

Severe Weather

Clackamas County experiences a range of weather-related hazards on an annual basis, such as severe heat, winter storms and wind storms. This section combines the above hazard sections from the previous two Mitigation Plans into a single Severe Weather section.

Causes and Characteristics of Severe Weather

Severe weather events occur throughout Oregon at all times of the year. Often originating in the Pacific Ocean, westerly winds pummel the coast, slowing as they cross the Coastal mountain range and head into the inland valleys.¹ Similarly, severe winter storms consisting of rain, freezing rain, ice, snow, cold temperatures, and wind originate from troughs of low pressure offshore in the Gulf of Alaska or in the central Pacific Ocean that ride along the jet stream during fall, winter, and early spring months.² In summer, the most common wind directions are from the west or northwest; in winter, they are from the south and east. Local topography, however, plays a major role in affecting wind direction. For example, the north-south orientation of the Willamette Valley channels the wind most of the time, causing predominately north and south winds.

CLIMATE CHANGE FACTORS

Oregon and the Pacific Northwest experience a variety of extreme weather incidents ranging from severe winter storms and floods to drought and dust storms, often resulting in morbidity and mortality among people living in the impacted regions. According to the Oregon Climate Change Research Institute, climate change is expected to increase the frequency and intensity of some weather incidents.³

Climate change poses risks for increased injuries, illnesses and deaths from both direct and indirect effects. Incidents of extreme weather (such as floods, droughts, severe storms, heat waves and fires) can directly affect human health as well as cause serious environmental and economic impacts. Indirect impacts can occur when climate change alters or disrupts natural systems.

SEVERE HEAT

Between 1979 and 2003, heat waves killed at least 8,015 Americans, according to the Centers for Disease Control and Prevention. That's more than hurricanes, lightning,

¹ US Department of Agriculture. <http://www.fsa.usda.gov/or/Notice/Flp104.pdf>

² Interagency Hazard Mitigation Team. 2000. State Hazard Mitigation Plan. Salem, OR: Oregon State Police – Office of Emergency Management

³ Oregon Climate Change Research Institute <http://occri.net/wp-content/uploads/2011/04/chapter9ocar.pdf> Page 412

tornadoes, floods and earthquakes combined. And it's largely an urban problem—the bulk of those deaths occur in cities.⁴

Severe Heat History

A severe heat episode or "heat wave" occurs about every two to three years and typically lasting two to three days, but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the average number of days we have temperatures greater than or equal to 90F and 100F. Listed below are climatological data for high temperatures in the Portland area. These are based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

Table SW-1: Average Annual High Heat Events

Temperature	Average Days/Year
>= 90F	13.6
>= 100F	1.4

Source: NWS Portland Weather Forecast Office

At the time of this report entry (August 2012), the Portland metro area had experienced two days exceeding 100F in 2012. The region's last severe heat episode was a five day event in July 2009. The five-day event delivered three consecutive days in excess of 100F and two days over 90F; high temperatures on July 28-29 of 2009 were recorded at 106F each day. The most recent event prior to the 2009 event occurred in July 2006.

Urban Heat Island Effect

Cities are more vulnerable to heat waves because that's where more people are concentrated but also because there is less vegetation to permit evaporation, cars and factories give off heat, and the proximity of asphalt roads and buildings store and radiate heat. On a hot summer day, urban areas can be 5°F to 18°F hotter than surrounding rural areas which is enough to turn a heat wave into a serious health crisis.⁵

Mitigation Actions to reduce the urban heat island effect include:

1. Planting appropriate trees to provide shade and passive cooling of buildings and to provide local cooling through evaporation.
2. Improving the reflective surfaces of urban roof tops to bounce light (heat) rather than absorbing it. Ideally, solar panel arrays could absorb sunlight and shade the

⁴ U.S. Centers for Disease Control and Prevention
http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp

⁵ [Study: Many U.S. Cities Unprepared for Future Heat Waves](#) (*Washington Post: Ezra Klein's Wonk Blog*)

roof tops from storing heat, while also providing a source of energy for the internal powering of fans, or air conditioning and diminish the draw on local and regional power demands at peak use periods.

Community Vulnerability

Very high temperatures can create serious health problems. Pets are also affected by the higher temperatures. “Prevention is the best defense,” said Mel Kohn, M.D., M.P.H., director of Oregon Public Health. “Drinking plenty of water, staying out of the sun during the hottest part of the day, knowing the warning signs of heat-related illness and taking precautions when swimming are a few important steps people can take.” Kohn added: “We have had hot weather in the past, but with the climate change we are likely to have more high temperature days in Oregon.”⁶

A significant percentage of the population does not have air conditioning, so once temperatures get into the 90s, it is quite uncomfortable. If a hot weather pattern persists for a few days, the situation gets worse because of the number of days in sequence. Reports show that heat-health related problems really increase once you get multiple days in a row of very hot weather. Oregon Public Health officials remind people to take precautions to avoid getting sick from extreme heat and be careful when swimming in Oregon’s lakes, streams and the ocean.

The first symptoms of health problems from the heat can include headache, dizziness and weakness. In extreme cases heat-related illness can cause convulsions and sudden loss of consciousness and can be fatal. Those at greatest risk for heat-related illness include infants and children up to 4 years of age, people 65 and older, people who are overweight, and people who are ill or on certain medications, as well as those who work outdoors.

Climate Change factor

Predicted average increases in summer temperatures will make heat waves a greater likelihood. Without mitigation, increased numbers of extreme heat events will likely result in additional heat-related morbidity and mortality, especially among vulnerable populations, such as the elderly, low income populations, pregnant women and those who work in outdoor occupations.⁷

WINTER STORMS

Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They often originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the Clackamas County typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.⁸

⁶ Oregon Health Authority <http://cms.oregon.gov/DHS/news/2010news/2010-0813.pdf>

⁷ Oregon Climate Change Research Institute <http://occri.net/wp-content/uploads/2011/04/chapter9ocar.pdf> Page 408.

⁸ Interagency Hazard Mitigation Team. 2000. State Hazard Mitigation Plan. Salem, OR: Oregon State Police – Office of Emergency Management

Winter Storm History

The County received a FEMA Disaster Declaration for an extended severe winter weather event from December 22 through December 28, 2008, when Clackamas County (and Oregon in general) experienced heavy snow accumulations, ice, and sustained freezing temperatures that caused extensive property damage. Transportation networks were significantly affected, as major freeways, railways, and the Portland International Airport were periodically closed.

Downed trees disrupted power to several portions of the county, leaving many residents without heat or water for several days. Residential care facilities, home-bound ill personnel requiring daily treatment, hospital patients, and anyone requiring emergency assistance was affected by this winter storm because obstructed roadways prevented emergency vehicle movement. The damage to fire stations, equipment, roads, and other infrastructure affected the ability to effectively respond, as well as reducing the operating budgets of these facilities.



Car covered in ice, 2004

Source: Clackamas County
Emergency Management

Hazard Identification

MAPPING:

The County does not have adequate data for mapping the winter storm hazards, as Climatic hazards are difficult to portray geographically.

GEOGRAPHIC EXTENT:

Winter storm events can occur countywide. The primary effects of winter storms are on road and power systems, which cause widespread transportation disruption and prolonged power outages over widespread areas.

FREQUENCY:

According to historical records, there have been an estimated 16 severe winter storm events in the past 100 years, which is about one every six years.

Vulnerability Assessment

RISK TO LIFE & PROPERTY: MODERATE TO HIGH

Winter storms are deceptive killers. Many of the deaths that occur are indirectly related to the actual storm, including deaths resulting from traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold.

RISK TO CRITICAL FACILITIES AND INFRASTRUCTURE: MODERATE TO HIGH

Trees, power lines, telephone lines, and television and radio antennas can be impacted by ice, wind, snow, and falling trees and limbs. Delay in emergency personnel response may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls.

Risk Assessment

Factors that should be included in a winter storm risk analysis include: population and property distribution in the hazard area; the frequency of winter storm events; and information on the types of trees and failure rates most susceptible to severe storm events as well as and information on utilities, and infrastructure that may be impacted by severe winter storms. Modeling software is required to predict potential losses from a particular storm event.

Due to insufficient data and modeling capability, Clackamas County is unable to perform a quantitative severe storm risk assessment at this time. The County has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

WINDSTORMS

Damaging windstorms are not uncommon in the Pacific Northwest. When a strong windstorm strikes a community, it leaves behind a distinctive trail. Trees toppled over on buildings and cars, downed power lines crisscrossing the roads, and widespread power outages are a few of the signs that a windstorm has struck. After such an event, it can take communities days, weeks, or longer to return to normal activities. In addition to costly structural damages, windstorms can cause injury or even death.

Windstorms History

The most destructive windstorm ever recorded in Oregon, in terms of loss of life and property damage, was the Columbus Day storm of 1962. Damage was most severe in the Willamette Valley.⁹ The storm killed thirty-eight people and did upwards of \$200 million in damage (over \$800 million in today's dollars).¹⁰ Hundreds of thousands of homes were without power for short periods of time, while others were without power for two to three weeks. More than 50,000 homes were seriously damaged, and nearly 100 were completely destroyed. The storm destroyed fruit and nut orchards and killed scores of livestock. Intense wind speeds were recorded in the metropolitan areas with gusts of 116 mph on Portland's Morrison Bridge.

More recently, Clackamas County experienced several high wind events during the past five years since the October 2007 Hazard Mitigation Plan Update. A regional storm in early December 2007 that required a federal disaster declaration along the Oregon Coast brought high winds and heavy rain to the County.

⁹ National Weather Service, Portland Bureau, (February 2002) <http://www.wrh.noaa.gov/Portland>.

¹⁰ Ibid

On March 13, 2011, 50 mph winds with 70 mph gusts brought trees down in numerous areas of the County and left power out for tens of thousands of residents. Damages were concentrated in the eastern half of the County along in communities like Molalla and Estacada in the Cascade foothills.

Since 2007 the National Weather Service reports three tornadoes that have touched down in or near Clackamas County: On January 10, 2008 an EF1 tornado touched down in Vancouver, Washington causing considerable damage; October 26, 2009 an EF0 tornado touched down near Oregon City causing damage to many houses; and on December 14, 2010 a damaging EF2 tornado struck in the City of Aumsville in Marion County not far from the southern border of Clackamas County.



Windstorm damage – March 13, 2011

Source: Clackamas County Emergency Management

Hazard Identification

MAPPING:

The County does not have adequate data for mapping the windstorm hazards, as Climatic hazards are difficult to portray geographically.

GEOGRAPHIC EXTENT:

Windstorms occur countywide. The primary effects of windstorms are on road and power systems, which cause widespread transportation issues and prolonged power outages.

FREQUENCY:

According to historical records, there have been an estimated six major windstorm events in the past 100 years, which is about one every 16-17 years.

Vulnerability Assessment

RISK TO LIFE AND PROPERTY: MODERATE

The major risk to property results from exposed utilities, especially power lines and water pipes that are damaged by wind, broken tree limbs. Businesses also suffer economic losses when they must close as the result of the inclement weather and/or the loss of power, which, in turn, disrupts the local supply chain of goods and services. When transportation

routes are impassable, emergency response services are hindered and the mobility of residents is limited, which could result in serious life safety issues.

Tornadoes and can cause significant property damage and pose a risk for injuries and loss of life. They can also require need to shelter and care for individuals impacted by the events. Although the majority of windstorm events in Clackamas County likely will not be as sudden and severe as tornados, it is important to consider the potential effects of these events on life and property because there is the potential for significant windstorms in Clackamas County.

RISK TO CRITICAL FACILITIES AND INFRASTRUCTURE: MODERATE

Windstorms can cause power outages, transportation, and economic disruptions, roof or building component failures and considerable structural damage. Trees, power lines, telephone lines, and television and radio antennas can be impacted by wind, falling trees and limbs. Delay in emergency personnel response may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls.

Risk Assessment

Factors that should be included in a windstorm risk analysis include: population and property distribution in the hazard area; the frequency of windstorm events; and information on the types of trees and failure rates most susceptible to severe windstorm events as well as and information on utilities, and infrastructure that may be impacted by windstorms. These inputs can be used in modeling software such as Multi-Hazard HAZUS to predict potential losses from a particular storm event.

Due to insufficient data and modeling capability, Clackamas County is unable to perform a quantitative severe storm risk assessment at this time. The County has addressed this issue in the action items, and will be completing a risk assessment as data and resources become available.

Severe Weather Mitigation Action Items

The following severe weather actions have been identified by the Clackamas County NHMP steering committee, and are recommended for mitigating the potential effects of severe weather in Clackamas County. Refer to the individual city addenda for city specific severe weather actions. Appendix A provides a full list of county mitigation action item worksheets.

SW#1:

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