for policy development and multi-party dispute resolution. The Center is a joint effort of the University of Washington and Washington State University.

# II. The SR 530 Landslide

## Emergency Response Timeline

To better understand the collective emergency response to the SR 530 Landslide, the Commission was asked by the Governor and Snohomish County Executive to review the incident and establish a timeline of events. The timeline is provided in Appendix B. The goal of the timeline is to inform, illustrate, and support the observations and recommendations of the Commission.

## Community Impact

In addition to fulfilling the request to provide a timeline of events, the Commission believes it is important to provide the human face of the SR 530 Landslide, to understand the event through the experiences of those who were there and lived it. The people of the Stillaguamish Valley, Oso, Darrington, and Arlington, and the Sauk-Suiattle Indian Tribe, the Stillaguamish Tribe of Indians, and the Tulalip Tribes experienced the incident in different ways. Rather than attempt to try to tell their stories and recreate what has already been written, the Commission has opted to provide the following article, courtesy of the Herald of Everett, which captures those stories.

*Permission for use granted by The Herald of Everett, author Rikki King.*

**Photo: A hand-carved sign commemorates the date and time of the slide.**
Flickr/Snohomish County - CC: BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/14028279333/in/set-72157642910921003/

HeraldNet
Everett, Washington

Published: Sunday, April 13, 2014, 12:01 a.m.

# In Darrington, firefighter found a community of unshakable will

By Rikki King, Herald Writer

DARRINGTON — Cheer for. Not against.

Something about that message, written on the wall of the Darrington High School gym, stuck with Gregg Sieloff.

Sieloff, 57, is the assistant chief of operations for the Lynnwood Fire Department. On April 7, he marked his 34th year as a firefighter.

Sieloff was called to the Oso mudslide the first day, March 22.

That night in Arlington, incident commanders made a plan for the next morning: Sunday, March 23. Day 2. People on the east side of the slide, in Darrington, needed resources.

Sieloff was sent to Darrington to work as the deputy incident commander. When he returned six days later, he'd seen a community pull together. Like others who experienced the destruction and the confusion of those first few days, he's trying to make sense of what happened.

What he saw, and who he met, changed who he was and what he believed.

At first, Darrington was like an island, he said. The phone lines, cable and power were out.

The emergency crews who responded on Day 1 were from Skagit County, the only option with Highway 530 blocked between Darrington and Arlington.

"We didn't know what we had," Sieloff said. "We didn't know what the access was."

People from Darrington were going into the debris field and trying to find survivors among their family, friends and neighbors. Officials weren't in the loop. Locals knew the logging and service roads that weren't blocked by patrol cars.

Sieloff and others arrived, and they were already behind, he said. The North Fork Stillaguamish River was blocked by debris, and the backup flooding was thwarting search efforts.

Sieloff met with Darrington Mayor Dan Rankin that Sunday. They were joined by a couple of others at first, including Mukilteo assistant fire chief Brian McMahan and folks from the county Department of Emergency Management and the U.S. Forest Service.

That Sunday night was the first public meeting at the Darrington community center, in the same gym used for high school sports. The room was packed. People were mourning. The only available route out of town, Highway 20, was more than 80 miles to Arlington.

It was time to get organized.

Sieloff was sent as part of a regional Incident Management Team. Traditionally, the team handles the administrative side of things, not operations.

Sieloff saw that sign on the wall: "Cheer For! Not Against!"

"It just stuck with me in the back of my head, that we needed to gather these people and get them to trust us," he said.

Many in the crowd had "mud up to their knees." It took Sieloff a few moments to realize why they were muddy — they'd been digging in the debris.

That original Day 2 plan they'd made the night before in Arlington wouldn't work. Not for this place, this time. Conditions were too uncertain.

On Monday, Day 3, a man dropped by City Hall. He showed pictures from the debris field where firefighters appeared to be standing around, holding equipment but not doing much else. The man also had pictures of locals digging. He held up both images. His words were barbed.

"He was clearly agitated with the progress of our work," Sieloff said."We heard him out."

He asked a question: "Where are these people digging?"

Sieloff and others leading the search efforts went to the debris field. Locals were using a logging road to get to the south end of the slide.

One of them was Dayn Brunner, a Tulalip police officer, whose sister Summer Raffo was later found in the debris. The family grew up in Darrington.

Brunner pointed out to the firefighters where houses had stood. All they could see was busted-up siding, Sieloff said. He was providing good information the official searchers needed.

Around that same time, the officials got GPS coordinates for a body that had been found. Someone broadcast the coordinates over the radio. The firefighters didn't know who called on the radio, and the person didn't want to identify himself.

"In the beginning, there was no trust," Sieloff said.

The Darrington end of the slide still was covered in water. The south end was an area of devastation. It was clear to people there that it was unlikely they would find anyone alive.

"It was where the locals wanted to go because they were looking for loved ones," Sieloff said.

On that first Monday, Sieloff and others talked to the mayor for hours. They needed his help. The debris was threaded with downed trees.

They asked Rankin for a list of people in town with access to heavy machinery. Without that connection, they would have had to use the phone book.

Sieloff started calling the volunteer troops, "for lack of a better term, 'Rankin's Army.' "

"Once we talked and he started providing resources, they just came from everywhere," Sieloff said. "We needed to allow them access. We needed them, but we wanted to control the environment to make sure it was safe."

At first, it was a couple of small trackhoes, one belonging to Rankin. By Tuesday morning, they had seven machines of all sizes, "all local, all ready to go. It was phenomenal," Sieloff said.

They sent out 25 volunteers on Tuesday, in groups of five plus a firefighter. Ninety people signed up. They created rotating shifts. Priority was given to volunteers who had missing loved ones.

The firefighters had to acknowledge that people from Darrington were going to go into the debris no matter what. The firefighters figured they might as well be careful and work together.

One family whose basement was flooded provided their personal all-terrain vehicles to shuttle crews, Sieloff said. Volunteers even ran the volunteer sign-up sheets.

"I just couldn't be any prouder of a community that pulled together and did all the things that we did in such a short amount of time," he said.

By late Monday or early Tuesday, searchers had to decide whether to work at night, Sieloff said. Some people didn't have helmets. Some were in tennis shoes.

The locals volunteered to keep their machines going overnight to clear safe paths into the debris field.

Using volunteers in the field helped the community understand the conditions firefighters were up against, Sieloff said.

"Any lack of success wasn't based on a lack of effort," he said.

By Tuesday, Day 4, rain was falling hard. The dirt road they were using for access turned to mud.

A lot of the trucks were two-wheel drive with dual rear wheels. The trucks were fishtailing and couldn't make it over some of the hills. One hill's aggressive slope threatened to send people and machines tumbling.

They had to stop working. They met with Rankin again.

They needed a road. The loggers knew how to make roads.

Within an hour, volunteers arrived in dump trucks and road graders. They decided to create a route

between the east and west sides of the slide. From the edge of the slide in Oso to the edge of the floodwaters in Darrington was nearly two miles.

It's being called a service road, but to Sieloff, it was "Determination Road," he said.

There were problems at first communicating with the command center in Arlington. People didn't have each other's phone numbers. Some phone service carriers weren't working. They learned as they went.

Two women, Sieloff doesn't know their names, stepped in to manage the volunteers. Phone lists were created and shared.

Margo Powell, who owns a beauty salon in Darrington and serves on the Cascade Valley Hospital board, started keeping track of equipment serial numbers and driver's license numbers. After a few days, Powell said she needed to return to her business. She was told she would be missed. She was back the next morning.

They needed better maps. Amy Lucas, a map specialist in the county planning department, made it happen, working with the Forest Service and with command teams on both sides of the slide.

"She pulled off miracles," Sieloff said.

Other leaders in Darrington the first few days included Tom Cooper, the deputy Arlington fire chief who served as the slide east branch director, and Marysville fire battalion chief Scott Goodale, who served as east division supervisor.

After a few days, the Darrington Ranger District provided housing for the firefighters. Before that, Sieloff spent a night at the mayor's house, another in his car. Like others, he didn't have personal medications with him. Crews suffered headaches from the dehydration.

They had trouble getting shovels, hard hats, safety vests.

They had to adjust operations. Volunteers cut up the downed trees so machines could get in and move mud.

Someone was assigned to communicate with helicopters overhead.

While Sieloff was in Darrington, only two volunteers got hurt, and neither mishap was the fault of the volunteers, he said. One man was hit in the head by debris kicked up by helicopter rotor wash. Luckily, that man had a helmet, he said.

A second man, in his 80s, was bitten by a dog they rescued, one of three dogs and a cat they found alive.

Volunteers from Darrington provided the searchers with breakfast, lunch and dinner.

Eventually, the firefighters got decontamination sites set up, using brush trucks and hoses. That would have been one of the first things to happen at any other emergency, Sieloff said. The resources took longer to come together in Darrington after the slide.

There were concerns about people eating without washing the contaminated mud from their hands. People were told that if they got any open wounds, they would have to leave.

Those on the ground tried to address the problems with the tools they had, Sieloff said.

"We were operating on the edge of safety, but we were always safety-conscious," he said.

Eventually, a regional search-and-rescue team brought in doctors and decontamination supplies. Some of the volunteers were asked to keep working, even as state and national resources arrived, Sieloff said.

They never let him down.

It was "a phenomenal, unbelievable effort by the community," he said. "I can't express enough gratitude for all they did."

In Lynnwood, crews face all sorts of emergencies all day, every day. Darrington was different.

"We see things, but you don't come back the next day and see it again," Sieloff said. "Every day it was the same thing over and over."

When Sieloff got back home, he spent time with his wife, daughters and granddaughter.

He recognized the need to return to routine, to the life he had before.

On Monday, March 31, he was back to work in Lynnwood. Someone was complaining about a hole in a pair of pants.

The problem seemed so small. Sieloff has been thinking about what soldiers must go through during months of deployment.

He was in Darrington less than a week.

He knows he probably will never again face the same kind of stress, the same hour-after-hour of intense decision-making. He had to trust his bosses who picked him to go.

Sieloff wants to visit Darrington again. He didn't get to say goodbye and thank the people who helped in so many ways.

He remembers what the locals said as they fought the mud:

"Logger Up."

"Make It Happen."

If he ever faces another tough situation, those words will be there.

He learned that in Darrington.

"We tried to stay as positive as we could, and we wanted them to 'Cheer for us, not against us,' just like the sign said in the gym," he said.

*Rikki King: 425-339-3449; rking@heraldnet.com.*

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# III. Lessons Learned & Recommendations

The Commission was tasked with reviewing the landslide and the collective response to it, including the initial emergency search and rescue, recovery of victims, community efforts, incident management, and coordination among local, county, state, tribal and federal governments. Preparedness for future disasters depends largely on the lessons learned from this and other disasters and the collective willingness to plan, prepare, and budget for the catastrophic or unimaginable. By no means 'all inclusive', the Commission has identified key lessons to be learned from the SR 530 Landslide and has translated those lessons into recommendations, discussed below.

## Lesson Learned

### *There were many successes associated with the response*

Given the magnitude, remoteness, and impact of the SR 530 Landslide, it is worthy to note there were many successes associated with the response. These successes can be attributed both to the professional responders who applied their skills and training under the most difficult circumstances, and to the many "spontaneous" volunteers from the communities who filled resource gaps through innovation, adaptation, and sheer willpower. Among these successes is the extraordinary fact that everyone who could have been rescued from the mud was rescued on the first day. Also remarkable and equally improbable is that all victims were eventually recovered. Neither of these successes could have been expected given the nature of the event, nor would one have predicted those accomplishments without serious physical injury to rescuers or responders.

Many successes can be attributed to the availability of appropriate resources – either by virtue of pre-planning or by happenstance. The near and immediate availability of helicopter support helped immensely. Volunteer local, state, and federal geologists, one trained in the

**Photos above, starting at left:**
**1. Rescue Crew.** Flickr/Snohomish County - CC:BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13433463654/in/set-72157642910921003
**2. Debris from the slide.** Flickr/GovInslee - CC:BY-ND 2.0
https://www.flickr.com/photos/govinslee/13678629663/in/set-72157642811787053/
**3. USACE berm construction.** Flickr/Snohomish County - CC:BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13702073944/in/set-72157642910921003

Incident Command System (ICS), helped to assess the landslide, address continued risk to responders, and provided mapping and flow modeling resources.

The linkages between people and agencies, citizens, and Non-Governmental Organizations (NGO) also contributed to the success. There was also an outpouring of public and private support. Three local tribes stepped up with support. NGOs and privately donated resources greatly helped people whose lives were impacted by the landslide. The mayors of Arlington and Darrington each assumed mantles of responsibility and initiative, not even vaguely contemplated when they took office. The Washington Department of Transportation exceeded expectations in quickly getting SR 530 reopened.

The role of local volunteers was hugely instrumental to the successes, and neighboring communities and entities contributed in many critical ways. Loggers brought essential expertise and equipment for log and debris clearing. Loggers and contractors from Darrington expanded Seattle City Light's utility access road around the landslide that reconnected Darrington to Oso within 36 hours from the time they began.

These success stories are just some of the powerful examples of how communities come together to support each other in times of need.

# Lesson Learned

## *Sufficient, sustainable funding and cross-jurisdictional coordination for emergency management efforts is vital*

**Photo: Members of the National Guard Assist with the Search and Rescue Operation.** Photo credit: National Guard. Flickr/ Snohomish County - CC: BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13436374384/in/set-72157642910921003

Sufficient and sustainable funding for state, county, tribal, and municipal emergency management efforts is vital. Improvements to emergency preparedness including sufficient staffing, adequate training and equipment, utilization of new technologies, hazard and risk assessment, development and implementation of programs, and public education require resources. However, local and state funding has been diminishing due to the recession and competing funding needs. Starting in 2001, federal grants through the Office of Homeland Security funded a variety of state and local programs, but this funding is now significantly reduced.

It is often difficult to prioritize funding for emergency preparedness and management when there are so many other immediate needs. Lessons learned from the SR 530 Landslide emphasize the critical importance of sufficient and sustainable funding, especially given the budgetary limits of small municipalities and rural areas.

Washington will likely be faced with catastrophic disasters in the future, whether from landslides, earthquakes, wild fires, or extreme weather events. Resilience will depend on foresight and preparedness, and the ability to adapt and improve emergency preparedness and response systems as lessons emerge. An evaluation of how Washington's emergency management and response system is organized and how the system is funded relative to state and local statutes is needed to identify where opportunities for improvements exist.

An example of such a re-evaluation was undertaken by the State of Florida following Hurricane Andrew in 1992. The Governor of Florida established the Disaster Planning and Response Review Committee to evaluate existing statutes, plans, and programs for natural and man-made disasters. The Committee's recommendations included improvements to plans and programs for responding organizations, and a request for increased and sustained funding for emergency preparedness and recovery programs. In 1993, the Florida State Legislature voted to create the Emergency Management, Preparedness, and Assistance Trust Fund which provided funding through a $2 surcharge per homeowner's casualty insurance policy and a $4 surcharge per commercial casualty insurance policy.

# Recommendation 1

## *Integrate and Fund Washington's Emergency Management System*

**The Commission recommends the Governor convene a funded task force, charged with affecting change and include participation from the Governor's office, the Legislature, tribes, county and municipal government, first responders, transportation agencies, non-government support agencies, the private sector, and members of the public. The task force should report to the Governor by December 2016 with recommendations to build a more robust and innovative system of response and to secure an adequate, sustainably funded emergency management system across the state.**

- The SR 530 Landslide made clear that, despite the adoption and broad implementation of the Incident Command System (ICS) and the National Incident

Management System (NIMS) model within the State, there is still need for substantially stronger funding in some areas, and both vertical and horizontal linkage across agencies and entities. Emergency managers and responders – particularly in western Washington – have not had the incentive or opportunity to connect, train, and exercise across jurisdictional lines. Where such linkages have been formed, they have been crafted out of perceived necessity. To the extent such linkages contributed to the response to the SR 530 Landslide, they were a reflection of local initiatives that have not been broadly replicated elsewhere. These linkages, both formal and informal, are critical to the formation of the familiarity and trust which make it possible to effectively work together in emergencies or disasters. Emergency management organizations can provide the nucleus of such efforts, and the State has an opportunity to formally encourage and support the formation of such linkages.

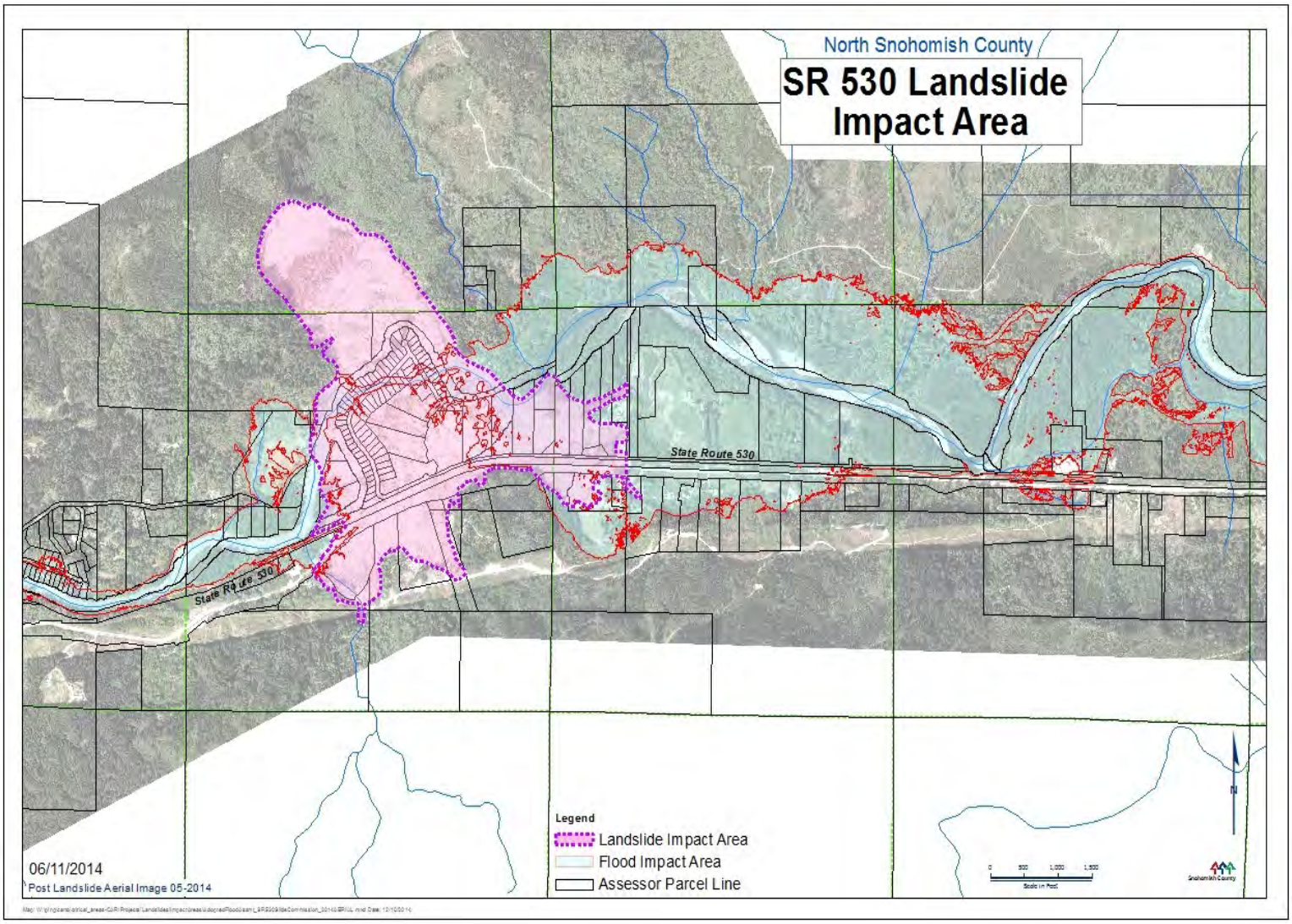
- Adequate funding is critical in order to fully benefit from any effort to improve horizontal and vertical integration; the participating emergency management entities must have sufficient capacity. The historic reliance on federal funding and recent reductions in those funding streams have contributed to a resource gap in many emergency management and response organizations across the state.
- The task force called for in this recommendation, at a minimum, should understand and evaluate:
  - Regional and statewide threats and hazards
  - Existing emergency management programs, including their funding and statutory authority
  - Other examples of nationwide emergency management innovations including Emergency Management Accreditation Standards
  - Integration of the emergency maagement principles and practice into government across the state
  - Strategies to implement state-sponsored cross-jurisdictional joint training and exercises
- The task force should report to the Governor by December 2016 with recommendations to build a more robust and innovative system of response and to secure an adequate, sustainably funded emergency management system across the state.

**Photo: Members of the National Guard Assist with the Search and Rescue Operation.**
Courtesy of National Guard. Flickr/Snohomish County - CC: BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13436213335/in/set-72157642910921003

# Lesson Learned

## *Washington State has few adequate landslide hazard, risk, or vulnerability maps*

Protecting human life and property requires a sustainably funded statewide program to map geologic hazards, assess risks and vulnerability, notify the public of potential hazards, and develop effective and affordable measures to reduce risk. To best inform public policy decisions and reduce public and economic risk, Washingtonians need high-quality data about landslides. The current lack of mapping products, that are based on high-resolution data, hampers efforts under the Growth Management Act (RCW 36.70A) and other policy initiatives to account and plan for these hazards.




**Map courtesy of Snohomish County, Planning and Development Services**

Washington lacks sufficient accurate geological information, lidar,[5] and robust geological databases for cities, counties, state agencies, and the public to make important permitting, land-use, and other critical regulatory decisions. It can be extremely difficult to plan or mitigate for an existing hazard if that hazard is not delineated and documented. Geologic mapping at a scale of 1:24,000 currently covers approximately 13% of Washington state.[6] A few small areas of Washington are covered by landslide inventory and hazard maps where local jurisdictions initiated and/or funded such efforts; however, few if any adequate landslide hazard, risk, or vulnerability maps exist within the state. Geotechnical studies of the SR 530 Landslide area date back to the 1950s, but none of the studies were conducted with an eye towards the risks of development downslope. The mapped hazard for the development affected by the landslide only concerned flooding. The SR 530 Landslide highlights the need to incorporate landslide hazard, risk, and vulnerability assessments into land-use planning and to expand and refine geologic and geohazard mapping throughout the state of Washington.

Geologic maps and articles are commonly published, yet geologic hazard information is not easily accessible to end users. Land-use planners require enough guidance to incorporate these products into decision-making and regulatory tools. Geohazard workshops typically target urban populations. Such opportunities for outlying and rural communities to participate in workshops and be provided with information on the nature and warning signs of geologic hazards and associated risks that may affect them, are more limited.

# Recommendation 2

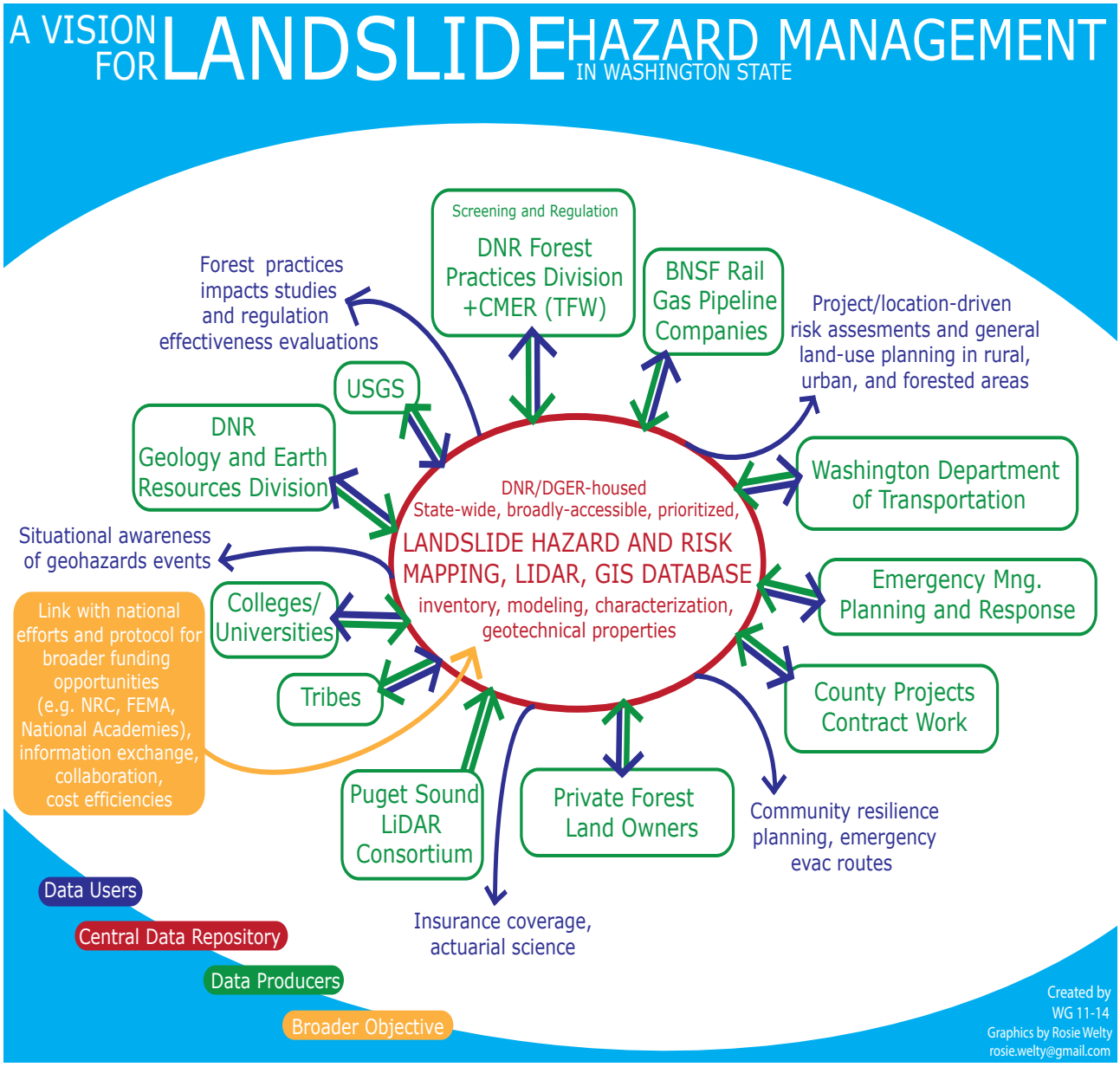
## *Support a Statewide Landslide Hazard and Risk Mapping Program*

**The Commission recommends the Legislature significantly expand data collection and landslide mapping efforts, which will provide the foundation for sound public and private land-use planning and decision-making. The Department of Natural Resources, Division of Geology and Earth Sciences (State Geological Survey) is the appropriate science-based agency to conduct this work. To immediately initiate this program, the Commission recommends that the Legislature fund the State Geological Survey to accomplish the following key elements:**

- Identify mapping priority areas and high-resolution lidar coverage needs in Washington.
- Facilitate lidar data acquisition and establish statewide mapping criteria.

5 Lidar (Light Detection and Ranging) is remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light used to examine the surface of the earth. In the context of identifying past landslides, this technology is used to make high-resolution bare earth maps (i.e., foliage removed) so that geologists can more quickly and clearly identify landslide debris fields over a broad area.

6 A geologic map shows geologic information such as the distribution and nature of the rock units (the surficial deposits such as landslides may or may not be mapped separately), and the occurrence of structural features (folds, faults, joints, etc.), mineral deposits, and fossil locations.




The above diagram illustrates the Commission's vision for an interactive, collaborative, sustainably-funded state-wide landslide hazard mapping program, with the Department of Natural Resources' Division of Geology and Earth Resources as the data host. At the center of the program is an expanding database of GIS-based information critical to risk-based land-use planning. The surrounding boxes represent the wide range of data input sources and data end users, often one and the same. Beyond those are some of the many product applications of the data. In the spirit of collaboration and interaction, expanding coverage, and to fostering cost-efficiencies, the Commission encourages developing relationships and seeking support from agencies and entities beyond state boundaries.

- Ensure that landslide hazard and risk mapping first occur in the highest priority areas, including transportation corridors, such as the Everett-Seattle rail line and the trans-Cascades highways, residential areas, urban growth areas, emergency evacuation routes, and forest lands where the State has regulatory authority over forest practices (i.e., RCW 76.09.020(15). In addition to existing and past landslides, hazard maps should include potential landslide initiation and runout zone areas. Evaluate and recommend hazard reduction/risk mitigation measures for identified high-risk sites.
- Ensure that landslide hazard maps receive peer reviews to ensure the highest possible quality map products. Once produced, ensure that such maps are publicly available in a manner that is easily assessable and useable without specialized training for all residents.
- Recommend a protocol for transferring locally generated information and data on geologic hazards and mapping into a publically accessible, statewide GIS platform (e.g., a common platform) that includes the identification of parcel boundaries.
- Establish a technical advisory group to provide input and advice on the above elements that includes representatives from the geotechnical community, academic institutions, and other agency geologists.

# Recommendation 3

## *Establish a Geologic Hazards Resilience Institute*

**The Commission recommends the Governor explore the creation of a geologic hazards resilience institute to address education, outreach, and research needs, professional practice guidelines, and other geologic issues impacting Washington communities. The institute could work with members of tribal, state, local, non-profit, academic, and private sector specialists to align efforts and identify opportunities for collaboration. Additional areas where such an institute could provide assistance include:**

- Assisting tribal, state, and local governments to establish programs and staffing to address local geologic hazards.
- Providing accurate information on geologic hazards and risks relevant to land use planners as well as to the general public.
- Identifying needs and providing training for geohazard specialists; for example, ICS training, and other training that assures successful emergency response.
- Establishing public information response protocol for emergencies.
- Enhancing public education and awareness programs and partners.
- Identifying long-term research and education/outreach funding partners.
- Conducting educational, outreach, and research activities.

# Lesson Learned

## *Clear parameters are needed for activating all-hazards mobilization*

On March 23, 2014, the second day following the landslide, Chief Willy Harper, District 25 (Oso), made a request to Chief Eric Andrews, Northwest Regional Coordinator for the Washington State Fire Defense Board, for a mobilization of state resources. Chief Andrews assessed the situation per state mobilization guidelines and made a formal request to the Washington State Patrol (WSP) for state fire service mobilization (all-hazards or state mobilization) under RCW 43.43.960 - -.964. This request was denied by WSP due to their legal counsel's interpretation that state fire service mobilization resources and funding is available only for fire disasters.

First response in a disaster is tasked with preservation of life and should not be confused with the role of comprehensive emergency management and policy making. Professional first responders have unique leadership skills and organizational expertise under crisis situations. When a request was made for state mobilization, the need for more assistance in the command and control function was critical. The Commission believes that all-hazards mobilization provides the best operational infrastructure for the first response and "search and rescue" leadership, while working in cooperation with, and parallel to, broader emergency management functions. It is imperative that public safety professionals be allowed to 'run the scene' until the search and rescue work is finished.

There is a sense that in the SR 530 incident, there was a lack of appreciation for the differences in "first response" versus "comprehensive emergency management" needs. Disaster scenes are highly dynamic with a need for strong procedures and policy, yet not be impeded by them. Response by all parties must be adaptive, creative, and innovative.

The Commission concludes that state mobilization is a significant tool to use in emergency incidents such as the SR 530 Landslide. State mobilization is the only intrastate plan that has been used and exercised many times, and is a well-tested plan that has earned the faith and confidence of fire emergency responders. An all-hazard state mobilization would have improved command and control by allowing for a Type 2 Incident Management Team (IMT) to arrive sooner and provide resources for first responders – technical rescue relief teams and equipment.

**Photo: Washington Department of Fish & Wildlife Police transport search & rescue teams to the 530 slide.**
Flickr/GovInslee - CC: BY – ND 2.0)
https://www.flickr.com/photos/govinslee/13572341005/in/set-72157642811787053

## All-Hazards Mobilization

The Washington State Legislature adopted legislation (Substitute House Bill 1017; Chapter 391, Laws of 1995; Effective date 7/1/95) that codified a broader transfer of emergency management authorities from the Department of Community, Trade, and Economic Development to the Military Department. A portion of the law included a change to the definition of "mobilization" that changed the focus of possible responses from just fires to all-hazard situations.

Subsection 5 of the 1995 law (now codified in RCW 43.43.960(5)) made the following changes: "'Mobilization'" means that fire fighting resources beyond those available through existing agreements will be requested and, when available, sent ((~~to fight a fire~~)) in response to an emergency or disaster situation that has ((~~or soon will exceed~~)) exceeded the capabilities of available local resources. During a large scale ((~~fire~~)) emergency, mobilization includes the redistribution of regional or state-wide fire fighting resources to either direct ((~~fire fighting~~)) emergency incident assignments or to assignment in communities where fire fighting resources are needed. . . ."

Subsection Section 6 (now codified in RCW 43.43.961) further stated: "Because of the possibility of the occurrence of disastrous fires or other disasters of unprecedented size and destructiveness, the need to insure that the state is adequately prepared to respond to such as fire or disaster the need to establish a mechanism and a procedure to provide for reimbursement to firefighting agencies that respond to help others in a time of need or to host fire district that experiences expenses beyond the resources of the fire district, and generally to protect the public peace, health, safety, lives, and property of the people of Washington . . . ."

The Commission believes the best way to interpret the 1995 amendments is the inclusion of non-fire emergencies in the scope of events subject to all-hazards mobilization.

# Recommendation 4

## *Provide Legislative Clarity for the Definition of "All Hazards" Mobilization*

**The Commission recommends to the State Legislature that legislative clarity be given for the definition of all-hazards mobilization.**

- The Washington State Fire Marshal, an element of the WSP, has been advised by legal counsel that the state mobilization legislation prevents deployment of resources to non-fire disasters. The Commission believes the Legislature spoke quite clearly to the issue in 1995. The plain language reflects that mobilizations may occur for any "emergency or disaster situation that has exceeded the capabilities of available local resources." Thus, the mobilization language should be interpreted to apply to 'all-hazards' deployment.
- While some may see the term "firefighting resources" in RCW 43.43.960(5) and believe that such resources can only be used in fires, the Commission believes that the types of resources to mobilize and the disaster events for which they may be mobilized, are

separately addressed in the "mobilization" definition. Moreover, "firefighting resources" (people, ladders, ropes, chainsaws, axes, certain heavy equipment, and the like) can often prove critical during non-fire emergencies.

- The next section of the 1995 bill clearly recognized the need to mobilize "[b]because of the possibility of the occurrence of disastrous fires or other disasters of unprecedented size and destructiveness…" (Substitute House Bill 1017; Chapter 391, Section 6, Laws of 1995; Effective date 7/1/95). A laundry list attempting to explain these provisions would add unnecessary complexity to an already clear definition of appropriate mobilization process.
- Furthermore, the adopted Washington Fire Services Resource Mobilization Plan and the WSP website clearly outlines that mobilizations may occur for "fires, disaster or other event . . . within a local jurisdiction boundary, or imminently threatening the jurisdiction."

The Commission recommends the legislature adopt the following three amendments suggested below. These amendments are consistent with the 1995 amendments and add clarity by confirming that fire services mobilization may occur for all hazards.

**New Definitions (in RCW 43.43.960):**

"Firefighting resources" means any personnel or equipment used to fight fires. For non-fire mobilizations, such resources may also be useful in response to an emergency or other disaster situation.

"Emergency or Other Disaster Situation" means any fire or non-fire emergency that could benefit from the use of firefighting resources to protect the public peace, health, safety, lives, and property of the people of Washington.

**Addition to RCW 43.43.961 (underlined would come before present text):**

State fire services may be mobilized for fires or non-fire emergency or other disaster situations. Because of the possibility of the occurrence of disastrous fires or other disasters of unprecedented size and destructiveness, the need to insure that the state is adequately prepared to respond to such a fire or disaster, the need to establish a mechanism and a procedure to provide for reimbursement to state agencies and local firefighting agencies that respond to help others in time of need or to a host fire district that experiences expenses beyond the resources of the fire district, and generally to protect the public peace, health, safety, lives, and property of the people of Washington, it is hereby declared necessary to: . . .

**Photo: Flood Waters.** Flickr/Snohomish County - CC: BY-NC-ND 2.0 https://www.flickr.com/photos/snoco/13409221564/in/set-72157642910921003

# Recommendation 5

## *Establish Adequate Funding in the Disaster Response Account*

**The Commission recommends the Legislature provide clarity in establishing adequate funding levels for all hazard deployments.**

Recent attempts at clarity in legislation have also outlined that additional funding to the Disaster Response Account (Fund 05H) is necessary to adequately support state agency and local government disaster response and recovery efforts. This is the stated purpose of the Fund, according to RCW 38.52.105. Currently, $8 million is placed in the account per biennium and has been overspent for the past four biennia.

The Commission believes that funding should be increased to $10 million per biennium. Disasters cannot be predicted and can overwhelm jurisdictions and resources immediately. Funding must be available to preserve life and public safety. Funding verbiage in legislation should reflect the plain language of the "mobilization" definition's scope, such that it pertains to mobilizations regarding any emergency or disaster situation that has exceeded the capabilities of available local resources.

### WHY $10 MILLION?

There have been 162 mobilization events since the inception of the Fire Mobilization Plan in 1994, with two non-fire events. The previous non-fire mobilizations resulted in expenditures of $1,386,000 and $232,693. During the past four biennia, fire mobilizations have exceeded its $8 million appropriation, requiring supplementation from General Funds. The frequency of future non-fire mobilization is assumed to be rare, based upon the past experience of one such event per decade. The additional $2 million is a best estimate recommendation based on historical over-runs, and data from previous non-fire mobilization expenditures.

Reference: FNS063 Individual State Agency FIscal Note, FNS060 Local Government Fiscal Note - Bill: 1126 P 2S HB

# Recommendation 6

## *Pro-Active Preparations*

**The Commission recommends county departments of emergency management take on the responsibility of:**

- **Knowing about the state all-hazard mobilization**
- **Knowing how to request the state all-hazard mobilization**
- **Pro-actively train and build trusting relationships with regional Incident Management Teams.**

# Lesson Learned

## *Command and control must operate and transition smoothly from one phase of the response to the next - so that leadership and management are seamless among and across responding organizations*

Establishing the most appropriate level of command and control as quickly as possible within the first hours of a large-scale event provides the operational infrastructure from which the response is accomplished. The challenge is to establish who is 'in charge' as quickly as possible. Once established, command and control must operate and transition smoothly from one phase of the response to the next - so that leadership and management are seamless among and across responding organizations. ICS and the NIMS provide the basic command structure and management system used to direct all operations at a scene.

The SR 530 Landslide was an extremely complex incident that simultaneously engaged every aspect of the 15 incident management system essential functions (Federal Emergency Support Functions). There were as many as 30 different agencies in the Snohomish County Emergency Operation Center (EOC), complicating effective coordination and leadership. Significant challenges emerged due to geographically separated communities and command structures. The interface of technical experts with the ICS had not been fully developed, yet their expertise was essential for understanding the risks.

Delegation of authority between the Northwest All Hazard IMT and the Snohomish County Department of Emergency Management (DEM) was initially unclear. This confusion carried over to the roles and responsibilities of the elected officials and other local leaders. This was the first time that the IMT and the Snohomish County EOC had worked together.

In western Washington, many local jurisdictions are unfamiliar with engaging a Type 2 or Type 3 IMT during a response. Type 2 IMTs consist of a variety of federal, state, county, and local agencies that come together to manage all-hazard state incidents, but predominately to manage wildfires. Type 3 IMTs consist of trained personnel from different departments, organizations, agencies, and jurisdictions within a region acting to support incident management at incidents. IMTs need to be effectively integrated into the response structure, coordinated with the EOC, and scaled appropriately for the complexity of the incident.

Even though there were aspects of the command and control environment that were unique to this incident, many of the same agencies and similar jurisdictions will engage in future incident responses and be faced with complex interactions. It is important that statutory responsibility and delegation of authority be explicit. Roles and responsibilities need to be fully understood by all levels of emergency responders, elected officials, and technical experts.

# Recommendation 7

## *Activate Washington's Command and Control Structure for Catastrophic Events*

**The Commission recommends State and county emergency management organizations work with IMT personnel to develop guidelines and processes that define delegation of authority, resource allocation, and expectations for all-hazard responses between IMT's and counties during non-fire emergencies.**

- All levels of the emergency management community can benefit from building relationships prior to events. Coordinated regional training will enhance opportunities for large and small jurisdictions to clarify responsibilities and build trust.
- Statewide response systems and capabilities need to be fully understood by policy makers and appropriate organizations, including representatives from organizations such as the Association of Washington Cities, Washington City/County Management Association, and Washington State Association of Counties.

# Recommendation 8

## *Develop a Standardized Process for Requesting, Tracking, Mobilizing, and Demobilizing Resources*

**The Commission recommends the State Emergency Management Division develop a standardized process for requesting, tracking, mobilizing, and demobilizing resources.**

- Responders reported to the Commission that the process for ordering resources (equipment, personnel, etc.) was antiquated, confusing, slow, and in some cases, redundant.
- Develop agreements between IMTs and Urban Search and Rescue Teams (US&R) to ensure specialized equipment, personnel and other resources are rapidly deployed.
- This work can be accomplished as part of an expanded statewide quarterly "all hands" training and exercise program that includes IMTs.

**Photo: An Excavator Working in the Debris Field near Oso.** Photo courtesy of WSP. Flickr/ Snohomish County - CC: BY-NC-ND 2.0 https://www.flickr.com/photos/snoco/13455469653/in/set-72157642910921003

# Lesson Learned

## *Continue to study and monitor the SR 530 Landslide and adjacent landslides*

The potential for landslide remobilization remains uncertain. Concerns include highway inundation, and flooded homes up and downstream of the March 22nd, 2014 landslide deposit.

- The stability of the landslide mass on the slope is unknown. Landslide reactivation could block the river channel and divert flow toward the highway, as well as destabilize the existing headscarp, potentially causing another large-scale slope failure.
- The March 22nd, 2014 landslide filled the river valley with sediment, which significantly increases the likelihood of: flooding, channel migration, transport of sediment/debris downstream, and habitat degradation.
- Prehistoric landslides of comparable size and runout are present for several miles on both sides of the valley. These landslides could be reactivated or new ones initiated through river erosion or severe weather. The frequency of occurrence of these catastrophic landslides is unknown.
- Groundwater conditions in the undisturbed sediments are known to contribute to slope instability and are not well understood. Building a 3D model of subsurface geology and groundwater conditions through proper characterization of sediments and aquifers would contribute understanding to continued risks along the SR 530 corridor and in similar geologic settings across the state.

Additional landslide investigations are required to characterize and quantify these risks and should continue to be coordinated with on-going investigations.

# Recommendation 9

## *Conduct Landslide Investigations*

**The Commission recommends the Department of Natural Resources (DNR) Division of Geology and Earth Sciences, Washington State Department of Transportation (WSDOT), Snohomish County, and the US Geological Survey (USGS) conduct landslide investigations to characterize the mechanisms that activated the landslide and to understand the stability of the landslide mass.**

- The current investigations by WSDOT, DNR, Snohomish County, the Tulalip and Stillaguamish Tribes, USGS and University of California, Berkeley are focused on characterizing the stratigraphy and groundwater conditions above the scarp. Necessary investigations include continuing drilling, monitoring, and mapping along the SR 530 corridor adjacent to the landslide.

- Model conditions that led to the March 22nd landslide using empirical data from the geotechnical investigation, including its runout distance and speed. Identify where similar conditions may exist or could occur elsewhere in the valley that could put additional lives, property, infrastructure, and habitat at risk. Use geologic and geomorphic mapping, including radiometric dating of prehistoric large runout deposits and associated fluvial (river) terraces in the valley to determine ages and frequency of large landslides.

# Lesson Learned

## *Large incidents with multiple fatalities can overwhelm the capacity of local coroners and medical examiners*

Mass fatality planning and management response falls to the local jurisdiction, typically the coroner (RCW 36.24) or medical examiner offices (RCW 36.24.190). Coroners are elected; medical examiners are appointed. Most coroners plan for and handle small incidents. Large incidents with multiple fatalities can overwhelm the capacity of local coroners and medical examiners. Mass casualty/fatality plans may exist, but practice in executing them may be limited in most jurisdictions. Mass fatality management planning must be made a priority.

During the SR 530 incident the Snohomish County Medical Examiner's Office was not staffed to handle this mass fatality event. In the early hours, there was confusion regarding which agency had the responsibility of maintaining missing person lists. This resulted in a number of responding organizations and volunteers making their own lists. Family members were in the uncomfortable position of being asked to repeat information as they attempted to file a missing person's report, identify loved one's remains, or provide personal information. This was described to several Commissioners as 'cruel'. While law enforcement has the statutory authority for missing persons, they may not always be in the best position to accomplish the task because they may be needed in rescue efforts.

The Snohomish County Health District went forward with the Medical Examiner's Plan to establish a Family Assistance Center (FAC), without a firm understanding of the trigger points for establishing a FAC. Excessive time and effort were spent trying to acquire location(s) and staffing for a FAC, which ultimately was not established. This was further complicated by the separation of the communities - Arlington, Oso, and Darrington.[7]

Effective response will require enlisting the cooperation and assistance of other agencies, municipalities and counties. This could include identifying a medical examiner from another part of the state, or county to oversee the overall mortuary component of the response, allowing local medical examiners and coroners to focus on ongoing county-specific workload. This will require establishing mutual aid agreements and multicounty plans well in advance of a disaster, so that resources can be rapidly deployed in an actual event. FACs could provide a

7 Snohomish County Health District SR 530 Mudslide and Flooding Event, After-Action Report/Improvement Plan. July 1, 2014.

vital service and central location for families and friends to gather to get assistance in locating their missing loved one(s).

# Recommendation 10

## *Prioritize Mass Fatality Management Planning Statewide*

**The Commission recommends the State Department of Health convene a representative group of county health departments, tribes, and Medical Examiners/Coroners Offices to develop a statewide mutual aid agreement structure for medical examiners and coroners.**

**The Commission also recommends the State Department of Health work collaboratively with tribes, county health departments, and Medical Examiners/Coroners Offices to identify opportunities for improvements to planning for and managing mass fatality incidents, including establishing Family Assistance Centers.**

- The Commission recommends tribes, county health departments, and Medical Examiners/Coroners Offices work together to ensure an operational plan exists and to conduct practice drills together for multi-county mass fatality incidents, including incidents which involve federal response resources. The Commission encourages Snohomish County to share its lessons learned and recommendations from the SR 530 Landslide.
- The Commission also recommends county health departments partner with law enforcement to ensure appropriate plans are in place for addressing the missing persons' count.
- One form for missing persons must be developed and shared among the 'need to know' agencies, so that families don't have to repeat personal information about their missing loved ones multiple times to multiple agencies.

# Lesson Learned

## *Local residents, loggers, contractors, business owners, officials, and many others were invaluable to the rescue effort*

Each day of the initial response involved the use of local resources such as chain saws, helicopters, bulldozers, and responder support services such as food and lodging. Local responders were instrumental in accessing the area by alternate routes and pinpointing the locations of residences that had disappeared in the landslide. Loggers brought essential expertise and equipment for log and debris clearing. Loggers and contractors from Darrington expanded Seattle City Light's utility access road around the landslide that reconnected Darrington to Oso within 36 hours from the time they began. The access road

significantly reduced the four hour round trip to the Arlington EOC. During the response effort, a large number of outside volunteers joined the response and rescue effort. Working with the hundreds of local volunteers significantly highlighted the need for pre-certifying volunteers and their equipment.

Local community members are first to respond in a catastrophic event and the Stillaguamish Valley communities were critical to the effectiveness of the response effort. The SR 530 Landslide highlights the importance of effectively using community volunteers quickly and proactively. Whether it be in rural or urban areas of Washington, there are untapped resources which could be made available by developing statewide systems to effectively coordinate volunteers and to proactively establish groups of volunteers with skills and resources.

The effectiveness of volunteer coordination relies on a foundation of trusting local relationships. While there is no one way to quickly build trusting relationships, there are basic structured systems that can be developed and used to initiate the conversations that may lead to these types of relationships.

# Recommendation 11

## *Improve Volunteer Process*

**The Commission recommends the emergency management agencies and organizations that make up Incident Management Teams work collaboratively to develop a process to evaluate and improve both the pre-incident and rapid onsite identification, registration, credential verification, training, and engagement of volunteers.**

- This process should be informed by input from representatives from tribal, county, and city emergency management departments.
- Volunteer information should be updated yearly and held at an accessible, centralized location.
- The Commission also recommends expanding the "Map Your Neighborhood" program to include the business community, volunteer skills, and an inventory of equipment for use in cases of emergency response. Also Include clear definitions of the roles and responsibilities of responding agencies and organizations and what impacted communities can reasonably expect from them.

### Map Your Neighborhood Program

The Map Your Neighborhood (MYN) program was implemented statewide by the State of Washington's Emergency Management Division (WA-EMD) in 2006. The program has been effective as with the Nisqually Earthquake on February 28, 2001, in which 92% of 460 organized neighborhoods effectively responded to the earthquake utilizing the 9-Step Neighborhood Disaster Response Plan. In 2012, WA-EMD received an award in Innovative Training and Education Programs for its MYN program. More than 50 counties and cities in Washington State today are in various stages of implementing MYN. MYN provides guidance under the premise that in a disaster, traditional 9-1-1 and First Responder capabilities such as fire, police, medics, and utility personnel will be overwhelmed and unable to immediately assist individuals.

The Washington Military Department website offers tools to where community groups can begin their Preparedness Plans (http:// www.emd.wa.gov/myn/index.shtml).

# Lesson Learned

## *It is important to coordinate with tribes prior to and during an emergency*

Due to the location and impact of the SR 530 Landslide, a number of concerns arose that are specific to each of the three Tribes in the Stillaguamish Valley. The Sauk-Suiattle Indian Tribe, the Stillaguamish Tribe of Indians, and the Tulalip Tribes were impacted in different ways during this event. For example, the Sauk-Suiattle Tribe lost telephone and internet service immediately. Transportation was costly and difficult particularly for the Tribal elders and other vulnerable tribal members and families.

The Stillaguamish Tribe provided technical resources to help de-water flooded areas adjacent to the river. Large amounts of new sediment and the force of the landslide changed the direction and depth of the Stillaguamish River, creating a new configuration that may be too shallow and narrow to carry floodwaters. The river was a spawning ground for Chinook salmon and it is unclear how the changes in river topography and ecology from the landslide, in combination with other pre-existing environmental pressures, will impact this run's production. By implication, changes to the number of fish caught, pursuant to river's Chinook production may affect tribal treaty fishing rights.

Situational awareness and incident response and recovery efforts need to be informed by tribal knowledge and actions need to be sensitive to tribal concerns. Prior to and during an incident, it is important to understand the needs of impacted and neighboring tribes as well as to understand the resources and assistance tribes can provide to the response and recovery efforts.

# Recommendation 12

## *Deploy Liaisons to Coordinate with Each Impacted Tribe*

**The Commission recommends liaisons be deployed from state government and pre-determined regional coalitions to coordinate with each impacted tribe throughout an emergency.**

- Acknowledging that some counties have less than 1 FTE to manage disaster preparedness activities, it is recommended that liaisons be developed on a regional basis and be allowed the time and resources to develop a trusting relationship and be well known by all the tribes in the region.
- Liaisons will be responsible for confirming tribal information is included in situational awareness.
- NGOs responding should consider deploying liaisons. To avoid overwhelming a tribe, liaisons from all agencies/organizations should coordinate their activities with pre-event planning.

- Liaisons also need to be ICS trained and knowledgeable in all resources available (such as disaster case managers and the Navigator Program, described on pg. 31).
- Liaisons need to be incorporated into the emergency management structure.
- All relationships and activities must be conducted in adherence to the Centennial Accord.[8]

# Lesson Learned

## *In emergency events, effective communication is challenging. Issues fall into the categories of infrastructure, interoperability, content, and strategy*

In emergency events, effective communication is challenging. This dynamic is a common element in incident after-action reports. The SR 530 Landslide was no exception and provides timely examples of opportunities to improve communications. There were numerous reports of communication challenges among both the first responders and members of the public, especially within the first 24-72 hours. Landlines and much of the cell service in Darrington and the surrounding area was disrupted, making development of shared situational awareness difficult. Different operational frequencies used by some of the responding organizations also created communication challenges. Critical and timely information was not always available to impacted communities.

When regular and cell phone service is disrupted, alternate forms of communication must be relied upon. It is critical that redundant communication systems be developed and in place in advance of an event. For example, community volunteers who aided in communications, such as Ham radio operators, were an invaluable asset, particularly in Darrington. They need to be more fully

**Communications: Traditional and Social Media**

The bifurcated nature of the SR 530 incident and the multiple agencies involved created communications challenges. Some testimony to the Commission expressed an opinion that a Joint Information Center (JIC) could have been created earlier to provide timely and accurate information. Individuals and agencies at the scene did, however, provide valuable and heartfelt information to media very soon after the event started. In any case, all responders should be mindful of the need for a single point of contact for information as soon as possible. To disseminate technical information, technical expertise should be available.

The Commission also heard from local residents that many received a majority of their information from Twitter, Facebook and other social media. Local agencies involved in the Boston Marathon Bombing , particularly the Boston Police Department, found that having social media accounts and existing relationships with the community made a huge difference in communicating important information in a dynamic and intense public safety crisis. In the future, media briefings and other traditional elements of a JIC should consider the conscious inclusion of social media outreach as well.

8 Centennial Accord between the Federally Recognized Indian Tribes in Washington State and the State of Washington: http://goia.wa.gov/Relations/Relations.html

incorporated into the response network.

Generally, the reported issues fall into the categories of infrastructure, interoperability, content, and strategy. The inability to effectively share information vertically and horizontally contributed to reduced situational awareness and a lack of a common operating picture among responders, the emergency management community, and affected communities.

**Photo: Local Assistance with Search Efforts.** Flickr/ Snohomish County - CC: BY-NC-ND 2.0 https://www.flickr.com/photos/snoco/13429462163/in/set-

# Recommendation 13

## *Activate the First Responder Network Authority*

**Washington State should actively participate in the design of the FirstNet network, under the leadership of the State Interoperability Executive Committee (SIEC), with the goal of being one of the first states to deploy this new nationwide network.**

- In 2012 Congress authorized and funded the First Responder Network Authority ("FirstNet"). FirstNet is mandated to build a separate, robust nationwide wireless data network for use by all responders, with first responders having priority use. FirstNet is required to consult with responders in the state during development of a state specific design.
- Note: While FirstNet will not directly address voice communications or supplant land mobile radio, it is designed to provide robust data-sharing capacity. Access to informational systems such as FirstNet would have significantly aided recovery efforts.

### Situational Awareness was a Significant Issue in the Early Stages

"Situational awareness", or simply knowing the general scope and immensity of the challenge being faced, was a consistent theme from input taken by the Commission. Many responders commented that because they saw only one side of the slide during the first few days, they had no idea how large it was or how far it extended. Because helicopters were performing rescues, other aircraft doing overflights to survey the landslide itself would have been excluded for safety reasons.

The Commission finds there is no easy answer to improve situational awareness in circumstances like the one rescuers found themselves in, during this incident. One possible option would be to deploy small and inexpensive drones, which may provide a better view. However, their use would rely on availability and adequate weather. Any policy discussion in the state of Washington about approved uses of drones should take this type of incident into account.

# Recommendation 14

## *Update the State Communication Interoperability Plan*

**The Commission recommends the SIEC immediately update the State Communication Interoperability Plan (Plan) to include formal certification of Communications Leader and Communications Technician response positions and maintain a State listing for use by incident commanders during a major disaster.**

- The Plan should also include inventories of communications assets available to responding agencies such as handheld radios, specialized communications vehicles, deployable antennas, and base stations. This effort should also include specific training and exercises for communications personnel, and the creation of a Field Operations Guide for the State, which includes and lists all the radio frequencies, assets, communications personnel, and other resources available to manage a disaster in each county or region of the state.
- The SIEC has issued a draft report concerning communications during response to the SR 530 Landslide. That report highlights a number of observations and recommendations – all of which comport with the assessment of the Commission and should be heeded. Specifically, while restoration of basic communication capacity occurred fairly quickly, and there were a number of official and unofficial communication mechanisms available throughout much of the critical stages of the event, they were not managed, coordinated, or leveraged to maximum benefit. One critical component of this was the lack of awareness of those resources. Another issue was insufficient capacity to integrate the many disparate modalities in a coherent fashion.

# Lesson Learned

## *Washington Administrative Code guidelines for designating geological hazard areas and assessing risk are permissive, due in part to the lack of statewide geologic and geohazard mapping*

The Growth Management Act requires cities and counties to prepare critical area regulations to classify and designate geologically hazardous areas, wetlands, frequently flooded areas, aquifer recharge areas, and fish and wildlife habitats in their Comprehensive Plans. The Washington Administrative Code (WAC) includes a set of guidelines for local governments to use when classifying and designating critical areas, and preparing local development regulations. The guidelines for designating geological hazard areas and assessing risk are permissive, due in part to the lack of statewide geologic and geohazard mapping. However,

before local governments can effectively regulate land uses in geologically hazardous areas, it is imperative to know where such hazard areas are and what relative risks exist. In comparison to other recognized critical areas, state subdivision laws allow disapproval of land subdivisions due to flooding but are silent on regulating proposed subdivisions affected by geologic hazards.

# Recommendation 15

## *Update the WACs Related to Critical Area Regulations*

**The Commission recommends to the Washington State Department of Commerce that the WACs related to Critical Area Regulations be updated to require counties and cities to identify, classify, and regulate land uses in geologic hazard areas based on up-to-date and available geologic information and risk mapping.** ***(Note: amend WAC 365.190.080 and .120)***

- In addition, the Commission recommends updating state subdivision laws to require new land development activities to conduct geologic risk assessment studies as part of development permit applications when located in identified geologic hazard areas.
- When land use or development proponents seek to conduct activities in areas mapped as a medium or high potential landslide hazard area, regulatory entities should secure a peer or third-party review by technical permitting/regulatory staff or other reviewers with the appropriate technical expertise of the proponent's geologic studies associated with the planned activity.
- The Commission recommends counties and cities adopt and use innovative development regulations and practices to enable development and use that promotes public safety and respects personal property rights in identified geologic hazard areas.

### Innovative Development Regulations

Examples of innovative development regulations include:

- Transfer of development rights
- Critical area buffer widths based on site specific geotechnical studies
- Slope-density regulations
- Land banking
- Engineered building structures within potential unstable areas
- Conservation easements
- Acquisition by public land trusts
- Grading ordinances

Local jurisdiction concerns related to property values adjacent to or in landslide hazard areas should be incorporated in planning around the following:

- **Economic Impact** – real estate worth is determined by what income it produces or its perceived value to a qualified and informed purchaser.
- **Scientific** – the key impacts on value is verifiable and repeatable science regardless of who is impacted. It is also true that mitigation may be possible at a cost.
- **Political** – Given that Washington is a "home rule" state, the body of government regulations in place (or lack thereof) reflects local politics as much or more than it does science.

# Lesson Learned

## *Disaster assistance after an event needs a "one stop shop", in order to help families navigate the various aid systems*

Multiple NGOs partnered to provide services to SR 530 Landslide survivors and their families. Snohomish County Division of Housing and Community Services has a well established 'Navigator Program', consisting of individuals, referred to as "navigators", who are professionally trained in a variety of disciplines to help support the wellbeing of their constituents. Although the Snohomish County "Navigator" system was originally established to assist with the issue of homelessness, the program assisted in managing survivor needs following the SR 530 Landslide. On March 22nd, Snohomish County Executive Lovick asked the County Department of Emergency Management to take the lead on mobilizing the human services response to impacted individuals and families. The County called upon the Human Services Department as the lead for Emergency Support Function (ESF) 6 and Behavioral Health under ESF 8 to mobilize the navigators to help families.

There were many professionals and volunteers on the ground organized by a variety of agencies, including 'navigators,' disaster case managers, disaster outreach services staff members, and volunteers. There was some confusion among those in need about where to go for services and frustration was expressed with support agencies that repeatedly asked for the same information. Coordination among the entities providing services is necessary and this issue is currently being addressed in Snohomish County.

# Recommendation 16

## *Develop a Navigator Program for Emergency Management*

**The Commission recommends the State Department of Social and Health Services collaborate with appropriate stakeholders to develop a regional, standardized Navigator Program for managing survivor needs.**

- Training and establishment of regional Navigator teams should be a priority. The teams could be activated much like the IMTs are in emergencies and disasters.

**The Commission recommends Snohomish County, which successfully created and managed the Navigator system, document their processes and findings as a guide for the State to create a statewide Navigator system.**

**Photo: Flag found in debris field.**
Flickr/Snohomish County- CC: BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13520618504/in/set-72157642910921003

# Lesson Learned

## *Public awareness of the potential negative impacts to property caused by the existence of geologic hazards is important in ensuring the protection of the general public*

Often, property transfers occur with little knowledge of potential risks associated with living in existing or newly developed areas. Although the real estate industry and sellers are required to disclose the existence of known natural hazards on Form 17 (the "Seller Disclosure Statement" as defined in RCW 64.06.005(4)), real estate professionals and the general public may be unaware of such geologic hazards due to the lack of appropriate and adequate geologic hazards mapping, and lack of ready access to such mapping products.

# Recommendation 17

## *Advance Public Awareness of Geologic Hazards*

- **The Commission recommends local governments develop public awareness initiatives to inform property owners (e.g. through property tax assessment notices) and the general public of designated geologic hazard areas, once these hazards are identified from local, regional, or statewide mapping programs.**
- **The Commission encourages the Washington State Real Estate Commission to include natural hazards awareness - and in particular, landslides - in its "core" curriculum that informs licensees on current trends and issues of importance.**
- **The Commission supports the development of educational programs specific to local community issues, to raise awareness of natural hazards and risks from landslides, debris flows, flooding, volcanic eruptions, and earthquakes.**

**Aerial Photo.**
Flickr/GovInslee- CC: BY-ND 2.0
https://www.flickr.com/photos/govinsleesets/72157642811787053/

# IV. Call To Action

The Commission reviewed a large volume of material from diverse sources to identify lessons learned from the SR 530 Landslide and translated those lessons into recommendations. The Commission considers the recommendations contained in this report to be those that provide the most potential benefit to public safety. The Commission also endeavored to meet the task, as specified in its Charter, to identify the "top recommendations related to the SR 530 Landslide that, if implemented today, would make us safer tomorrow." The Commission's consensus is that the following recommendations represent critical first steps towards making the people of Washington safer in the future. These recommendations require leadership from the State to implement and should be addressed immediately. Preparedness for future disasters depends largely on the lessons learned from this and other disasters and the collective willingness to plan, prepare, and budget for the catastrophic or unimaginable.

## Critical First Steps

### *Support a Statewide Landslide Hazard and Risk Mapping Program*

The Commission recommends the Legislature significantly expand data collection and landslide mapping efforts, which will provide the foundation for sound public and private land-use planning and decision-making. The SR 530 Landslide highlights the need to incorporate landslide hazard, risk, and vulnerability assessments into land-use planning, and to expand and refine geologic and geohazard mapping throughout the State. The lack of current, high-quality data seriously hampers efforts under the Growth Management Act (RCW 36.70A) and other regulatory programs to account and plan for these hazards.

### *Integrate and Sustainably Fund Washington's Emergency Management System*

The Commission recognizes the need for further study of the State's emergency management system. The SR 530 Landslide involved all levels of government in multiple jurisdictions and

**Photos above, starting at left:**
**1. In front of the Oso Fire Department.** Flickr/Snohomish County - CC:BY-NC-ND 2.0 https://www.flickr.com/photos/snoco/14005062602/in/set-72157642910921003
**2. Mayor Rankin (Darrington) and Mayor Tolbert (Arlington) on site.** Flickr/GovInslee - CC: BY-ND 2.0 https://www.flickr.com/photos/govinslee/13671998583/in/set-72157642811787053
**3. Messages of support hang inside the Oso Fire Department.**
Flickr/Snohomish County CC: BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/14005063492/in/set-72157642910921003/

disciplines. The Commission recommends the Governor convene a funded task force, charged with affecting change and include participation from the Governor's office, the Legislature, tribes, county and municipal government, first responders, transportation agencies, non-government support agencies, the private sector, and members of the public. The task force should report to the Governor by December 2016 with recommendations to build a more robust and innovative system of response and to secure an adequate, sustainably funded emergency management system across the state.

### *Clarify State Fire Service Mobilization Laws to Support Front Line Responders at Non-Fire Emergencies*

The Commission recommends the State Legislature clarify the definition of "all-hazards" mobilization and establish adequate funding in the disaster response account. Fire service mobilization was requested in response to the landslide, but refused because it was a non-fire emergency. The Commission concludes that state fire service mobilization is a significant tool to use in emergency incidents such as the SR 530 Landslide. State fire service mobilization is the only intrastate plan that has been used and exercised many times, and is a well-tested plan that has earned the faith and confidence of fire emergency responders. An all-hazard state mobilization would have provided improved command and control by allowing for a Type 2 Incident Management Team to arrive sooner and provide resources for first responders – technical rescue relief teams and equipment.

## Leadership & Action

Many of the recommendations contained in this report are being actively implemented by the agencies involved in the SR 530 Landslide response. Other recommendations can be implemented at the agency level requiring only encouragement and perhaps funding support from the State. Also included in this group are recommendations that may require a formal or structured effort, or a higher funding commitment, to achieve.

The **Responsible Lead Entity Matrix** on the following page, lists the recommendations presented in this report and "calls to action" an entity and/or entities to take the lead to ensure timely implementation of the recommendation.

**Photo: SR 530 slide - April 10.**
Flickr/Snohomish County - CC:BY-NC-ND 2.0
https://www.flickr.com/photos/snoco/13786694425/in/set-72157642910921003

## Responsible Lead Entity Matrix

| Recommendation | Governor | Legislature | State | Counties | Cities | Other |
|---|---|---|---|---|---|---|
| **Rec.1** Integrate and Fund Washington's Emergency Management System | Governor | | | | | |
| **Rec. 2** Support a Statewide Landslide Hazard and Risk Mapping Program | | State Legislature | | | | |
| **Rec. 3** Establish a Geologic Hazards Resilience Institute | Governor | | | | | |
| **Rec. 4** Provide Legislative Clarity for the Definition of "All-Hazards" Mobilization | | State Legislature | | | | |
| **Rec. 5** Establish Adequate Funding in the Disaster Response Account | | State Legislature | | | | |
| **Rec. 6** Pro-Active Preparations | | | | County Departments of Emergency Management | | |
| **Rec. 7** Activate WA's Command and Control Structure for Catastrophic Events | | | State Emergency Management Organizations | County Emergency Management Organizations | | |
| **Rec. 8** Develop a Standardized Process for Requesting, Tracking, Mobilizing, and Demobilizing of Resources | | | WA State Military Department, Emergency Management Division | | | |
| **Rec. 9** Conduct Landslide Investigations | | | Department of Natural Resources, Division of Geology and Earth Sciences<br>WA Department of Transportation | Snohomish County | | US Geological Survey |
| **Rec. 10** Prioritize Mass Fatality Management and Planning Statewide | | | State Department of Health<br>State coordinate with tribes | | | |
| **Rec. 11** Improve Volunteer Process | | | Emergency Management Agencies and Organizations that make up the IMTs | County Emergency Management Agencies and Organizations | City Emergency Management Agencies and Organizations | |

| Recommendation | Governor | Legislature | State | Counties | Cities | Other |
|---|---|---|---|---|---|---|
| **Rec. 12**<br>Deploy Liaisons to Coordinate with each Impacted Tribe | | | WA State Military Department, Emergency Management Division<br>State Emergency Management Agencies.<br>State coordinate with tribes | | | |
| **Rec. 13**<br>Activate the First Responder Network Authority | | | State Interoperability Executive Committee | | | |
| **Rec. 14**<br>Update the State Communication Interoperability Plan | | | State Interoperability Executive Committee | | | |
| **Rec. 15**<br>Update the WACs Related to Critical Area Regulations | | | State Department of Commerce | | | |
| **Rec. 16**<br>Develop a Navigator Program for Emergency Management | | | State Department of Social and Health Services | | | |
| **Rec. 17**<br>Advance Public Awareness of Geologic Hazards | | | | Counties | Cities and Towns | Real Estate Commission |

# Appendix A. Charter

## The Joint SR 530 Landslide Commission CHARTER

**Purpose**
Governor Jay Inslee and Snohomish County Executive John Lovick are working together to form a joint commission in response to the SR 530 landslide of March 2014.

**Operations**
The Governor and the Executive have agreed the Commission's operations should:

- Operate independently from the state and county executives
- Be led by a commission of 12 members
- Be thoughtful, fair, compassionate and credible
- Be transparent and abide by open meetings and public records laws
- Produce a report of prioritized recommendations by December 15, 2014

**Scope**
One of government's preeminent roles is to promote public safety. To that end, the Commission will focus its work on identifying the top recommendations related to the SR 530 landslide that, if implemented today, would make us safer tomorrow.

- The Commission will perform a review of the incident and establish a timeline of events.
  *Intent: To better understand the collective response and inform recommendations for the future that will guide policy makers.*
- Review of the emergency response to the slide may include the initial emergency search and rescue, recovery of victims, community efforts and coordination among local, county, state, tribal and federal governments.
  *Intent: To inform recommendations for the future that will guide policy makers.*
- Recommendations may identify information gaps, lessons learned or technical needs, and they may also include proposed changes to policy, code or operational procedures.
  *Intent: To improve planning and response for similar events.*
- The Commission will not determine liability, cause or fault.
  *Intent: To not act as a substitute for the courts in any way.*

**Executive Director**
An Executive Director will be appointed who is an experienced people and project manager, and can be an objective leader who will effectively help the Commission fulfill its mission. The Executive Director will serve as the non-voting Chair of the Commission. The Executive Director will also manage the Commission's budget, and will be tasked with working with non-profits and the private sector to raise any additional funds, in-kind and pro-bono resources to complete the Commission's mission.

**Facilitation**
The Commission will be staffed by a facilitator and researcher/writer. The Executive Director must approve of the choice for facilitator, and can opt to replace the facilitator at any time.

**Legal**
Appointed commissioners are immune from civil liability for any discretionary decision or failure to make a discretionary decision within their official capacity. *(RCW 4.24.470)*

**Commissioners**
All Commissioners will be jointly appointed by the Governor and Snohomish County Executive.

In order to preserve the Commission's independence, those who were directly involved in the landslide response and recovery efforts are not eligible to serve on the Commission.

The Governor and Snohomish County Executive are committed to appointing a diverse, talented and dedicated group of people. The Commission should include representatives from the following categories: Geologists and/or Hydrologists; Emergency management experts; Land use experts/County planners; Current or retired public safety experts; Tribal and Citizen representatives; Elected/former elected officials.

**Meetings and Time Commitment**
Commissioners will be expected to contribute 10 to 12 hours per month for the duration of the Commission's work (not including travel time).

The Commission will meet at least once a month for a minimum of two hours. The Commission is encouraged to hold these meetings in Snohomish County. Other potential subcommittee work, field work, community work, preparation and research may require Commissioners' additional attention and time.

**Final Report**
The Commission will provide the Governor and Snohomish County Executive with a report of prioritized recommendations by December 15, 2014. The Executive Director and Commissioners may be asked to periodically present and explain recommendations to the media, legislature and other audiences beyond this deadline on a pro-bono basis.

**Community Engagement**
The Commission is encouraged to engage the Stillaguamish Valley community in meaningful ways throughout its work, and particularly as it prepares to submit the final report.

The Commission will share a draft report of prioritized recommendations with the Governor, Snohomish County Executive by November 15, 2014 and consult with the following local leaders: Sauk-Suiattle Tribal Chair Norma Joseph; Stillaguamish Tribal Chair Shawn Yanity; Tulalip Tribal Chair Herman Williams Sr.; Darrington Mayor Dan Rankin; Arlington Mayor Barbara Tolbert and Oso Fire Chief Willy Harper.

**Decision-Making**
The Commission will practice consensus decision-making. That is to say, the Commission will seek general agreement and an acceptable resolution that can be supported by the group, even if it's not the favorite of each individual. The Commission's ultimate decisions are advisory only, and may inform the future policy choices of the State of Washington or Snohomish County. The Commission itself has no other decision making authority.

**Ethics and Public Records**
All Commissioners will abide by the ethical and professional expectations set by the state and county, and they will be required to complete online ethics and public disclosure training.

To maintain a single repository for public record keeping, Commissioners and staff will Cc the following email address on all correspondence related to the Commission: SR530commission@gov.wa.gov

In accordance with the open meeting rules, the Executive Director will post meeting agendas and materials on a Commission webpage.

# Appendix B. Timeline

## SATURDAY, MARCH 22, 2014

**10:37am**
Massive landslide (seismically recorded)

**10:41am**
Massive landslide (seismically recorded)

**10:45am**
Fire Dispatch Darrington & Oso Fire to slide

**10:53am**
Fire Chief 37 on scene, west side SR 530 100% blocked. Local volunteers on scene, remained active throughout the response

**10:54am**
Call received by Deputy Bergstrom: power out, slide, person on barn screaming for help

**10:58am**
Rescue 38 request SAR helicopter

**11:01am**
Darrington Fire Chief requests Navy helicopter

**11:03am**
Governor advised by DOT: Snohomish County (SnoCo) lead responder; planning evacuation due to fear of catastrophic flooding

**11:04am**
SnoHawk 10 helicopter diverted from training to SAR

**11:09am**
WSP Trooper reports house on road

**11:15am**
Request for Naval air assistance - Naval SAR respond within 60 minutes

**11:28am**
SnoHawk 10 was first aircraft to arrive; survivors observed. SnoHawk 1 called for air management and for DEM assessment of size and damage

**11:34am**
Initial slide notification from SnoCo to State Emergency Operations Center. SEOC activated by 6 pm

**11:37am**
SnoHawk 10 begins rescue of survivors. Ongoing slide movement

**11:59am—12:12pm**
SnoHawk 1 launched. Airlift 3 departs Olympia; Naval rescue 75 departs Whidbey

**12:13pm**
Civilians assisting fire/rescue on scene. Slide moving. SnoCo tweets: Huge land-slide on SR 530 at mileposts 37-38, please avoid area. Update #530slide

**12:17pm**
Official activation of Snohomish County EOC (DEM)

## SATURDAY, MARCH 22, 2014

**12:40pm**
Helicopters transport firefighters to assist with extraction.

**1:00pm**
SnoHawk 1 announce aircraft use 123.1 VHF at site. Rescue 75 transferred 1st survivor in critical condition.

**1:05pm**
Rescue 75 hoists 1 survivors from house

**1:12pm**
SnoHawk 1 arrives to monitor and control air traffic; request made to SNOPAC 911 for video downlink.

**1:30pm**
Rescue 75 lifts 2 more survivors from only place for hoisting—using the extraction litter floated on mud slurry.

**2:00pm**
Ground crew texted for chainsaw & supplies. Commander/SnoCo SAR advises largest slide in 30 years.

**2:15pm**
SnoHawk 1 flew low level, began detailed visual and thermal search. No evidence/signs of life besides responders and local volunteers. Hand signals given for "ok"

**Time Uncertain**
Informal request made for Type 2 NWIMT and all-hazard mobilization - denied.

**3:10pm**
Rescue 3 inserted 3 Federal Firefighters via one wheel landing

**3:25pm**
SnoHawk 1 conducted visual, thermal search while pilot in charge managed rescue helicopters.

**3:35pm**
WSDOT informs Governor's office of the slide. SnoCo is the lead responder at the command post.

**3:53pm**
No more survivors located by air or with FLIR. Navy ground team working on last known extraction.

**4:21pm**
SnoHawk 10 conducting visual search. Ceiling is lowering with mixed rain and snow.

**4:22pm**
Rescue 75 transfers last survivor to awaiting ambulance

**4:26pm**
SnoHawk 10 picks up 2 Darrington Firefighters

**4:30pm**
SnoHawk 10 returns to wood pile to hoist 2 firefighters, 1 civilian. Rescue 75 picks up 4 Navy team members.

## SATURDAY, MARCH 22, 2014

**4:30pm**
WS-DOT Emergency Services began set up of Air Branch Arlington EOC.

**4:35pm**
SnoHawk 10 picked up civilian rescuer

**4:45pm**
SnoHawk began video and downlinking. SnoCo DEM announced downlink receiver "on" but no signal. Performed high bird operation & radio signal relay for ground units. Thermal search, "hot spots" confirmed as uninjured civilians looking for loved ones.

**4:56pm**
SnoHawk 10 attempts to pick up 2 fatalities—diverted to unconfirmed report of survivor

**5:01pm**
SnoHawk 10 picked up 2 fatalities. Previous attempt to do so diverted to unconfirmed report of survivor.

**5:35pm**
SnoHawk 1 continues thermal search, no evidence of signs of life.

**6:00pm**
State Emergency Operations Center fully activated

**6:25pm**
Air search operations concluded for day 1. local volunteers, loggers, contractors, family members, continue ground search until after 10pm. Many local volunteers worked with responders and led recovery efforts for up to 37 days following the slide.

**10:15pm**
Governor Inslee declares State of Emergency

## SUNDAY, MARCH 23, 2014

**6:00am**
Type 3 NWIMT officially activated, took command

**7:05am**
SnoHawk 1 departs, arriving 7:25am Significant flooding. Began detailed visual, thermal search; No evidence of signs of life.

**8:05am**
Thumb drive recording of river, slide area, and flooding delivered to WSDOT representative at Arlington airport.

**8:30am**
SnoHawk 10 loaded 4 engineers, geologists, and surface water specialists to make several orbits around slide area.

**9:40am**
SnoHawk 10 picks up 2 engineers and geologists to survey slide area. Geologists monitor the area for weeks

**10:10am**
SnoHawk 1 conducts visual, thermal search. No evidence of signs of life.

**10:15am**
Smokey 4 departs Olympia to slide area working as high bird. Downlinking through channel 5 works—received at DEM

**12:24pm**
SnoHawk 10 conducts visual, thermal search; no signs of life. In total, there were at least 8 such searches the first two days.

**1:15pm**
Smokey 6 arrives Arlington for Snoho Executive Lovick and Government staff. En route slide area. Lands in Darrington.

**2:00pm**
Smokey 4 departs Arlington airport over slide with photographer.

**2:10pm**
Smokey 6 departs Darrington with passengers in route Arlington.

**3:10pm**
SnoHawk 1 concludes search operations.

## SUNDAY, MARCH 23, 2014

**4:39pm**

SNOCO Sheriff advises death toll at 4.

**5:10pm**

SnoHawk 10 departs, report of 2 trapped adults off Sea Post Road. Unable to locate.

**5:15pm**

SnoHawk 1 to Arlington to pick up incident commander for transport to Darrington. Arrived 6:00pm

**5:45pm**

SnoHawk 10 conducts 3 fatality recoveries at 6:10pm.

**7:15pm**

Verizon phones and landlines working in Darrington. DOT provides lights for night rescue.

# MARCH 24 -31, 2014

### March 24th

- Governor Inslee requests a Federal Emergency Declaration.
- President Obama issues a Federal Emergency Declaration.
- Frontier restores communication with fiber cable.
- US Transportation Secretary announces $1 million in emergency relief to help cover repair costs.

### March 25th

- Local loggers begin expansion of Seattle City Light (utility access road).
- Snohomish County requests National Guard assistance. National Guard Search and Extraction Team and two Blackhawk helicopters sent to assist with search and recovery.
- WADFW shuttle personal and equipment into the debris field and upstream in jet boats.
- Command Post moved from Arlington City Hall to Old Arlington High School.

### March 26th

- WSDOT and Snohomish County crews clear and re-open the Mountain Loop Highway in just three days, providing an alternate route into Darrington. Seattle City Light utility access road open, responders only.

### March 27th

- WA team 4 type 2 - 16 day activation.
- WSDOT continues to work with SnoCo, DNR, and locals to expand, maintain, and improve Seattle City Light utility access road.

### March 28th

- Governor requests an expanded Federal Emergency Declaration; approved by President Obama.
- New emergency bus service to connect residents of Darrington and Sauk-Suiattle tribe with services in Skagit County.
- National Guard has 97 people on the ground and called in additional 50 from WA National Guard and search and fatality team from Colorado National Guard.
- Lake level has dropped by two feet and river cutting a new path smoothly, reducing concerns about a big break and flooding.
- Type 3 IMT demobilized as Type 2 IMT transitioned into the management and coordination role for the continued victim recovery efforts.

### March 29th

- National Guard activated a 16 member team from the Colorado National Guard to assist the WA National Guard's Fatality Search and Rescue Team
- National Guard activated an additional 50 soldier engineering company to assist the Guard's Search and Extraction Team.
- National Guard activates two 8-man decontamination teams.
- Geologists from DNR on-site to monitor the headscarp.

### March 31st

- Governor Inslee asks President Obama to issue a Major Disaster Declaration for Snohomish County, the Sauk-Suiattle, Stillaguamish and Tulalip Indian Tribes

# APRIL 2014

### April 1st

- WSDOT allocates $200k for needed transportation.
- Field assessment for broadened utility road

### April 2nd

- President Obama approves Governor's request for Major Disaster Declaration
- CA TF-USAR - 13 day activation. USAR Dog Team - 22 day activation. WA NG Mobile Med - 28 day activation.

### April 3rd

- FEMA Blue First - 20 day activation.
- WA NG Debris Management - 22 day activation.

### April 4th

- WA Department of Ag for the 1st time deployed reserve veterinary corps to provide for SAR dogs.
- 350 National Guardsmen were part of the 900 searches and support personnel throughout the response. Many of the 900 were local volunteers including loggers, contractors, and family members
- WA TF-1 USAR White - 20 day activation.

### April 7th

- Amphibious backhoes work 287 acres of flooded land.
- 30 excavators on slide. Hundreds search 40' x 40' (1/2 BB court): dogs and search teams comb surface, then excavators remove debris & mud to native soil.
- USACE begins construction of berm dewatering—berm completed 4/13; dewatering completed 4/18

### April 9th

- Geologists continue to measure & monitor slide stability.
- WA Team 3 type 2 - 15 day activation.

### April 14th

- State FEMA Joint Field office opens.
- Students return from break, use Seattle City Light utility access road.

### April 22nd

- President Obama tours slide area.
- US Department of Labor announces grant to WA economic security.

### April 23th

- Type III IMT re-activated to assist in preparing for the transition and demobilization of the official search and recovery efforts. That transition occurred the evening of Monday, April 28.

### April 24th

- Partnership announced with WA Dept. of Commerce, United Way & Hampton Mill - $300,000 to offset trucking costs.

### April 28th

- Formal victim recovery efforts end.
- Locals continue search.

# MAY - SEPTEMBER 2014

**May 1st**

Governor Inslee's request for additional FEMA support for SR 530 slide recovery efforts is approved by President Obama.

**May 6th**

Governor Inslee approves a $150,000 state economic recovery grant to aid tourism efforts in 530 slide area.

**May 31st**

WSDOT opens SR 530 to one-way traffic

**June 6th**

Darrington Fir Street project approved & funded.

**June 11th**

SEOC to Phase 1.

**June 20th**

FEMA, WSDOT, SNOCO reopen SR530 2-lane traffic. 90,000 cubic yards of debris removed. Highway elevated 10' to 20' in some places.

**June 30th**

Debris removal begins per SnoCo Executive John Lovick. Complete 9/12 10 days ahead of schedule. 200,000 cubic yards of materials processed, nearly 1,000 items recovered.

**July 14th**

Last victim discovered.

**September 27th**

- WSDOT permanently opens the newly reconstructed SR 530 to two-way traffic.
- Families of victims plant 43 trees in a small grove east of Steelhead Drive.

# Timeline Glossary

**Airlift 3** – National Guard helicopter

**Amphibious Backhoe** – A floating excavator.

**CA TF-US&R** – California Task Force Urban Search and Recovery

**Cloud Ceiling** –The cloud level under which the helicopters were operating.

**DEM** – Washington State Division of Emergency Management

**DOT** – Washington State Department of Transportation

**Extraction Litter** - Equipment used to carry and hoist survivors from the debris field.

**FEMA Blue First** – Federal Emergency Management Agency nomenclature for naming their management teams.

**FLIR** - Forward Looking Infrared Radar, a thermal imaging device used to look for survivors.

**High Bird Duties** – An aerial communications relay platform.

**Hot Spots** – Use of thermal imaging from helicopters to identify location of people on the ground.

**Naval Rescue 75** – NAS Whidbey SAR "Rescue 75": A helicopter rescue effort from the Naval Air Station on Whidbey Island.

**NWIMT** – Northwest Incident Management Team

**SAR** - Search and Rescue or Search and Recovery

**SEOC** – State Emergency Operations Center

**Smokey** - Name of Washington State Patrol helicopters, e.g. Smokey 4.

**SnoCo** –Snohomish County

**SnoHawk** – Name of Snohomish County helicopters; e.g. SnoHawk 1 and SnoHawk 10.

**SNOPAC 911 –** a regional public safety communications center that receives law enforcement, fire and medical 9-1-1 calls for 37 different Snohomish County jurisdictions.

**Thermal Grid Search** –Search using thermal imaging devices along with the grid of the area.

**USACE** - United States Army Corps of Engineers

**VHF** – Very High Frequency; a radio frequency.

**WA NG Debris Management** – Washington National Guard unit tasked with debris management.

**WA NG Mobile Med** – Washington National Guard Mobile Medical Unit

**WA TF-1 US&R (White)** – Washington Task Force One - Urban Search and Recovery Team.

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