

Section 12: Volcano Updates

Volcanic Activity Since 2002

Mount Hood

The strongest earthquake in the Mount Hood area in decades occurred on June 29, 2002. The magnitude 4.5 event, which was located about 4.5 km south of the summit at a depth of 6 km, was widely felt. Hundreds of aftershocks followed, including two >M3. Typically, several earthquake swarms occur each year at Mount Hood, with little or no damage. However, the activity is a reminder that this seemingly dormant volcano is indeed active.

Mt St. Helens

In September, 2004, Mount St. Helens began an eruptive period stemming from dome growth. On September 24th, 2004, the USGS sent out an Information Statement, indicating that earthquake swarms began occurring from 2 am to 5pm on Sept. 23rd. USGS upgraded the alert level to a Notification of Volcanic Unrest on 9-26-04 due to an increase in the magnitude of the earthquakes. Although earthquake activity continued at Mt St Helens, no new information was released by the CVO. Three days later, on Sept. 29th, the CVO upgraded the alert level to the second of three levels, "Volcano Advisory" because the largest earthquakes of the swarm are approaching Magnitude 2.5 and they are becoming more frequent.

On October 2nd, the volcano produced another blast of steam and ash, and had M3 EQ. The activity continued to escalate, as here were harmonic tremors felt at about 3:00 am on Oct. 3rd, indicating that there is magma flowing. This caused the USGS to raise the alert to level 3, which is the highest level of alert, and evacuate the Johnston Ridge Observatory and a five-mile radius. During the 9:30 am press event, the following day, another event occurred involving steam and ash.

Mount St. Helens continues to have activity, although it has decreased significantly in the past few months. The current volcanic alert level is a watch, as growth of the new lava dome inside the crater of Mount St. Helens continues, accompanied by low rates of seismicity, low emissions of steam and volcanic gases, and minor production of ash. During such eruptions, changes in the level of activity can occur over days to months. The eruption could intensify suddenly or with little warning and produce explosions that cause hazardous conditions within several miles of the crater and farther downwind. Small lahars could suddenly descend the Toutle River if triggered by heavy rain or by interaction of hot rocks with snow and ice. These lahars pose a negligible hazard below the Sediment Retention Structure (SRS) but could pose a hazard along the river channel upstream.

Three Sisters

March 24, 2004

On Tuesday, March 23, an ongoing swarm of small earthquakes began in the Three Sisters volcanic center in the central Oregon Cascade Range. The regional seismic network had detected approximately 100 earthquakes ranging in magnitude up to about 1.5. The rate of earthquakes peaked late March 23rd and appeared to be declining slowly. The earthquakes were occurring in the northeast part of an area centered 5 kilometers (3 miles) west of South Sister volcano in which the ground has been uplifted by as much as 25 cm (about 10 inches) since late 1997. On the basis of multiple lines of evidence, scientists infer that the cause of the uplift is the continuing intrusion of a modest volume of magma (molten rock).

The magma appeared to be accumulating at a depth of about 7 kilometers (4 miles) below the ground surface and, at the time, measured about 40 million cubic meters (about 50 million cubic yards) in volume. Until March 23rd, only a few earthquakes have accompanied this process, but scientists have expected that swarms of small earthquakes such as the present one would eventually accompany the uplift. The most likely cause of the earthquakes is small amounts of slippage on faults as the Earth's crust adjusts to the slow ground deformation of the past 7 years. Heat and gases related to the magmatic intrusion have probably caused increases in fluid pressure deep underground, which also helps to trigger minor faulting events.

September 13, 2005

Ongoing accumulation of a modest volume of magma at a depth of about 3 to 4 miles has caused the ground to rise a maximum of about 1 to 1.5 inch per year over a broad dome-shaped area. This area is about 10 miles in diameter and is centered 3 miles west of South Sister volcano. Annual field work includes sampling of spring waters, repair of seismic and GPS stations, and two types of surveys that measure ground deformation.

December 14, 2005

The area of uplift is about 12 miles (20 kilometers) in diameter and is centered 3 miles (5 kilometers) west of South Sister volcano. Seismic activity related to the uplift has been scant, except for a swarm of more than 300 small earthquakes in late March 2004. Volcanic gases released from the intruding magma dissolve in ground water so water in local springs and streams is slightly enriched in chemical components derived from volcanic gases.

April 11, 2007

Two continuously recording GPS receivers and annual field surveys during summer 2005 and 2006 confirm that over the past two years this rate has slowed somewhat. Leveling measurements indicate that the rate of vertical motion has slowed by about one-half, while GPS measurements also show that the rate of vertical motion has slowed, but not by as much. The uplift and extension are likely driven by intrusion of a modest volume of magma, or molten rock, at a depth of about 4 miles. Slowing of ground deformation implies a decrease in the rate of magma intrusion. In the past year, 7 small earthquakes were located in and near the area of uplift; maximum magnitude was 1.8.

Hazard Assessment Updates

Hazard Identification

Mapping: The USGS/Cascades Volcano Observatory (CVO) produced a volcanic hazard zonation report for Mount Hood in 1997 and 2000. The report includes a description of potential hazards that may occur to immediate communities. The hazard zones illustrated on Map 11 were determined based on the distance from the volcano, vent location, and type of hazardous events. The two Proximal zones show two potential eruptive scenarios. The zone shown in peach indicates failure of the vents on the north, east, or western flanks. The proximal hazard zone shown in purple is the more likely scenario, which is a failure of the lava dome, Crater Rock.

Geographic Extent: About 17% of total county acres are exposed to volcano hazards. These areas are centralized around potential failure areas in the proximal zone, as well as the Sandy and Hood River valleys in the distal zones. Only 5% of total county parcels are exposed, as the volcanic landscape generally does not lend itself well to development.

Frequency: Mt Hood is the presents the highest volcanic hazard to Clackamas County. This volcano has been relatively quiet, with about 1 major event every 100 years. However, Mt St. Helens could also affect Clackamas County from ashfall and indirect regional environmental and economic impacts. Mt St Helens has a frequency of about 6 events every 100 years.

Vulnerability & Risk Assessment

Risk to Life & Property: High

Proximal Hazard Zones 1 and 2 are areas subject to rapidly moving debris avalanches, pyroclastic flows, and lahars that can reach the hazard boundary in less than 30 minutes, as well as slow-moving lava flows. Areas within proximal hazard zones should be evacuated before an eruption begins because there is little time to get people out of harm's way once an eruption starts. Most pyroclastic flows, lava flows, and debris avalanches will stop within the proximal hazard zone, but lahars can travel much farther. Evacuation may prove problematic, as volcanoes are difficult to predict, and there is only one primary route (Hwy 26) off the mountain. In addition, Mt. Hood is a prime destination for tourists and recreators during all seasons. For these reasons, the threat to life is quite high.

Risk to Critical Facilities and Infrastructure: High

Distal Hazards Zones 3 includes areas adjacent to rivers that are pathways for lahars. Estimated travel time for lahars to reach these zones is more than 30 minutes, which may allow individuals time to move to higher ground and greater safety if given notice. Lahars could affect transportation corridors by damaging or destroying roads, and can damage Bull Run pipelines that cross the Sandy River. Although only one critical facility is exposed to the volcano hazard, the affect of lahars and pyroclastic flows and ashfall on equipment and infrastructure will be devastating.

Risk analysis is the third, and most advanced phase of a hazard assessment. It builds upon hazard identification and vulnerability assessments. Key factors included in assessing risk from volcanic eruptions and ash fall include population and property distribution in the hazard area at the time of eruption, the scale of the event, potential wind direction, and more. At the time of publication of this plan, data were insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available. building partnerships that will support the development of a flood risk analysis in Clackamas County.

Current Mitigation Activities

A National Volcano Early Warning System (NVEWS) is being formulated by the Consortium of U.S. Volcano Observatories (CUSVO) to establish a proactive, fully integrated, national-scale monitoring effort that ensures the most threatening volcanoes in the United States are properly monitored in advance of the onset of unrest and at levels commensurate with the threats posed. Volcanic threat is the combination of hazards (the destructive natural phenomena produced by a volcano) and exposure (people and property at risk from the hazards).

The Cascades Volcanic Observatory made a presentation at the Hoodland Area Response Team (HART) regular meeting in December, 2006. The presentation focused on hazards that can be expected from Mount Hood, and concluded with a discussion of appropriate mitigation and response activities.

The Mount Hood Coordination Plan was developed to coordinate the actions that various agencies must take to minimize the loss of life and damage to property before, during, and after hazardous geologic events at Mount Hood volcano. The plan strives to ensure timely and accurate dissemination of warnings and public information. The plan also includes the necessary legal authorities as well as statements of responsibility of County, State and Federal agencies.

Volcanic Eruption Mitigation Action Items

VE#1: Work with the state and other impacted jurisdictions to implement and update the Mount Hood Inter-Agency Coordination Plan.

Ideas for Implementation

1. Coordinate with local and regional groups to conduct exercises, plan evaluation and revisions.

Coordinating Organization: Clackamas County Emergency Management
Plan Goals Addressed: Public Awareness, Partnerships and Implementation, Emergency Services
Priority: Medium

VE#2: Collaborate with USGS-CVO and related agencies to develop ash fall models that are specific to Clackamas County.

Ideas for Implementation

1. Determine critical activities that must be implemented for varying degrees of ash fall; and
2. Work with the National Early Volcano Warning System collaborative group to better assess ash fall modeling and warning systems in Clackamas County.

Coordinating Organization: Clackamas County Emergency Management, Clackamas County Geographic Information Systems
Plan Goals Addressed: Public Awareness, Partnerships and Implementation, Protect Life and Property
Priority: Low

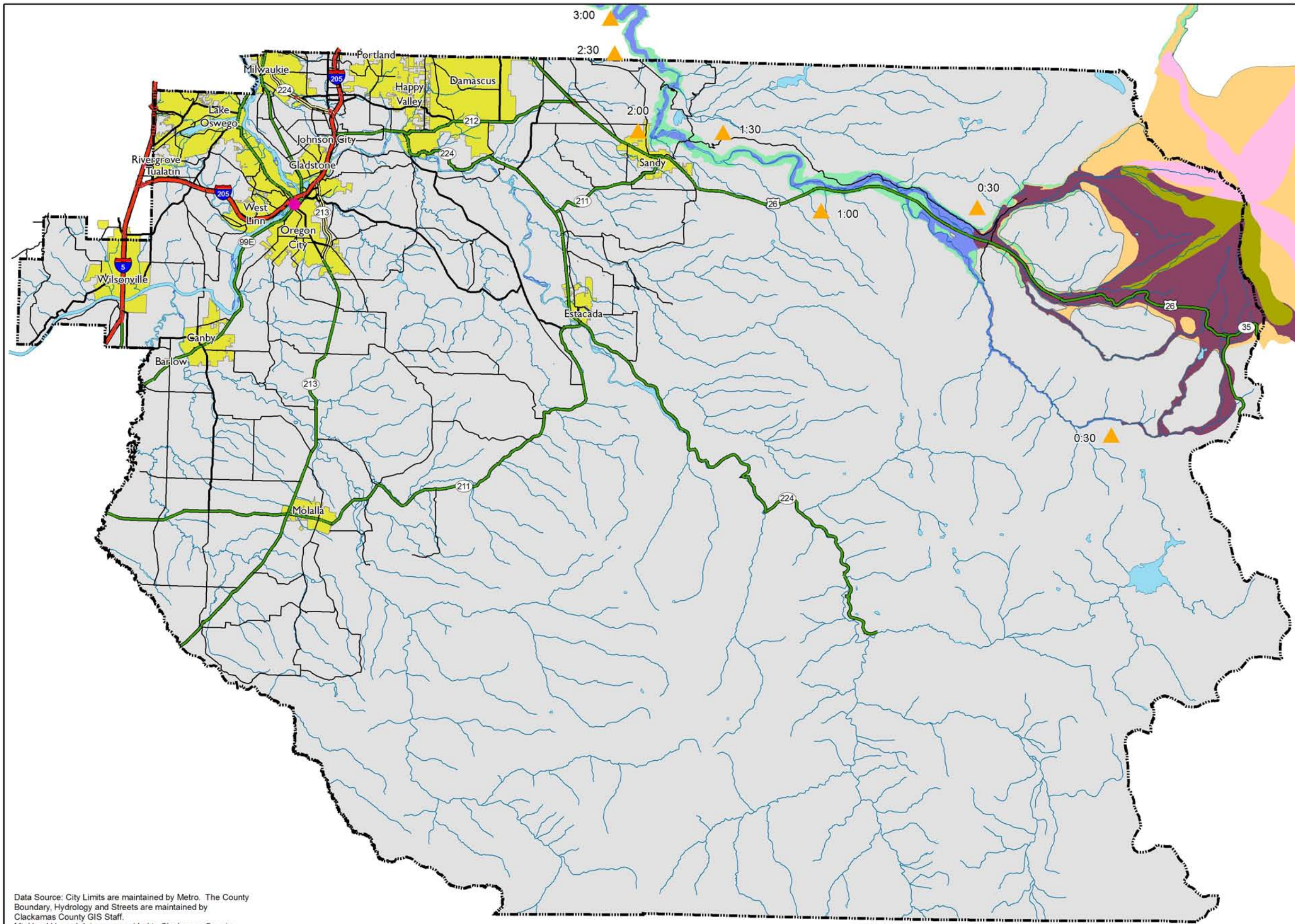
VE#3: Strengthen response and recovery programs, and develop and implement public education programs for volcanic eruption hazards.

Ideas for Implementation

1. Develop basic public education materials that describe volcanic eruption hazards (pyroclastic surges, pyroclastic flows, lahars, mudflows, landslides, ash fall), potential impacts, and appropriate response and mitigation activities;
2. Coordinate with the media for volcanic hazard education programs to reduce conveyance of misinformation;
3. Participate with eh NVEWS to develop a public education program for volcano hazards specific to Clackamas County; and
4. Work with active citizen groups to sustain volcanic hazards education programs.

Coordinating Organization: Clackamas County Emergency Management
Plan Goals Addressed: Protect Life and Property, Emergency Services Public Awareness, Partnerships and Implementation
Multi-Jurisdictional: Canby, Milwaukie, Lake Oswego, Gladstone, West Linn
Priority: Low

Map 11 Clackamas County Mt Hood Hazards



Proximal

- Zone 1: Vent at or near Crater Rock, which is considered the most likely case during future eruptions
- Zone 2: Vent on east, north, or west flank, or the summit.

Distal

- Zone 3: Major valleys that pyroclastic flows and lahars would follow from lava-dome collapses on the upper flanks or summit. As an eruptive episode progresses, one or more of these valleys might become filled with debris, so that pyroclastic flows and lahars could spill into adjacent valleys and affect a broader sector of zone one. Also, includes areas that are affected frequently by small lahars and debris avalanches generated by storms and rapid snowmelt.
- Area that may be affected by hazards as described above for zones 1 and 3.
- Area that may be affected by hazards as described above for zone 2 and 3.
- Area along Sandy River (and its tributaries) and White River that are subject to lahars generated by eruptions at vents located at or near Crater Rock and debris avalanches and related lahars generate from steep upper flanks on west and south side of Mt Hood.
- Areas along Sandy and Hood Rivers subject to inundation by a debris avalanche and lahar of approx. 500 million cubic meters, which is considered to be among the largest magnitude events possible at Mt Hood.
- Travel Time of Lahars Down River



GEOGRAPHIC INFORMATION SYSTEMS

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Data Source: City Limits are maintained by Metro. The County Boundary, Hydrology and Streets are maintained by Clackamas County GIS Staff. Mt. Hood Hazard data was provided to Clackamas County by the USGS.