

## Natural Hazard Mitigation Plan

Produced By:



Douglas County Planning Dept.

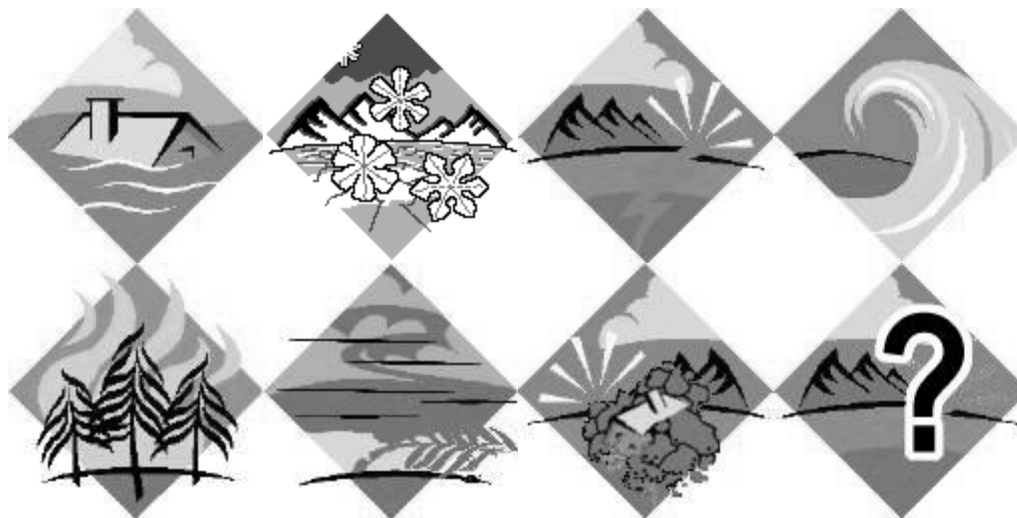


Oregon Natural Hazards Workgroup



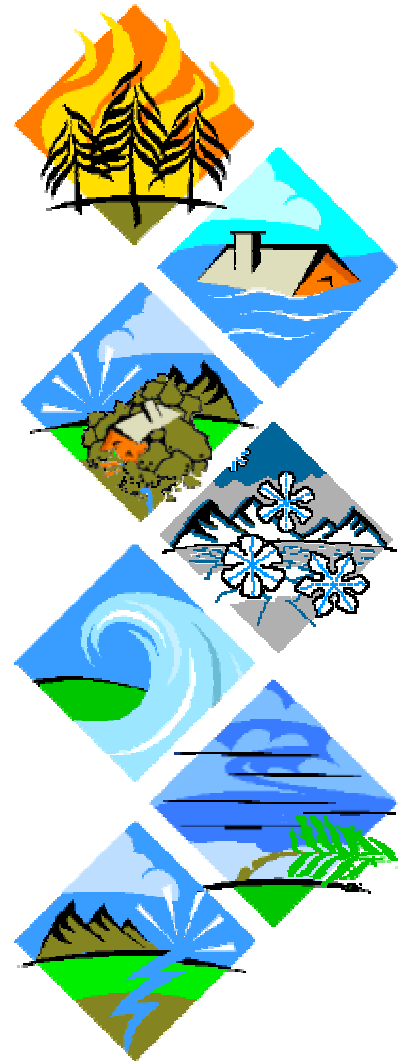
Douglas County Emergency Management

### Introduction and Appendices



# Douglas County

## Natural Hazard Mitigation Plan



**Produced in 2003 By:**

Douglas County Emergency Management

Douglas County Planning Department

Produced With The Assistance of  
The Oregon Natural Hazards Workgroup

# Douglas County

## Natural Hazards Mitigation Plan

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Sharon Loper	FEMA Region X
Dennis Sigrist	Oregon Emergency Management

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Plan Created With the Assistance of The Oregon Natural Hazards Workgroup

## Future Partners

The Douglas County Natural Hazard Mitigation Plan was created to include all unincorporated areas of Douglas County. We would like to address the incorporated areas of Douglas County in this plan as “Future Partners” of the Natural Hazard Mitigation Plan.

It is our intention and hope that the Cities and Special Districts of Douglas County can use this document as a template and guide to assist them in the creation of Natural Hazard Mitigation Plans that identify their own natural hazard vulnerabilities, risk assessments and action item mitigation strategies and measures.

Appendix E of this document is a template that Douglas County Cities can use, based on this Natural Hazard Mitigation Plan, to more efficiently create and adopt individual Natural Hazard Mitigation Plans.

As Natural Hazard Mitigation Plans for the Cities and Districts (where necessary) become available, we will include those with this plan as addenda.

## DOUGLAS COUNTY CITIES

<b>City of Canyonville</b>	<b>City of Glendale</b>	<b>City of Reedsport</b>	<b>City of Sutherlin</b>
<b>City of Drain</b>	<b>City of Myrtle Creek</b>	<b>City of Riddle</b>	<b>City of Winston</b>
<b>City of Elkton</b>	<b>City of Oakland</b>	<b>City of Roseburg</b>	<b>City of Yoncalla</b>

## DOUGLAS COUNTY SPECIAL DISTRICTS

Azalea RFPD	Myrtle Creek Rural Fire District	Sutherlin Water Control District
Camas Valley RFPD	North Douglas County Rural Fire & EMS	Tenmile RFPD
Camas Valley School District 21j	North Douglas Park & Recreation District	Tiller RFPD
Days Creek RFPD	North Douglas School District #22	Tri City Water District
Douglas County Fire Dist. #2	Oakland School District	Tri City Sanitation District
Douglas Soil & Water Conservation District	Oakland Rural Fire District	Umpqua Soil & Water Conservation District
Elkton School District #34	Reedsport School District	Union Gap Water District
Fair Oaks RFPD	Riddle School District	Union Gap Sanitation District
Gardiner RFPD	Riddle Municipal & Rural Fire District	Winchester Bay RFPD
Gardiner Sanitary	Roberts Creek Water	Winchester Bay Sanitary
Glendale School District #77	Roseburg School District # 4	Winchester Water Control District
Glendale Rural Fire District	Scottsburg RFPD	Winston-Dillard Rural Fire District #5
Glide RFPD	South Umpqua School District #19	Winston Dillard School District # 116
Glide School District	South Western Oregon Community College	Winston Dillard Water District
Green Sanitary	Sutherlin Recreation District	Yoncalla Park & Recreation District
Lookingglass RFPD	Sutherlin School District #130	



# Douglas County

## Natural Hazards Mitigation Plan

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### Table of Contents

#### **Division One: Plan Process, Organization and Information**

##### Section 1: Douglas County Natural Hazard Mitigation Plan Introduction and Planning Process

Introduction.....	page 1
Planning Process.....	page 2
Plan Maintenance.....	page 4
Plan Adoption.....	page 5
Action Item Prioritization.....	page 6

##### Section 2: Douglas County Community Profile

#### **Division Two: Hazard Specific Information**

##### Section 3: Flooding

##### Section 4: Severe Winter Storms

##### Section 5: Earthquake

##### Section 6: Tsunami

##### Section 7: Windstorm

##### Section 8: Wildfire

##### Section 9: Landslide

##### Section 10: Multi Hazard Action Items and "Acts of God"

#### **Division Three: Resources**

Appendix A: Hazard Analysis For Douglas County Oregon

Appendix B: Natural Hazard Mitigation Plan Development Timeline

Appendix C: Hazard Specific Agency Contact Information

Appendix D: Household Natural Hazards Preparedness Survey and Focus Group Report for Douglas County

Appendix E: Natural Hazard Mitigation Plan Template for use by incorporated Cities and Special Districts in Douglas County.

## **Section 1:**

# **Douglas County Natural Hazard Mitigation Plan Introduction and Planning Process**

## **What Is Hazard Mitigation?**

Hazard mitigation refers to long-term or permanent measures to reduce disaster damages through avoiding hazard risk or reducing the vulnerability. By reducing potential damages, communities increase their safety and economic stability.

For existing development, examples of hazard mitigation activities include retrofitting schools to increase their ability to withstand earthquakes, or elevating homes above the 100-year flood level. For new development, hazard mitigation would include identifying high hazard areas prior to building site selection, thus providing a safer building site location.

## **Why Develop a Mitigation Plan?**

This mitigation plan seeks to provide resources, information and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout unincorporated areas of Douglas County. The Natural Hazard Mitigation Plan provides a set of action items to reduce risk from natural hazards through education, outreach activities, and the enhancement of partnerships, which then can decide how to implement measures that would lessen a disaster's impact in Douglas County.

The resources and information within the mitigation plan establish a foundation for the following:

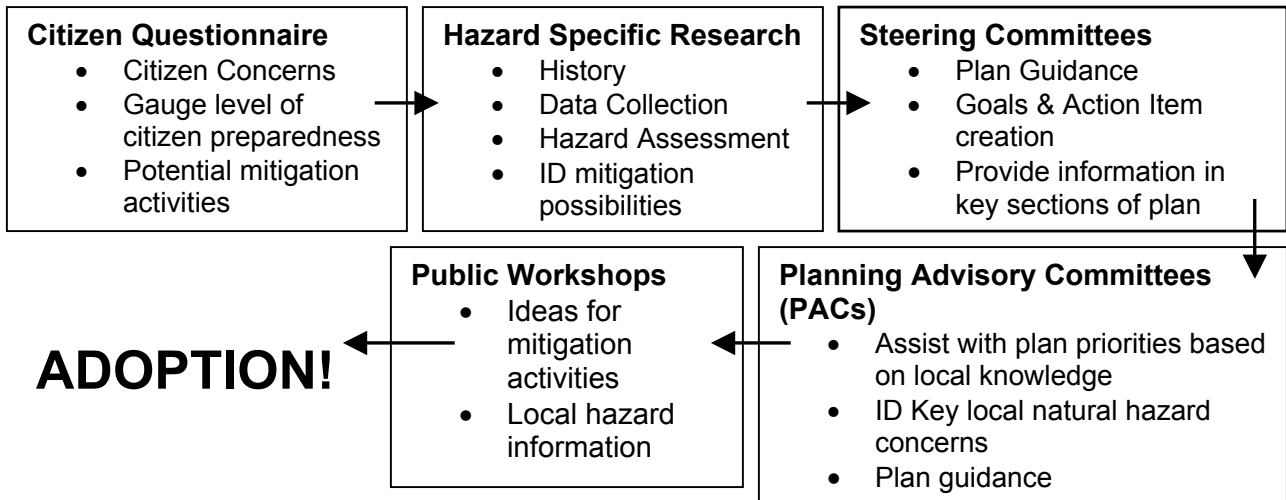
- Coordination and collaboration among agencies and the public in Douglas County
- Identification of specific vulnerabilities and possible future mitigation actions
- Assistance to communities seeking to qualify for federal disaster assistance programs
- Provides new and updated information for reviewing Douglas County Comprehensive Plan and Emergency Operation Plans
- New natural hazard mitigation strategies

## **Who Will Benefit From This Mitigation Plan?**

All unincorporated areas within the County, including all rural unincorporated communities, and special districts have an opportunity to benefit from The Natural Hazard Mitigation Plan.

# Planning Process

Figure 1-1. Douglas County's Natural Hazard Mitigation Plan Process



## Citizen Questionnaire

In January 2003, Douglas County with the assistance of the Oregon Natural Hazards Workgroup sent out a natural hazard survey letter to Douglas County residences. The survey letter provided citizens with an opportunity to share opinions about preparing for and reducing their risk to natural disasters. The information gathered in these surveys will show citizen concerns and issues.

1500 survey letters were sent to Douglas County Residents at random, of these 228 were returned (15%). A fair number of returned surveys expressed interest in future public workshops and being involved in hazard mitigation planning education outreach.

## Hazard Specific Research

The Douglas County Planning Department has collected data, compiled previously, on natural hazards specific to Douglas County. The hazards include: flood, landslide, severe winter storm, windstorm, wildfire, earthquake, and tsunami. Research included materials from previously published information from the Douglas County Planning Department, Douglas County Emergency Management, and various State and Federal agencies. Current mitigation activities, resources, programs and specific short and long-term action items are also listed in each section.

## Natural Hazard Mitigation Plan Steering Committees

Two Natural hazard mitigation plan steering committees were formed to help guide the development of the mitigation plan. The reasoning behind the two-committee approach is the differences in geography, natural hazard type, occurrence and magnitude of natural hazards between Coastal Douglas County and Central Douglas County.

Examples of the differences are: higher seismic zone rating for the Coastal area, and tsunami danger at the Coast. The two committees will hold a total of seven members.

Both Steering Committees role is in developing the mission, goals and action items for the mitigation plan.

### Central County Steering

**Committee:** Comprised of six members representing various agencies and organizations in Central Douglas County, including

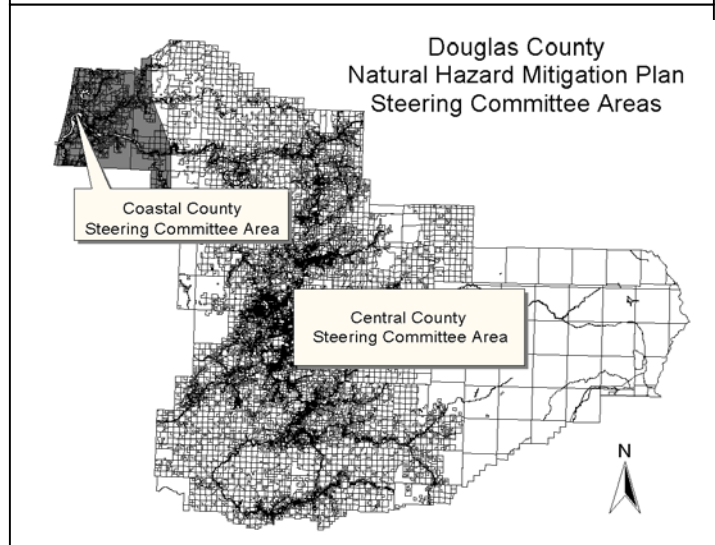
- Douglas County Emergency Management
- Umpqua Regional Council of Governments (coordinating with small incorporated communities in Douglas County)
- Oregon Emergency Management Representative
- Douglas County Fire District #2
- Douglas Electric Coop (representing infrastructure and the private sector)
- Douglas County Planning Department
- Oregon Natural Hazards Workgroup

**Coastal County Steering Committee:** The Coastal Steering Committee was formed to address coast-specific natural hazards such as tsunami and increased earthquake danger. The Coastal Steering committee was formed by using the pre-existing Coastal Planning Advisory Committee. The committee members represent a cross section of residents from Coastal Douglas County, with varying backgrounds.

## Planning Advisory Committees

Oregon Statewide Planning Goal 1 requires that all cities and counties develop a program, which “Insures the opportunity for citizens to be involved in all phases of the planning process”. Douglas County’s Citizen Involvement Program is the mechanism in which citizens in Douglas County can participate in Douglas County’s land use process.

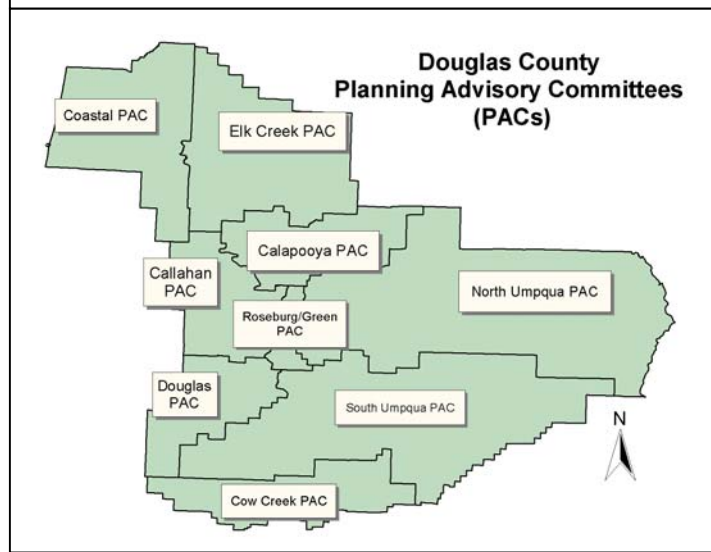
**Figure 1-2 Douglas County Natural Hazard Steering Committee Areas**





The Douglas County Citizen Involvement Program is organized into nine Planning Advisory Committee (PAC) areas. (Figure 1-3) The County Commissioners appoint 5 to 9 residents from each PAC area to serve as an advisory committee to the Planning Department. PAC Members generously give of their own personal time to review and make recommendations on land use applications. The hands-on, local knowledge obtained from PAC members and citizens who participate in the PAC Meetings is important in the development of the Natural Hazard Mitigation Plan.

**Figure 1-3 Douglas County PACs**



It is the goal of the Planning Department to have at least one PAC meeting in each area, in addition to the Steering Committee and Public Meetings. Throughout 2003, as the Natural Hazard Mitigation Plan is developed, The Plan will be an item on each Planning Advisory Committee’s agenda at their meetings. Staff will seek input on the Natural Hazard Mitigation Plan and update the PAC on the progress of the plan. We anticipate at least one meeting for each PAC. These meetings are by public notice and the general public is invited to attend.

## **Public Workshops**

In addition to the PAC meetings and Steering Committee meetings, three public workshops will be facilitated in 2003 to inform the public on Douglas County Natural Hazards. The public meetings will gather comments and ideas from the citizens of Douglas County about natural hazard mitigation planning. Two workshops will be held in Central Douglas County, and one in Coastal Douglas County.

## **Plan Maintenance**

Maintenance of this document will ensure that the Douglas County Natural Hazard Mitigation Plan remains an active and relevant document. The maintenance process will evaluate the Plan and produce a plan revision every five years. The county will integrate public participation throughout the plan maintenance process through the Planning Advisory Committees. The Douglas County Planning Department may choose to incorporate some of the mitigation strategies outlined in this Plan into other documents such as Douglas County’s Comprehensive Plan.

## Plan Adoption

The Douglas County Board of Commissioners are the decision-making authority for adopting, by resolution, the Douglas County Natural Hazard Mitigation Plan. The Board of Commissioner's have the authority to promote sound public policy regarding natural hazards. Once the plan has been adopted by resolution, the County Emergency Manager, and the Planning Director will be responsible for submitting it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. The Plan is required to be reviewed by FEMA and approved, prior to adoption of a resolution by the Board of Commissioners. Upon approval by FEMA, Douglas County will gain eligibility for Hazard Mitigation Grant Program funds.

## Monitoring and Implementing the Plan

### Natural Hazard Mitigation Plan Action Items

The mitigation plan identifies action items developed through data collection and research, and the public participation process. Mitigation plan activities may be considered for funding through federal and state grant programs, and when other funds are made available through the county. Action items address hazard specific issues and multi-hazard action items that could mitigate for several hazards. To help ensure activity implementation, each action item includes information on the timeline and coordinating organizations. Upon implementation, the coordinating organizations may look to partner organizations for resources and technical assistance.

- **Coordinating Organization.** The coordinating organization is the organization that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs.
- **Timeline.** Each action item includes an estimate of the timeline for implementation.
- **Ideas for Implementation.** Each action item includes ideas for implementation and potential resources, which may include grant programs or human resources.
- **Plan Goals Addressed.** The plan goals addressed by each action item are included as a way to monitor and evaluate how well the mitigation plan is achieving its goals once implementation begins.

## **Action Item Prioritization**

The Natural Hazard Mitigation Plan Steering Committees have prioritized the Action Items for each identified natural hazard in the plan. The prioritization of Action Items has ranked the action items with the greatest opportunity of providing mitigation success and achieving plan goals.

Although this prioritization provides a guide for Douglas County natural hazard mitigation implementation, Douglas County has the option to implement **any** of the action items at any time. This option to consider all action items for implementation allows Douglas County to consider mitigation strategies as new situations arise, such as capitalizing on funding sources that could pertain to an action item that is not the highest priority.

## **Plan Adoption**

The Douglas County Board of Commissioners has the authority to adopt this plan by resolution. The Board of Commissioner's have the authority to promote sound public policy regarding natural hazards. Once the plan has reached final draft, the County Emergency Manager, and the Planning Director will be responsible to submit it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. The Plan is required to be reviewed by FEMA and approved, prior to adoption of a resolution by the Board of Commissioners. Upon approval by FEMA, Douglas County will gain eligibility for Hazard Mitigation Grant Program funds.

## **Implementation**

Douglas County addresses statewide planning goals and legislative requirements through its Comprehensive Plan. The Natural Hazard Mitigation Plan provides a series of recommendations – many of which are closely related to the goals and objectives of existing planning programs. The Douglas County Planning Department will have the opportunity to implement recommended mitigation action items through existing planning program.

The Douglas County Natural Hazard Mitigation Plan can also be co-adopted by cities and Special Districts. Cities and Special Districts can adopt the Douglas County Plan and customize it to meet their own vulnerabilities and hazard mitigation needs. The goals and action items developed in the Plan will help local governments, Special Districts as well as Douglas County to address natural hazards. After completing and adopting their plans using the Douglas County Plan as a guide, their Natural Hazard Mitigation Plans would be adopted as addenda to the Douglas County Natural Hazard Mitigation Plan.

This Document and Statewide Planning Goal 7 will assist communities in protecting life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards. Goal

7 requires local governments to mitigate development in known areas of natural disasters and hazards.

## **Economic Analysis of Mitigation Projects**

The Federal Emergency Management Agency's accepted methods for determining the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, Douglas County will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, Douglas County may use other approaches to understand the costs and benefits of each action item and develop a prioritized list.

Based on funding and extent of mitigation, the higher priority mitigation activities would be selected from this prioritization list. Based upon funding opportunities, Douglas County has the option to implement action items as funding becomes available, in order to assure mitigation funding is best spent, and the greatest mitigation happens, using cost/benefit analysis as a primary decision-making tool will aid the County in selecting the best possible mitigation strategy.

## **Plan Evaluation**

The Douglas County Natural Hazards Mitigation Plan will be evaluated on an annual basis to determine opportunities for making the Plan more effective and also to reflect changes that may affect mitigation priorities. Planning Department will be responsible for contacting the Hazard Mitigation Steering Committee, or Planning Advisory Committee members and organizing a meeting.

Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan. The committees will review the goals and action items to determine their relevance to changing situations in the county, as well as changes in State or Federal policy, and to ensure they are addressing current and expected conditions. The committees will also review the risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The organizations responsible for the various action items will have the opportunity to report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination

efforts, and which strategies should be revised.

The Planning Department will update the plan every five years. The Planning Department will also notify all holders of the Natural Hazard Mitigation Plan when changes have been made. Every five years the updated plan will be submitted to the State Hazard Mitigation Officer and the Federal Emergency Management Agency for review.

### **Continued Public Involvement**

Douglas County is dedicated to involving the public directly in review and updates of the Natural Hazard Mitigation Plan. The Natural Hazard Mitigation Plan Steering Committee, and Planning Advisory Committee members are responsible for participating in the annual review of the plan.

A public meeting will be held for each annual evaluation when deemed necessary by the Douglas County Planning Department. The meetings will provide a public forum for expressing concerns, opinions, or ideas about the Plan. The Planning Department will be responsible for publicizing public meetings and maintaining public involvement.

## **Section 2:**

# **Douglas County Community Profile**

## **Why Plan for Natural Hazards in Douglas County?**

Natural hazards impact citizens, property, the environment, and the economy of Douglas County. Historically, natural hazards such as flooding have exposed Douglas County residents and businesses to the financial and emotional challenges of recovering after natural disasters. The risk associated with natural hazards increases as more people move to areas affected by natural hazards. The inevitability of natural hazards, combined with a growing population creates a need to develop strategies, coordinate resources, and increase public awareness about natural hazards. Identifying risks posed by natural hazards, and developing strategies to reduce the impact of a hazard event, protect life and property. Douglas County residents and businesses can work together with local, state and federal agencies to create an effective natural hazard mitigation plan.

## **Geography and the Environment**

Douglas County is located in Southwest Oregon and covers an area of 5,071 square miles. The County extends from sea level to 9,182-foot Mount Thielsen in the Cascade Range. The entire Umpqua Watershed is within Douglas County, which contains nearly 2.8 million acres of forest lands.

Over 50% of the land area in Douglas County is owned by the federal government. The US Forest Service and the Bureau of Land Management manage these lands.

There are 12 incorporated cities within Douglas County: Canyonville, Drain, Elkton, Glendale, Myrtle Creek, Oakland, Reedsport, Riddle, Roseburg, Sutherlin, Winston, and Yoncalla.

Douglas County is comprised of four geologic provinces, three of which converge near the center of the County.

The Klamath Mountains Province occupies south central Douglas County. It is the oldest geological province in the County, which was created through volcanic activity, and sedimentary formations of sandstone, siltstone and mudstone. Mountains in the Klamath Province are rugged and rise to an elevation of nearly 4,100 feet. The mountains are steep with a valley floor of about 400 feet.

The Coast Range Province contains rugged mountains rising to an elevation of 3,000 feet. The valleys in this Province are fertile, with an elevation of about 300 feet above sea level. Sea level is the lowest point in this province, which encompasses the northwestern portion of Douglas County, to the Pacific Ocean. Rocks of the Coast Range province are typically igneous and sandstone.

The Western Cascade Province is the third oldest in the county. Here igneous rocks were made from material squeezed and flung in volcanic activity. Narrow “V” shaped valleys are a common natural feature in this region. Elevations in the Western Cascade region top 6,000 feet.

The high Cascade Province is the youngest in the county. This region was formed by volcanic activity. Rocks are much less weathered in this province. Mount Thielsen (9,182 feet) is the most obvious formation in this province.

### **Rivers**

Within the boundary of Douglas County lies the entire Umpqua River drainage basin. The basin covers an area of approximately 4,560 square miles. This is unique for a county boundary to entirely encompass a major river watershed.

The Umpqua Basin has ten major streams. All ten flow into the main Umpqua River, which meanders westward and joins the Pacific Ocean near Reedsport. From the confluence of the North and South Umpqua Rivers near Roseburg, the Umpqua

River flows 111 miles. The North Umpqua, from its headwaters at Maidu Lake, flows 106 miles, while the South Umpqua River flows roughly 104 miles from the headwaters of Castle Rock Creek. The other major tributaries include Cow Creek, Elk Creek, Calapooya Creek, Little River, Lookingglass Creek, Deer Creek and Smith River.

Stream gradients in the basin vary greatly. The North Umpqua River has an average gradient of 86 feet per mile. The South Umpqua to Cow Creek has a relatively flat average gradient of 6 feet per mile, increasing to an average gradient of 42.5 feet per mile near Castle Rock Creek. On the Mainstem Umpqua, there is a gentle average gradient of 4-4 1/2 feet per mile from the confluence of the North and South Umpqua Rivers to tidewater at Scottsburg.

## **Climate**

In the Umpqua Valley, moisture-laden breezes from the Pacific Ocean set the pace for seasonal temperatures and rainfall. These breezes blow over the Coast Range, through the inland valleys, and up to the Cascade Mountains, creating three distinct climatic areas. The coastal areas have the most moderate seasons. The inland valleys experience the hottest summer sun, while the Cascades witness the most extreme winter temperatures. In all three areas, however, the prevailing westerly winds cool the heat of summer and warm the chill of winter.

The ocean winds lose some of their velocity, and much of their moisture as they climb the Coast Range and enter the inland valleys. Coastal Douglas County receives the most rainfall, reporting 80 inches per year at Reedsport, and over 100 inches per year in the Coast Range. In summer the average countywide temperature ranges between 52 and 70 degrees Fahrenheit. In winter the average temperature does not drop below 37 degrees Fahrenheit. This temperature climate is due, in part, to the ocean winds that flow onshore.

The protected inland valleys have some of the lowest wind velocities in the United States. Here rainfall averages 35 inches annually. This moderate climate is marked with comfortable winters and temperate summers. Days without frost generally occur between April and October. The first hard frost usually does not arrive until December.

As ocean winds climb up the western face of the High Cascade Range they bring relatively warm days, except in winter when they bring cool and wet weather. Winter temperatures are the most extreme at high elevations. Rainfall increases to 70 inches annually. Snow is common at elevations above 2,500 feet.

## **Minerals and Soils**

The soils present in Douglas County are the acidic and leached products of weathering in a moist temperate climate under coniferous cover. Upland soils in Douglas County are characterized by variable thickness, moderate to rapid runoff, and moderate to extreme erosion hazard. Terrace soils have slow to moderate runoff and slight to high erosion potential depending on the steepness of slope. Lowland soils in the Umpqua



Valley are the products of ongoing deposition. These deep alluvial soils are rich in minerals and are great for agriculture.

Potential soil related hazards include; landslides when steep slope, shallow soils are inundated and liquefaction, an earthquake related hazard where sandy silt soils turn from a solid state to a liquid state as a result of stress and pressure.

Minerals in the Umpqua Valley are abundant and provide ample sources of ore and building materials. The abundance of minerals is due primarily to the close proximity and convergence of the four geologic provinces within Douglas County (refer to geography and environment section).

Understanding the geologic characteristics of Douglas County is an important step in hazard mitigation and avoiding at-risk development sites.

### Other Significant Geologic Features

Douglas County, like most of the Pacific Northwest, lies over the Cascadia Subduction Zone where the North American crustal plate overrides the Juan de Fuca plate underneath the earth’s crust. The fault along these two plates creates a structural sag at the Willamette River Valley. Volcanoes are present along this structural sag, and the activity on these mountains is caused by the buoyant melted rock of the Juan de Fuca plate, as it rises to the surface.

## Population and Demographics

Historically, people have lived in the Umpqua Valley as natural resources and jobs were available. They lived near their place of employment, thus creating many small communities. Now, recreational opportunities, industrial diversification, regional services and other amenities are adding reasons for residing in Douglas County.

Douglas County has a population of 100,399 in an area of 5,071 square miles. The population of Douglas County has steadily increased in the years from 1850 through 2000, and increased 6.1% from 1990 to 2000 according to the 2000 Census. Population growth is projected to continue (as shown in Figure 2-1), according to Douglas County Planning Department Projections.

**Figure 2-1. Projected Douglas County Population**

Douglas County Population Projections	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
	117,574	125,670	135,014	145,348

Source: Douglas County Comprehensive Plan: Population Element

Over 60% of Douglas County’s population resides in Central Douglas County from Oakland south to Winston. The largest cities in the county are Roseburg and Sutherlin, with 2000 populations of 20,017 and 6,669, respectively. Green is the largest unincorporated area in the County, with a population of 6,174. The largest city in the Coastal Region of Douglas County is Reedsport with a population of 4,378.

### Table 2-1. Douglas County Cities

City	2000 Population	1990 Population	% Change
Canyonville	1,293	1,219	6.07%
Drain	1,021	1,011	0.9%
Elkton	147	172	-14.5%
Glendale	855	707	20.9%
Myrtle Creek	3,419	3,063	11.6%
Oakland	954	844	13.0%
Reedsport	4,378	4,796	-8.7%
Riddle	1,014	1,143	-11.3%
Roseburg	20,017	17,032	17.5%
Sutherlin	6,669	5,020	32.8%
Winston	4,613	3,773	22.3%
Yoncalla	1,052	919	14.5%

Source: US Census Bureau

The twelve incorporated communities within the county comprised about 45% of the county population, leaving the 55% of the population in unincorporated areas. Table 2-1 shows the percent change in Douglas County's twelve incorporated communities from 1990 to 2000. Population in incorporated areas has increased 14.4% in this time span.

**Table 2-2. Douglas County Population, Incorporated and Unincorporated**

Year	Incorporated	Unincorporated
1990	39,699	54,950
2000	45,432	54,967

Source: 2000 Census

**Table 2-3. Douglas County Unincorporated Areas Population**

Area	2000 Population
Dillard	526
Gardiner	271
Glide CDP	1,690
Green CDP	6,174
Roseburg North CDP	5,473
Tri City CDP	3,519
Shady	189
Winchester Bay CDP	488

Source: 2000 Census

The increase of people living in Douglas County creates changes in how agencies prepare for and respond to natural hazards. For example, more people living on the rural resource interface can increase risk of fire. Wildfire has an increased chance of starting due to human activities in the rural resource interface, and has the potential to injure more people and cause more property damage.

Furthermore, increased density can affect risk. For example, narrower streets are more difficult for emergency service vehicles to navigate, in addition, the higher ratio of residents to emergency responders affects response times. Homes located closer together increase the chances of fires spreading house to house.

**Table 2-4. Douglas County Population By Race, 2000 Census**

<b>TOTAL POPULATION:</b>	<b>100,399</b>	
One Race:	94,687	97.3%
White:	94,234	93.9%
Black or African American:	177	0.2%
American Indian & Alaskan Native:	1,530	1.5%
Asian:	628	0.6%
Hispanic or Latino:	3,283	3.3%
Native Hawaiian or Pacific Islander:	93	0.1%
Other Race:	1,025	1.0%
Two or more races:	2,712	2.7%

Source: 2000 Census

Poverty is a serious concern in Douglas County. Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, may be disproportionately impacted by natural hazards.

According to the Poverty Status in 1999 information from the Census Bureau, Douglas County has 2,731 families below the poverty level, with 1,210 families having a female head of house. 12,999 individuals are living below the poverty level in Douglas County.

## **Land and Development**

Douglas County has an acknowledged Comprehensive Plan and Land Use and Development Ordinance, which is in compliance with Oregon's land use laws. Douglas County's Land Use Program provides opportunities for citizens to achieve their land use and property ownership objectives in accordance with law.

### **Highlights of Oregon's and Douglas County's Planning History**

- 1955 - Douglas County Subdivision Ordinance adopted
- 1960 - Douglas County Zoning Ordinance Adopted
- 1969 - Senate Bill 10 adopted requiring comprehensive planning and zoning regulations by local governments
- 1971 - Douglas County Floodplain management program started
- 1972 – Major revisions to scope of Subdivision Regulations
- 1973 – All of Douglas County zoned
- 1974 – Statewide Planning Goals adopted; State Uniform Building Code adopted
- 1980 - Douglas County Comprehensive Plan and Land Use & Development Ordinance adopted
- 1982 - Douglas County Plan and Ordinance acknowledged by Oregon LCDC
- 1983 – Douglas County Coastal Resources plan created
- 1984 - Douglas County Coastal Resources plan acknowledged
- 1987 – Periodic Review of Comprehensive Plan and Ordinance begun by Douglas County
- 2000 - Douglas County completes Periodic Review process

The Douglas County Comprehensive Plan provides policies and guidelines for land

use and development opportunities for land in Douglas County. The Plan is the County’s tool for complying with Oregon Statewide Planning Goals. The Land Use and Development Ordinance (LUDO) provides the local regulatory mechanism to carry out the Comprehensive Plan and Oregon Statewide Planning Goals.

The twelve cities in Douglas County each have their own Comprehensive Plan. All cities in the County also have an Urban Growth Boundary, required by law, which is intended to identify lands that are needed to satisfy the demands of population and employment growth for a 20-year period. The County and cities jointly manage the Urban Growth Areas.

## Housing and Community Development

The attractive nature of Douglas County with its rural settings and smaller cities, along with relatively low interest rates from late 1996 to the present, has contributed a great deal to a strong real estate market. The number of dwellings built between 1990 and 2000 was 4,986, an 11.5% increase in new housing from the 1990 Census.

**Table 2-5. Douglas County Housing Type Data 1990 and 2000 Census**

<b>2000 Census: 43,284 Housing Units</b>			<b>1990 Census: 38,298 Housing Units</b>		
Single Family Dwellings	27,166	62.8%	Single Family Dwellings	24,899	65.0%
Duplex	2,089	4.8%	Duplex		
Multi Family Dwellings	3,809	8.8%	Multi Family Dwellings		5.9%
Mobile Homes	9,364	21.6%	Mobile Homes	9,054	22.7%
Recreational Vehicles	676	1.6%	Recreational Vehicles		1.6%

Source: US Census Bureau Housing Characteristics 2000 Census; 1990 Census

Home ownership in Douglas County is listed at 71.7%, higher on average than the State, with a 64% home ownership. Renter occupied homes make up 28.3% of the housing in Douglas County. The average value for homes in rural and urban Douglas County are comparable, estimated at \$104,800.

## Employment and Industry

### Douglas County Employment and Industries

- Lumber and Wood Products
- Service Industry
- Retail Trade and Services
- Tourism
- Health Care
- Local, State, Regional and Federal Agencies
- Agriculture

The lumber and wood products industry still provides many jobs and businesses in Douglas County. Retail trade and services are centered in Roseburg. Roseburg’s trade area encompasses a buying population of about 60,000 people. The retail

trade sector employs a great number of workers, and fosters the greatest number of businesses in Douglas County. The services industry provides many jobs in support of existing businesses and tourism, and is a source for a number of businesses in the county. Local, State and Federal Government agencies support a large number of jobs in Douglas County, and Health Care is also a very large contributor to the Douglas County Economy.

Douglas County is a prime location for tourism. Approximately 100 miles of Interstate-5 pass through the county, nearly 1/3 of I-5's total mileage in the State. Destination points such as the Oregon Dunes National Recreation Area, Salmon Harbor, Wildlife Safari, Seven Feathers Casino and Crater Lake National Park are large attractions for tourists. The tourism industry and the related service industry are on the rise in Douglas County.

Agriculture is also an important factor in the economy with field crops, orchards, wine making and livestock as major products.

## **Transportation and Commuting Patterns**

### **Public Highways and Roads**

Douglas County has a vast network of public highways and roads maintained by federal, state, and local governments.

The heaviest traveled routes are the Interstate-5 corridor and state highways. Interstate-5, part of the nationwide interstate freeway system runs north and south through Douglas County's interior. Traffic on I-5 exceeds 13,000 vehicles daily. Cars and other light vehicles comprise 74% of the traffic, heavy truck traffic makes up 26% of the total traffic volume.

Entirely within Douglas County, State Highways 38 and 138 run from the coast to Douglas County's eastern border in the Cascades. Other State Highways parallel the Interstate, or the east-west route. U.S. Highway 101 goes north and south through Gardiner, Reedsport and Winchester Bay at the Pacific Coast. State Highway 42 connects Interstate 5 with the city of Coos Bay to the west, and goes east and west through Winston, Tenmile and Camas Valley.

Intersecting the Interstate and State Highways are paved County roads. County roads access areas throughout Douglas County, and provide access to rural communities.

Over the past 30 years, the use of the automobile as a means of transportation in Douglas County has increased steadily. The number of annual miles traveled per capita over this period has increased from approximately 2,900 in 1950 to 6,900 in 1982 and to 9,500 in 1990. In 1994, 89% of the workers in the county traveled to work by private automobile. 76% of workers drive to work alone, while 13% carpool. Mean travel time to work is 19.6 minutes.

## **Bus Service**

Public bus lines serve the major cities in Douglas County. Umpqua Transit operates daily bus service from Roseburg south to Winston, and north to Oakland.

Greyhound bus service operates north and southbound directions from Roseburg, and also north and southbound directions in Reedsport and Gardiner on the Coast.

## **Air Transportation**

There are three existing public use airports in Douglas County including Roseburg Regional, Myrtle Creek Airport, and the US Forest Service Toketee Airfield. There are also numerous public airstrips located throughout the County, which provide service to agricultural, industrial and residential users.

## **Rail Transportation**

The Central Oregon Pacific Railroad provides rail service to Douglas County. Central Oregon Pacific operates two branch lines that run through the County, one line on the Coast and another through the central valley.

The shipment of goods to and from the County by rail totals 1,214,000 tons. The total originating and terminating tonnage in Douglas County is 3.6 percent of the state total.

There is no passenger rail service available in Douglas County.

## **Water Transport**

The lower 27 miles of the Umpqua River is a commercially navigable waterway. The Port of Umpqua ships the third largest tonnage of all Oregon Coast ports. Port facilities include Salmon Harbor at Winchester Bay and docking facilities at Reedsport, Gardiner and Bolon Island. Portions of three rivers in Douglas County are navigable for freight transportation including the Umpqua River, Smith River and Schofield Creek. Channel depth in the Umpqua and Smith Rivers are maintained by the US Army Corps of Engineers.

## **Community Profile Resources**

Douglas County Transportation System Plan – December 2001

A Place Called Douglas County- Douglas County Planning Department.

US Census Bureau, 1990 Decennial Census

US Census Bureau, Census 2000

Environmental Geology of Western Coos and Douglas Counties, Oregon – State of Oregon Department of Geology and Mineral Industries, 1975

# **Section 3: Flood**

## **Table of Contents**

### **WHY ARE FLOODS A THREAT TO DOUGLAS COUNTY?**

History Of Flooding In Douglas County

What Factors Create Flood Risk?

Flood Terminology

Characteristics Of Flooding

What Is The Effect Of Development On Floods?

How Are Flood-Prone Areas Identified?

### **HAZARD ASSESSMENT**

Hazard Identification

Vulnerability Assessment

Risk Analysis

### **COMMUNITY FLOOD ISSUES**

What Is Susceptible To Damage During A Flood Event?

Flood Mitigation Activities

### **Community Rating System (CRS)**

Community Issues Summary

### **FLOOD MITIGATION ACTION ITEMS**

## Why are Floods a Threat to Douglas County?

Flooding represents the most common and best known of the natural hazard threats in Douglas County. They also encompass the broadest range of characteristics among natural hazards. Floods can occur quickly, as in flash floods, or slowly, as those resulting from the spring thaws. Floods can be of extreme magnitudes in confined locations, such as canyons, or a costly nuisance, as in broad river valleys. The topography and geology of the Umpqua River Basin are conducive to runoff, and peak flows on many of the tributaries occur within hours of the passage of weather fronts. Historically, the highest flows usually occur during the period from November through March as a result of the heavy rains augmented by snow melts. Heavy rains in Douglas County occur on a semi-annual basis and often affects the safety of property and/or life as does major flooding events.

There are over 320 miles of river or major streams that flow through Douglas County, with an estimated 24,396 acres of land in the 100-year floodplain. Flooding can pose a threat to life and safety, and can cause severe damage to public and private property. The county was most recently affected by flooding in the winter of 1996. The regional floods of November and December 1996 surpassed the county's normal seasonal flood events.

A heavy rainstorm occurred in Douglas County on November 17, 18 and 19, 1996. The storm delivered between 2-4 inches of rain in one night depending on location. Many of the rivers and smaller tributaries in the county quickly reached their flood levels, causing flooding. The flooding warranted road closures (including washing out a portion of Interstate 5 near Roseburg) and the evacuation of some homes in the County.

Strong winter storms beginning in early December 1996 and continued through December 15, 1996 began building the snowpack over the southwestern portion of the state. Water equivalent of the snow pack ranged from 2-6 inches in southwest Oregon. Widespread rain showers followed the storm that brought heavy snows to the Cascade Mountains on December 19 and 20, 1996.

Beginning on December 25, 1996 a moist weather front, originating near the Hawaiian Islands, began moving toward Oregon. This front moved inland over the state, starting a series of storms that lasted through January 1, 1997. The moist front that existed during this period produced repeated periods of moderate to heavy rainfall and the freezing level to above 10,000 feet by December 30, 1996. The melting snow pack and moderate to heavy rainfall that resulted from these conditions produced near record flows in rivers and streams of Douglas County. Rivers began decreasing in flow by January 3.

A combination of high river levels, accumulated silt and debris, land and mudslides and saturated soils created public safety concerns.

The combined effects of flooding, land/mud slides and sinkholes damaged many city and county transportation facilities. As a result of road closures, many rural communities were difficult to reach by road. Road closings affected access to private and federal



timber harvest areas. Major highways experienced damage, including Interstate Highway 5, U.S. Highway 101 and State Highways 42 and 38.

In addition, both disasters damaged the agricultural economy by damaging crops, outbuildings and equipment. Erosion of productive soils and deposition of debris in agricultural areas caused problems. Businesses throughout the County experienced damage and lost revenues. [3]

**Table 3-1a. One-day Precipitation Record – Roseburg Oregon**

	1996 Amount (in)	1965 Old Record (in)
<b>Roseburg</b>	4.35"	3.28"

Source: Storm Impacts and Landslides of 1996- Oregon Department of Forestry

The November/December 1996 flooding caused approximately \$2,211.023 in damage to Douglas County according to citizen reports. The damages were listed in two categories, business loss estimates and residential loss estimates. The Elkton RV Park with an estimated \$500,000 in damages was approximately 50% of the business losses in dollars. The cities of Drain (22.66%), Elkton (10.54%), Reedsport (23.64%) and Roseburg (20.41%) combined, comprised approximately 77.25% of the residential losses in dollars.

The 1996 floods caused a statewide loss of \$400 million in damages, as 26 major rivers rose to flood stage. More than 100 Red Cross and Salvation Army shelters were opened, and 23,000 residents fled their homes. Seven casualties were reported, and 50 people were injured. An estimated 1,700 Oregonians lost their jobs due to flooding, and the Small Business Association (SBA) loaned Oregon businesses over \$40.5 million to assist with recovery efforts.

Although this flood was a large-scale disaster, it was not unprecedented. During the Christmas Flood of 1964, over \$157 million in damage was done, and 20 Oregonians lost their lives.

Residents in Douglas County share a statewide concern about flood issues. According to the National Flood Insurance Program (NFIP), Oregon has 256 communities choosing to participate in the National Flood Insurance Program. All counties in Oregon are vulnerable to flooding, with the risk of loss being higher in some counties than others.

## **History of Flooding in Douglas County**

Douglas County has several and small tributaries in both unincorporated and incorporated areas that are susceptible to flooding. Major floods have affected the citizens of the county since as early as 1861 when the great freshet of 1861 washed away lower Scottsburg. Table 6-1b illustrates major flood events in Douglas County. Although the 1996 floods were devastating to the entire region, the floods of 1890, and 1964 were larger. Table 6-1c shows documented flood crests throughout the county for major flooding events since 1955.

**Table 3-1b. Major Flood Events in Douglas County since 1861**

**Years with Established Flood Records:**

1861, 1890, 1893, 1907, 1909, 1927, 1931, 1932, 1942, 1945, 1948, 1950, 1953, 1955, 1956, 1958, 1961, 1964, 1971, 1974, 1981, 1983, 1996

The floods which occurred in 1945, 1955, 1961, 1964, 1971, 1974, 1974, 1981, 1983, and 1996 represent when the North, South and Main Umpqua, Cow Creek, Deer Creek, Elk Creek and Calapooya Creek were at or above established flood levels, representing moderate to major flooding.

Source: Floodplain Management Information Guide-Douglas County

**Table 3-1c. Flood Crest Comparisons**

STATION NAME	FLOOD STAGE	1955	1964	1971	1974	1981	1983	1996
S. Umpqua River @ Tiller	18.0'	20.85'	25.72'	18.46'	18.36'	18.37'	16.80'	19.74'
S. Umpqua River @ Winston	26.0'	31.55'	34.28'	30.62'	32.64'	28.74'	30.32'	24.62'
S. Umpqua River @ Roseburg	22.0'	29.20'	34.05'	27.83'	30.50'	24.90'	27.70'	22.09'
Deer Creek near Roseburg	9-10'	13.67'	11.88'	13.43'	12.73'	15.39'	14.29'	14.35'
Cow Creek @ Azalea	10.0'	12.76'	15.63'	11.80'	16.40'	14.94'	14.78'	
Cow Creek @ Riddle	18-22'	27.35'	27.67'	25.01'	28.17'	24.42'	26.79'	14.51'
Steamboat Creek	10.0'	17.96'	25.60'	16.66'	12.23'	16.74'	12.27'	19.56'
N. Umpqua River below Steamboat	19.5'				16.92'	24.30'	18.06'	28.93'
North Umpqua River near Winchester	26.0'	29.14'	34.20'	26.39'	23.36'	25.25'	20.89'	27.64'
North Umpqua River @ Winchester Dam	18.0'	19.80'	24.20'	18.20'	15.70'	18.70'	16.30'	21.30'
Calapooya Creek near Oakland	14.0'	20.47'	20.72'	18.60'	18.72'	20.83'	19.16'	21.62'
Umpqua River near Elkton	33.0'	45.60'	51.95'	43.63'	44.20'	39.18'	37.53'	38.41'
Elk Creek near Drain	15.5-16'	19.06'	19.48'	14.24'	18.76'	21.97'	17.50'	22.74'
Lookingglass Creek	18.0'	24.93'	25.28'	17.59'	14.28'	17.71'	17.93'	

Source: Floodplain Management Information Guide-Douglas County

Douglas County is a rural community. Over half of Douglas County's population lives outside of urban areas in rural areas, often times close to or adjacent to a river. The portion of the population that lives in urban areas, also often times live close to a river, in an area that has a rural "atmosphere". The residential areas are then supported by water and sewer systems that are also in floodplain areas. The residential areas and needed infrastructure are the two most likely components of the community, to be impacted by flooding. In the event of a flood, people would be displaced from their homes, and needed infrastructure, water and sewer service, would be damaged.

Many residents have purchased flood insurance to help recover from losses due to a flood event. Flood insurance covers the improved land or building structure providing some financial protection from flooding. Unfortunately some residents who have had flood damage rebuild in the same areas with the potential of being flooded again. Local governments as well as federal agencies such as FEMA recognize this issue with floodplain insurance, and attempt to remove the risk of flooding again through acquiring land and relocating homes, or by elevating the structures. Continued repetitive loss claims from flood events lead to higher insurance rates, and contribute to the rising cost of taxpayer funded disaster relief for flood victims. The total claims and repetitive loss claims that have been filed with FEMA since 1978 are illustrated

in Table 6-2a. It is important to note, however, that many properties in the county are not insured from flood events, so the total damage from floods could be higher than shown in Table 6-2a. Historically, approximately 7% of structural development in Douglas County is built in the 100 year floodplain. Table 6-2b illustrates the repetitive loss properties that are responsible for a large portion of the total claims paid. The total assessed value for the structures on repetitive loss properties in the unincorporated and incorporated areas in the county are \$6,498,770 and \$15,014,630, respectively.

**Table 3-2a. Douglas County Flood Damage (1978 - 2001)**

	<b>Incorporated Cities in Douglas County</b>	<b>Unincorporated Areas in Douglas County</b>
Reported damage to buildings	<b>\$ 750,682</b>	<b>\$ 391,497</b>
Reported damage to contents	<b>\$ 62,938</b>	<b>\$ 120,130</b>
<b>Total of claims paid</b>	<b>\$ 699,659</b>	<b>\$457,624</b>

Source: Dennis Sigrist, Oregon Emergency Management

**Table 3-2b. Douglas County Repetitive Flood Losses (1978 - 2001)**

Repetitive loss properties with at least 2 losses in a rolling 10-year period and 2 losses that are at least 10 days apart.

	<b>Incorporated Cities in Douglas County</b>	<b>Unincorporated Areas in Douglas County</b>
Reported damage to buildings	<b>\$ 29,129.98</b>	<b>\$ 60,074.10</b>
Reported damage to contents	<b>\$ 17,133.17</b>	<b>\$ 13,049.65</b>
<b>Total of claims paid</b>	<b>\$ 46,263.15</b>	<b>\$ 73,123.75</b>

Source: Dennis Sigrist, Oregon Emergency Management

## **What Factors Create Flood Risk?**

Flooding occurs when climate (or weather patterns), geology, and hydrology combine to create conditions where water flows outside of its usual course. In Douglas County, geography, hydrology and climate combine to create flooding conditions.

### **Precipitation**

Douglas County spans from the Pacific Ocean Shoreline to Mt. Thielsen in the Cascade Range. As a result of the vastness of Douglas County, there is considerable variation in precipitation, with elevation being the largest factor in precipitation totals. Moving east from sea level at the coast to Mt Thielsen at 9,182 feet above sea level, annual precipitation averages range from 80 to 100 inches per year in Coastal Douglas County to just over 30 inches in the interior valleys, to over 70 inches, in the Cascade Mountains. This change in elevation causes a significant increase in precipitation, in the form of both rain and snow. Douglas County enjoys a fairly mild winter, with average temperatures not falling below 37 degrees Fahrenheit. The higher elevations (>2,500 feet) in Eastern Douglas County have snow for the majority of the winter months. Snowmelt in the Cascades and North Umpqua Basin provide a continuous water source throughout the year, and can be a major contributor to high waters.

During the rainy season, monthly rainfall totals average far higher than other months of the year (as shown in Figure 6.1). This results in high water, particularly in

December and January. High water is usually the result of heavy rains of two-day to five-day durations augmented by snowmelt at a time when the soil is near saturation from previous rains.

**Figure 3.1. Average Monthly Mean Rainfall for Sites in Douglas County, Oregon (Inches)**

	Average Monthly Precipitation Rainfall (inches)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Drain	7.2	6.13	5.28	3.81	2.52	1.3	.46	.87	1.38	3.25	7.79	7.87	47.86
Elkton	8.09	6.97	6.05	3.92	2.42	1.10	.35	.68	1.45	3.29	8.89	9.29	52.50
Glendale	8.5	4.48	3.63	2.39	2.14	1.15	.34	.36	1.03	3.12	5.82	7.53	36.09
Idleyd Park	9.01	7.51	6.99	5.29	3.52	1.88	.74	1.08	2.03	4.58	10.41	10.32	63.36
Oakland	5.66	4.97	3.92	3.37	2.39	1.25	.60	.70	1.29	2.97	6.46	6.48	40.20
Myrtle Creek	5.16	4.51	3.98	3.41	2.62	1.35	.57	.59	1.09	2.82	6.57	6.36	37.01
Riddle	4.7	3.86	3.51	2.42	1.56	.86	.38	.62	1.01	2.15	5.20	5.28	31.55
Roseburg	4.97	4.1	3.81	2.75	1.82	.92	.44	.67	1.07	2.27	5.42	5.42	33.66
Toketee Falls	6.61	5.55	5.44	4.26	3.07	1.75	.80	1.13	1.63	3.55	7.65	7.41	48.85
Winchester	5.14	4.47	3.97	2.94	1.93	.98	.40	.65	1.14	2.41	5.89	5.81	35.73

Source: Oregon Climate Service

### Geography and Geology

Douglas County is almost entirely within the Umpqua River basin. The floodplains of the valley are susceptible to inundation by floodwaters. The surface materials include poorly drained, unconsolidated, fine-grained deposits of silt, sand, and gravel. Torrential flood events can introduce large deposits of sand and gravel that assist in the drainage of the otherwise poorly drained soils.

### Flood Terminology

#### Floodplain

The floodplain, as defined by the Douglas County Land Use and Development Ordinance (LUDO), is the area adjoining a stream river, or coast that is subject to regional flooding. The “100-year flood” means the same thing as “regional flood”, which is a flood that has a one percent chance of occurring in any given year. The 100-year flood area has been mapped in Douglas County by FEMA.

#### 100-Year Flood

The 100-year flood event is a flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood. Figure 6-2 is a schematic drawing of the 100-year floodplain.

#### Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a

recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodways be kept open and free from development or other structures that would increase the floodway water height. Douglas County regulations require development in the floodway to be certified by an Oregon licensed engineer. The licensed engineer must include a statement that no increase in flood levels (caused by the proposed structure) shall occur during a regional flood. The NFIP floodway definition is “the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

### **Flood Fringe**

Areas that may be flooded with standing water are said to be in the floodway fringe. The floodway fringe is located within the floodplain boundary.

### **Development**

For floodplain ordinance purposes, development is broadly defined by the Douglas County Land Use Development Ordinance to mean “any manmade change to improved or unimproved real estate, including but not limited to the construction, alteration, installation or use of buildings, division of land, creation of private or public streets, mining, excavation, farming, forest use, open storage of materials, or any activity specifically regulated by the provisions of this ordinance.” The definition of development for floodplain purposes is generally broader and includes more activities than the definition of development used in other sections of local land use ordinances.

### **Base Flood Elevation (BFE)**

The term “Base Flood Elevation” refers to the elevation (normally measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood, however, the National Flood Insurance Program regulations focus on development in the 100-year floodplain.

### **Characteristics of Flooding**

Two types of flooding primarily affect Douglas County: riverine flooding and urban flooding (see descriptions below). In addition, any low-lying area has the potential to flood. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's (ditch or sewer) capability to remove it.<sup>13</sup>

### **Riverine Flooding**

Riverine flooding is the overbank flooding of rivers and streams. The natural process of riverine flooding adds sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as

areas that are inundated by the 100- year flood with flood depths of only one to three feet. These areas are generally flooded by low velocity sheet flows of water.

### **Urban Flooding**

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with violent force.

Most of Douglas County is rural, with a low percentage of incorporated land. However much of the population lives within cities or rural unincorporated areas with a high concentration of impermeable surfaces that either collect water, or concentrate the flow of water. During periods of urban flooding, streets carry water to culverts. Culverts and storm drains sometimes back up with vegetative debris causing localized flooding.

### **Dam Failure Flooding**

Loss of life and damage to structures, roads, utilities and crops may result from a dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. These effects could possibly accompany the failure of one of the major dams in Douglas County. Six major water impoundment dams have been developed in Douglas County to serve flood control and water needs. Because dam failure can have severe consequences, FEMA requires that all dam owners develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with county officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner. For more detailed information regarding dam failure flooding, and potential flood inundation zones for a particular dam in the county, please refer to the Douglas County Emergency Action Plan, available at the Douglas County Sheriffs Department.

## **What is the Effect of Development on Floods?**

When structures or fill are placed in the floodway or floodplain, water is displaced. Development raises the river levels by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway or floodplain and no fill is removed to compensate, serious problems can arise. Floodwaters may be forced away from historic floodplain areas. As a result, other existing floodplain areas may experience floodwaters that rise above historic levels.

Local governments must require engineer certification to ensure that proposed developments would not adversely affect the flood carrying capacity of the Special Flood Hazard Area (SFHA). Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses, and other facilities. Careful attention

should be given to development that occurs within the floodway to ensure that structures are prepared to withstand regional flood events. In highly urbanized areas, increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems to ensure that these runoff waters are dealt with effectively.

## **How Are Flood-Prone Areas Identified?**

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and "sound floodplain management." In Douglas County, the NFIP and related building code regulations went into effect on March 1, 1978. NFIP regulations (44 Code of Federal Regulations [CFR] Chapter 1, Section 60.3) require that all new construction in floodplains must be elevated at or above base flood level. The Oregon Building Code requires new construction to be elevated to one foot above the base flood elevation. Communities participating in the NFIP may adopt regulations that are more stringent than those contained in 44 CFR 60.3, but not less stringent.

### **Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS)**

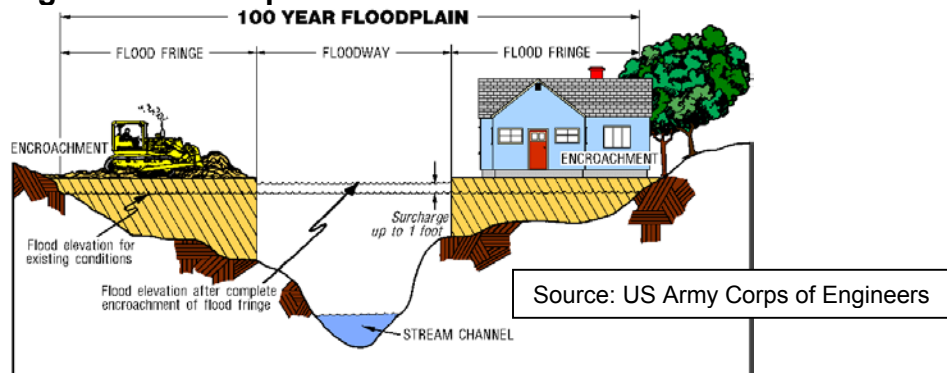
Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA, which delineates SFHA in communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases they also include base flood elevations (BFEs) and areas located within the 500-year floodplain.

Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. However, it is important to note that not all 100-year or 500-year floodplains have been mapped by FEMA.

FEMA flood maps are not entirely accurate. Flood studies and maps represent flood risk at the point in time when FEMA completed the studies, and do not incorporate planning for floodplain changes in the future due to new development. Most FIRM maps for Douglas County were completed in 1978.

**Figure 3-2. Floodplain Schematic**



## Flood Mapping Methods and Techniques

Although many communities rely exclusively on FIRMs to characterize the risk of flooding in their area, there are some flood-prone areas that are not mapped but remain susceptible to flooding. These areas include locations next to small creeks, local drainage areas, and areas susceptible to manmade flooding.

The use of GIS (Geographic Information System) is becoming an important tool for flood hazard mapping. FIRM maps can be imported directly into GIS, however their projections are not sufficiently accurate in use as a screening tool. Coordination between FEMA and local planning jurisdictions is the key to making effective and accurate GIS technology for the purpose of flood hazard mapping.

## Hazard Assessment

### Hazard Identification

Hazard identification is the first phase of flood-hazard assessment. Identification is the process of estimating: (1) the geographic extent of the floodplain (i.e., the area at risk from flooding); (2) the intensity of the flooding that can be expected in specific areas of the floodplain; and (3) the probability of occurrence of flood events. This process usually results in the creation of a floodplain map. Floodplain maps provide detailed information that can assist jurisdictions in making policies and land-use decisions.

### Data Sources

FEMA mapped the 100-year and 500-year floodplains through the Flood Insurance Study (FIS) in conjunction with the United States Army Corps of Engineers (USACE) for Douglas County in 1978. Previous studies were done prior to 1978 by Douglas County. In 1978, Douglas County initially entered into the NFIP. The county has updated portions of the USACE and FEMA maps through smaller drainage studies in the county since that time. The County's Orthoquads, completed in 1972 with 5' intervals were also used.

### Vulnerability Assessment

Vulnerability assessment is the second step of flood-hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an



inventory of the property within the floodplain. Understanding the population and property exposed to natural hazards will assist in reducing risk and preventing loss from future events. Because site-specific inventory data and inundation levels given for a particular flood event (10-year, 25-year, 50-year, 100-year, 500-year) are not readily available, calculating a community's vulnerability to flood events is not straightforward. The amount of property in the floodplain, as well as the type and value of structures on those properties, should be calculated to provide a working estimate for potential flood losses.

## **Risk Analysis**

Risk analysis is the third and most advanced phase of a hazard assessment. It builds upon the hazard identification and vulnerability assessment.

A flood risk analysis for Douglas County should include two components: (1) the life and value of property that may incur losses from a flood event (defined through the vulnerability assessment); and (2) the number and type of flood events expected to occur over time. Within the broad components of a risk analysis, it is possible to predict the severity of damage from a range of events.

Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event.

Using GIS technology, aerial photographs and flow velocity models, it is possible to map the damage that can be expected from flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties.

At the time of publication of this plan, data was insufficient to conduct a risk analysis for flood events in Douglas County. This plan includes recommendations for building partnerships that will support the development of a flood risk analysis in Douglas County.

## **Community Flood Issues**

### **What is Susceptible to Damage During a Flood Event?**

The largest impact on communities from flood events is the loss of life and property. Property loss from floods strikes both private and public property. Public sector impacts (e.g., impacts to water and sewer systems, roads, etc.) statewide resulted in approximately two-thirds of the damage from the 1996 flood events.

### **Property Loss Resulting from Flooding Events**

The type of property damage caused by flood events depends on the depth and velocity of the floodwaters. Faster moving floodwaters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by basement flooding and landslide damage related to soil saturation

from flood events. Seepage into basements or daylight basements is common during flood events, not only in or near floodplains, but also on hillsides and other areas that are far removed from floodplains. Most flood damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances).

### **Homes**

Homes in frequently flooded areas can also suffer damage to septic systems and drain fields. Homes in rural floodplain areas often depend on private sewage treatment systems, and inundation of these systems may result in leakage of wastewater into surrounding areas. In many cases, flood damage to homes renders them unlivable.

### **Manufactured Homes**

Statewide, the 1996 floods destroyed 156 housing units. Of those units, 61% were mobile homes and trailers. Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability than stick-built homes, and must be anchored to provide additional structural stability during flood events. Because of confusion in the late 1980s resulting from multiple changes in NFIP regulations, there are some communities that do not actively enforce anchoring requirements. Lack of enforcement of manufactured home construction standards in floodplains can contribute to severe damages from flood events.

### **Business/Industry**

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

### **Public Infrastructure**

Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services.

Government can take action to reduce risk to public infrastructure from flood events, as well as craft public policy that reduces risk to private property from flood events.

There are a variety of drinking water, surface water, and wastewater service providers throughout the county. During flooding events, the infrastructure that supports the water service providers in the county can be damaged.

### **Buildings**

In the wake of the 1996 flood events, damage to public buildings statewide represented 34% of total public losses. Of particular importance during flood events are facilities located in flood hazard areas that are critical to government response

and recovery activities.

### **Roads**

During natural hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Roads systems in Douglas County are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Transportation agencies responsible for road maintenance are typically aware of roads at risk from flooding.

### **Bridges**

Bridges are key points of concern during flood events because they are important links in road networks, watercourse crossings, and they can be obstructions in watercourses, inhibiting the flow of water during flood events. The bridges in Douglas County are state, county, city, or privately owned. A state-designated inspector must inspect all state, county, and city bridges every two years, but private bridges are not inspected, and can be very dangerous. The inspections are rigorous, looking at everything from seismic capability to erosion and scour. Upon inspection, the bridges are subject to a sufficiency score. This score uses a scale of 1 to 100 with 1 being the worst rating. Then the bridges are ranked throughout the state according to their score. The state then prioritizes the bridge repair according to each score. If the bridge receives a sufficiency score of less than 50, it is on the list for upgrading and rehabilitation. If it scores over 50, it is not included on the list. The smaller, more economically feasible repairs to county bridges are the responsibility of Douglas County Public Works Department. The larger projects require funding through the Highway Bridge Replacement and Rehabilitation Program (HBRR). HBRR provides 80% of funding, and the county is responsible for 20%.

### **Storm Water Systems**

Local drainage problems are common throughout the region. Several communities have drainage master plans, and local public works staff is often aware of local drainage threats. The problems are often present where open ditches enter culverts or go underground into storm sewers. In addition, high water tables in some areas can mean wet crawl spaces, yards, and basements after storms because the accumulated water does not drain quickly into a stream or storm sewer. Filled ditches and swales near buildings can inhibit or prevent the flow of water and compound these problems. Inadequate maintenance, especially following leaf accumulation in the fall, can also contribute to the flood hazard in urban areas.

### **Water Quality**

Major water quality issues occur in those streams that have low flows and pass through areas where human activities are concentrated. In conjunction with seasonal low flow problems, stream quality is degraded by high water temperatures that are common in the Umpqua River system and tributaries from June through October.

## **Existing Flood Mitigation Activities**

Flood mitigation activities listed here include current mitigation programs and

activities that are being implemented by Douglas County Departments, agencies or organizations.

### **Douglas County Codes**

Article 30 of the Douglas County Land Use and Development Ordinance describes possible development in the floodplain but, before the Douglas County Planning Department can give clearance for development, the applicant must provide the department with a "Certificate Of Elevation" prepared by an Oregon licensed surveyor or engineer. The Certificate of Elevation will determine the "minimum required floor height above ground" for the proposed structure. Under Douglas County requirements, the lowest habitable floor of a new dwelling is required to be one foot above the 100-year floodplain height.

If the building site elevation is 18" or more below flood height, or if the site is designated as "high hazard" or is in the floodway, the foundation plans must be prepared by an Oregon Licensed Engineer or Architect. If the site is in the floodway, the certificate must also include a statement from an Oregon licensed engineer stating that any increase in flood levels (caused by the proposed structure) shall not result in any increase in flood levels during the occurrence of a regional flood.

Fill in the floodway (placement of sand, soil, sediment or other material to raise the elevation of the land requires the same documentation as does structural development in the floodway.

Once construction of the foundation and floor is complete, the surveyor/engineer will inspect the structure. If the minimum floor height specification has been met, the surveyor/engineer will sign off the certification form, and submit it to the Douglas County Building Department.

Accessory buildings such as garages, woodsheds, etc. require certification but do not necessarily require elevation. Agricultural buildings are subject to floodplain regulations if located in the floodplain. Flood proofing required in floodplain areas can be achieved by such methods as breakaway panels in the building, venting, or elevating the site to meet specifications.

### **Community Rating System (CRS)**

In 1997, FEMA audited the Douglas County Planning Department floodplain program. The result of the audit was a recommendation from FEMA to the Community Rating System (CRS). The Community Rating System reviewed the recommendation, and then did an audit also. The result of the audits concluded that Douglas County's Floodplain Program complied with the requirements of the National Flood Insurance Program in an exemplary manner. The result of the FEMA and CRS audits was a rating of Douglas County's Floodplain Program by the CRS. The CRS rated Douglas County's Floodplain Program an "8", which resulted in a 10% reduction in the cost of flood insurance for residents of Douglas County. This 10% reduction translates into about \$40,000.00 dollars annually in saved insurance premiums for residents of Douglas County. Following completion of this natural hazard mitigation plan, Douglas County will be audited again, and hopefully obtain

another 5 to 10% reduction.

### **State of Oregon Floodplain and Floodway Removal/Fill Law**

The Oregon Removal/Fill Law, which is administered by the Oregon Division of State Lands (DSL), requires a permit for activities that would remove or fill 50 cubic yards or more of material in waters of the state (e.g., streams, lakes, wetlands).

### **Natural Systems**

Maintaining and restoring natural systems help to mitigate the impact of flood events on the built environment. Flooding changes the natural environment and hydrology of an affected area. High water can be beneficial to the natural processes within a floodplain, and can benefit riparian areas. The best flood control techniques work to control water using the natural features such as wetlands that assist in water storage and bank stability.

### **Riparian Areas**

Riparian areas are important transitional areas that link water and land ecosystems. Vegetation in riparian areas is dependent on stream processes, such as flooding, and often is composed of plants that require large amounts of water, such as willows and cottonwood trees. Healthy vegetation in riparian buffers can reduce streamside erosion

### **Wastewater Management**

There are a variety of wastewater service providers in the county, ranging from cities to service districts that help to keep the waters of Douglas County clean and pure.

### **Wetlands**

Many floodplain and stream-associated wetlands absorb and store storm water flows, which reduces flood velocities and stream bank erosion. Preserving these wetlands reduces flood damage and the need for expensive flood control devices such as levees. When the storms are over, many wetlands augment summer stream flows by slowly releasing the stored water back to the stream system. Wetlands are highly effective at removing nitrogen, phosphorous, heavy metals, and other pollutants from water. For this reason, artificial wetlands are often constructed for cleaning storm water runoff and for tertiary treatment of wastewater.

Wetlands bordering streams and rivers and those that intercept runoff from fields and roads provide this valuable service free of charge. Wetland restoration projects have been initiated and completed by various organizations throughout the county. Many detention ponds are constructed wetlands.

## **Community Issues Summary**

Douglas County works to mitigate problems regarding flooding through a proactive floodplain program. The Douglas County Planning Department administers Douglas County's floodplain program, which is rated an "8" by the Community Rating System. Douglas County believes that displacement of people from their homes and damage to needed water and sewer facilities, are mitigation priorities for flood events in

Douglas County.

## Flood Mitigation Goals

### GOAL A

*Protect structures in the floodplain from flooding.*

### GOAL B

*If a structure becomes a repetitive loss structure, inform owner of possible mitigation funding options.*

### GOAL C

*If a structure becomes a repetitive loss structure, and a cost benefit analysis reveals the repetitive loss has a substantial cost, encourage owner to use mitigation funding options.*

## Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that organizations and residents in Douglas County can undertake to reduce risk and prevent loss from flood events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

**ACTION ITEM 1 – Require elevation certification forms prior to planning approval, per floodplain regulations, for structural development within 100-year flood plain.**

***Ideas for Implementation***

Douglas County's Floodplain Management Program.

**Coordinating Organization:** Douglas County Planning Department

**Timeline:** Continue.

**Plan Goals Addressed:** GOAL A.

**ACTION ITEM 2 – Require engineer “no rise” certification prior to planning approval, per floodplain regulations, for structural development within the federal floodway.**

***Ideas for Implementation***

Douglas County's Floodplain Management Program.

**Coordinating Organization:** Douglas County Planning Department

**Timeline:** Continue.

**Plan Goals Addressed:** GOAL A.

**ACTION ITEM 3 – Increase Douglas County's CRS rating through encouraging non-regulatory flood mitigation.**

***Ideas for Implementation***

Request an audit by the CRS, following completion of the natural hazard mitigation plan. Discuss floodplain issues when clients have contact with the Douglas County Planning Department. Discuss floodplain issues through outreach opportunities.

**Coordinating Organization: Douglas County Planning Department.**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL A.**

**ACTION ITEM 4 – Identify opportunities to upgrade Federal Insurance Rate Map.**

***Ideas for Implementation***

Douglas County's Floodplain Management Program.  
**Coordinating Organization: Douglas County Planning Department**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL A.**

**ACTION ITEM 4 – Identify opportunities to upgrade Douglas County Planning Department's GIS system for floodplain mapping.**

***Ideas for Implementation***

Douglas County's Floodplain Management Program.  
**Coordinating Organization: Douglas County Planning Department**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL A.**

**ACTION ITEM 5 – Distribute information regarding flooding to the general public efficiently.**

***Ideas for Implementation***

Douglas County Emergency Management Outreach Program.  
**Coordinating Organization: Douglas County Emergency Management.**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL A.**

**ACTION ITEM 6 – Identify surface water drainage obstructions, and seek funding for culvert drainage mitigation projects, through FEMA's Hazard Mitigation Grant Program.**

***Ideas for Implementation***

Douglas County Emergency Management Outreach Program.  
**Coordinating Organization: Douglas County Emergency Management.**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL A, B, and C.**

**ACTION ITEM 7 – Explore funding for repetitive loss property mitigation projects, through FEMA's Hazard Mitigation Grant Program.**

***Ideas for Implementation***

Douglas County Emergency Management Outreach Program.  
**Coordinating Organization: Douglas County Emergency Management.**  
**Timeline: Continue.**  
**Plan Goals Addressed: GOAL B and C.**

## **Flood Endnotes**

- Beckham, Steven Dow; *Land of the Umpqua; A History of Douglas County Oregon* (1986)
- Douglas County Planning Department, *A Place Called Douglas County* (1990)
- Flood Hazard Mitigation Plan - Douglas County, Douglas County Planning Department & Umpqua Regional Council of Governments
- Flood Insurance Payments Summary, Oregon Emergency Management
- Douglas County Planning Department Comprehensive Plan

# **Section 4: Severe Winter Storms**

## **Table of Contents**

### **WHY ARE SEVERE WINTER STORMS A THREAT TO DOUGLAS COUNTY?**

History Of Severe Winter Storm Events In Douglas County

Characteristics of Severe Winter Storms

### **HAZARD ASSESSMENT**

Hazard Identification

Vulnerability Assessment

### **COMMUNITY SEVERE WINTER STORM ISSUES**

What Is Susceptible During Severe Winter Weather?

Existing Mitigation Activities

### **SEVERE WINTER STORM MITIGATION ACTION ITEMS**



# Why are Severe Winter Storms a Threat to Douglas County?

Severe winter storms pose a significant risk to life and property in Douglas County by creating conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes. Severe winter storms can produce rain, freezing rain, ice, snow, cold temperatures, and wind. Ice storms accompanied by high winds can have destructive impacts, especially to trees, power lines, highway safety and utility services. Severe freezes, where high temperatures remain below freezing for five or more days, occur every three to five years in Douglas County. Severe or prolonged snow events occur less frequently, and are very geographic in nature. The eastern part of Douglas County is affected the most severely, having widespread impacts on people and property in the county.

## Historical Severe Winter Storm Events

### SNOWSTORMS

From January 1, 1931 to December 31, 2001, there were 82 days where an inch of snow or greater fell in Roseburg and other areas of the Umpqua Valley. All of the snow events occurred between November and April.

**Table 4-1a. Mean Snowfall (inches) –Areas in Douglas County, Oregon 1971-2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Drain	.39	1.2	.03	0	0	0	0	0	0	0	.2	.74	2.91
Elkton	.44	.22	.1	.05	0	0	0	0	0	0	.03	.31	1.42
Idleyld Park	4.28	4.40	1.65	.47	.02	0	0	0	0	1.5	3.9	8.8	39.1
Riddle	.64	.94	.17	0	0	0	0	0	0	0	.26	.79	2.97
Tokette Falls	8.46	7.81	3.98	.24	0	0	0	0	0	.23	3.77	8.37	34.6
Winchester	.45	.20	.02	0	0	0	0	0	0	0	.03	.31	0.59

Source: Oregon Climate Service

### December 24, 1889 to February 13, 1890

The big snow of '90 started the day before Christmas. Snow fell continually for 52 days, leaving between 5 ½ and 7 ½ feet, in the town of Glendale and more in the surrounding mountains. The weather then turned warm and the snow began to melt so fast, the ground became soggy and there was high water and flooding. A severe landslide covered the railroad tracks and dammed up Cow Creek near West Fork below Glendale for many days. Reportedly several Chinese workers perished in the slide and that unstable area of the mountain became known as the Chinaman's slide. Nothing could get through except people on foot, by climbing on the canyon wall high above the slide and mud area.

### December 1919

The December 1919 snowstorm was recorded as the third heaviest snowfall-producing storm in Oregon.

**January 1950**

A total of 28.0 inches of snow fell in Roseburg January 9-15. Riddle was hit even harder with 42.9 inches of snow. There were three severe storms in January 1950, with very little time separating them. Their net effect was a nearly continuous storm. The storm had severe effects on infrastructure, residents, and businesses across the state. Deep snowdrifts closed all highways west of the Cascades. Sleet that turned to freezing rain caused unsafe conditions on highways and damaged trees and power lines.

**Table 4-1b. 1950 Snowstorm Accumulation- Areas in Douglas County, Oregon**

Location	January 1950 Snowfall
Reedsport	5.0 inches
Riddle	42.9 inches
Roseburg	28.0 inches
Crater Lake	136.0 inches

Source: National Weather Service

**Winter 1969**

January 21 to February 6, 1969 when strong storms, accompanied by snow, ice, wind, and freezing rain hit Oregon statewide. In the Roseburg area alone, 43.7 inches of snow fell over an 8-day period, including 25.5 inches between January 26<sup>th</sup> and 27<sup>th</sup>.

**ICESTORMS**

Ice storms (sleet and freezing rain), are typically a short-lasting event in Douglas County. In the winter of 1978, freezing rain covered the Umpqua Valley. The build-up of ice caused power failures, brought down trees, and created serious hazards for motorists.

**EXTREME COLD WEATHER STORMS**

Extreme cold weather snaps are a common, but short lasting hazard in Douglas County. Below, tables 9-1b and 9-1c list historical temperature data since 1971.

**Table 4-1b. Average Number of Days: Maximum Temperature 32 degrees F or Less – Areas in Douglas County, Oregon 1971-2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Drain	0.2	0.1	0	0	0	0	0	0	0	0	.1	0.7	1.1
Elkton	0	0.1	0	0	0	0	0	0	0	0	0	0.6	0.8
Idleyld Park	0.1	0.1	0	0	0	0	0	0	0	0	0	0.6	0.6

Riddle	0.1	0.1	0	0	0	0	0	0	0	0	0	0.5	0.7
Tokette Falls	0.5	0.2	0	0	0	0	0	0	0	0	0.2	1.2	2.1
Winchester	0.4	0	0	0	0	0	0	0	0	0	0	0.8	1.4

Source: Oregon Climate Service

**Table 4-1c. Average Number of Days Minimum Temperature 32 degrees F or Less – Areas in Douglas County, Oregon 1971-2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Drain	11.1	7.4	5.5	2.0	0.2	0	0	0	0.1	1.6	3.9	9.1	42.3
Elkton	6.9	4.4	2.2	0.7	0	0	0	0	0.1	0.6	2.0	6.2	22.4
Idleyld Park	16.1	12.4	10.6	5.7	2.1	0.2	0	0	0.8	4.2	8.8	16.0	77.6
Riddle	10.2	6.9	5.4	1.9	0.2	0	0	0	0	1.5	3.9	8.8	39.1
Tokette Falls	21.8	16.8	15.1	7.8	1.3	0	0	0	.7	5.1	13.4	21.2	101.7
Winchester	10.3	7.4	4.8	1.0	0.1	0	0	0	0	0.5	4.0	10.2	37.5

Source: Oregon Climate Service

## Characteristics of Severe Winter Storms

### Weather Patterns

Severe winter storms affecting Oregon typically originate in the Gulf of Alaska and in the central Pacific Ocean. These storms are most common from October through March. Most of Douglas County has average annual precipitation of between 30 and 70 inches, with parts of the Coastal County receiving over 70 inches.

The National Climatic Data Center has established climate zones in the US for areas that have similar temperature and precipitation characteristics. (Figure 9-1) Oregon's latitude, topography, and nearness to the Pacific Ocean give the state diversified climates. The county's climate generally consists of wet winters and dry summers. Normal distribution of precipitation is about 50% of the annual total from December through February, lesser amounts in the spring and fall, and very little during summer months.

There is an average of only five days per year of measurable snow with snowfall accumulations rarely measuring more than two inches. Very Cold air rarely moves west of the Cascades Range. The Cascades act as a natural barrier, damming cold air east of the range. The only spigot is the Columbia River Gorge, which funnels the cold air into the Portland area. Cold air then begins deepening in the Columbia River valley, eventually becoming deep enough to sink southward into the Willamette and Umpqua valleys. If the cold air east of the Cascades is deep, it will spill through the gaps of the Cascades and flow into the western valleys via the many river drainage

### Figure 4-1 Oregon Climate Zones

Zone 1: Coastal Area  
 Zone 2: Willamette Valley  
 Zone 3: Southwestern Interior  
 Zone 4: Northern Cascades  
 Zone 5: High Plateau  
 Zone 6: North Central Area  
 Zone 7: South Central Area  
 Zone 8: Northeast Area  
 Zone 9: Southeast Area  
 Source: Oregon Climate Service

areas along the western slope. The cold air in western Oregon is now in place. If a storm from the Pacific moves near or over the cold air, freezing rain, sleet, and/or snow will be produced. Nearly every year, minor snowfalls of up to six inches occur in the western interior valleys. However, it is a rare occurrence for snowfalls of over a foot in accumulations.

### **Snow**

Snow is very common in the higher elevations of the Cascades; Diamond Lake reports an average of 6-8 feet of snow per year, while Mount Bailey averages approximately 600 inches per year. However in the lower elevations of the Umpqua Valley, snow is relatively rare. Snowfall events do occur in the Umpqua Valley however. An example of a snowstorm event occurred in January 1969, when 43.7 inches of snow fell over an 8-day period in Roseburg.

Severe snowfall events can result in area-wide or localized loss of life, property, and power, gas, or other service disruptions. The variable character of this hazard is determined by a variety of meteorological factors including snowfall, snowpack, rainfall, temperature, and wind.

### **Ice**

Like snow, ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation, including freezing rain, sleet, and hail.

Freezing rain can be the most damaging of ice formations. While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions within a community. Ice buildup can bring down trees, communication towers, and wires creating hazards for property owners, motorists, and pedestrians alike.

### **Extreme Cold Weather**

Extreme cold weather stretches are also rare throughout Douglas County with the exception of very high altitudes. Extreme cold hazards include infrastructure damage to pipes, power lines and roadways. Prolonged low temperatures when combined with power outages could be a hazard to vulnerable populations like the elderly.

## **Severe Winter Storm Hazard Assessment Hazard Identification**

A severe winter storm is generally a prolonged event involving snow or ice. The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. If a severe ice storm occurs within Douglas County, there may be prolonged power outages over widespread areas. The probability of such an ice storm is uncertain due to limited historical records. The National Weather Service, Medford Bureau, monitors the stations and provides public warnings on storm, snow, and ice events as

appropriate.

## **Vulnerability and Risk**

A vulnerability assessment that describes the number of lives or amount of property exposed to elements of severe winter storms has not yet been conducted for Douglas County. However, severe winter storms can cause power outages, transportation and economic disruptions, and pose a high risk for injuries and loss of life. The events can also require needed shelter and care for adversely impacted individuals. The county has suffered severe winter storms in the past that brought economic hardship and affected the life safety of county residents.

Factors included in assessing severe winter storm risk include population and property distribution in the hazard area, the frequency of severe winter storm events, and information on trees, utilities, and infrastructure that may be impacted by severe winter storms. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed. Insufficient data currently exists to complete a risk analysis.

## **Community Winter Storm Issues**

### **What is Susceptible to Winter Storms?**

#### **Life and Property Damage**

Winter storms have the potential for loss of life. Loss of life can occur indirectly from traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold.

Property is at risk of damage due to flooding and landslides resulting from heavy snow melt. Trees, power and telephone lines, television and radio antennas can all be impacted by ice, wind, snow, falling trees and limbs. Saturated soil can cause trees to lose their ability to stand and results in damage to houses, cars, utilities, roads and other structures. Heavy snowpack on flat or low-pitched roofs can cause structural damage, or roof collapse in vulnerable buildings. If streets are icy, blocked by downed trees or damaged, it is difficult for emergency personnel to travel, posing a secondary threat to life if police, fire, and medical personnel cannot respond to calls.

#### **Roads and Bridges**

Snow and ice events resulting in icy road conditions can lead to major traffic accidents. Roads blocked by fallen trees during a windstorm may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for county residents, organizations, and providers of essential services such as hospitals and utilities.

#### **Power Lines**

Historically, falling trees have been the major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring

electric power lines down, creating the possibility of lethal electric shock. Snow and ice can also damage utility lines and cause prolonged power outages. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from severe winter storms as more life and property are exposed to risk.

### **Water Lines**

The most frequent water system problem related to cold weather is a break in cast iron mainlines. Breaks most often times occur during severe freeze events, as well as during extreme cooling periods during the months of October, November, and December. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated potable water and fire sprinkler pipes can rupture and cause extensive damage to property.

### **Severe Winter Storm Tracking and Warning**

#### **National Weather Service**

The Medford Office of the National Weather Service issues severe winter storm watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for retransmission using the Emergency Alert System.

## **Winter Storm Mitigation Goals**

### **GOAL A**

***Protect structures from winter storm damage.***

### **GOAL B**

***Maintain road system circulation capacity.***

### **GOAL C**

***Prevent utility damage from falling trees.***

### **GOAL D**

***Prevent falling trees from becoming a fire hazard.***

## **Severe Winter Storm Mitigation Action Items**

The severe winter storm mitigation action items provide direction on specific activities that organizations and residents in Douglas County can undertake to reduce risk and prevent loss from severe winter storm events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

### **ACTION ITEM 1 – Encourage harvesting of trees along utility and road corridors, preventing potential winter storm damage.**

#### ***Ideas for Implementation***

Douglas County Agencies, State Agencies, Federal Agencies and Utility Operators

shall encourage the harvesting of trees along utility corridors and roads, which will prevent winter storm damage. The Planning Department shall encourage Federal, State, Local Agencies and Utility Operators to harvest trees in the corridors which will prevent winter storm damage, mitigate fire hazards, and could be used in fish enhancement projects.

**Coordinating Organization: Douglas County Planning Department.**

**Timeline: Continue.**

**Plan Goals Addressed: GOAL A, B, C and D.**

**ACTION ITEM 2 - Develop partnerships between utility providers and public works agencies to document known hazard areas.**

***Ideas for Implementation***

Coordinate with the Public Works Department about preparedness.

**Coordinating Organization: Douglas County Emergency Management.**

**Timeline: 2 years.**

**Plan Goals Addressed: Goal B and C.**

**ACTION ITEM 3 – Encourage right of way coordination, education and management between property owners, utility operators and government agencies.**

***Ideas for Implementation***

Douglas County Agencies, State Agencies, Federal Agencies and Utility Operators shall encourage the cooperation and education for managing right of way corridors with property owners.

**Coordinating Organization: Douglas County Emergency Management**

**Timeline: Continue.**

**Plan Goals Addressed: GOAL A, B, C and D.**

**ACTION ITEM 4 - Develop coordinated management strategies for de-icing, snow plowing, and clearing roads of fallen trees and debris.**

***Ideas for Implementation***

Coordinate with the Public Works Department about preparedness.

**Coordinating Organization: Douglas County Emergency Management.**

**Timeline: 2 years.**

**Plan Goals Addressed: Goal B.**

**ACTION ITEM 5 – Encourage harvesting of trees that are blown down during a winter storm.**

***Ideas for Implementation***

Douglas County Planning Department shall encourage the harvesting of trees blown down in a winter storm. The Planning Department shall encourage Federal, State, and Local Agencies to harvest trees that have fallen during a winter storm, which will mitigate fire hazards, and could be used in fish enhancement projects.

**Coordinating Organization: Douglas County Planning Department.**

**Timeline: Continue.**

**Plan Goals Addressed: GOAL A and D.**

**ACTION ITEM 6 – Distribute information regarding winter storm to the general public efficiently.**

***Ideas for Implementation***

Douglas County Emergency Management Outreach Program.

**Coordinating Organization: Douglas County Emergency Management.**

**Timeline: Continue.**

**Plan Goals Addressed: GOAL A, B, C, and D.**



# **Section 5: Earthquake**

## **Table of Contents**

### **WHY ARE EARTHQUAKES A THREAT TO DOUGLAS COUNTY?**

HISTORY OF EARTHQUAKE EVENTS IN DOUGLAS COUNTY

CAUSES AND CHARACTERISTICS OF EARTHQUAKES IN DOUGLAS COUNTY

EARTHQUAKE RELATED HAZARDS

### **EARTHQUAKE HAZARD ASSESSMENT**

HAZARD IDENTIFICATION

VULNERABILITY ASSESSMENT

RISK ANALYSIS

### **COMMUNITY EARTHQUAKE ISSUES**

WHAT IS SUSCEPTIBLE TO EARTHQUAKES?

EXISTING MITIGATION ACTIVITIES

### **EARTHQUAKE MITIGATION ACTION ITEMS**

# Why Are Earthquakes a Threat to Douglas County?

While Douglas County has no significant recent history of Earthquake activity, there is a concern due to the Pacific Northwest's geologic history.

The most recent earthquake event to affect Douglas County was the September 20th, 1993 Klamath Falls earthquake. Two earthquakes shook Klamath Falls causing two deaths and \$10 million in damage. Douglas County felt the quake very slightly with only a rattle of lampshades and glasses

Oregon ranks third in the nation for future earthquake damage estimates. Projected losses in the Northwest could exceed \$12 billion, with over 30,000 destroyed buildings, and 8,000 lives lost in the event of a magnitude 8.5 Cascadia Subduction Zone earthquake.<sup>1</sup>

Social and geological records show that Oregon has a history of seismic events. Recent research suggests that the Cascadia Subduction Zone is capable of producing magnitude 9 earthquakes. Furthermore, there is evidence of the existence of faults along the Douglas County Coast, as well as other areas of the state. Where known to exist, it is believed that they are capable of generating magnitude 7 earthquakes.

Earthquakes pose a serious threat to many Oregon communities. Local governments, planners, and engineers must consider the threat as they seek to balance development and risk. Identifying locations susceptible to seismic activity generated by local faults or the Cascadia Subduction Zone, adopting strong policies and implementing measures, and using other mitigation techniques are essential to reducing risk from seismic hazards in Douglas County.

Most of the earthquake mapping and mitigation efforts made in Oregon have been accomplished in the past two decades, and public awareness has risen remarkably during this time. Major federal, state, and local government agencies and private organizations support earthquake risk reduction, and have made significant contributions in reducing the adverse impacts of earthquakes. Despite the progress, there is still a great need for earthquake hazard education in Oregon communities.

To better understand the earthquake hazard, the scientific community has looked at historical records and accelerated research on crustal faults, which are among the sources of the earthquakes occurring in the Douglas County region. Historical earthquake records can generally be divided into records of the pre-instrumental period and the instrumental period. In the absence of instrumentation, earthquake detection is based on observations and felt reports, and dependent upon population density and distribution. Since

Oregon was sparsely populated in the 1800s, the detection of pre-instrumental earthquakes is quite difficult. Populations in some regions in or near the Willamette Valley and along the Columbia River began distribution of newspapers as early as the 1850s. Newspapers from these towns provide a good source of historical documentation of earthquakes of a magnitude five or greater since about 1850. The seismic damage potential is more severe today than in the past because the population is increasing.

## History of Earthquake Events in Douglas County

Dating back to 1841, there have been more than 6,000-recorded earthquakes in Oregon, most with a magnitude below three. Coastal Oregon, including the Douglas County Coastline is the most seismically active in the State.

### Table 5-1. Historical Earthquake Events

There have been no recorded earthquakes in Douglas County. The following lists earthquakes that have occurred near Douglas County.

#### January 26, 1700

A magnitude of about 9 Earthquake was centered off the Northwest Coast. Buried forests have been discovered along the entire Oregon Coast as a result of this event. Native American villages along the coast were destroyed and Japanese temple records from that time described a Tsunami generated from the event.

#### November 3, 1981

Magnitude 6.2 earthquake off the Oregon Coast

#### March 13, 1985

Magnitude 6.1 earthquake located in the Pacific Ocean 140 miles west of Coos Bay

#### November 8, 1990

Magnitude 7.0 earthquake off the Oregon Coast

#### September 20, 1993

Magnitude 5.9 and 6.0 earthquakes struck 15 miles northeast of Klamath Falls, causing two deaths and \$10 million in damages.

#### December 4, 1993

Magnitude 5.1 earthquake occurred, centered 10 miles northwest of Klamath Falls. Light damages to buildings.

Source: Oregon Department of Geology and Mineral Industries, Earthquake Education- Historic Earthquakes In The Pacific Northwest. <http://www.oregon.geology.com/earthquakes/historiceqs.htm>

## Causes and Characteristics of Potential Earthquakes in Douglas County

### Crustal Fault Earthquakes

Crustal fault earthquakes are the most common earthquakes and occur at relatively shallow depths of 6-12 miles below the surface. While most crustal fault earthquakes are smaller than magnitude 4 and generally create little or no damage, they can produce earthquakes of magnitudes up to 7, which cause extensive damage.

### **Deep Intraplate Earthquakes**

Occurring at depths from 25 to 40 miles below the earth's surface in the subducting oceanic crust, deep intraplate earthquakes can reach up to magnitude 7.5. The February 28, 2001 earthquake in Washington State was a deep intraplate earthquake. It produced a rolling motion that was felt from Vancouver, British Columbia to Coos Bay, Oregon and east to Salt Lake City, Utah. A 1965 magnitude 6.5 intraplate earthquake centered south of Seattle-Tacoma International Airport caused seven deaths.

### **Subduction Zone Earthquakes**

The Pacific Northwest is located at a convergent plate boundary, where the Juan de Fuca and North American tectonic plates meet. The two plates are converging at a rate of about 1-2 inches per year. This boundary is called the Cascadia Subduction Zone. It extends from British Columbia to northern California. Subduction zone earthquakes are caused by the abrupt release of slowly accumulated stress. Subduction zones similar to the Cascadia Subduction Zone have produced earthquakes with magnitudes of 8 or larger. Historic subduction zone earthquakes include the 1960 Chile (magnitude 9.5) and 1964 southern Alaska (magnitude 9.2) earthquakes.

Geologic evidence shows that the Cascadia Subduction Zone has generated great earthquakes, most recently about 300 years ago. It is generally accepted to have been magnitude 9 or greater. The average recurrence interval of these great Cascadia earthquakes is approximately 500 years, with gaps between events as small as 200 years and as large as 1,000 years. Such earthquakes may cause great damage to the coastal area of Oregon as well as inland areas in western Oregon. Shaking from a large Subduction zone earthquake could last up to five minutes. A Cascadia Subduction Zone Earthquake is the most likely to occur, and the most damaging to Douglas County of the three types of Earthquakes discussed.

**Figure 5-1. Cascadia Subduction Zone**



Source: *Off Shore Fault Zone: Washington State Department of Ecology*  
<http://www.ecy.wa.gov/programs/sea/coast/waves/fault.html>

## **Earthquake Related Hazards**

Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.

### **Ground Shaking**

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

### **Earthquake-Induced Landslides**

Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in Oregon have a high likelihood of encountering such risks, especially in areas with steep slopes.

### **Liquefaction**

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

### **Amplification**

Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the

earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification can also occur in areas with deep sediment filled basins and on ridge tops.

### **Un-reinforced Brick or Masonry Buildings (URMs)**

Most injuries in an earthquake are from building failures. The most potentially dangerous buildings are constructed of un-reinforced brick masonry. URMs are typically older brick buildings, often concentrated in an urban setting.

### **Fire**

A serious hazard following an earthquake is fire, often caused by damage to utility lines.

### **Tsunami**

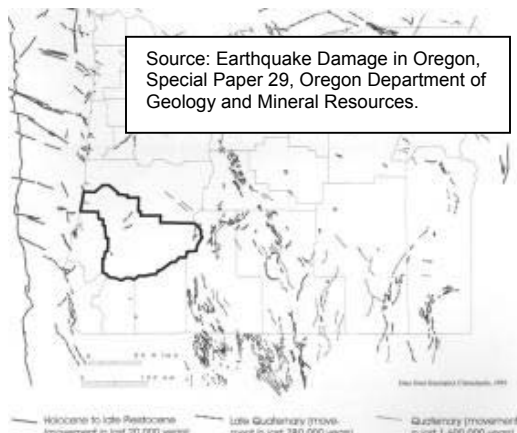
A tsunami is a series of sea waves generated by an earthquake. Damage as a result of Tsunami are discussed more thoroughly in Section 6 of the Douglas County Natural Hazard Mitigation Plan.

## **Earthquake Hazard Assessment**

### **Hazard Identification**

The Department of Geologic and Mineral Industries (DOGAMI), in partnership with other state and federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards and risks, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. Seismic hazard maps have been published and are available for many communities in Oregon through DOGAMI.

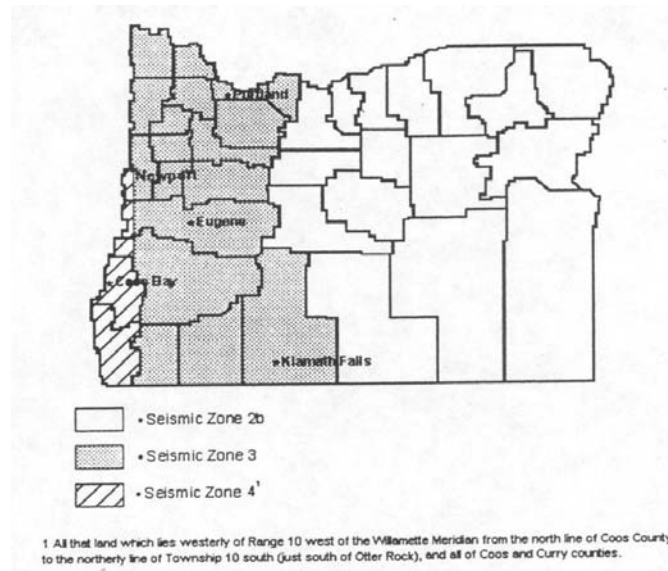
#### **Map 5-1. Fault Locations in Douglas County**



The Oregon Building Codes Division revised and upgraded its construction standards for new buildings to make them resistant to seismic events. The State Building Codes reflect three seismic zones. An increase in zone number reflects increased seismic activity. The *Current Seismic Zones* map below shows that Douglas County east of Range 10 West is within Zone 3, while west of Range 10 West is within Seismic Zone 4.

Many buildings in Douglas County were built prior to the Zone 3 and Zone 4 code requirements, established in 1993.

**Figure 5-2. Seismic Zones in Oregon**



## Vulnerability Assessment

The effects of earthquakes span a large area, and an earthquake occurring in Douglas County would probably be felt throughout the county. However, the degree to which the earthquakes are felt, and the damages associated with them may vary. At risk from earthquake damage are large stocks of old buildings and bridges, hazardous materials facilities, extensive sewer,

water, and natural gas pipelines, dams, a petroleum pipeline, and other critical facilities and private property located in the county. The areas that are particularly vulnerable to potential earthquakes in the county have been identified as the coastal area of the county, as reflected in the increased seismic zone rating of the areas west of Range 10W. The relative or secondary earthquake hazards, which are liquefaction, ground shaking, amplification, and earthquake-induced landslides, can be just as devastating as the earthquake. DOGAMI is currently conducting research regarding the location and potential damage associated with secondary earthquake hazards. Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

## Risk Analysis

Risk analysis is the third phase of a hazard assessment. Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time. Factors included in assessing earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the county due to an earthquake event in a specific location.

- Due to the high risk, but low probability of earthquakes in Douglas County, widespread mitigation of seismic hazards is probably not called for in the case of most typical buildings. New buildings will be built in accordance with current Seismic Zone 3 requirements

from Range 10W and East, and Seismic Zone 4 requirements in areas west of Range 10W. Thus, the seismic capacity of the Douglas County building stock will improve over time as the existing stock is gradually replaced and/or upgraded.

- Structural retrofit of buildings and infrastructure should focus on buildings that are most vulnerable to seismic damage, and are most important to the community, such as schools, hospitals, and other critical facilities. Priorities should include buildings on soft soil sites subject to amplification of ground motion and/or liquefaction.
- Non-structural bracing of equipment and contents is often the most cost-effective type of seismic mitigation. Inexpensive bracing and anchoring may protect expensive equipment whose function is critical in hospitals or power companies.

**Table 5-2. Cascadia Subduction Zone Earthquake (Magnitude 8.5) and 500 year return Interval Damage Estimate Model for Douglas County by Oregon Department of Geology and Mineral Resources**

Based on computer modeling and research, DOGAMI estimates future earthquake damage in a number of categories based on a magnitude 8.5 Subduction Zone earthquake off the Oregon Coast, and statewide earthquakes within a 500 year return interval.

**Cascadia Subduction Zone Magnitude 8.5 and 500 year Model for Douglas County**

	8.5 Subduction Zone Event	500-Year Model
<u>Injuries</u>	151	294
<u>Deaths</u>	2	4
<u>Displaced Households</u>	255	534
<u>Short Term Shelter Needs</u>	193	410
<u>Economic Loss for Buildings</u>	\$275 Million	\$546 Million
<u>Operating the Day After The Earthquake</u>		
<u>Fire Stations</u>	66%	NA
<u>Police Stations</u>	57%	NA
<u>Schools</u>	44%	NA
<u>Bridges</u>	74%	NA
 <u>Economic Losses to:</u>		
<u>Highways</u>	\$43 Million	\$69 Million
<u>Airports</u>	\$5 Million	\$9 Million
<u>Communication Systems</u>	\$7 Million	\$12 Million
	(61% operating the day of The Quake)	NA
<u>Debris Generated (thousands of tons)</u>	222	411

**Percentage of Buildings in Damage Categories  
8.5 Cascadia Event**

Building Type	None	Slight	Moderate	Extensive	Complete
Agricultural	19	10	12	9	6



Commercial	12	9	16	12	7
Education	25	8	10	7	4
Government	20	8	13	10	6
Industrial	19	8	13	10	7
Residential	36	10	6	3	2

### 500 Year Model

Building Type	None	Slight	Moderate	Extensive	Complete
Agricultural	19	10	12	9	6
Commercial	12	9	16	12	7
Education	17	9	13	10	6
Government	12	8	15	13	8
Industrial	11	8	16	13	9
Residential	27	14	9	4	2

Source: Wang, Yumei and Clark, J.L. *Earthquake damage in Oregon: Preliminary Estimates of Future Earthquake Losses* (1999), DOGAMI, Special Paper 29 with the following notation: “**These figures have a high degree of uncertainty and should be used only for general planning purposes. Because of Rounding, numbers may not add up to 100%.**” “**Because the 500-year model includes several earthquakes, the number of facilities operational the “day after” cannot be calculated.**”

## Community Earthquake Issues

### What is Susceptible to Earthquakes?

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways and utility lines) suffer damage in earthquakes and can cause death or injury to humans. The welfare of homes, major businesses, and public infrastructure is very important. Addressing the reliability of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake, are challenges faced by the county.

#### Dams

Douglas County dams hold millions of gallons of water in reservoirs. Releases of water from the major reservoirs are designed to protect Douglas County from high floodwaters. Seismic activity can compromise the dam structures, and the resultant downstream flooding would cause catastrophic flooding.

#### Buildings

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk and the cost to clean up the damages is great. In most Oregon communities, including Douglas County, many buildings were built before 1993 when building codes were not as strict. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of

buildings at risk remains high. The Oregon Building Codes Division revised its construction standards for new buildings to make them more resistant to seismic events. Central Douglas County, east of Range 10 west, is within Zone 3, while Douglas County West of Range 10 is within Seismic Zone 4. The Douglas County Building Department has an archive of building permits.

### **Infrastructure and Communication**

Residents in Douglas County commute almost exclusively by automobile. An earthquake can greatly damage bridges and roads, hampering the movement of people and goods. Damaged infrastructure strongly affects the economy of the community because it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

### **Bridge Damage**

Even modern bridges can sustain damage during earthquakes, leaving them unsafe for use. Some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link – with even minor damages making some areas inaccessible. Because bridges vary in size, materials, siting, and design, any given earthquake will affect them differently. Bridges built before the mid-1970's have a significantly higher risk of suffering structural damage during a moderate to large earthquake compared with those built after 1980 when design improvements were made.

Much of the interstate highway system was built in the mid to late 1960's. Bridges in Douglas County are state, county, city, or privately owned. A state-designated inspector must inspect all state, county, and city bridges every two years, and the inspections are rigorous, looking at everything from seismic capability to erosion and scour. However, private bridges are not inspected, and can be very dangerous.

Upon inspection, the bridges are subject to a sufficiency score. This score uses a scale of 1 to 100 with 1 being the worst rating. The bridges are ranked throughout the state according to their score. The state then prioritizes the bridge repair according to each score. If the bridge receives a sufficiency score of less than 50, it is on the list for upgrading and rehabilitation. If it scores over 50, it is not included on the list.

Small repairs to county bridges may be done entirely by Douglas County, while the larger projects require funding through the Highway Bridge Replacement and Rehabilitation program (HBRR). HBRR provides 80% of funding, and the county is responsible for 20%.

### **Damage to Lifelines**

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. Lifelines need to

be usable after an earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

### **Disruption of Critical Services**

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Many critical facilities are housed in older buildings that are not up to current seismic codes.

### **Businesses**

Seismic activity can cause great loss to businesses; both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to large and small shop owners who may have difficulty recovering from their losses.

### **Individual Preparedness**

A 1999 DOGAMI survey shows that about 39% of respondents think an earthquake will occur in Oregon within the next 10 years. Only 28% of Oregon residents say they are prepared for an earthquake, and 22% have earthquake insurance. In addition, only 24% correctly identified what to do during an earthquake.

Because the potential for earthquake occurrences and earthquake-related property damage is relatively high, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property, as well as being earthquake insured, and anchoring buildings to foundations are just a few steps individuals can take to prepare for an earthquake.

### **Death and Injury**

Death and injury can occur both inside and outside of buildings due to collapsed buildings falling equipment, furniture, debris, and structural materials. Downed power lines and broken water and gas lines can also endanger human life.

### **Fire**

Downed power lines or broken gas mains can trigger fires. When fire stations suffer building or lifeline damage, quick response to extinguish fires is less likely.

### **Debris**

After damage to a variety of structures, much time is spent cleaning up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials. Developing strong debris management strategies can assist in post-disaster recovery.

## **Existing Mitigation Activities**

Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies or organizations.

### **Douglas County Code**

Implementation of earthquake mitigation policy takes place at the local government level. Codes pertaining to earthquake hazards are managed through the Planning and Building Codes Departments. Developers in potential hazard-prone areas are required to retain a professional engineer to evaluate level of risk onsite and recommend mitigation measures.

### **Coordination Among County Building Officials**

The Oregon State Building Code Division (BCD) sets the minimum design and construction standards for new buildings. In 1993, BCD upgraded the Oregon Specialty Code (OSSC) seismic zone rating, which requires that new buildings be built at a higher seismic standard. Since 1993, BCD also requires that site-specific seismic hazard investigations be performed for new essential facilities, major structures, hazardous facilities, and special occupancy structures such as schools, hospitals, and emergency response facilities.

The county enforces the Unified Building Code (UBC), as adopted by the BCD to insure building code standards in new construction. Codes related to Natural Hazard Mitigation are Chapter 16 of the UBC. It introduces seismic zones, which are rated from 1-4 depending on risk. Each zone has different standards that are specific to the level of risk. The following sections of the UBC address the earthquake hazard: 1605.2.1 (Distribution of Horizontal Sheer); 1605.2.2 (Stability against Overturning); 1626 (Seismic); 1605.2.3 (Anchorage); and 1632, 1633.2.8, 1633.2.9 deal with specific earthquake hazards.

### **Businesses/Private Sector**

Natural Hazards can have a devastating impact on businesses. The Institute of Business and Home Safety has developed “Open for Business”, which is a disaster planning toolkit to help guide businesses in preparing for and dealing with the adverse affects of natural hazards. The kit integrates protection from natural disasters into the company’s risk reduction measures to safeguard employees, customers, and the investment itself. The guide helps businesses secure human and physical resources during disasters, and helps to develop strategies to maintain business continuity before, during, and after a disaster occurs.

### **Senate Bill 13: Seismic Event Preparation**

Senate Bill 13, signed on June 14, 2001, requires each state and local agency and persons employing 250 or more full-time employees to develop seismic preparation procedures and inform their employees about the procedures. Further, the bill requires agencies to conduct drills in accordance

with Office of Emergency Management guidelines. These drills must include “familiarization with routes and methods of exiting the building and methods of duck, cover and hold during an earthquake.” Each state and local agency and employer with 250 or more full-time employees shall maintain a file that documents the date the earthquake drill was conducted. Oregon Emergency Management (OEM) was tasked to write the Oregon Administrative Rule (OAR) for this bill. The draft rule went out for public comment in February 2002, and was revised based on public comment. The final rule (OAR 104-020-000-040) went into effect April 1, 2002.

#### **Senate Bill 14: Seismic Surveys For School Buildings**

The Governor signed Senate Bill 14 on July 19, 2001, which requires the State Board of Higher Education to provide for seismic safety surveys of buildings that have a capacity of 250 or more persons and are routinely used for student activities by public institutions or departments under the control of the board.

#### **Senate Bill 15: Seismic Surveys For Hospital Buildings**

The Governor signed Senate Bill 15 on July 19, 2001, which requires the Health Division to provide for seismic safety surveys of hospital buildings that contain an acute in-patient care facility. Seismic surveys shall also be conducted on fire stations, police stations, sheriffs’ offices, and similar facilities subject to available funding. The surveys should be completed by January 1, 2007.

#### **Earthquake Education**

All three of the state’s major public universities (University of Oregon, Oregon State University, and Portland State University) are involved with earthquake education in some capacity. At these institutions, the federally funded work conducted tends to be oriented towards basic research, whereas state funded work typically has more practical application.

The Department of Education is generally concerned with seismic safety in schools. It supports the required monthly earthquake drills mandated in Oregon Revised Statutes (ORS 336.072). The Department is not authorized to mandate seismic safety efforts in schools but can make recommendations to local school districts on such issues. It encourages the use of a curriculum produced by FEMA that focuses on mitigating non-structural hazards in schools and assists schools in obtaining funds for these purposes. Each year, Oregon Emergency Management provides information to facilitate school earthquake drills statewide. Currently, all thirteen Douglas County School Districts have committed to performing earthquake drills.

# Earthquake Mitigation Action Items

The earthquake mitigation action items provide guidance on suggesting specific activities that agencies, organizations, and residents in Douglas County can undertake to reduce risk and prevent loss from earthquake events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

## Earthquake Mitigation Goals

### GOAL A

Prevent Loss of Life from Earthquakes

### GOAL B

Reduce Property Damages

### GOAL C

Enhance Education and Public Awareness of Earthquake Danger

### GOAL D

Increase Preparedness of Communities and Agencies To Deal With Earthquakes

## Earthquake Mitigation Action Items

### **ACTION ITEM 1 – Promote and continue building code standards**

#### ***Ideas for Implementation:***

Continue building code education, promotion, and utilization to ensure earthquake resistant new construction.

**Coordinating Organization:** County and City Planning Departments and Douglas County Building Department

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

### **ACTION ITEM 2 – ID and strengthen weak existing buildings to mitigate for damage; especially: Schools, fire/police stations/hospitals, historic buildings, un-reinforced masonry buildings that could risk lives in a quake due to falling bricks**

#### ***Ideas for Implementation:***

Refit older public buildings to bring them up to current earthquake standards.

**Coordinating Organization:** County and City Planning Departments and Douglas County Building Department

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

### **ACTION ITEM 3 – Identify and enhance water, sewer, electric, gas and other utilities to improve their survivability in an earthquake.**

***Ideas for Implementation:***

Coordinate utility improvements with companies, cities and Douglas County.

**Coordinating Organization:** County and City Planning Departments, Douglas County Emergency Management, Douglas County Building Department, Douglas County Public Works

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

**ACTION ITEM 4 – Encourage Earthquake safety promotion and drills to schoolchildren and community groups**

***Ideas for Implementation:***

Conduct safety seminars with community groups to describe earthquake dangers, and steps that can be taken to reduce their impact. Encourage Douglas County Schools to promote earthquake safety education.

**Coordinating Organization:** County and City Planning Departments, Douglas County Emergency Management, Douglas County Schools, Community Organizations

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

**ACTION ITEM 5 – Continue and improve tsunami education for residents and tourists on the coast**

***Ideas for Implementation:***

Work with Coastal Communities and agencies dealing with tsunami dangers to continue education and enhancement of tsunami evacuation routes.

**Coordinating Organization:** County and City Planning Departments, Douglas County Emergency Management

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

**Earthquake Endnotes**

<sup>1</sup> Wang, Yumei and Clark, J.L. *Earthquake damage in Oregon: Preliminary estimates of future earthquake losses* (1999), DOGAMI, Special Paper 29.

<sup>2</sup> Preparing for Earthquakes in Oregon. Oregon Geology, Vol. 59. No. 2, March/April 1997.

Institute for Business and Home Safety Resources  
<http://www.ibhs.net/ibhsdocuments/pdf/earthquake.pdf>.

# Section 6: Tsunami

## Table of Contents

### **WHY ARE TSUNAMIS A THREAT TO DOUGLAS COUNTY?**

History Of Tsunamis In Douglas County  
Characteristics Of Tsunamis  
How Are Tsunami-Prone Areas Identified?

### **HAZARD ASSESSMENT**

Hazard Identification  
Vulnerability Assessment  
Risk Analysis

### **COMMUNITY TSUNAMI ISSUES**

What Is Susceptible To Damage During A Tsunami Event?  
Tsunami Mitigation Activities

### **TSUNAMI MITIGATION ACTION ITEMS**



## Why are Tsunamis a Threat to Douglas County?

Oregon coastal communities, including the Douglas County Coastline are threatened by tsunamis that are generated by both local earthquakes and distant earthquakes. Local tsunamis give residents only a few minutes to seek safety. Tsunamis of distant origins give residents more time to evacuate threatened coastal areas but increase the need for timely and accurate assessment of the tsunami hazard to avoid costly false alarms. Thus, Alaska or Hawaii can experience a local earthquake and tsunami while residents Douglas County may experience this disaster as a distant tsunami. Similarly, a local tsunami may also have an impact on the distant states of Alaska, Hawaii or even across the Pacific. Of the two, local tsunamis are more devastating.

In Oregon, prehistoric runups (i.e., how high a tsunami wave reaches above mean sea level) can be deduced with numerical methods. From such models, it was concluded that a tsunami that struck Salishan Spit in Lincoln County between 300 and 800 years ago had a runup of up to 40 feet above sea level. It is likely that the same wave probably overtopped a 16-foot-high barrier ridge at Cannon Beach and breached a 20-foot ridge at Seaside.

One of the largest subduction zone earthquakes ever recorded was the M 9.2 quake on March 27, 1964. A tsunami generated by the same 1964 Alaska earthquake also struck the Oregon coastline, killing four people and causing nearly \$1 million damage (in 1964 dollars). **The highest officially measured tsunami wave in Oregon in 1964 was 14.2 feet at the mouth of the Umpqua River [1].** When the same tsunami struck Crescent City, California, the maximum wave height was 14 feet, 11 people were killed, and approximately \$8 million of damage was done. Heights of tsunami waves generated by nearby earthquakes could be much higher.

There has been no significant damage in Douglas County from tsunamis. However, given the damages caused to Oregon coastal towns, and the historical evidence of tsunami impacts through the Pacific Ocean, a tsunami affecting vulnerable locations on the Douglas County Coast is a real issue.

## History of Tsunamis along the Oregon Coast and Douglas County

As stated previously, there is no recorded tsunami damage other than minor flooding “Run Up” as a result of the 1964 Tsunami, in Douglas County.

Tsunamis have historically been rare in Oregon. Since 1812, Oregon has experienced about a dozen tsunamis with wave heights greater than 3 feet; some of these were destructive. Ten of these were generated by distant earthquakes near Alaska, Chile or Japan. The worst damage and loss of life resulted from the 1964 Alaskan earthquake.

## **1964 Alaskan Earthquake and Tsunami**

The 1964 earthquake caused 115 deaths in Alaska alone, with 106 of these due to tsunamis, which were generated by tectonic uplift of the sea floor, and by localized subareal and submarine landslides. The earthquake shaking caused at least 5 local slide generated tsunamis within minutes after the shaking began. (In general, slide/slump induced tsunamis are generated within a few minutes after an earthquake starts.) This created a local tsunami causing much damage and the spreading of oil, which was on fire and floating on the water. About 20 minutes after this occurred, the first wave of the main tsunami arrived. The 11-13 fatalities in Seward were due to the local and the main tsunami.

Tsunamis generated by the 1964 earthquake (and their subsequent damage, loss of life, etc.) were recorded throughout the Pacific. This was the most disastrous tsunami to hit the U.S. West Coast and British Columbia in Canada. The largest wave height for this tsunami was reported at Shoup Bay, Valdez Inlet Alaska (67 meters). Summary of lives lost and damage for Alaska, Canada, Washington, Oregon and California are: Alaska- 106 deaths and \$84 million; British Columbia- \$10 million; Washington- minor damage throughout the coast; In Oregon, 4 deaths and \$0.7 million, with much of the damage away from the coast where rivers overflowed.

## **Characteristics of Tsunamis**

A tsunami, also called a seismic sea wave, or incorrectly called a tidal wave, travels across the deep ocean at speeds up to 500 miles per hour. A tsunami generated offshore from Japan or Alaska might not hit the Oregon coast for several hours. A tsunami following a Cascadia earthquake may hit in less than 30 minutes.

On the open ocean, a fast moving tsunami might be a wave only three to four feet high, with 100 miles separating wave crests. Approaching the coast, however, the tsunami begins to slow in shallow water, and successive waves bunch up, increasing in height. As the ocean bottom shallows even more, the wave rapidly rises and may break several tens of feet high with incredible destructive power. It has been conjectured that the configuration of the Oregon and Washington continental shelf could produce tsunami waves that would appear to rise slowly out of the ocean but build up to 30 feet or more in height as water is cast shoreward.

If you throw a pebble into standing water, a succession of ripples or waves moves across the water. Similarly, tsunamis almost never come as single waves but arrive as multiple crests that are sometimes hours apart. Often the first tsunami is not even the largest or most destructive, and wave four or five may be the largest of all.

Tsunamis are caused by undersea volcanic eruptions, landslides, or faulting as slabs of the sea floor are displaced vertically. Most commonly, rapid uplift or subsidence of the sea floor along faults is transmitted to the surface of the ocean, forming unusually large waves. Coastal slides from land under the water, also triggered by earth movement, can intensify the effects of tsunamis.

The undersea subduction zone, paralleling the Oregon coast at a distance of about 75 miles, is the junction between the Juan de Fuca and the North American tectonic plates. The two plates lock together, but periodically the stress is released suddenly with a snapping motion, and the resulting shock may trigger a tsunami. Distinctive, thin deposits of shallow marine sands along the coast are physical evidence of these ancient waves.

#### **Some Tsunami Facts:**

1. Tsunamis are caused by an underwater disturbance — usually an undersea earthquake. Landslides, volcanic eruptions, and even meteorites can also generate a tsunami.
2. Tsunamis can originate hundreds or even thousands of miles away from coastal areas. Local geography may intensify the effect of a tsunami. Areas at greatest risk are less than 50 feet above sea level and within one mile of the shoreline.
3. People who are near the seashore during a strong earthquake should listen to a radio for a tsunami warning and be ready to evacuate at once to higher ground.
4. Rapid changes in the water level are an indication of an approaching tsunami.
5. Tsunamis arrive as a series of successive “crests” (high water levels) and “troughs” (low water levels). These successive crests and troughs can occur anywhere from 5 to 90 minutes apart. They usually occur 10 to 45 minutes apart.

Two kinds of tsunamis could affect the Douglas County coast:

- Tsunamis generated by undersea earthquakes just off the Oregon coast can strike the coast within five to thirty minutes, possibly disrupting power lines and communications and leaving little time for an official warning. The actual ground shaking of the earthquake may be the only warning received.
- Tsunamis generated by earthquakes occurring thousands of miles away will take several hours to reach the coast. There would be time for official warning, no earthquake would be felt, and the only warning may be a sudden unexpected change in sea level.

A tsunami is not a single wave but a series of long period waves that can cause havoc along the coastline, in harbors and bays, and move up coastal rivers. The unusual, wild oscillations of sea level caused by the tsunami can last for hours following arrival of the first wave. In 1964, many people in Crescent City, California, thought it was safe to return to the harbor area only to be killed by later arriving

tsunami waves. The same happened in Hilo, Hawaii, in 1960.

## Hazard Assessment

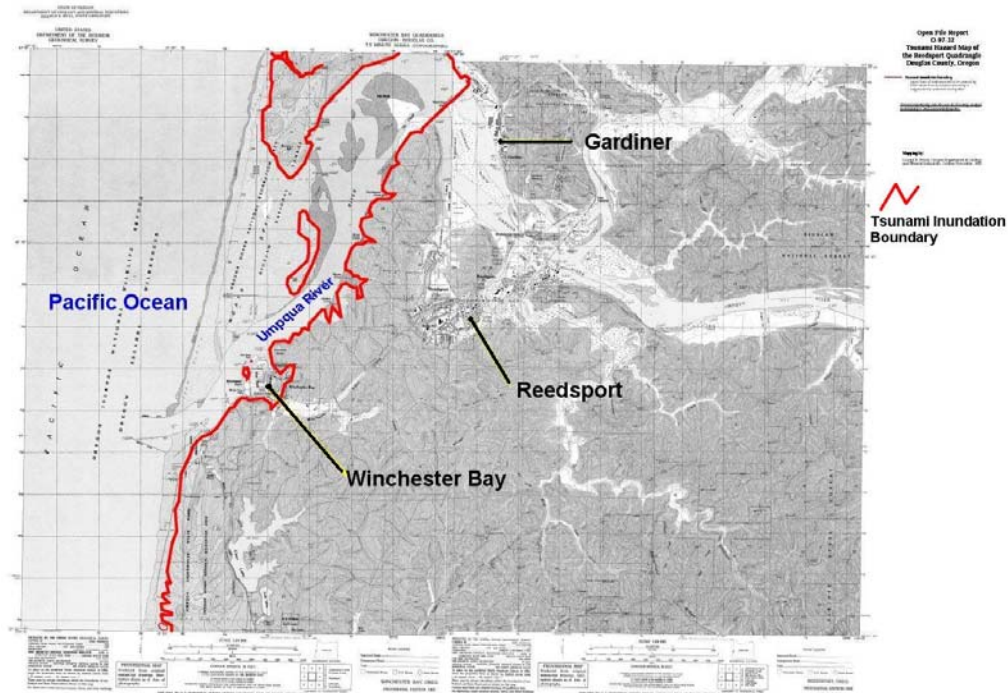
### Hazard Identification

#### DOGAMI Tsunami Hazard Maps

The tsunami hazard maps were produced to help implement Senate Bill 379 (SB 379), which was passed by the 1995 regular session of the Oregon Legislature.

SB 379, implemented as Oregon Revised Statutes (ORS) 455.446 and 455.447, and Oregon Administrative Rules (OAR) 632-005 limits construction of new essential facilities and special occupancy structures in tsunami flooding zones. The focus of the maps is therefore on implementation of this public safety bill and has minor impacts on land use or emergency planning.

#### Map 6-1 Tsunami Hazard Map for Winchester Bay and Reedsport



Source: Oregon Department of Geology and Mineral Resources – Enhanced for readability in this document

As part of an international cooperative effort to save lives and protect property, the National Oceanic & Atmospheric Administration's (NOAA) National Weather Service operates two tsunami warning centers. The West Coast & Alaska Tsunami Warning Center (WCATWC) in Palmer, Alaska, serves as the regional Tsunami Warning Center for Alaska, British Columbia, Washington, Oregon and California.

The Pacific Tsunami Warning Center (PTWC) in Ewa Beach, Hawaii, serves as the regional Tsunami Warning Center for Hawaii and as a national/international warning center for tsunamis that pose a Pacific-wide threat. This international warning effort became a formal arrangement in 1965 when PTWC assumed the international warning responsibilities of the Pacific Tsunami Warning System (PTWS). The PTWS is comprised of 26 international Member States that are organized as the International Coordination Group for the Tsunami Warning System in the Pacific. The PTWS operate national tsunami warning centers, providing warning services for their local area.

The objective of the PTWS is to detect, locate and determine the magnitude of potential tsunami generating earthquakes occurring in the Pacific Basin or its immediate margins. Earthquake information is provided by seismic stations operated by PTWC, WCATWC, the U.S. Geological Survey's National Earthquake Information Center and international sources. If the location and magnitude of an earthquake meet the known criteria for generation of a tsunami, a tsunami warning is issued to warn of an imminent tsunami hazard.

The warning includes predicted tsunami arrival times at selected coastal communities within the geographic area defined by the maximum distance the tsunami could travel in a few hours. A tsunami watch with additional predicted tsunami arrival times is issued for a geographic area defined by the distance the tsunami could travel in a subsequent time period.

If a significant tsunami is detected by sea-level monitoring instrumentation, the tsunami warning is extended to the entire Pacific Basin. The International Tsunami Information Center, part of the Intergovernmental Oceanographic Commission, monitors and evaluates the performance and effectiveness of the Pacific Tsunami Warning System. This effort encourages the most effective data collection, data analysis, tsunami impact assessment and warning dissemination to all TWS participants.

Tsunami watches, warning, and information bulletins are disseminated to appropriate emergency officials and the general public by a variety of communication methods. [2]

The WC/ATWC and PTWC may issue the following bulletins:

- **WARNING**: A tsunami was or may have been generated, which could cause damage; therefore, people in the warned area are strongly advised to evacuate.
- **WATCH**: A tsunami was or may have been generated, but is at least two hours travel time to the area in watch status. Local officials should prepare for possible evacuation if their area is upgraded to a warning.
- **ADVISORY**: An earthquake has occurred in the Pacific basin, which might generate a tsunami. WC/ATWC and PTWC will issue hourly bulletins advising of the situation.

- **INFORMATION:** A message with information about an earthquake that is not expected to generate a tsunami. Usually only one bulletin is issued.

### **Vulnerability Assessment**

A vulnerability assessment that describes the number of lives or amount of property exposed to tsunami threat has not yet been conducted for Douglas County. However, tsunamis can cause property damage, transportation and economic disruptions, and pose a high risk for injuries and loss of life. The tsunami event may also require needed shelter and care for adversely impacted individuals. The county has not experienced a serious damaging Tsunami event in the past, however the potential threat is one to be concerned about as the Douglas County Coastline is threatened by tsunamis that are generated by both local earthquakes and distant earthquakes. In general, the community of Winchester Bay is vulnerable, however topography and distance limit vulnerability of other areas outside of the immediate Douglas County coastline. However, communities in Oregon and other states along the Pacific Coast have experienced serious tsunami damage, and loss of life, therefore preparedness is needed.

Factors included in assessing tsunami risk include population and property distribution in the hazard area, tsunami warnings, and information on utilities, and infrastructure that may be impacted by a tsunami. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed. Insufficient data currently exists to complete a risk analysis.

## **Community Tsunami Issues**

### **What is Susceptible to Damage During a Tsunami Event?**

People and properties located in low-lying areas near the ocean are at greatest risk from tsunami flooding.

Boats and ships in harbor are also at great risk from the wild changes in sea level. The water level can change so fast that lines holding ships to the pier will break like string. Navigating in these conditions will be treacherous as unpredictable, dangerous currents can continue for hours while the water in the harbor shifts back and forth.

The rapidly increasing sea level caused by the tsunami picks up debris, rocks, logs and other materials that act as projectiles causing additional damage and dangers.

### **Existing Tsunami Mitigation Activities**

#### **Douglas County Codes**

**SECTION 3.35.960 of the Douglas County Land Use and Development Ordinance, Tsunami Inundation Overlay (TIO)**

The purpose of the Tsunami Inundation Overlay is to implement state legislation and agency rules adopted by the Governing Board of the Oregon Department of Geology and Mineral Industries (DOGAMI). The TIO Overlay is intended to reduce the risk of loss of life in the event of a Tsunami inundation. Inundation risks can be reduced by the provision of information and assistance from DOGAMI to developers, and by limiting where certain types of essential facilities or special occupancy structures may be located. This overlay also requires that, after land use approval, developers subject to overlay requirements shall submit building plans or proposals to DOGAMI for their review and response prior to receiving a development permit. The Overlay shall be applied to the Tsunami Inundation Zone, as defined in this Section, and as depicted in the Comprehensive Plan.

**1. Definitions:** For the purpose of this section only, the following definitions are established:

**ESSENTIAL FACILITY:** Hospitals and other medical facilities having surgery and emergency treatment areas; fire and police stations; structures and equipment in emergency-preparedness centers; and structures and equipment in government communication centers and other facilities required for emergency response.

**HAZARDOUS FACILITY:** Structures housing, supporting or containing sufficient quantities of toxic or explosive substance to be of danger to the safety of the public if released.

**MAJOR STRUCTURE:** A building over six stories in height with an aggregate floor area of 60,000 square feet or more; every building over ten stories in height; and parking structures as determined by Department of Consumer and Business Services rule.

**SPECIAL OCCUPANCY STRUCTURE:** Covered structures whose primary occupancy is public assembly with a capacity greater than 300 persons; buildings with a capacity greater than 50 individuals for every public or private school through secondary level or day care centers; buildings for colleges or adult education schools with a capacity greater than 500 persons; medical facilities with 50 or more residents, incapacitated patients already included in this definition; jails and detention facilities; and all structures and occupancies with a capacity greater than 5,000 persons.

**TSUNAMI INUNDATION ZONE:** A Tsunami is a series of ocean waves caused by an undersea earthquake. The Tsunami Inundation Zone was scientifically modeled by DOGAMI and estimates how far upland the tsunami wave will run.

**2. Permitted Uses:** Uses and activities permitted by the underlying zoning district shall be allowed unless specifically prohibited by Subsection 3 of this section. Water-dependent and water-related facilities and structures in the tsunami inundation zone are exempt from Tsunami Inundation Overlay restrictions.

**3. Buildings Prohibited:** The construction of, conversion to, or replacement of the following essential facilities or special occupancy structures shall not be allowed in the tsunami inundation zone:

- a. Hospitals and other medical facilities having surgery and emergency treatment areas;
- b. Fire and Police station unless there is a need for a strategic location;
- c. Government communication centers and other emergency response centers.
- d. Private or public elementary and/or secondary school, or day care center, with a capacity greater than 50 individuals unless there is a need for the school to be within the boundaries of a school district and no other sites are available;
- e. Colleges or adult education schools with a capacity greater than 500 persons; and
- f. Jails and detention facilities

**4. DOGAMI Review:** After planning approval, or prior to issuance of a development permit for construction of, conversion to, or replacement of any development on the following list, the owner or developer shall consult with the local building official to determine whether ORS 455 applies (in this subsection, ORS 455 shall specifically refer to those sections of the statute dealing with tsunami inundation zones, specifically the “prohibition of construction for certain facilities and structures” and, the “regulation of certain vulnerable structures”, identified in the 2001 Edition of the statutes as ORS 455.446 and ORS 455.447):

- 1) Emergency preparedness center
- 2) Hazardous Facilities
- 3) Covered structures used primarily for public assembly with capacity over 300 people
- 4) Medical facilities with over 50 patients
- 5) Structures with capacity over 5,000 persons
  - a. If the building official determines that ORS 455 is not applicable, then the owner or developer may proceed through the development permit process without further review under this Section.
  - b. If the building official determines that ORS 455 is applicable, then the owner or developer shall consult with DOGAMI and submit a copy of building plans or proposals to that agency for their review. In cases where ORS 455 is applicable, a local development permit shall not be issued until a written response is received from DOGAMI.

## **Tsunami Mitigation Goals**

### **GOAL A**

**Protect Lives of Residents and Visitors in Tsunami Prone Areas**

### **GOAL B**

**Reduce Property Damages and Loss in Tsunami Prone Areas**



## **GOAL C**

**Enhance Education and Public Awareness of Tsunami Dangers**

## **GOAL D**

**Increase Preparedness of Communities and Agencies To Deal With Tsunami Threat**

# **Tsunami Mitigation Action Items**

**ACTION ITEM 1 – Identify vulnerable assets (fire stations, equipment, utilities) likely to be impacted by tsunami and determine ways of mitigating the vulnerability.**

***Ideas for Implementation***

Coordinate emergency response to disaster, enhance local mapping capabilities and forecasting, encourage tsunami evacuation training for emergency responders.

**Coordinating Organization:** Douglas County Emergency Management

**Timeline:** continue

**Plan Goals Addressed:** B, C, D

**ACTION ITEM 2 –Work with coastal communities, citizen groups, property owners, recreation areas, emergency responders, schools and businesses in promoting tsunami awareness and evacuation**

***Ideas for Implementation:***

Distribution of Tsunami information describing dangers and evacuation routes for visitors at the coast and continued educational outreach for residents and business owners.

**Coordinating Organization:** County and City Planning Departments

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D

**ACTION ITEM 3 – Improve technology capacity of communities, agencies and responders needed to adequately map hazard areas, broadcast warnings, inform, and educate residents and visitors of tsunami dangers**

***Ideas for Implementation***

Improve and utilize tsunami information, utilize technology to assist in determining evacuation needs and concerns.

**Coordinating Organization:** Douglas County and City of Reedsport Planning Departments

**Timeline:** Continue

**Plan Goals Addressed:** A,B,C,D

**ACTION ITEM 4 – Develop, coordinate with state and surrounding counties, the development and installation of a coastal tsunami warning system.**

***Ideas for Implementation***

Develop a system to track and warn the Douglas County Coastline in coordination with the State, Federal and other Oregon County Emergency Planners.

**Coordinating Organization:** Douglas County Emergency Management, City of Reedsport, Salmon Harbor, Coastal Fire Agencies, ODOT, Douglas County Public

Works.

**Timeline:** Continue

**Plan Goals Addressed:** A,C,D

**ACTION ITEM 5 –Enhance tsunami evacuation route capacity and visibility**

***Ideas for Implementation***

Improve evacuation route road conditions, expand use and visibility of Tsunami Evacuation Route signs around hazard areas.

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Public Works, City of Reedsport, Oregon Department of Transportation

**Timeline:** Continue

**Plan Goals Addressed:** A, C, D

**ACTION ITEM 6 –Control evacuation of hazard areas by ensuring capacity of evacuation routes**

***Ideas for Implementation***

Prevent “onlookers” from becoming an obstacle to the evacuation of affected areas.

**Coordinating Organization:** Douglas County Emergency Management

**Timeline:** Continue

**Plan Goals Addressed:** A, C, D

# **Section 8: Wildfire**

## **Table of Contents**

### **WHY ARE WILDFIRES A THREAT TO DOUGLAS COUNTY?**

WILDFIRE CHARACTERISTICS

WILDFIRE HAZARD IDENTIFICATION

VULNERABILITY AND RISK

### **COMMUNITY WILDFIRE ISSUES**

WHAT IS SUSCEPTIBLE TO WILDFIRE?

WILDFIRE MITIGATION ACTIVITIES

### **WILDFIRE MITIGATION ACTION ITEMS**

# Why are Wildfires a Threat to Douglas County?

Fires are a natural part of the ecosystem in Oregon. However, wildfires can present a substantial hazard to life and property in growing communities. There are potential for losses due to wildland/urban interface fires in Douglas County.

The forest comprises approximately 90% of Douglas County. Douglas County's forests play an important role in the economy of the county, as well as surround it's residents homes and businesses. Wildfire is serious threat to the well being and quality of life in the Umpqua Valley.

## Douglas County Fires, 2002

The 2002 fire season was one of the most severe in the history of Oregon. Douglas County was at the forefront of the 2002 blazes. Locally, 136 fires were suppressed that burned 832 acres of Private, County, State and Bureau of Land Management land. Over 88,000 acres burned within the Umpqua National Forest. The ten-year annual fire average for DFPA is 88 fires and 317 acres. Prior to 2002, the worst fire season was in 1917 when 245 fires scorched 36,597 acres. Over 30,000 acres also burned in 1987 as a result of 179 fires.

**Table 8-1. US Forest Service reported fire statistics for 2002 (last updated in August 2002)**

Incident Name	Size (acres)	Personnel	Structures Lost
Biscuit	500,068	3,221	13
Tiller Complex	66,355	1,785	0
Apple	10,200	1,129	0

Source: United States Forest Service

**Apple (Umpqua National Forest):** This fire was 21 miles east of Glide, and encompassed 9,800 acres. Twenty residences were threatened.

**Tiller Complex (Umpqua National Forest):** Fire at 75 percent contained. This 65,824-acre fire, consists of eight large and many small fires, is on the Tiller Ranger District and in the Rogue-Umpqua Divide Wilderness Area, 25 miles east of Canyonville. Sixty-seven residences were threatened.

**Biscuit Fire (Siskiyou National Forest):** This fire cost more than \$150 million to fight, and was located in southern Oregon and northern California. The fire began on July 13, 2002 and reached 500,023 acres in August 2002. Estimated to be The Nation's largest wildfire in recorded history, the Biscuit Fire encompasses most of the Kalmiopsis Wilderness. The boundary of the Biscuit Fire stretches from 10 miles east of the coastal community of Brookings, Oregon; south into northern California; east to the Illinois Valley; and north to within a few miles of the Rogue River. There were 274 structures threatened by this fire. Four residences and nine outbuildings were lost.



Satellite Photo taken 8/13/02 of Tillier Complex and Biscuit Fire. Source: Wildfire News

## Historic Fires in Oregon

In 2002, Southern Oregon's devastating Biscuit Fire became costliest fire in U.S. history, at \$154 million, burning over 500,000 acres. Large and destructive wildfires have occurred throughout recorded history in Oregon. Table 8-2 lists the major wildfires that occurred in Oregon between 1848 and 1966.

**Table 8-2a. Large Historic Fires in Oregon (1848-1966)**

Year	Fire	# of Acres Burned
1848	Nestucca	290,000
1849	Siletz	800,000
1853	Yaquina	482,000
1865	Silverton	988,000
1868	Coos Bay	296,000
1933	Tillamook	240,000
1936	Bandon	143,000
1939	Saddle Mountain	190,000
1945	Wilson River/Salmonberry	180,000
1951	North Fork/Elkhorn	33,000
1966	Oxbow	44,000

Source: "Atlas of Oregon," William G. Loy, et al, University of Oregon Books, 1976. Oregon Department of Forestry, "Tillamook Burn to Tillamook State Forest," revised 1993.

**Table 8-2b. Large Historic Fires in Douglas County (Douglas Forest Protective Association Administered Lands) (1956-2001)**

### DOUGLAS FOREST PROTECTIVE ASSOCIATION

#### HISTORY OF FIRES

YEAR	MAN CAUSED FIRES	ACRES	LIGHTNING CAUSED FIRES	ACRES	TOTAL FIRES	TOTAL ACRES	YEAR	MAN CAUSED FIRES	ACRES	LIGHTNING CAUSED FIRES	ACRES	TOTAL FIRES	TOTAL ACRES
1956	45	533	8	23	53	556	1980	87	1,979	48	26	135	2,005
1957	75	1,312	14	0	89	1,312	1981	50	488	0	0	50	488
1958	66	1,462	18	3	84	1,465	1982	55	612	15	12	70	624
1959	55	5,259	17	5	72	5,264	1983	22	26	13	6	35	32
1960	59	1,535	35	95	94	1,630	1984	64	437	48	7	112	444
1961	58	6,429	48	49	106	6,478	1985	76	774	25	5	101	779
1962	61	1,197	3	0	64	1,197	1986	45	324	10	0	55	324
1963	64	721	24	9	88	730	1987	84	10,908	95	19,532	179	30,440
1964	72	967	4	2	76	969	1988	58	1,462	26	57	84	1,519
1965	136	4,998	48	13	184	5,011	1989	51	315	25	7	76	322
1966	153	2,011	49	35	202	2,046	1990	50	319	12	74	62	393
1967	106	2,779	21	1,308	127	4,087	1991	45	401	15	5	60	406
1968	63	1,292	10	0	73	1,292	1992	60	378	26	5	86	383
1969	85	407	11	0	96	407	1993	42	449	26	4	68	453
1970	174	1,383	39	75	213	1,458	1994	57	262	52	25	109	287
1971	75	165	4	35	79	200	1995	47	49	18	9	65	58
1972	115	1,138	14	0	129	1,138	1996	74	311	47	22	121	333
1973	125	3,711	21	12	146	3,723	1997	32	31	4	1	36	32
1974	124	404	30	132	154	536	1998	58	226	60	40	118	266
1975	134	801	44	9	178	810	1999	59	107	7	1	66	108
1976	81	180	10	0	91	180	2000	50	239	3	0	53	239
1977	75	895	11	10	86	905	2001	81	353	24	5	105	358
1978	32	111	88	273	120	384	AVG.	73.33	1323.87	25.70	476.78	99.02	1800.65
1979	93	758	12	1	105	759							

Source: 2002 Douglas Forest Protective Association Cooperators Fire Operations Plan

During the 2000 fire season, more than 7.5 million acres of public and private lands burned in the US, resulting in loss of property, damage to resources, and disruption of community services. In 2000, taxpayers spent more than \$1.6 billion to combat 90,000 fires nationwide. Many of these fires burned in wildland/urban interface areas

and exceeded the fire suppression capabilities of those areas.

The magnitude of the 2000 fires is the result of two primary factors: (1) severe drought, accompanied by a series of storms that produce thousands of lightning strikes and windy conditions; and (2) the buildup of brush and small diameter trees in the nation's forests and rangelands. Table 8-3 illustrates fire suppression costs for state, private, and federal lands protected by the Oregon Department of Forestry (ODF) between 1985 and 2000.

**Table 8-3a. Fire Suppression Costs in Oregon 1985-2000\***

Year	Suppression Costs in Dollars
1985	3,268,644
1986	5,847,018
1987	32,080,746
1988	13,192,596
1989	6,394,593
1990	8,279,974
1991	5,381,192
1992	17,000,000
1993	4,023,033
1994	21,100,000
1995	4,360,349
1996	5,066,227
1997	1,210,692
1998	2,056,343
1999	5,320,555
2000	5,750,862

\* Fire Suppression Costs include ONLY costs spent fighting fires; training and readiness costs are not included in these figures

Source: Oregon Department of Forestry: <http://www.odf.state.or.us> \*Figures apply to the 15.8 million acres of state, private, and federal lands protected by ODF.

**Table 8-3a. Fire Suppression Costs in Douglas Forest Protective Association Area of Douglas County 1998-2002\***

Year	Suppression Costs	Fire Damages
1998	\$408,976	\$165,958
1999	\$150,333	\$88,124
2000	\$163,154	N/A
2001	\$589,925	\$154,175
2002	\$1,376,293	\$624,679

\* Fire Suppression Costs include ONLY costs spent fighting fires; training and readiness costs are not included in these figures

Source: 2002 Douglas Forest Protective Association Cooperators Fire Operations Plan

## Wildfire Characteristics

There are three categories of interface fire:

- The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas;
- The mixed wildland/urban interface is characterized by isolated homes, subdivisions, and small communities situated predominantly in wildland settings; and
- The occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area.

Certain conditions must be present for significant interface fires to occur. The most

common conditions include: hot, dry, and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel, topography, weather, drought, and development.

### **The Interface**

One challenge Douglas County faces regarding the wildfire hazard is from the increasing number of houses being built on the urban/rural fringe compared to twenty years ago. Since the 1970s, Oregon's growing population has expanded further and further into traditional resource lands including forestlands.

The “interface” between urban and suburban areas and the resource lands created by this expansion has produced a significant increase in threats to life and property from fires, and has pushed existing fire protection systems beyond original or current design and capability. Often times, property owners in the interface are not aware of the problems and threats they face. Therefore, many owners have done very little to manage or offset fire hazards or risks on their own property. Furthermore, human activities increase the incidence of fire ignition and potential damage.

### **Fuel**

Fuel is the material that feeds a fire, and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of “fuel loading,” or the amount of available vegetative fuel. The type of fuel also influences wildfire. Oregon, a western state with prevalent conifer, brush, and rangeland fuel types, is subject to more frequent wildfires than other regions of the nation. An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures, and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire’s ability to spread. After decades of fire suppression, “dog-hair” fir thickets and brush accumulation such as Poison Oak and weeds have accumulated. These enable high intensity fires to flare and spread rapidly. Because of the many different possible “fuels” found in the interface landscape, firefighters have a difficult time predicting how fires will react or spread.

### **Graphic 8-1 Fire Behavior in High Fuel Loading Area**



Fire behavior in a small area that was Thinned Fire burns low and on the ground.

Fire behavior in unthinned forests: Fires burn at high temperatures and reaches tops of trees.

Source: Healthy Forests Initiative, <http://www.whitehouse.gov/infocus/healthyforests/>

## **Topography**

Topography influences the movement of air, thereby directing a fire's course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces upslope drafts that can complicate fire behavior. Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

## **Weather**

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. High-risk areas in Oregon share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. Predominant wind directions may guide a fire's path.

## **Drought**

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. The term *drought* is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions, and leave reservoirs and water tables lower. Drought leads to problems with irrigation, and may contribute to additional fires, or additional difficulties in fighting fires.

## **Development**

Growth and development in forested areas is increasing the number of human-made structures in the interface in Oregon. Wildfire has an effect on development, yet development can also influence wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation, and use natural materials. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make fuel reduction activities, evacuation and firefighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel, leading a fire directly to the combustible fuels of the home itself.

# **Wildfire Hazard Assessment**

## **Wildfire Hazard Identification**

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control, such as the surrounding fuel load, weather, topography, and property characteristics. Generally, hazard identification rating systems are based on



weighted factors of fuels, weather, and topography.

In order to determine the “base hazard factor” of specific wildfire hazard sites and interface regions, several factors must be taken into account. Categories used to assess the base hazard factor include:

- Topographic location, characteristics, and fuels;
- Site/building construction and design;
- Site/region fuel profile (landscaping);
- Defensible space;
- Accessibility;
- Fire protection response; and
- Water availability.

The use of Geographic Information System (GIS) technology in recent years has been a great asset to fire hazard assessment, allowing further integration of fuels, weather, and topography data for such ends as fire behavior prediction, watershed evaluation, mitigation strategies, and hazard mapping.

## Vulnerability and Risk

Douglas County residents are served by a variety of local fire districts and fire departments, as well as state and federal fire districts (Map 8-1). Data that includes the location of interface areas in the county can be used to assess the population and total value of property at risk from wildfire, and direct these fire districts in fire prevention and recovery. Douglas Forest Protective Association is seeking to develop a wildfire hazard map for lands served by the Douglas Forest Protective Association. This map would identify the wildland/urban interface in the Douglas Fire Prevention District, and show acreage in this district that are subject to the wildfire hazard.

The county has a large number of acres that are susceptible to wildland fires. Including federal lands, the areas of potential wildfires comprise an estimated 90% of the county.

**Table 8-4. Douglas County Forested Land**

Ownership	Acreage	Percentage
Federal	1,646,906	51%
State of Oregon	57,469	2%
Local Government	29,001	1%
Forest Industry	695,000	21%
Other Ownership	492,624	15%
TOTAL	2,921,000	90% of County

Source: Douglas County Planning Department, “A Place Called Douglas County”

The mitigation plan will have a direct impact on the health, welfare and safety of residents who live in or near areas of potential wildfires in Douglas County. Development of wildfire hazard maps will assist county fire districts and fire departments in developing fire mitigation plans to address the areas most vulnerable to wildfires in Douglas County.

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence, and weather, as well as occurrences of drought. At the time of publication of this plan, data was insufficient to conduct a risk analysis. The National Wildland/Urban Fire Protection Program has developed the Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. For more information on wildfire hazard assessment refer to <http://www.Firewise.org>.

## Community Wildfire Issues

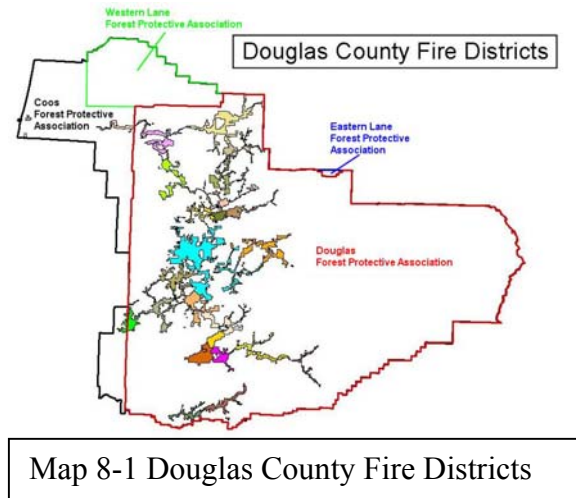
### What is Susceptible to Wildfire?

#### Growth and Development in the Interface

The forested hills where homes and structures are built are considered to be interface areas. The development of homes and other structures encroaching onto the forest wildland and natural areas is expanding the wildland/urban interface. The interface areas are characterized by a diverse mixture of varying housing structures, development patterns, ornamental and natural vegetation, and natural fuels.

In the event of a wildfire, vegetation, structures, and other flammables can merge into unwieldy and unpredictable events. Factors germane to the fighting of such fires include access, firebreaks, proximity of water sources, distance from a fire station, and available firefighting personnel and equipment. Reviewing past wildland/urban interface fires shows that many structures are destroyed or damaged for one or more of the following reasons:

- Combustible roofing material;
- Wood construction;
- Structures with no defensible space;
- Fire department with poor access to structures;
- Structures located on steep slopes covered with flammable vegetation;
- Limited water supply; and
- Winds over 30 miles per hour.



#### Road Access

Road access is a major issue for all emergency service providers. As development encroaches into the rural areas of the county, the number of houses without adequate turn-around space is increasing. Developers are not required to provide adequate space for emergency vehicles in single-family residential homes, causing emergency workers to have difficulty doing their jobs because they cannot access houses. As fire trucks are large, firefighters are challenged by narrow roads and limited access. When there is doubt concerning the stability of a residential bridge, or

adequate turn around space, the fire fighters can only work to remove the occupants, but cannot save the structure.

### **Water Supply**

Fire fighters in remote and rural areas are faced by limited water supply and lack of hydrant taps. Rural areas are characteristically outfitted with small diameter pipe water systems, inadequate for providing sustained fire fighting flows. Some rural fire districts are adapting to these conditions by developing secondary water sources.

### **Rural Services**

People moving from more urban areas frequently have high expectations for fire protection services. Often, new residents do not realize that they are living outside of a fire protection district, or that the services provided are not the same as in an urban area. The diversity and amount of equipment, as well as the number of personnel can be substantially limited in rural areas. Fire protection may rely more on the landowner's personal initiative to take measures to protect his or her own property. Therefore, public education and awareness may play a greater role in rural or interface areas. However, great improvements in fire protection techniques are being made to accommodate for large, rapidly spreading fires that threaten large numbers of homes in interface areas.

Growth and development in rural areas of Douglas County influence the wildland/urban interface. While historical losses from wildfires in Douglas County have been relatively low, the increase in growth and development, and along with it an increase in fuel loads, expands the public need for natural hazards mitigation planning in the county.

### **Wildfire Mitigation Activities**

Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies or organizations.

### **Local Programs**

Douglas County residents are served by a variety of local fire districts and fire departments, as well as state and federal fire districts. Although each district or department is responsible for fire related issues in specific geographic areas, they work together to keep Douglas County residents safe from fire.

Douglas Forest Protective Association is responsible for protection from fire to approximately 1.6 million acres of forestland, covering most of Douglas County. The District provides protection to private, state, county and federal lands.

Coos Forest Protective Association is divided into two sub units, with the northern Reedsport unit covering the Douglas County Coastal area, eastward to Range 8.

Western Lane Forest Protective Association Provides fire protection to 750,650 acres of private and public forestland in western Lane County and parts of northern

Douglas County. The district's State Lands program manages 26,002 acres of forestland.

Eastern Lane Forest Protective Association Provides fire protection to approximately 3,500 acres of private and public forestland in western Lane County and parts of northern Douglas County.

Forest Protection Associations in Douglas County work closely with Federal; State and local fire agencies to ensure coordination of resources on a regional scale. The Associations have created Fire Operations Plans, and Fire Prevention Management Plans, which document available resources and defined protocol for providing large-scale emergency response and adequate levels of emergency services during an emergency. In addition to individual operations plans, fire jurisdictions in the county have partnered to form the Douglas County Fire Prevention Co-Op, to assist in fire prevention education and outreach, and ensure availability of resources.

The Forest Protection Associations have provided local fire chiefs and local fire departments wildland fire training through Oregon Department of Forestry Funding. Firefighters get a range of experience from exposure to wildland firefighting. Firefighters can also obtain wildland fire training documentation, and attend extensive workshops combining elements of structural and wildland firefighting, defending homes, and operations experience.

Forest Protective Associations have also been involved with training for emergency managers who provide support during non-fire events. Forest Protective Districts partner with timber companies and industry to share equipment in the case of extremely large fires.

Douglas County fire departments and Forest Protective Associations provide essential public services in the communities they serve, and their duties far surpass extinguishing fires. In fact, many of the districts and departments provide other services to their jurisdictions, including Emergency Medical Technicians (EMT) and paramedics who can begin treatment and stabilize sick and injured patients before an ambulance arrives.

All of the fire service providers in the county are dedicated to fire prevention, and use their resources to educate the public to reduce the threat of the fire hazard, especially in the wildland/urban interface.

### **County Codes**

The Douglas County Land Use and Development Ordinance (LUDO), administered by the Douglas County Planning Department, lists Fire Siting Standards for new dwellings and structures to be located in areas zoned FF (Farm-Forest; section 3.5.170 of LUDO), AW (agriculture and woodlot section 3.6.145 of LUDO), and TR (timberland resource section 3.2.170 of LUDO). Fire siting does not apply in other zoned areas of the county, due to a lower fuel loading and a much lower risk of wildfire. The fire siting standards **are requirements** in Forest Zones, where wildland fire is the most dangerous, and are as follows:

### **SECTIONS 3.2.170; 3.5.170; 3.6.145 Fire Siting Standards for New Dwellings and Structures**

The following fire siting standards shall apply to all new dwellings or structures.

1. Owners of new dwellings shall maintain an adequate water supply suitable for fire protection, and the appropriate fire fighting equipment to contain fire from spreading to surrounding forest lands.
  - a. The property owner shall provide and maintain a water supply of at least 500 gallons with an operating water pressure of at least 50 PSI and sufficient 3/4 inch garden hose to reach the perimeter of the primary fuel-free building setback.
  - b. If another water supply (such as a swimming pool, pond, stream, or lake) is nearby, available, and suitable for fire protection, then road access to within 15 feet of the water's edge shall be provided for pumping units. The road access shall accommodate the turnaround of fire fighting equipment during the fire season. Permanent signs shall be posted along the access route to indicate the location of the emergency water source.
2. Road access to new dwellings shall, at a minimum, meet the following standards:
  - a. Maximum grade shall not exceed 20 percent;
  - b. Top surface width shall be 12 feet;
  - c. A turn-around shall be provided which allows for either a 35 foot radius cul-de-sac, or a 60 foot "T-shaped" design;
  - d. The road bed shall have an all weather surface; and
3. Owners of new dwellings and other structures shall:
  - a. Maintain a primary fuel-free building setback, on land that is owned or controlled by the owner, of at least 30 feet surrounding all structures. Vegetation within this primary safety zone may include mowed grasses, low shrubs (less than 2 feet high), and trees that are spaced with more than 15 feet between the crowns and pruned to remove dead and low (less than 8 feet from the ground) branches. Accumulated needles, limbs and other dead vegetation should be removed from beneath trees.

- b. Clear and maintain a secondary fuel-free building setback, on land that is owned or controlled by the owner, of at least 100 feet in all directions around the primary safety zone. Vegetation within this secondary safety zone should be pruned and spaced so that fire will not spread between the crowns of trees.
    - c. Maintain adequate access, conforming with road access standards in this section, to the dwelling for fire fighting equipment vehicles.
    - d. Use fire resistant building materials and construction standards. All buildings regulated by the Uniform Building Code shall have Class A or B roofing as defined by the Code. Powerlines that service the dwelling or structure shall be insulated. If the dwelling has a chimney or chimneys, each chimney must have a spark arrestor.
  4. If adjacent to a Rural Fire Protection District, the property owner shall apply for annexation into that district.
5. In areas subject to the State Scenic Waterway Program, compliance with the primary and secondary fuel-free building setback requirements of this section may be modified to comply with specific siting standards contained in a state approved Scenic Waterway Management Program when such regulations conflict.

In addition, section 510 in the Unified Building Codes; administered by the Douglas County Building Department, documents further fire resistant standards in regard to roofing. County and City Building Inspectors and Fire Officials are responsible for implementing these requirements.

### **State Statutes**

**ORS 215.730**, County governments must require, as a condition of approval, that single-family dwellings on lands zoned as forestland meet the following requirements:

- Dwelling has a fire retardant roof;
- Dwelling will not be sited on a slope of greater than 40 percent;
- Evidence is provided that the domestic water supply is from a source authorized by the Water Resources Department and not from a Class II stream as designated by the State Board of Forestry;
- Dwelling is located upon a parcel within a fire protection district or is provided with residential fire protection by contract;
- If dwelling is not within a fire protection district, the applicant provides evidence that the applicant has asked to be included in the nearest such district;
- If dwelling has a chimney or chimneys, each chimney has a spark arrestor; and

- Dwelling owner provides and maintains a primary fuel-free break and secondary break areas on land surrounding the dwelling that is owned or controlled by the owner.

If a governing body determines that meeting the fourth requirement is impractical, local officials can approve an alternative means for protecting the dwelling from fire hazards.

#### **ORS 477.015-061**

- Directs the State Forester to establish a system of classifying forest land-urban interface areas;
- Defines forestland-urban interface areas;
- Provides education to property owners about fire hazards in Forest land-urban interface areas. Allows for a forestland-urban interface county committee to establish classification standards;
- Requires maps identifying classified areas to be made public;
- Requires public hearings and mailings to affected property owners on proposed classifications;
- Allows property owners appeal rights;
- Directs the Board of Forestry to promulgate rules that set minimum acceptable standards to minimize and mitigate fire hazards within forestland-urban interface areas; and
- Creates a certification system for property owners meeting acceptable standards. Establishes a \$100,000 liability limit for cost of suppressing fires, if certification requirements are not met.

**ORS 478**, Rural Fire Protection Districts, includes the following provisions, among others, related to wildfire hazard mitigation:

***ORS 478.120 Inclusion of forestland in district.*** Gives a Rural Protection District the authority to include forestland within a rural fire protection district.

***ORS 478.140 Procedure for adding land to district by consent of owner.***

***ORS 478.910 Adoption of fire prevention code.*** A district board may, in accordance with ORS 198.510 to 198.600, adopt a fire prevention code.

***ORS 478.920 Scope of fire prevention code.*** Authorizes a fire prevention code to provide reasonable regulations relating to:

1. Prevention and suppression of fires.
2. Mobile fire apparatus means of approach to buildings and structures.
3. Providing fire-fighting water supplies and fire detection and suppression apparatus adequate for the protection of buildings and structures.
4. Storage and use of combustibles and explosives.
5. Construction, maintenance and regulation of fire escapes
6. Means and adequacy of exit in case of fires and the regulation and maintenance of fire and life safety features in factories, asylums, hospitals, churches, schools, halls, theaters, amphitheaters, all buildings, except private residences, which are

occupied for sleeping purposes, and all other places where large numbers of persons work, live, or congregate from time to time for any purpose.

7. Requiring the issuance of permits by the fire chief of the district before burning trash or waste materials.

8. Providing for the inspection of premises by officers designated by the board of directors, and requiring the removal of fire hazards found on premises at such inspections.

***ORS 478.927 Building Permit review for fire prevention code.*** A district adopting a fire prevention code shall provide plan review at the agency of the city or county responsible for the issuance of building permits for the orderly administration of that portion of the fire prevention code that requires approval prior to the issuance of building permits.

### **Senate Bill 360**

The introductory language of Senate Bill 360 states: “The fire protection needs of the interface must be satisfied if we are to meet the basic policy of the protection of human life, natural resources, and personal property. This protection must be provided in an efficient and effective manner, and in a cooperative partnership approach between property owners, local citizens, government leaders, and fire protection agencies.”

Senate Bill 360, passed in 1997, is state legislation put in place to address the growing wildland/urban interface problem. The bill has three purposes:

- To provide an interface fire protection system in Oregon to minimize cost and risk and maximize effectiveness and efficiency;
- To promote and encourage property owners' efforts to minimize and mitigate fire hazards and risks; and
- To promote and encourage involvement of all levels of government and the private sector in interface solutions.

The bill has a five-year implementation plan that includes public education and outreach, and the development of rules, standards, and guidelines that address landowner and agency responsibilities.

The success of Senate Bill 360 depends upon cooperation among local and regional fire departments, fire prevention cooperatives, and the Oregon Department of Forestry, which means interagency collaboration is vital for successful implementation of the bill. This cooperation is important in all aspects of wildland firefighting. Resources and funding are often limited, and no single agency has enough resources to tackle a tough fire season alone.

### **Oregon Department of Forestry (ODF)**

ODF provides funding and expertise to local Fire Protective Associations, who then train local firefighters in wildfire suppression techniques.

### **Federal Programs**

The proposed role of the federal land managing agencies in the wildland/urban



interface is reducing fuel hazards on the lands they administer; cooperating in prevention and education programs; providing technical and financial assistance; and developing agreements, partnerships, and relationships with property owners, local protection agencies, states, and other involved parties in wildland/urban interface areas. These relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence.

The Federal Government has two programs administered by the US Forest Service, which assist in meeting the needs of rural areas: the Rural Fire Prevention and Control (RFPC) and Rural Community Fire Protection (RCFP). These programs provide cost-share grants to rural fire districts. The annual federal share of these programs has remained relatively stable, totaling approximately \$16 million and \$3 million, respectively. Renewed focus on these programs, emphasizing local solutions, is encouraged.

### **Federal Emergency Management Agency (FEMA) Programs**

FEMA is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland/urban interface is to encourage comprehensive disaster preparedness plans and programs, which increase the capability of state and local governments, and provide for a greater understanding of FEMA's programs at the federal, state, and local levels.

### **Fire Suppression Assistance Grants**

Fire Suppression Assistance Grants may be provided to a state with an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property, and encourage the development and implementation of viable multi-hazard mitigation measures, and provide training to clarify FEMA's programs. The grant may include funds for equipment, supplies, and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for a fire.

The grants are cost-shared with states. FEMA's US Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues, and the USFA's National Fire Academy provides training programs.

### **Hazard Mitigation Grant Program**

Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities which reduce the possibility of damages from all future fire hazards, ultimately reducing the costs to the nation for responding to and recovering from the disaster.

### **National Wildland/Urban Interface Fire Protection Program**

Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

## **U.S. Forest Service**

The U.S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on US forestlands. The USFS has little to no jurisdiction in the lower valleys, where oftentimes fires start and burn up the hills and into the higher elevation US forestlands.

## **Prescribed Burning**

The health and condition of a forest will determine the magnitude of a wildfire. If fuels such as slash, dry or dead vegetation, fallen limbs and branches are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The resulting fires are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to get rid of these fuels. In 1998, 3,000 prescribed fires were used to burn approximately 163,000 acres statewide, in Douglas County, approximately 11,000 acres of pastureland undergoes prescribed burning and 3,000 acres of slash burning occurs annually.

## **Firewise**

Firewise is a program developed within the National Wildland/ Urban Interface Fire Protection Program, and is the primary federal program addressing interface fire. It is administered through the National Wildfire Coordinating Group whose extensive list of participants includes a wide range of federal agencies. The program is intended to empower planners and decision makers at the local level.

Through conferences and information dissemination, Firewise increases support for interface wildfire mitigation by educating professionals and the general public about hazard evaluation and policy implementation techniques. Firewise offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive home page allows users to ask fire protection experts questions, and to register for new information as it becomes available.

## **FireFree Program**

FireFree is a unique program for private/public interface wildfire mitigation involving partnerships with insurance companies and local government agencies. It is an example of an effective nonregulatory approach to hazard mitigation. Originating in Bend, the program was developed in response to the city's "Skeleton Fire" of 1996, which burned over 17,000 acres and damaged or destroyed 30 homes and structures. Bend sought to create a new kind of public education initiative that emphasized local involvement. SAFECO Insurance Corporation was a willing supporter in this effort. Bend's pilot program included:

- A short video production featuring local citizens as actors, made available at local video stores, libraries, and fire stations;
- Two city-wide yard debris removal events;
- A 30-minute program on a model FireFree home, aired on a local cable television station; and
- Distribution of brochures, featuring a property owner's evaluation checklist and a listing of fire-resistant indigenous plants.

The success of the program helped to secure \$300,000 in Federal Emergency Management Agency (FEMA) "Project Impact" matching funds. By fostering local community involvement, FireFree also has the potential for building support for sound interface wildfire policy.

## **Wildfire Mitigation Action Items**

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Douglas County can undertake to reduce risk and prevent loss from wildfire events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

## **Wildfire Mitigation Goals**

### **GOAL A**

**Protect Lives of Residents and Firefighters in Wildfire Hazard Areas**

### **GOAL B**

**Increase Fire Prevention/Reduction Activities and Fire Fighting Response Abilities**

### **GOAL C**

**Reduce Property Damages and Loss in Wildfire Hazard Areas**

### **GOAL D**

**Enhance Education of Wildland/Urban Interface Area Property Owners and Public Awareness of Wildfire Dangers and Prevention**

### **GOAL E**

**Increase Preparedness of Communities and Agencies To Deal With Wildfire Threat**

**Action Item 1: Seek funding and labor opportunities to staff fuel-reduction projects throughout wildfire hazard prone areas in Douglas County**

***Ideas for Implementation:***

- Work on Wildfire Hazard mapping of Douglas County to identify areas and homes that would most benefit from fuel reduction projects
- Promote opportunities for landowners to utilize fuel reduction projects
- Enable communities and agencies to quickly transform grant opportunities to on-the-ground projects
- Investigate potential funding opportunities for individual mitigation projects

**Coordinating Organization:** Douglas County Emergency Management, Douglas and Coos Forest Protective Associations

**Timeline:** 2 years

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 2: Increase communication, coordination, and collaboration between wildland/urban interface property owners, city and county planners, and fire prevention crews and officials to address risks, existing mitigation measures, and federal assistance programs.**

***Ideas for Implementation:***

- Encourage single-family residences in wildfire hazard areas to have fire plans and promote homeowner wildfire hazard mitigation;
- Encourage Planning and Building Departments to educate landowners and/or developers who choose to build in the wildland/urban interface to identify and mitigate conditions that aggravate wildland/urban interface wildfire hazards, including:
  1. Limited access for emergency equipment due to width and grade of roadways;
  2. Inadequate water supplies
  3. Inadequate fuel breaks, or lack of defensible space;
  4. Inappropriate construction materials;
  5. Preexisting, older building lots and subdivisions that are not in compliance with state and local land use and fire protection regulations;
  6. Encourage all new homes and major remodels involving roofs or additions that are located in the interface to have fire resistant roofs and residential sprinkler systems; and
  7. Encourage the public to evaluate access routes to rural homes for fire-fighting vehicles and to develop passable routes if they do not exist.

**Coordinating Organization:** Douglas County Planning Department, Douglas County Building Department, Douglas Forest Protective Association; Coos Forest Protective Association, Douglas County Emergency Management

**Timeline:** Ongoing

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 3: Maintain and Further Develop Interagency and Private Industry Relationships for Continuing Strong Fire Response in Douglas County**

***Ideas for Implementation:***

- Maintain and enhance protocol for fire jurisdictions, private industry cooperators and Landowners to avoid problems during wildfire chaos
- Promote and advocate reduction of “Red Tape” to enable faster private industry assistance (use of vehicles, manpower, etc) in a wildfire situation

**Coordinating Organization:** Douglas Forest Protective Association; Coos Forest Protective Association, Douglas County Emergency Management

**Timeline:** Continue

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 4: Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing the exposure of citizens, public agencies, private property owners, and businesses to natural hazards.**

***Ideas for Implementation:***

- Visit urban interface neighborhoods and rural areas and conduct education

- and outreach activities;
- Conduct specific community-based demonstration projects for fire prevention and mitigation in the urban interface;
- Perform public outreach and information activities in Douglas County by creating “Wildfire Awareness Week” activities. Fire stations can hold open houses and allow the public to visit, see the equipment, and discuss wildfire mitigation with the station crews.

**Coordinating Organization:** Douglas Emergency Management, Individual Fire Departments, Douglas and Coos Forest Protective Associations

**Timeline:** Ongoing

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 5: Create incentives and assist landowners in reducing fuel loads on private property**

***Ideas for Implementation:***

- Investigate potential funding opportunities for individual mitigation projects
- Develop, approve, and promote cost share and assistance programs for landowners seeking fire mitigation activities and suppression preparedness.

**Coordinating Organization:** Douglas Forest Protective Association; Coos Forest Protective Association

**Timeline:** 1-2 years

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 6: Look for solutions to protect structures located outside of fire districts through partnerships, grant funding or expansion of fire district services.**

***Ideas for Implementation:***

- Form community partnerships that are equipped and trained by fire district personnel to combat fires in those areas

**Coordinating Organization:** Douglas Emergency Management, Individual Fire Departments, Douglas and Coos Forest Protective Associations

**Timeline:** Ongoing

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 7: Seek improved information gathering, and distribution and technology for enhancing fire identification, initial response and evacuation if necessary.**

***Ideas for Implementation:***

- Update wildland/urban interface hazard maps
- Conduct risk analysis incorporating data and the created hazard maps using GIS technology to identify risk sites and further assist in prioritizing mitigation activities; and
- Encourage development and use of new data and systems to identify hazard areas and better inform firefighters, communities and landowners of wildfire status once a fire occurs

**Coordinating Organization:** Douglas County Planning Department, Douglas Forest Protective

Association; Coos Forest Protective Association, Douglas County Emergency Management

**Timeline:** 1-3 years

**Plan Goals Addressed:** A, B, C, D, E

**Action Item 8: Promote and continue support of agricultural uses that reduce fuel loads in interface areas**

***Ideas for Implementation:***

- Educate the public on how agriculture can help to reduce fuel loads in interface areas
- Investigate and seek funding for conventional, chemical and biological fuel reduction and weed control programs

**Coordinating Organization:** Douglas Forest Protective Association; Coos Forest Protective Association

**Timeline:** Ongoing

**Plan Goals Addressed:** B, C, D

# **Section 7: Windstorm**

## **Table of Contents**

### **WHY ARE WINDSTORMS A THREAT TO DOUGLAS COUNTY?**

HISTORICAL WINDSTORM EVENTS  
CHARACTERISTICS OF WINDSTORMS

### **WINDSTORM HAZARD ASSESSMENT**

HAZARD IDENTIFICATION  
VULNERABILITY AND RISK

### **COMMUNITY WINDSTORM ISSUES**

WHAT IS SUSCEPTIBLE TO WINDSTORMS?  
EXISTING MITIGATION ACTIVITIES

### **WINDSTORM MITIGATION ACTION ITEMS**

# Why are Windstorms a Threat to Douglas County?

Windstorms are a concern to communities across Douglas County. Severe windstorms can leave 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 cause great risk to people.

Recently, windstorms in 1995 and 2002 damaged numerous homes, utilities, businesses, and public facilities, Oregon received \$2.8 million through the Federal Emergency Management Agency's (FEMA) Public Assistance program to repair and restore damaged infrastructure. Douglas County received a Presidential Disaster Declaration for the 1995 and 2002 windstorms.

## Historical Windstorm Events

### **December 4, 1951**

This storm reached its greatest intensity along the coast, where unofficial observations reported sustained wind speeds between 60 and 100 mph, while inland valley locations reported sustained wind speeds up to 75 mph. The fastest mile at Portland airport was 57 mph, Baker at 42 mph, and Roseburg with 40 mph. Serious damage to buildings and widespread power losses occurred throughout the state.

### **Columbus Day Windstorm October 1962**

The Columbus Day storm in 1962 was the most destructive windstorm ever recorded in Oregon, both in terms of loss of life and property damage. Damage was most severe in the Willamette Valley. The storm did upwards of \$200 million in damage (over \$800 million in today's dollars). Hundreds of thousands of homes were without power for short periods of time, while others were without power for two to three weeks. Statewide, more than 50,000 homes were seriously damaged, and nearly 100 were completely destroyed. Roseburg experienced gusts of up to 62 mph.

### **October 2, 1967**

This storm brought the highest winds recorded since the Columbus Day storm of 1962 to much of western, central, and northeastern Oregon. Significant widespread damage occurred to agriculture, timber, power and telephone utilities, and homes. Wind speeds of 100 to 115 mph were unofficially recorded along the Oregon coast. There was one fatality and about 15 persons were seriously injured. Roseburg experienced 69 mph wind gusts during the storm.

### **April 1972**

The windstorm on April 5, 1972 has been described as an exceptionally destructive windstorm, as it was the most devastating tornado in Oregon's recorded weather history. The tornado damaged fifty cabin cruisers and destroyed a dry rock, boathouses and dock shelters. The funnel, described as a "black mass," was not



observed locally due to flying debris and mud. Douglas County was not significantly affected by the storm, but high winds caused damage to utilities and homes.

### **November 1981 Windstorm**

November 1981 saw two successive windstorms on November 13 and 14. Numerous injuries resulted from wind-blown debris in western Washington and Oregon. Across the Pacific Northwest, hundreds of downed trees and power lines caused massive power outages and roof damage. Estimates indicated that nearly 500,000 homes were without power for at least a short time during the weekend. Numerous airports across Oregon and Washington suffered damage.

### **December 1995 Windstorm**

On December 11, 1995 a large low pressure storm approached the Southern Oregon/Northern California coast and began to slow and intensify. The National Weather Service issued high wind warnings for the coast and inland valleys as the storm center tracked north along the Oregon coast. Gusts of over 100 mph occurred along the coast while gusts in the Willamette Valley exceeded 60 mph. Hundreds of thousands of people in the state lost power, and there was widespread damage to homes, buildings, and boats. Four Oregonians lost their lives during the storm.

Douglas County received a presidential disaster declaration. The most damaged areas included Reedsport and Winchester Bay. Throughout the county, the windstorm tore roofs from buildings, uprooted or otherwise damaged many trees, and knocked out electric and telephone service.

### **February 7, 2002 Windstorm**

A powerful windstorm hit coastal Douglas County on February 7, 2002. A strong low-pressure system struck the northwest corner of Douglas County before moving inland to the Willamette Valley.

Wind gusts were reported at more than 100 miles per hour near Reedsport. The storm lasted less than an hour but caused loss of power, damage to businesses and homes and Officials estimate about 44 acres of timber fell within the drainage of Threemile Creek on the Oregon Dunes National Recreational Area and within the Umpqua Spit Roadless Area.

## **Characteristics of Windstorms**

The most frequent surface winds in Oregon are from the southwest. These widespread winds are associated with storms moving onto the coast from the Pacific Ocean. Winds coming from the south are the most destructive. The Columbus Day Storm of 1962 was an example of this type of windstorm.

West winds generate from the Pacific Ocean and are strong along the coast, but slow down inland due to the obstruction of the Coastal and Cascade mountain ranges. Prevailing winds in Oregon vary with the seasons. In summer, the most common wind directions are from the west or northwest; in winter, they are from the south and east.

## **Tornadoes**

Tornadoes are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause widespread damage. Wind speeds in excess of 300 mph have been observed within tornadoes, and it is suspected that some tornado winds exceed 400 mph. The low pressure at the center of a tornado can destroy buildings and other structures it passes over.

Tornadoes are most common in the Midwest, and are more infrequent and generally small west of the Rockies. Nonetheless, Oregon and other western states have experienced tornadoes on occasion, many of which have produced significant damage and occasionally injury or death.

Oregon's tornadoes can be formed in association with large Pacific storms arriving from the west. Most of them however, are caused by intense local thunderstorms. These storms also produce lightning, hail, and heavy rain, and are more common during the warm season from April to October.

# **Windstorm Hazard Assessment**

## **Hazard Identification**

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. Windstorms can affect areas of the county with significant tree stands, as well as areas with exposed property, major infrastructure, and above ground utility lines. The lower wind speeds typical in central Douglas County are still high enough to knock down trees and power lines, and cause other property damage.

Mountainous sections of the county experience much higher winds under more varied conditions. Because of the local nature of wind hazards in the mountains, a high-resolution wind speed map would be required to accurately identify the degree of wind hazard throughout the county. Such a map could identify wind hazards other than treefalls, such as winds high enough to cause various degrees of structural damage. Unfortunately, high-resolution wind maps were not available at the time of this publication, so a precise wind hazard analysis could not be performed.

## **Vulnerability and Risk**

A vulnerability assessment that describes the number of lives and amount of property exposed to the wind hazard has not yet been conducted for Douglas County windstorms. However, there are many issues related to what is in danger within communities experiencing windstorms. Windstorms can cause power outages, transportation, and economic disruptions, and significant property damage and pose a high risk for injuries and loss of life. They can also be typified by a need to shelter and care for individuals impacted by the events. Several destructive windstorms, (most notably the 1962 Columbus Day storm) brought economic hardship and affected the life safety of county residents. Future windstorms may cause similar impacts countywide.

Factors that should be included in 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 windstorm events. When sufficient data is collected for hazard identification and vulnerability assessment, a risk analysis can be completed. Insufficient data currently exists to complete a risk analysis.

## Community Windstorm Issues

### What is Susceptible to Windstorms?

#### Life and Property

Windstorms have the ability to cause damage over 100 miles from the center of storm activity. Isolated wind phenomena in the mountainous regions have more localized effects. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage. The effects of wind speed are shown in Table 7-1.

**Table 7-1. The Effect of Wind Speed**

Wind Speed (mph)	Wind Effects
<b>25-31</b>	Large branches will be in motion.
<b>32-38</b>	Whole trees in motion; inconvenience felt walking against the wind.
<b>39-54</b>	Twigs and small branches may break off of trees; wind generally impedes progress when walking; high profile vehicles such as trucks and motor homes may be difficult to control.
<b>55-74</b>	Potential damage to TV antennas; may push over shallow rooted trees especially if the soil is saturated.
<b>75-95</b>	Potential for minimal structural damage, particularly to unanchored mobile homes; power lines, signs, and tree branches may be blown down.
<b>96-110</b>	Moderate structural damage to walls, roofs and windows; large signs and tree branches blown down; moving vehicles pushed off roads.
<b>111-130</b>	Extensive structural damage to walls, roofs, and windows; trees blown down; mobile homes may be destroyed.
<b>131-155</b>	Extreme damage to structures and roofs; trees uprooted or snapped.
<b>Greater than 155</b>	Catastrophic damage; structures destroyed.

Source: Washington County Office of Consolidated Emergency Management

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls of buildings. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

## **Infrastructure**

Storm winds can damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted.

Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damages and interrupted services.

## **Utilities**

Historically, falling trees have been the major cause of power outages in Douglas County. Windstorms can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Utility lines brought down by summer thunderstorms have also been known to cause fires, which start in dry roadside vegetation.

Falling trees can bring electric power lines down to the pavement, creating the danger of electric shock. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from windstorms as more life and property are exposed to risk.

## **Existing Mitigation Activities**

One of the most common problems associated with windstorms is power outage. High winds commonly occur during winter storms, and can cause trees to bend, sag, or fail (tree limbs or entire trees), coming into contact with nearby distribution power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wildland fires.

The basic strategy adopted by power companies to avoid wind-induced damage is to maintain adequate separation between its transmission circuits and trees. This is done with tree height limitations and ongoing tree trimming.

# Windstorm Mitigation Goals

## GOAL A

Protect Lives During Windstorms

## GOAL B

Reduce Property Damage Resulting From Windstorms

## GOAL C

Enhance Survivability of Infrastructure and Utilities During Windstorms

## GOAL D

Enhance Education and Public Awareness of Windstorm Dangers

## GOAL E

Increase Preparedness of Communities and Agencies

# Windstorm Mitigation Action Items

The windstorm mitigation action items provide direction on specific activities that organizations and residents in Douglas County can undertake to reduce risk and prevent loss from windstorm events. Goals Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

## **ACTION ITEM 1 - Develop and implement programs to keep trees from threatening lives, property, and public infrastructure during windstorm events.**

### ***Ideas for Implementation***

- Partner with responsible agencies and organizations to design and disseminate education information to property owners to reduce risk from tree failure to life, property, and utility systems.
- Enhance partnerships between utility providers and county and local public works agencies and landowners to document known hazard areas.
- Identify and find solutions to potentially hazardous trees in urban areas, near utility corridors, and near vital infrastructure.

**Coordinating Organization:** Douglas County Public Works, Utility Providers

**Timeline** 2 years

**Plan Goals Addressed:** Goals A, B, C, E

## **ACTION ITEM 2 - Map locations around the county that have the highest incidence of extreme windstorms.**

### ***Ideas for Implementation***

Enhance mapping and tracking of severe windstorms and vulnerable homes, infrastructure and utilities. Data collected should include:

1. Windstorm data (sustained speeds, gusts, storm durations) for localities

- throughout the county;
2. Maps of the locations within the county, which are most vulnerable to high winds; and
  3. Injury and property damage estimates, including locations

Identify public infrastructure and facilities subject to damage or closure during windstorm events.

**Coordinating Organization:** Douglas County Planning Department, Douglas County Emergency Management

**Timeline** 5 years

**Plan Goals Addressed:** Goals A, B, C, D, E

### **ACTION ITEM 3 – Encourage critical facilities to secure emergency power.**

#### ***Ideas for Implementation***

Seek funding and capital improvements for emergency power stations for critical facilities.

**Coordinating Organization:** Douglas County Planning Department, Douglas County Emergency Management

**Timeline** Ongoing

**Plan Goals Addressed:** Goals A, C, E

### **ACTION ITEM 4 - Support/encourage contractors, homeowners and electrical utilities to use windstorm resistant construction methods where possible to reduce damage and power outages from windstorms.**

#### ***Ideas for Implementation***

- Increase the use of underground utilities where possible.
- Provide guidance on wind-resistant construction methods

**Coordinating Organization:** Douglas County Planning and Building Departments

**Timeline:** 5 years

**Plan Goals Addressed:** Goals B, C, D, E

### **ACTION ITEM 5 – Encourage harvesting of trees along utility and road corridors, preventing potential windstorm damage.**

#### ***Ideas for Implementation***

Douglas County Agencies, State Agencies, Federal Agencies and Utility Operators shall encourage the harvesting of trees along utility corridors and roads, which will prevent windstorm damage. The Planning Department shall encourage Federal, State, Local Agencies and Utility Operators to harvest trees in the corridors which will prevent windstorm damage, mitigate fire hazards, and could be used in fish enhancement projects.

**Coordinating Organization:** Douglas County Planning Department.

**Timeline:** Continue.

**Plan Goals Addressed:** Goals A, B, C and E.

### **ACTION ITEM 6 – Encourage harvesting of trees that are blown down during a windstorm.**

#### ***Ideas for Implementation***

Douglas County Planning Department shall encourage the harvesting of trees blown down in a winter storm. The Planning Department shall encourage Federal, State, and Local Agencies to harvest trees that have fallen during a windstorm, which will mitigate fire hazards, and could be used in fish enhancement projects.

**Coordinating Organization:** Douglas County Planning Department.

**Timeline:** Continue.

**Plan Goals Addressed:** Goal E

**ACTION ITEM 7 - Enhance strategies for debris management for windstorm events.**

***Ideas for Implementation***

Develop coordinated management strategies for clearing roads of fallen trees, and clearing debris from public and private property.

**Coordinating Organization:** Douglas County Public Works, Utility Providers

**Timeline** 2 years

**Plan Goals Addressed:** Goals A, B, C, E

**ACTION ITEM 8 - Increase public awareness of windstorm mitigation activities.**

***Ideas for Implementation***

- Collect information on public education materials for protecting life, property, and infrastructure from windstorm events; and
- Distribute educational materials to Douglas County residents and public and private sector organizations regarding preparedness for no power situations.

**Coordinating Organization:** Douglas County Planning Department, Hazard Mitigation Advisory Committee

**Timeline** Ongoing

**Plan Goals Addressed:** Goals A, B, C, D, E

# **Section 9: Landslide**

## **Table of Contents**

### **WHY ARE LANDSLIDES A THREAT TO DOUGLAS COUNTY?**

HISTORY OF LANDSLIDE EVENTS AND IMPACTS

LANDSLIDE CHARACTERISTICS

LANDSLIDE CONDITIONS

### **LANDSLIDE HAZARD ASSESSMENT**

HAZARD IDENTIFICATION

VULNERABILITY AND RISK

### **COMMUNITY LANDSLIDE ISSUES**

WHAT IS SUSCEPTIBLE TO LANDSLIDES?

LANDSLIDE MITIGATION ACTIVITIES

COMMUNITY ISSUES SUMMARY

### **LANDSLIDE MITIGATION ACTION ITEMS**



## **Why are Landslides a Threat to Douglas County?**

Landslides are a serious geologic hazard in many states, including Oregon. Nationally, landslides cause 25 to 50 deaths each year. The best estimate of direct and indirect costs of landslide damage in the United States range between \$1 and \$2 billion annually. In Oregon, a significant number of locations are in danger of being impacted by landslides. While not all landslides result in private property damage, many landslides impact transportation corridors, fuel and energy conduits, and communication facilities. Landslides can also pose a serious threat to human life.

Landslides can be broken down into two categories: (1) rapidly moving, and (2) slow moving. Rapidly moving landslides present the greatest risk to human life, and people living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Rapidly moving landslides have also caused most of the recent landslide related injuries and deaths in Oregon. During the winter storms of 1996, a rapidly moving landslide debris flow killed four people in Douglas County. Slow moving landslides can cause significant property damage, but are less likely to result in serious human injuries.

## **History of Landslide Events and Impacts**

Landslides are a common hazard in Oregon. In fact, a prominent theme of the 1996 flood disaster was that a significant amount of building damage affected structures outside of identified flood hazard areas, which were in debris flow channels.

In many parts of Douglas County, weathering and the decomposition of geologic materials produces conditions conducive to landslides. Human activity is believed to further exacerbate the landslide problem. A study conducted by Dr. Scott Burns at Portland State University found that changes to the slope through cutting or filling increased the risk of landslides in 76% of the 701 inventoried landslides in the Metro region. The study documented 48 landslides that occurred in Oregon City in February 1996, and found that about half the slides were considered natural.

Landslides are difficult to mitigate, particularly in areas of large historic movement with weak underlying geologic materials. As communities continue to modify the terrain and influence natural processes, it is important to be aware of the physical properties of the underlying bedrock as it, along with climate, dictates hazardous terrain. Without proper planning, landslides will continue to threaten the safety of people, property, and infrastructure.

## **Landslide Characteristics**

### **What is a Landslide?**

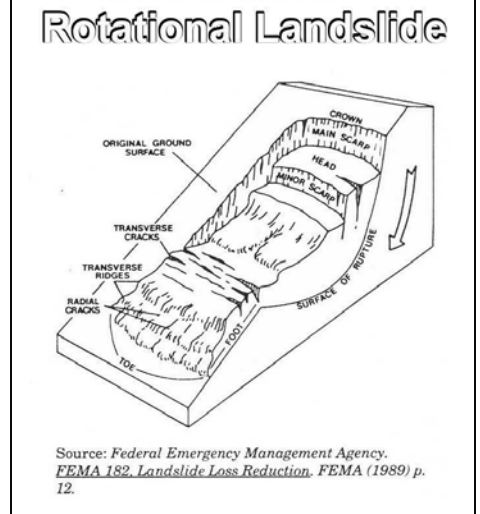
Landslides are downhill movements of rock, debris, or soil mass. The size of a landslide usually depends on the geology and the initial cause of the landslide. Landslides vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure and their composition and characteristics.

**Slides** move in contact with the underlying surface. These movements include rotational slides where sliding material moves along a curved surface, and translational slides where movement occurs along a flat surface. These slides are generally slow moving and can be deep. Slumps are small rotational slides that are generally shallow (See Figure 9.1).

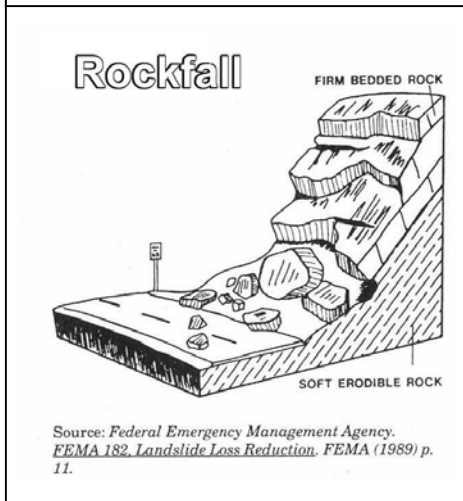
Slow moving landslides can occur on relatively gentle slopes and can cause significant property damage, but are far less likely to result in serious injuries than rapidly moving landslides.

Washouts caused by **erosion** can occur in Douglas County. These occur when ditches or culverts beneath hillside roads become blocked with debris. If the ditches are blocked, run-off from slopes is inhibited during periods of precipitation. This causes the run-off water to collect in soil, and in some cases, cause a slide.

**Figure 9.1 Rotational Slide**



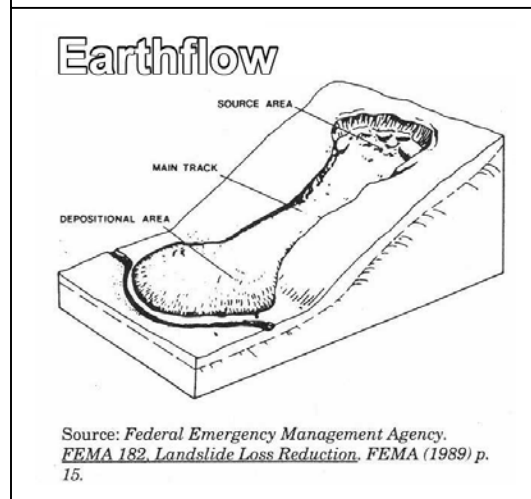
**Figure 9.2 Rock fall**



**Rock falls** (see Figure 9.2) occur when blocks of material come loose on steep slopes.

Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast moving with the materials free detached from a steep slope or cliff. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage. A motorist was killed from a rock fall in 1993. The 1993 rock fall occurred near Klamath Falls during the 1993 Earthquakes.

**Figure 9.3 Earthflows**



**Earthflows** (see Figure 9.3) are liquid movements of landmass (e.g. soil and rock), which breaks up and flows during movement. Earthquakes are often the mechanism, which trigger flows. Debris flows normally occur when a landslide moves downslope as a semi-fluid mass scouring, or partially scouring soils from the slope along its path. Flows are typically rapidly moving and also tend to increase in volume as they scour out the channel.

Flows often occur during heavy rainfall, can occur on gentle slopes, and can move rapidly for large distances. One example of a flow in Oregon is the Dodson debris flow that occurred in 1996. This debris flow started high on the Columbia Gorge cliffs, and traveled far down steep canyons to form debris fans at Dodson.

## **Landslide Conditions**

Landslides are typically triggered by periods of heavy rainfall or rapid snowmelt. Earthquakes, volcanic activity, and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events. Landslides on steep slopes are more dangerous because movements can be rapid. Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and construction can decrease the stability of a hillslope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Other human activities effecting landslides include: excavation, drainage and groundwater alterations, and changes in vegetation.

## **Natural Conditions**

Natural processes can cause landslides or re-activate historical landslide sites. The removal or undercutting of shoreline-supporting material along bodies of water by currents and waves produces countless small slides each year. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on gentle slopes above steep streams and riverbanks. Landslides are particularly common along stream banks, reservoir shorelines, large lakes, and seacoasts. Steep, concave-shaped slopes with larger drainage areas appear to be more susceptible to landslides than other landforms. Landslides associated with volcanic eruptions can include volumes of over one cubic mile of material. All soil types can be affected by natural landslide triggering conditions.

## **Particularly Hazardous Landslide Areas**

Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

- On or close to steep hills;
- Steep road-cuts or excavations;
- Existing landslides or places of known historic landslides (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground);
- Steep areas where surface runoff is channeled, such as below culverts, V-shaped valleys, canyon bottoms, and steep stream channels; and
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.

## **Impacts of Development**

Although landslides are a natural occurrence, human impacts can affect the potential for landslide failures in Douglas County. Proper planning can protect people,

property, and infrastructure.

### **Excavation and Grading**

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading these slopes can result in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at an increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill.

### **Drainage and Groundwater Alterations**

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even lawn irrigation and minor alterations to small streams in landslide prone locations can result in damaging landslides. Ineffective storm water management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology and topography of an area. Development that results in an increase in impervious surface impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems. Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides.

### **Changes in Vegetation**

Removing vegetation from very steep slopes can increase landslide hazards. The *Storm Impacts Study* conducted by the Oregon Department of Forestry found that landslide hazards in three out of four steeply sloped areas were highest for a period of roughly 10 years after timber harvesting. Areas that have experienced wildfire and land clearing for development may have long periods of increased landslide hazard. In addition, woody debris in stream channels (both natural and man-made from logging) may cause the impacts from debris flows to be more severe.

## **Landslide Hazard Assessment**

### **Hazard Identification**

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. The Oregon Department of Forestry (ODF) and the Department of Geology and Mineral Industries (DOGAMI) are active in developing maps and collecting data on hazard risk. The final products might be useful for local geologists, engineers, planners, and policy makers interested in addressing landslide hazards.

### **Vulnerability and Risk**

Vulnerability assessment for landslides will assist in predicting how different types of property and population groups will be affected by a hazard. Data that includes specific landslide-prone and debris flow locations in the county can be used to

assess the population and total value of property at risk from future landslide occurrences. While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been conducted for Douglas County landslide hazard areas, there are indicators such as steepness of slope which indicate potential vulnerability. Landslides have impacted major transportation routes causing residents to temporarily be without essential services and businesses. Past landslide events have caused property damage and loss of life. Mapping county landslide and debris flow areas might help in preventing future loss.

Factors included in assessing landslide risk include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the county due to a specific landslide or debris flow event. At the time of publication of this plan, data was insufficient to conduct a risk analysis.

## **Community Landslide Issues**

### **What is Susceptible to Landslides?**

Landslides can affect utility services, transportation systems, and critical lifelines. Communities may suffer immediate damages and loss of service. Disruption of infrastructure, roads, and critical facilities may also have a long term effect on the economy. Utilities, including potable water, wastewater, telecommunications, natural gas, and electric power are all essential to service community needs. Loss of electricity has the most widespread impact on other utilities and on the whole community. Natural gas pipes may also be at risk of breakage from landslide movements as small as an inch or two.

### **Roads and Bridges**

The largest losses incurred from landslide hazards in Douglas County have been associated with roads. The Douglas County Public Works Department and the Oregon Department of Transportation (ODOT) are responsible for responding to slides that inhibit the flow of traffic and/or damage a road or bridge.

It is not cost effective to mitigate for all slides, due to the fact that some historical slides are likely to become active again even after mitigation measures have been implemented. The County Public Works Department alleviates problem areas by grading slides, and by installing new drainage systems on the slopes to divert water from the landslides. This type of response activity is often the most cost-effective in the short-term.

### **Lifelines and critical facilities**

Lifelines and critical facilities should remain accessible during a natural hazard event. The impact of closed transportation arteries is increased if the closed road or bridge is the access to a hospital or other emergency facility. Therefore, inspection and repair of critical transportation facilities and routes is essential and should be a high priority. Loss of power and/or phone service is also potentially a consequence of landslide events. In hillside areas, soil erosion can be accelerated by heavy rains, resulting in loss of soil support beneath high voltage transmission towers.

## **Landslide Mitigation Activities**

Landslide mitigation activities include current mitigation programs and activities that are being implemented by local or county organizations.

### **County**

#### **Douglas County Land Use and Development Ordinance**

Douglas County addresses development on steep slopes in Section 3.35.500 of the Land Use and Development Ordinance (LUDO). This section outlines standards for steep slope hazard areas, which are slopes greater than 25 percent. The ordinance requires an engineering geologist or (qualified) engineer to certify that the proposed development may be completed without threat to public safety or welfare.

## **Community Issues Summary**

Communities in Douglas County face problems in identifying the location of landslides, because calculating where a landslide hazard area is located, involves numerous variables. Some of the variables are steepness of slope, soil type, age of trees and bushes, amount of rain fall, etc. Landslides are more prevalent in some parts of the county than others. It is not feasible to identify all hazard areas. In addition, historically, there are no landslide records. The County Public Works Department and Planning Department's however, do deal with landslides and their repercussions.

## **Landslide Mitigation Goals**

### **GOAL A**

**Prevent Loss of Life from Landslides**

### **GOAL B**

**Reduce Property Damages**

### **GOAL C**

**Enhance Education and Public Awareness of Landslide Danger**

### **GOAL D**

**Increase Preparedness of Communities and Agencies To Deal With Landslides**

## **Landslide Mitigation Action Items**

The landslide mitigation action items provide direction on specific activities that cities, organizations, and residents in Douglas County can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

**Action Item #1: Encourage construction, site location and design that can be applied to steep slopes to reduce the potential threat of landslides.**

***Ideas for Implementation***

- Develop a “How-To” development and construction guide for homeowners in potential landslide hazard areas
- Develop public information to emphasize economic risk when building on potential or historical landslide areas.

**Coordinating Organization:** Douglas County Planning Department, Douglas County Building Department

**Timeline:** 3 years

**Plan Goals Addressed:** A, B, C, D

**Action Item #2: Mitigate activities in identified potential and historical landslide areas through public outreach.**

***Ideas for Implementation***

- Identify and use existing mechanisms for public outreach (e.g., SWCD, NRCS, watershed councils, etc.).
- Distribution of landslide educational materials to public

**Coordinating Organization:** Douglas County Planning Department, Douglas County Emergency Management

**Timeline:** Ongoing

**Plan Goals Addressed:** A, B, C

**Action Item #3: Increase coordination between local jurisdictions, Emergency Responders, homeowners and ODF for landslide warning systems.**

***Ideas for Implementation***

- Educate at risk home sites about climatic and soil conditions that are conducive to landslides.
- Develop mitigation and evacuation information and procedures for at risk home sites

**Coordinating Organization:** Douglas County Emergency Management

**Timeline:** 3-5 years

**Plan Goals Addressed:** A, B, C, D,

# **Section 10:**

## **Multi-Hazard Action Items**

### **Table of Contents**

**MULTI- HAZARD MITIGATION GOALS**

**MULTI- HAZARD ACTION ITEMS**



## Multi-Hazard Mitigation Goals

1. Protect Life and Property
2. Develop Partnerships and Implementation Strategies
3. Public Awareness
4. Improve Emergency Services

## Multi-Hazard Action Items

Multi-hazard action items are those activities that pertain to all seven hazards in the mitigation plan: flood, landslide, wildfire, severe winter storm, windstorm, earthquake, and tsunami.

### **Multi Hazard Action Item 1: Provide assistance to incorporated communities and Special Districts in developing Natural Hazard Mitigation Plans.**

#### ***Ideas for Implementation:***

- Develop workshops and outreach materials with ONHW, Douglas County Emergency Management, and Douglas County Planning Department to incorporated communities in Douglas County to assist in developing Natural Hazard Mitigation Plans
- Assist the Umpqua Regional Council of Governments in developing Natural Hazard Mitigation Plans for smaller cities in Douglas County
- Incorporate Completed, approved mitigation plans with the Douglas County Natural Hazard Mitigation Plan as Addenda.

**Coordinating Organization:** Umpqua Regional Council of Governments, Douglas County Planning Department, Douglas County Emergency Management, Incorporated Communities in Douglas County.

**Timeline:** Ongoing

**Plan Goals Addressed:** Partnerships and Implementation

### **Multi-Hazard Action Item 2: Consider the goals and action items from the Douglas County Natural Hazard Mitigation Plan for implementation in other County documents and programs, where appropriate.**

#### ***Ideas for Implementation:***

- Review the Natural Hazard Mitigation Plan for opportunity's to update the County's Comprehensive Plan. Statewide Planning Goal 7 is designed to protect life and property from natural disasters and hazards through planning strategies;
- Consider how components of the County's Natural Hazard Mitigation Plan might be used in updating current and future capital improvement plans.

**Coordinating Organization:** Natural Hazard Mitigation Plan Steering Committee

**Timeline:** Ongoing

**Plan Goals Addressed:** Partnerships and Implementation

### **Multi-Hazard Action Item 3: Identify funding opportunities for developing and implementing local and county mitigation activities.**

#### ***Ideas for Implementation:***

- Develop incentives which encourage local governments, citizens, and businesses to consider hazard mitigation projects;

- Consider funding sources which assist in completing mitigation projects when possible;
- Develop partnerships amongst organizations and agencies in Douglas County, which identify grant programs and foundations that support mitigation activities.

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Planning

**Timeline:** Ongoing

**Plan Goals Addressed:** Partnerships and Implementation

**Multi-Hazard Action Item 4: Develop a process for the Douglas County Natural Hazards Mitigation Plan Committee, which assists in implementing, monitoring, and evaluating countywide mitigation activities.**

***Ideas for Implementation:***

- Oversee implementation of the mitigation plan.
- Provide a mechanism to update and revise the mitigation plan.
- Monitor hazard mitigation implementation.
- Update the Natural Hazards Mitigation Action Plan with new information in accordance with Section 1.
- Conduct a review of the Natural Hazards Mitigation Action Plan at least every 5 years, evaluating mitigation successes, failures, and areas that were not addressed.

**Coordinating Organization:** Natural Hazard Mitigation Plan Steering Committee

**Timeline:** Ongoing

**Plan Goals Addressed:** Partnerships and Implementation

**Multi-Hazard Action Item 5: Identify collaborative programs which seek to avoid activities that increases risk to natural hazards.**

***Ideas for Implementation:***

- Distribute information about flood, fire, earthquake, and other forms of natural hazards to property owners in areas identified at risk through hazard mapping.
- Educate individuals and businesses on the benefit of mitigation activities.
- Encourage communication and dissemination of natural hazard mitigation information.

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Planning, Chambers of Commerce

**Timeline:** Ongoing

**Plan Goals Addressed:** Protect Life and Property, Public Awareness, Partnerships and Implementation

**Multi-Hazard Action Item 6: Develop public and private partnerships to foster Natural Hazard Mitigation Program coordination and collaboration in Douglas County.**

***Ideas for Implementation:***

- Coordinate with City's in Douglas County and the Umpqua Regional Council of Governments on development of Natural Hazard Mitigation Plans which are consistent with the goals and framework of the County Plan.
- Identify all organizations within Douglas County that have programs or interests

- in Natural Hazards Mitigation Planning.
- Involve private businesses throughout the county in mitigation planning.

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Planning

**Timeline:** Ongoing

**Plan Goals Addressed:** Partnerships and Implementation

**Multi-Hazard Action Item 7: Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects.**

***Ideas for Implementation:***

- Identify critical facilities at risk from natural hazards events.
- Develop strategies to mitigate risk to these facilities, or to utilize alternative facilities should natural hazard events cause damage to the facilities in question.
- Identify bridges at risk from flood or earthquake hazards.
- Enhance evacuation route system capacities

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Planning and Douglas County Public Works

**Timeline:** 1-2 Years

**Plan Goals Addressed:** Protect Life and Property, Partnerships and Implementation

**Multi-Hazard Action Item 8: Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs, and enhancing public education on a regional scale.**

***Ideas for Implementation:***

- Educate private property owners on limitations of infrastructure in an emergency.
- Encourage private property owners to upgrade private roadways to support weight of fire trucks and emergency vehicles and provide clearance for emergency vehicles.
- Encourage individual and family preparedness through public education projects.
- Encourage coordination of emergency transportation routes between the Douglas County Sheriff's Office, Emergency Management, Douglas County Public Works, City jurisdictions, and the Oregon Department of Transportation.
- Identify partnership opportunities amongst citizens, private contractors, and other jurisdictions, which increase availability of equipment and manpower for response efforts.
- Continue coordination with public officials on requirements for disaster assistance.

**Coordinating Organization:** Douglas County Emergency Management, Douglas County Planning and Douglas County Public Works

**Timeline:** Ongoing

**Plan Goals Addressed:** Emergency Services

**Multi-Hazard Action Item 9: Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools.**

***Ideas for Implementation:***

- Develop a web page to facilitate information sharing.

- Develop outreach programs to Douglas County business organizations emphasizing the need to prepare for natural hazard events.
- Develop adult and child Public Service Announcements geared for the community to be used by local radio and cable stations.

### **Education**

- Coordinate with school programs and adult education on reducing risk and preventing loss from natural hazards through education.
- Conduct natural hazard awareness program outreach in schools and community centers.
- Conduct workshops for public and private sector organizations to raise awareness of mitigation activities and programs.
- Develop outreach materials for mitigation, preparedness, response and recovery.

**Coordinating Organization:** Douglas County Planning, Buildings, Health and Emergency Management, Emergency response providers

**Timeline:** Ongoing

**Plan Goals Addressed:** Public Awareness, Protect Life and Property

## **“Acts of God”**

This Douglas County Natural Hazard Mitigation Plan also includes any natural hazard outside of the seven identified hazards in this document as an “Act of God”. Natural systems are in a constant state of flux, which creates unpredictability where unforeseen and unplanned Natural Hazard events happen.

The Douglas County Natural Hazard Mitigation Plan, through the use of the above multi-hazard action items would like to address these types of unforeseen natural events through preparedness. It is Douglas County’s belief that all of the action items contained in this document, both hazard-specific and multi-hazard, complement each other making our communities more prepared to cope with Natural Hazard events.

# **Douglas County**

## **Natural Hazards Mitigation Plan**

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### **Appendix A:**

#### **Hazard Analysis For Douglas County, Oregon**

(Douglas County hazard analysis not available in electronic format. Please contact Douglas County Planning Department at 541-440-4289 for a paper copy sent to you)



# Douglas County

## Natural Hazards Mitigation Plan

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### **Appendix B:**

#### **Natural Hazard Plan Development Timeline**

Project List	Draft Douglas County Natural Hazards Mitigation Plan Schedule 2002-2003												Staff Lead	Product	STATUS		
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct				Nov	Dec
<b>Phase 1: Project Organization and Start-Up</b>																	
1	●														County / ONHW	Revised Work Program	☀️
2	—●		●												County	Draft Mitigation Plan Framework	☀️
3	—●		●												County	County & Hazard-Specific Profiles	☀️
4	—●		●												County	Steering Committee Roster	☀️
5		—		—				●							County	Summary of Participant Input on Hazards and Mitigation Actions	☀️
6			—		●										County / ONHW	Summary of Site Visits/ Public Survey	☀️
7						☺️									County	Initial Public Workshop	☀️
						24-Apr											
<b>Phase 2: Inventory and Analysis</b>																	
8				—			●								County	Hazard Identification Information	☀️
9				—				●							County	Vulnerability Assessment (where data is available)	☀️
<b>Phase 3: Action Plan</b>																	
10				—				●							County	Draft Goals and Action Items	☀️
11			★		★		★		★		★				County	Steering Committee Meetings/Minutes	☀️
12					★				★			★			County	Steering Committee Meetings/Minutes	☀️
					13-Feb		10-Apr		12-Jun		14-Aug		9-Oct				
							★				★						
							14-May					★					
								—		●					County	Action Items & Implementation Strategies	☀️
13								—		●					County	Action Items & Implementation Strategies	☀️
14								☺️							County	Final Public Workshop	☀️
								26-Jun									
15									☺️						County	Coastal Public Workshop	☀️
									9-Jul								
16									—		●				County	Final Mitigation Plan	☀️
17											—		●		County	Approved Mitigation Plan	☀️
													1-Oct-03				
18														☠️	County	Finished Project	☀️
<b>Project Timeline</b>																	
—●		—●			★		—●				☺️		☠️		☀️		
		Steering Committee Meeting					Public Workshop						Completed				



# **Douglas County**

## **Natural Hazards Mitigation Plan**

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### **Appendix C:**

#### **Hazard Specific Agency Contact Information**

## Resource Directory List

The following resource directory lists the resources and programs that can assist Douglas County communities and organizations. The resource directory will provide contact information for local, county, regional, state and federal programs that deal with specific natural hazards.

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### Flood Resource Directory

#### County Resources

##### Watershed Councils

##### Umpqua Basin Watershed Council

**Contact:** Chair

**Address:** 1758 NE Airport Rd, Roseburg OR 97470

**Phone:** (541) 673-5756

**Website:** <http://www.ubwc.org/>

##### Elk Creek Watershed Council

**Contact:** Chair

**Phone:** (541) 849-2719

##### Smith River Watershed Council

**Contact:** Chair

**Phone:** (541) 271-5848

#### State Resources

##### Oregon's Wetlands Protection Program

Oregon's Wetlands Program was created in 1989 to integrate federal and state rules concerning wetlands protection with the Oregon Land Use Planning Program. The Wetlands Program has a mandate to work closely with local governments and the Division of State Lands (DSL) to improve land-use planning approaches to wetlands conservation. A Local Wetlands Inventory (LWI) is one component of that program. DSL also develops technical manuals, conducts wetlands workshops for planners, provides grant funds for wetlands planning, and works directly with local governments on wetlands planning tasks.

**Contact:** Division of State Lands

**Website:** <http://statelands.dsl.state.or.us/>

##### Oregon Department of Fish and Wildlife (ODFW)

ODFW's mission is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations. ODFW regulates stream activity and engages in stream enhancement activities.

**Contact:** ODFW

**Address:** 2501 SW First Avenue, PO Box 59, Portland, OR 97207

**Phone:** (503) 872-5268

**Website:** <http://www.dfw.state.or.us/>

**Email:** [odfw.info@state.or.us](mailto:odfw.info@state.or.us)

##### Oregon Division of State Lands (DSL)

DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve, and make the best use of the state's water resources. It generally requires a permit from DSL to remove, fill, or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in state scenic waterways and areas designated essential salmon habitat, where a permit is required for all instream activity, regardless of size. DSL and the US Army Corps of Engineers may issue these permits jointly.

**Contact:** Division of State Lands

**Address:** 775 Summer Street NE, Suite 100, Salem, OR 97301-1279

**Phone:** (503) 378-3805

**Fax:** (503) 378-4844

**Website:** <http://statelands.dsl.state.or.us/>

##### Oregon Water Resources Department (WRD)

The WRD's mission is to serve the public by practicing and promoting wise long-term water management.

The WRD provides services through 19 watermaster offices throughout the state. In addition, five regional offices provide services based on geographic regions. The Department's main administration is performed from the central office in Salem.

**Contact:** WRD

**Address:** 158 12<sup>th</sup> ST. NE, Salem, OR 97301-4172

**Phone:** (503) 378-8455

**Website:** <http://www.wrd.state.or.us/index.shtml>

### **Federal Resources and Programs**

#### **Federal Emergency Management Agency (FEMA)**

FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, and technical assistance. FEMA also operates the National Flood Insurance Program. FEMA's mission is to reduce loss of life and property and protect the nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery. FEMA Region X serves the northwestern states of Alaska, Idaho, Oregon, and Washington.

**Contact:** FEMA, Federal Regional Center, Region 10

**Address:** 228<sup>th</sup> St. SW, Bothell, WA 98021-9796

**Phone:** (425) 487-4678

**Website:** <http://www.fema.gov>

**To obtain FEMA publications:**     **Phone:** (800) 480-2520

**To obtain FEMA maps, Contact:** Map Service Center

**Address:** P.O. Box 1038, Jessup, Maryland 20794-1038

**Phone:** (800) 358-9616

**Fax:** (800) 358-9620

#### **National Flood Insurance Program (NFIP)**

Oregon has 256 flood-prone communities. Flood insurance is available to citizens in communities that adopt and implement NFIP building standards. The standards are applied to development that occurs within a delineated floodplain, a drainage hazard area, and properties within 250 feet of a floodplain boundary. These areas are depicted on federal Flood Insurance Rate Maps available through the county. Oregon's Department of Land Conservation and Development is the state's NFIP coordinating agency.

**Contact:** National Flood Insurance Program

**Website:** <http://www.fema.gov/nfip/>

#### **The Community Rating System (CRS)**

The Community Rating System (CRS) recognizes community floodplain management efforts that go beyond the minimum requirements of the NFIP. Property owners within the county would receive reduced NFIP flood insurance premiums if the county implements floodplain management practices that qualify it for a CRS rating

**Contact:** National Flood Insurance Program

**Website:** <http://www.fema.gov/nfip/crs.htm>

#### **The Floodplain Management Association**

The Floodplain Management website was established by the Floodplain Management Association (FMA) to serve the entire floodplain management community. It includes full-text articles, a calendar of upcoming events, a list of positions available, an index of publications available free or at nominal cost, a list of associations, a list of firms and consultants in floodplain management, an index of newsletters dealing with flood issues (with hypertext links if available), a section on the basics of floodplain management, a list of frequently asked questions about the Website, and a catalog of Web links.

**Contact:** Floodplain Managers Association

**Website:** <http://www.floodplain.org>   **Email:** [admin@floodplain.org](mailto:admin@floodplain.org)

#### **The Association of State Floodplain Managers**

The Association of State Floodplain Managers is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning, and recovery. ASFPM fosters communication among those responsible for flood hazard activities, provides technical advice to governments and other entities about proposed actions or policies that will affect flood hazards, and encourages flood hazard research, education, and training. The ASFPM Web site includes information on how to become a member, the organization's constitution and bylaws, directories of officers and committees, a publications list, information on upcoming conferences, a history of the association, and other useful information and Internet links.

**Contact:** The Association of State Floodplain Managers  
**Address:** 2809 Fish Hatchery Road, Madison, WI 53713  
**Phone:** (608) 274-0123  
**Website:** <http://www.floods.org>

**Northwest Regional Floodplain Managers Association (NORFMA)**

This site is a resource for floodplains, fisheries, and river engineering information for the Northwest. This site provides technical information, articles, and Internet links in the field of floodplain and fisheries management.  
**Contact:** Northwest Regional Floodplain Managers Association  
**Website:** <http://www.norfma.org/>

**FEMA's List of Flood Related Websites**

This site contains a long list of flood related Internet sites from "American Heritage Rivers" to "The Weather Channel," and is a good starting point for flood information on the Internet.  
**Contact:** Federal Emergency Management Agency.  
**Phone:** (800) 480-2520  
**Website:** <http://www.fema.gov/nfip/related.htm>

**National Weather Service, Medford Bureau**

The National Weather Service provides flood watches, warnings, and informational statements for rivers in Douglas County. The Coastal County falls in the NWS "South Central Oregon Coast" region. The eastern portions of the County fall in the "Eastern Douglas County Foothills" region, with the far eastern portion falling in the "South Central Oregon Cascades" Region. The remainder of the county falls in the "Central Douglas County" Region. The NWS Medford office provides river level information online and by phone.  
**Contact:** National Weather Service, Medford Bureau  
**Address:** 4003 Cirrus Drive Medford, OR 97504-4198  
**Phone:** (541) 776-4303  
**Website:** <http://www.wrh.noaa.gov/Medford/index.html>

**Office of Hydrology, National Weather Service**

The National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer information on floods and other aquatic disasters. This site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, an Automated Local Flood Warning Systems Handbook, Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding.  
**Contact:** Office of Hydrology, National Weather Service  
**Website:** <http://www.nws.noaa.gov/oh>

**Farm Services Agency, US Department of Agriculture Douglas County FSA**

Stabilizing farm income, helping farmers conserve land and water resources, providing credit to new or disadvantaged farmers and ranchers, and helping farm operations recover from the effects of disaster are the missions of the USDA Farm Service Agency (FSA).  
**Contact:** County Executive Director  
**Address:** 251 NE Garden Valley Blvd., Roseburg, Oregon 97470  
**Phone:** (541) 673-6071  
**Website:** <http://www.fsa.usda.gov/pas/default.asp>

**National Resources Conservation Service (NRCS), US Department of Agriculture**

NRCS provides a suite of federal programs designed to assist state and local governments and landowners in mitigating the impacts of flood events. The Watershed Surveys and Planning Program and the Small Watershed Program provide technical and financial assistance to help participants solve natural resource and related economic problems on a watershed basis. The Wetlands Reserve Program and the Flood Risk Reduction Program provide financial incentives to landowners to put aside land that is either a wetland resource, or that experiences frequent flooding. The Emergency Watershed Protection Program (EWP) provides technical and financial assistance to clear debris from clogged waterways, restore vegetation, and stabilizing riverbanks. The measures taken under EWP must be environmentally and economically sound and generally benefit more than one property.  
**Contact:** Resource Conservationist  
**Address:** 251 NE Garden Valley Blvd., Roseburg, Oregon 97470  
**Phone:** (541) 673-6071  
**Website:** <http://www.nrcs.usda.gov/>

### **United States Geological Survey (USGS)**

The USGS website provides current streamflow conditions at USGS gauging stations in Oregon and throughout the Pacific Northwest. The Oregon USGS office is responsible for water-resources investigations for Oregon and part of southern Washington. Their office cooperates with more than 40 local, state, and federal agencies in Oregon. Cooperative activities include water-resources data collection and interpretive water-availability and water-quality studies.

**Contact:** USGS Oregon District Office  
**Address:** 10615 S.E. Cherry Blossom Dr., Portland, OR 97216  
**Phone:** (503) 251-3200      **Fax:** (503) 251-3470  
**Website:** <http://oregon.usgs.gov/>      **Email:** [info-or@usgs.gov](mailto:info-or@usgs.gov)

### **USGS Water Resources**

This web page offers current US water news; extensive current (including real-time) and historical water data; numerous fact sheets and other publications; various technical resources; descriptions of ongoing water survey programs; local water information; and connections to other sources of water information.

**Contact:** USGS Water Resources  
**Phone:** (503) 251-3200  
**Website:** <http://water.usgs.gov/>      **Email:** [info-or@usgs.gov](mailto:info-or@usgs.gov)

### **Bureau of Reclamation**

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

**Contact:** Bureau of Reclamation, Pacific Northwest Region  
**Address:** 1150 N. Curtis Road, Boise, ID 83706  
**Phone:** (208) 378-5012  
**Website:** <http://www.pn.usbr.gov/contact/index.shtml>

### **Army Corps of Engineers**

The Corps of Engineers administers a permit program to ensure that the nation's waterways are used in the public interest. Any person, firm, or agency planning to work in waters of the United States must first obtain a permit from the Army Corps of Engineers. In Oregon, joint permits may be issued with the Division of State Lands. The Corps is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation.

**Contact:** US Army Corps of Engineers-Portland District, Floodplain Information Branch  
**Address:** P.O. Box 2946, Portland, OR 97208-2946  
**Phone:** (503) 808-4874      **Fax:** (503) 808-4875  
**Website:** <http://www.nwp.usace.army.mil/>

### **Publications**

*Planning for Natural Hazards: The Oregon Technical Resource Guide*, Department of Land Conservation and Development (July 2000).

Produced by the Community Planning Workshop for the Department of Land Conservation and Development, this is a natural hazards planning and mitigation resource for Oregon cities and counties. It provides hazard-specific resources and plan evaluation tools. The document was written for local government employees and officials. The Technical Resource Guide includes a natural hazards comprehensive plan review, a hazard mitigation legal issues guide, and five hazard specific technical resource guides, including: flooding, wildfires, landslides, coastal hazards, and earthquakes.

**Contact:** Natural Hazards Program Manager, DLCD  
**Address:** 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540  
**Phone:** (503) 373-0050  
**Website:** <http://www.lcd.state.or.us/hazards.html>

*NFIP Community Rating System Coordinator's Manual*. FEMA/NFIP. Indianapolis, IN.

This informative brochure explains how the Community Rating System works and what the benefits are to communities. It explains in detail the CRS point system, and what activities communities can pursue to earn points. These points then add up to the "rating" for the community, and flood insurance premium discounts are calculated based upon that "rating." The brochure also provides a table on the percent discount realized for each rating (1-10). Instructions on how to apply to be a CRS community are also included.

**Contact:** NFIP Community Rating System  
**Phone:** (800) 480-2520 or (317) 848-2898  
**Website:** <http://www.fema.gov/nfip/crs.htm>

*Floodplain Management: A Local Floodplain Administrator's Guide to the NFIP.* FEMA-Region 10. Bothell, WA.

This document discusses floodplain processes and terminology. It contains floodplain management and mitigation strategies, as well as information on the NFIP, CRS, Community Assistance Visits, and floodplain development standards.

**Contact:** National Flood Insurance Program

**Phone:** (800) 480-2520

**Website:** <http://www.fema.gov/nfip/>

*Flood Hazard Mitigation Planning: A Community Guide*, (June 1997), Massachusetts Department of Environmental Management.

This informative guide offers a 10-step process for successful flood hazard mitigation. Steps include: map hazards, determine potential damage areas, take an inventory of facilities in the flood zone, determine what is or is not being done about flooding, identify gaps in protection, brainstorm alternatives and actions, determine feasible actions, coordinate with others, prioritize actions, develop strategies for implementation, and adopt and monitor the plan.

**Contact:** Massachusetts Flood Hazard Management Program

**Phone:** (617) 626-1250

**Website:** <http://www.magnet.state.ma.us/dem/programs/mitigate>

*Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials*, (February 1987), FEMA-116.

This guidebook offers a table on actions that communities can take to reduce flood losses. It also offers a table with sources for floodplain mapping assistance for the various types of flooding hazards. There is information on various types of flood hazards with regard to existing mitigation efforts and options for action (policy and programs, mapping, regulatory, non-regulatory). Types of flooding which are covered include alluvial fan, areas behind levees, areas below unsafe dams, coastal flooding, flash floods, fluctuating lake level floods, ground failure triggered by earthquakes, ice jam flooding, and mudslides.

**Contact:** Federal Emergency Management Agency

**Phone:** (800) 480-2520

**Website:** <http://www.fema.gov>

*Oregon Model Flood Damage Prevention Ordinance*, (January 1999).

This is an example of how to write an ordinance that complies with NFIP/FEMA standards. Communities can simply adopt this ordinance, word for word, filling in the blanks specific to their community or jurisdiction.

**Contact:** Department of Land Conservation and Development

**Phone:** (503) 373-0050

**Website:** <http://www.lcd.state.or.us/hazards.html>

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## Severe Winter Storm Resources

### State Resources

#### Oregon Climate Service

The Oregon Climate Service (OCS) collects, manages, and maintains Oregon weather and climate data. OCS provides weather and climate information to those within and outside the state of Oregon and educates the citizens of Oregon on current and emerging climate issues. OCS also performs independent research related to weather and climate issues.

**Contact:** Oregon Climate Service

**Address:** Oregon Climate Service, Oregon State University Strand Ag Hall Room 316, Corvallis, OR 97331-2209

**Phone:** (541) 737-5705

**Website:** **Email:** [oregon@oce.orst.edu](mailto:oregon@oce.orst.edu)

### Federal Resources

#### National Weather Service, Medford Bureau

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure, which can be used by other governmental agencies, the private sector, and the public.

**Contact:** National Weather Service, Medford Bureau

**Address:** 4003 Cirrus Drive Medford, OR 97504-4198  
**Phone:** (541) 776-4303  
**Website:** <http://www.wrh.noaa.gov/Medford/index.html>

#### **National Oceanic and Atmospheric Administration (NOAA)**

NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.

**Contact:** National Oceanic and Atmospheric Administration

**Address:** 14<sup>th</sup> Street & Constitution Avenue, NW, Room 6013, Washington, DC 20230

**Phone:** (202) 482-6090      **Fax:** (202) 482-3154

**Website:** <http://www.noaa.gov/>      **Email:** [answers@noaa.gov](mailto:answers@noaa.gov)

#### **Additional Resources**

*Public Assistance Debris Management Guide*, Federal Emergency Management Agency (July 2000).

The Debris Management Guide was developed to assist local officials in planning, mobilizing, organizing, and controlling large-scale debris clearance, removal, and disposal operations. Debris management is generally associated with post-disaster recovery. While it should be compliant with local and county emergency operations plans, developing strategies to ensure strong debris management is a way to integrate debris management within mitigation activities. The *Public Assistance Debris Management Guide* is available in hard copy or on the FEMA website.

**Contact:** FEMA Distribution Center

**Address:** 130 228<sup>th</sup> Street, SW, Bothell, WA 98021-9796

**Phone:** (800) 480-2520      **Fax:** (425) 487-4622

**Website:** <http://www.fema.gov/r-n-r/pa/dmgtoc.htm>

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## **Earthquake/Tsunami Resource Directory**

### **State Resources**

#### **Northwest GeoData Clearinghouse, Department of Geology – Portland State University**

Portland State University conducts geologic research and prepares inventories and reports for communities throughout Oregon. The GeoData Clearinghouse provides geologic information on earthquakes in the Northwest. It is especially useful for finding earthquake-related maps or links to geospatial mapping sites around the nation.

**Contact:** Department of Geology

**Address:** Portland State University P.O. Box 751, Portland OR 97207-0751

**Phone:** (503) 725-3022      **Fax:** (503) 725-3025

**Website:** <http://www.metro.dst.or.us/metro/growth/gms.html>

#### **Oregon Department of Geology and Mineral Industries (DOGAMI)**

The mission of the Department of Geology and Mineral Industries is to serve a broad public by providing a cost-effective source of geologic information for Oregonians and to use that information in partnership to reduce the future loss of life and property due to potentially devastating earthquakes, tsunamis, landslides, floods, and other geologic hazards. The Department has mapped earthquake hazards in most of western Oregon.

**Contacts:** Deputy State Geologist, Seismic, Tsunami, and Coastal Hazards Team Leaders

**Address:** 800 NE Oregon St., Suite 965, Portland, OR 97232

**Phone:** (503) 731-4100      **Fax:** (503) 731-4066

**Website:** <http://sarvis.dogami.state.or.us/homepage>

#### **Oregon Department of Consumer & Business Services-Building Codes Division**

The Building Codes Division (BCD) sets statewide standards for design, construction, and alteration of buildings that include resistance to seismic forces. BCD is active on several earthquake committees and funds construction related continuing education programs. BCD registers persons qualified to inspect buildings as safe or unsafe to occupy following an earthquake and works with OEM to assign inspection teams where they are needed.

**Contact:** Building Codes Division

**Address:** 1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309

**Phone:** (503) 378-4133      **Fax:** (503) 378-2322

**Website:** <http://www.cbs.state.or.us/external>

### **State Earthquake Legislation**

**Senate Bill 13: Seismic Event Preparation**

Senate Bill 13, signed by the Governor on June 14, 2001, requires each state and local agency and persons employing 250 or more full-time employees to develop seismic preparation procedures and inform their employees about the procedures. Further, the bill requires agencies to conduct drills in accordance with Office of Emergency Management guidelines. These drills must include “familiarization with routes and methods of exiting the building and methods of duck, cover and hold during an earthquake.” Each state and local agency and employer with 250 or more full-time employees shall maintain a file that documents the date the earthquake drill was conducted.

**Senate Bill 14: Seismic Surveys For School Buildings**

The Governor signed Senate Bill 14 on July 19, 2001. It requires the State Board of Higher Education to provide for seismic safety surveys of buildings that have a capacity of 250 or more persons and are routinely used for student activities by public institutions or departments under the control of the board. A seismic safety survey is not required for any building that has previously undergone a seismic safety survey or that has been constructed to the state building code standards in effect for the seismic zone classification. Subject to available funding, if a building is found to pose an undue risk to life and safety during a seismic event, a plan shall be developed for seismic rehabilitation or other seismic risk reducing activities. All seismic rehabilitation or other actions to reduce seismic risk must be completed before January 1, 2032, subject to available funding.

**Senate Bill 15: Seismic Surveys for Hospital Buildings**

The Governor signed Senate Bill 15 on July 19, 2001. It requires the Health Division to provide for seismic safety surveys of hospital buildings that contain an acute inpatient care facility. Seismic surveys shall also be conducted on fire stations, police stations, sheriffs’ offices, and similar facilities subject to available funding. The surveys should be completed by January 1, 2007.

A seismic survey is not required for any building that has undergone a survey or that has been constructed to the state building code standards in effect for the seismic zone classification at the site. Subject to available funding, if a building is evaluated and found to pose an undue risk to life and safety during a seismic event, the acute inpatient care facility, fire department, fire district or law enforcement agency using the building shall develop a plan for seismic rehabilitation of the building or for other actions to reduce the risk. All seismic rehabilitations or other actions to reduce the risk must be completed before January 1, 2022, subject to available funding.

**Federal Resources****US Geological Survey (USGS)**

The USGS is an active seismic research organization that also provides funding for research. (For an example of such research, see Recommended Seismic Publications below).

**Contact:** USGS, National Earthquake Information Center

**Address:** Box 25046; DFC, MS 967; Denver, CO 80225

**Phone:** (303) 273-8500      **Fax:** (303) 273-8450

**Website:** <http://neic.usgs.gov>

**Building Seismic Safety Council (BSSC)**

The Building Seismic Safety Council (BSSC), established by the National Institute of Building Sciences (NIBS), deals with complex regulatory, technical, social, and economic issues and develops and promotes building earthquake risk mitigation regulatory provisions for the nation.

**Address:** 1090 Vermont Avenue, NW, Suite 700, Washington, DC 20005

**Phone:** (202) 289-7800      **Fax:** (202) 289-109

**Website:** <http://www.bssconline.org/>

**National Weather Service Pacific Tsunami Warning Center**

As the Operational Center for the Tsunami Warning System in the Pacific, PTWC provides warnings for Pacific basin teletsunamis (tsunamis that can cause damage far away from their source) to almost every country around the Pacific Rim and to most of the Pacific island states. This function is carried out under the guidance of the UNESCO/IOC International Coordination Group for the Tsunami Warning System in the Pacific (ITSU). A few destructive teletsunamis are generated each century by great earthquakes around the Pacific Rim.

**Address:** 91-270 Ft. Weaver Rd, Ewa Beach, HI 96706

**Website:** <http://www.prh.noaa.gov/ptwc/>

**West Coast & Alaska Tsunami Warning Center**



The U.S. West Coast/Alaska Tsunami Warning Center (WC/ATWC) was established in Palmer, Alaska in 1967 as a direct result of the great Alaskan earthquake that occurred in Prince William Sound on March 27, 1964. This earthquake alerted State and Federal officials to the need for a facility to provide timely and effective tsunami warnings and information for the coastal areas of Alaska. In 1982, the WC/ATWC's area of responsibility (AOR) was enlarged to include the issuing of tsunami warnings to California, Oregon, Washington, and British Columbia, for potential tsunamigenic earthquakes occurring in their coastal areas. In 1996, the responsibility was again expanded to include all Pacific-wide tsunamigenic sources, which could affect the California, Oregon, Washington, British Columbia and Alaska coasts.

**Address:** 910 S. Felton St., Palmer, AK 99645 USA

**Phone:** (907)745-4212 **FAX:** (907)745-6071

**Website:** <http://wcatwc.gov/main.htm>

### **Additional Resources**

#### **Cascadia Region Earthquake Workgroup (CREW)**

The Cascadia Region Earthquake Workgroup provides information on regional earthquake hazards, facts, and mitigation strategies for homes and businesses. CREW is a non-profit coalition of private and public representatives working together to improve the ability of Cascadia Region communities to reduce the effects of earthquake events.

Members are from Oregon, Washington, California, and British Columbia. CREW's goals are to:

- Promote efforts to reduce the loss of life and property;
- Conduct education efforts to motivate key decision makers to reduce risks associated with earthquakes; and
- Foster productive linkages between scientists, critical infrastructure providers, businesses, and governmental agencies in order to improve the viability of communities after an earthquake event.

**Contact:** CREW, Executive Director

**Address:** 1330A S. 2<sup>nd</sup> Street, #105; Mount Vernon, WA 98273

**Phone:** (360) 336-5494 **Fax:** (360) 336-2837

**Website:** <http://www.crew.org>

#### **Western States Seismic Policy Council Earthquake Program Information Center (WSSPC)**

WSSPC is a regional earthquake consortium funded mainly FEMA. Its website is a great earthquake resource, with information clearly categorized – from policy to engineering to education.

**Contact:** Western States Seismic Policy Council

**Address:** 125 California Avenue, Suite D201, #1, Palo Alto, CA 94306

**Phone:** (650) 330-1101 **Fax:** (650) 326-1769

**E-mail:** [wsspc@wsspc.org](mailto:wsspc@wsspc.org) **Website:** <http://www.wsspc.org/home.html>

### **Publications**

*Environmental, Groundwater and Engineering Geology: Applications for Oregon – Earthquake Risks and Mitigation in Oregon*, Yumei Wang, (1998) Oregon Department of Geology and Mineral Industries, Star Publishing

This paper deals with earthquake risks in Oregon, what is being done today, and what policies and programs are in action to help prevent loss and damage from seismic events. This article also gives a good list of organizations that are doing work in this field within the state. This article provides vital information to communities around the state.

**Contact:** DOGAMI

**Address:** 800 NE Oregon St., Suite 965, Portland, Oregon 97232

**Phone:** (503) 731-4100 **Fax:** (503) 731-4066

**Website:** <http://sarvis.dogami.state.or.us/homepage>

*Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners*, Wolfe, Myer R. et al., (1986) University of Colorado, Institute of Behavioral Science, National Science Foundation.

This handbook provides techniques that planners and others can utilize to help mitigate for seismic hazards. It provides information on the effects of earthquakes, sources on risk assessment, and effects of earthquakes on the built environment. The handbook gives examples on application and implementation of planning techniques to be used by local communities.

**Contact:** Natural Hazards Research and Applications Information Center

**Address:** University of Colorado, 482 UCB, Boulder, CO 80309-0482

**Phone:** (303) 492-6818 **Fax:** (303) 492-2151

**Website:** <http://www.colorado.edu/UCB/Research/IBS/hazards>

*Public Assistance Debris Management Guide*, FEMA (July 2000).

The Debris Management Guide was developed to assist local officials in planning, mobilizing, organizing, and controlling large-scale debris clearance, removal, and disposal operations. Debris management is generally associated with post-disaster recovery. While it should be compliant with local and county emergency operations plans, developing strategies to ensure strong debris management is a way to integrate debris management within mitigation activities. The *Public Assistance Debris Management Guide* is available in hard copy or on the FEMA website.

**Contact:** FEMA Distribution Center

**Address:** 130 228<sup>th</sup> Street, SW, Bothell, WA 98021-9796

**Phone:** (800) 480-2520

**Fax:** (425) 487-4622

**Website:** <http://www.fema.gov/r-n-r/pa/dmgtoc.htm>

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## Windstorm Resource Directory

### State Resources

#### Oregon Climate Service

The Oregon Climate Service (OCS) collects, manages, and maintains Oregon weather and climate data. OCS provides weather and climate information to those within and outside the state of Oregon and educates the citizens of Oregon on current and emerging climate issues. OCS also performs independent research related to weather and climate issues.

**Contact:** Oregon Climate Service

**Address:** Oregon Climate Service, Oregon State University, Strand Ag Hall Room 316  
Corvallis, OR 97331-2209

**Phone:** (541) 737-5705

**Website:** <http://www.ocs.orst.edu>    **Email:** [oregon@oce.orst.edu](mailto:oregon@oce.orst.edu)

#### National Weather Service, Medford Bureau

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters, and ocean areas for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure, which can be used by other governmental agencies, the private sector, the public, and the global community.

### Federal Resources

#### National Oceanic and Atmospheric Administration (NOAA)

NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.

**Contact:** National Oceanic and Atmospheric Administration

**Address:** 14<sup>th</sup> Street & Constitution Avenue, NW, Room 6013,  
Washington, DC 20230

**Phone:** (202) 482-6090

**Fax:** (202) 482-3154

**Website:** <http://www.noaa.gov>

**Email:** [answers@noaa.gov](mailto:answers@noaa.gov)

### Additional Resources

*Public Assistance Debris Management Guide*, Federal Emergency Management Agency (July 2000).

The Debris Management Guide was developed to assist local officials in planning, mobilizing, organizing, and controlling large-scale debris clearance, removal, and disposal operations. Debris management is generally associated with post-disaster recovery. While it should be compliant with local and county emergency operations plans, developing strategies to ensure strong debris management is a way to integrate debris management within mitigation activities. The *Public Assistance Debris Management Guide* is available in hard copy or on the FEMA website.

**Contact:** FEMA Distribution Center

**Address:** 130 228<sup>th</sup> Street, SW, Bothell, WA 98021-9796

**Phone:** (800) 480-2520

**Fax:** (425) 487-4622

**Website:** <http://www.fema.gov/r-n-r/pa/dmgtoc.htm>

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## Wildfire Resource Directory

## County Resources

### Douglas Forest Protective Association

**Contact:** District Manager

**Address:** 1758 NE Airport Rd, Roseburg, OR 97470

**Phone:** (541) 672-6507

**Fax:** (541) 440-3424

**Website:** <http://www.odf.state.or.us/AREAS/southern/douglas/aboutdouglas.asp>

### Coos Forest Protective Association

**Contact:** District Manager

**Address:** 63612 fifth Rd, Coos Bay, OR 97420

**Phone:** (541) 267-3161 **Fax:** (541) 269-2027

**Website:** <http://www.odf.state.or.us/AREAS/southern/coosfpa/aboutcfpa.asp>

## State Resources

### Oregon Department of Forestry (ODF)

ODF's Fire Prevention Unit is involved in interface wildfire mitigation and provides information about Oregon's Wildfire Hazard Zones. The Protection From Fire section of the ODF website includes Oregon-specific fire protection resources. Wildfire condition reports can be accessed on the website as well. ODF's Protection from Fire Program works to do the following:

- Clarify roles of ODF, landowners, and other agencies in relation to wildland fire protection in Oregon;
- Strengthen the role of forest landowners and the forest industry in the protection system;
- Understand and respond to needs for improving forest health conditions and the role/use of prescribed fire in relation to mixed ownerships, forest fuels and insects and disease; and
- Understand and respond to needs for improving the wildland/urban interface situation.

**Contact:** Oregon Department of Forestry, Fire Prevention Unit

**Address:** 2600 State Street, Salem, Oregon 97310

**Phone:** (503) 945-7440

**Website:** <http://www.odf.state.or.us/fireprot.htm>

### Office of the State Fire Marshal (OSFM)

The Prevention Unit of Oregon's Office of the State Fire Marshal contains 19 Deputy State Fire Marshals located in various regions. The responsibilities of these deputies include public education for local fire districts and inspection of businesses, public assemblies, schools, daycare centers, and adult foster homes. The State Fire Marshal's Community Education Services unit works to keep Oregonians safe from fires and injury by providing them with the knowledge to protect themselves and their property.

**Contact:** Oregon State Fire Marshal

**Address:** 4760 Portland Road NE, Salem, Oregon 97305-1760

**Phone:** (503) 378-3473

**Fax:** (503) 373-1825

**Email:** [oregon.sfm@state.or.us](mailto:oregon.sfm@state.or.us)

## Federal Resources and Programs

### Federal Wildland Fire Policy, Wildland/Urban Interface Protection

This is a report describing federal policy and interface fire. Areas of needed improvement are identified and addressed through recommended goals and actions.

**Website:** <http://www.fs.fed.us/land/wdfire7c.htm>

### National Fire Protection Association (NFPA)

NFPA has information on the Initiative's programs and documents. Other members of the initiative include: the National Association of State Foresters, the US Department of Agriculture Forest Service, the US Department of the Interior, and the United States Fire Administration.

**Contact:** Public Fire Protection Division

**Address:** 1 Battery March Park, P.O. Box 9101, Quincy, MA 02269-9101

**Phone:** (617) 770-3000

### National Interagency Fire Center (NIFC)

The NIFC in Boise, Idaho is the nation's support center for wildland firefighting. Seven federal agencies work together to coordinate and support wildland fire and disaster operations. These agencies include the Bureau of Indian Affairs, Bureau of Land Management, Forest Service, Fish and Wildlife Service, National Park Service, National Weather Service, and Office of Aircraft Services.

**Contact:** National Interagency Fire Center

**Address:** 3833 S. Development Avenue, Boise, ID 83705-5354  
**Phone:** (208) 387-5512  
**Website:** <http://www.nifc.gov/>

**United States Fire Administration (USFA) of the Federal Emergency Management Agency (FEMA)**

As an entity of the Federal Emergency Management Agency, the mission of the USFA is to reduce life and economic losses due to fire and related emergencies through leadership, advocacy, coordination, and support.

**Contact:** USFA, Planning Branch, Mitigation Directorate  
**Address:** 16825 S. Seton Ave., Emmitsburg, MD 21727  
**Phone:** (301) 447-1000  
**Website:** <http://www.fema.gov/mit/wfmit.htm> - Wildfire Mitigation Planning  
<http://www.usfa.fema.gov/index.htm> - USFA Homepage  
<http://www.usfa.fema.gov/wildfire/> - USFA Resources on Wildfire

**Additional Resources**

**FireFree Program to Promote Home Safety**

In a pioneering effort to address wildfire danger in Bend, Oregon, four local agencies and a Fortune 500 corporation joined together to create "FireFree! Get In The Zone," a public education campaign designed to increase resident participation in wildfire safety and mitigate losses.

**Contact:** FireFree  
**Address:** 63377 Jamison St., Bend, OR 97701  
**Phone:** (541) 318-0459  
**E-mail:** [dcrfpd2@dcrfpd2.com](mailto:dcrfpd2@dcrfpd2.com)      **Website:** <http://www.firefree.org>

**Firewise – The National Wildland/Urban Interface Fire program**

Firewise maintains a Website designed for people who live in wildfire-prone areas, but it also can be of use to local planners and decision makers. The site offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences.

**Contact:** Firewise  
**E-mail:** [firewise@firewise.org](mailto:firewise@firewise.org)      **Website:** <http://www.firewise.org/>

**Publications**

*National Fire Protection Association Standard 299: Protection of Life and Property from Wildfire.* National Wildland/Urban Interface Fire Protection Program, (1991). National Fire Protection Association, Washington, D.C.

This document, developed by the NFPA Forest and Rural Fire Protection Committee provides criteria for fire agencies, land use planners, architects, developers, and local governments to use in the development of areas that may be threatened by wildfire. To obtain this resource:

**Contact:** National Fire Protection Association Publications  
**Phone:** (800) 344-3555  
**Website:** <http://www.nfpa.org>

*Wildland/Urban Interface Fire Hazard Assessment Methodology.* National Wildland/Urban Interface Fire Protection Program, (1998), NFPA, Washington, D.C. To obtain this resource:

**Contact:** Firewise (NFPA Public Fire Protection Division)  
**Phone:** (617) 984-7486  
**Website:** <http://www.firewise.org>

*Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility.* National Wildland/Urban Interface Fire Protection Program. (1998). Washington, D.C.: Author. To obtain this resource:

**Contact:** Firewise (NFPA Public Fire Protection Division)  
**Phone:** (617) 984-7486  
**Website:** <http://www.firewise.org>

*Planning for Natural Hazards: The Oregon Technical Resource Guide, Department of Land Conservation and Development* (July 2000). Produced by the Community Planning Workshop for the Department of Land Conservation and Development, this is a natural hazards planning and mitigation resource for Oregon

cities and counties.

**Contact:** Natural Hazards Program Manager

**Address:** 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540

**Phone:** (503) 373-0050

**Fax:** (503) 378-6033

**Website:** <http://www.lcd.state.or.us/hazards.html>

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## Landslide Resource Directory

### State Resources

#### Oregon State Building Codes Division

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by state and local municipalities throughout Oregon. The One and Two-Family Dwelling Code and Structural Specialty Code contain provisions for lot grading and site preparation for the construction of building foundations. Both codes contain requirements for cut, fill, and sloping of the lot in relationship to the location of the foundation. There are also building setback requirements from the top and bottom of slopes. The codes specify foundation design requirements to accommodate the type of soils, the soil bearing pressure, and the compaction and lateral loads from soil and ground water on sloped lots. The building official has the authority to require a soils analysis for any project where it appears the site conditions do not meet the requirements of the code or special design considerations must be taken. ORS 455.447 and the Structural Code require a seismic site hazard report for projects that include essential facilities such as hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools and prisons.

**Contact:** Oregon State Building Codes Division

**Address:** 1535 Edgewater St. NW, P.O. Box 14470, Salem, OR 97309

**Phone:** (503) 373-4133

**Website:** <http://www.cbs.state.or.us/external/bcd>

#### Oregon Department of Geology and Mineral Industries (DOGAMI)

DOGAMI is an important agency for landslide mitigation activities in Oregon. Some key functions of DOGAMI are development of geologic data, and identifying geologic hazards. The agency also provides technical resources for communities and provides data and geologic information to local, state, and federal natural resource agencies, industry, and private groups.

**Contact:** DOGAMI

**Address:** 800 NE Oregon Street, Suite 965, Portland, Oregon 97232

**Phone:** (503) 731-4100

**Fax:** (503) 731-4066

**Website:** <http://sarvis.dogami.state.or.us> **Email:** [info@naturenw.org](mailto:info@naturenw.org)

#### Oregon Department of Forestry (ODF)

The mission of the Oregon Department of Forestry is to serve the people of Oregon through the protection, management, and promotion of a healthy forest environment, which will enhance Oregon's livability and economy for today and tomorrow. ODF regulates forest operations to reduce the risk of serious injury or death from rapidly moving landslides related to forest operations, and assists local governments in the siting review of permanent dwellings on and adjacent to forestlands in further review areas. As part of the requirements of Senate Bill 12, ODF is currently administering the deferral of certain forest operations on landslide prone sites above homes and roads. The Department's policy is that timber harvesting or road construction operations will be prohibited on land where landslides or debris flows pose a significant threat to human safety. Exceptions for salvage or other purposes are considered on an individual basis, but have been infrequent in keeping with the intent of preventing significant risks to human life.

#### Oregon Debris Flow Warning Page

The Oregon Debris Flow Warning page provides communities with up to-date access to information regarding potential debris flows. The Debris Flow Warning system was initiated in 1997 and involves collaboration between ODF, DOGAMI, the Oregon Department of Transportation (ODOT), local law enforcement agencies, NOAA Weather Radio, and local media. The ODF is responsible for forecasting and measuring rainfall from storms that may trigger debris flows. Advisories and warnings are issued as appropriate. Information is broadcast over NOAA weather radio and provided to emergency services on the Law Enforcement Data System. DOGAMI provides additional information on debris flows to the media that convey the information to the public. ODOT also provides warnings to motorists during periods determined

to be of highest risk for rapidly moving landslides along areas on state highways with a history of being most vulnerable. Information is available on the ODF website.

**Contact:** ODF

**Address:** 2600 State Street, Salem, OR, 97310

**Phone:** (503) 945-7200      **Fax:** (503) 945-7212

**Website:** <http://www.odf.state.or.us/>

#### **Oregon Department of Transportation (ODOT)**

ODOT provides warnings to motorists during periods determined to be of highest risk of rapidly moving landslides along areas on state highways with a history of being most vulnerable to rapidly moving landslides. ODOT also monitors for landslide activity and responds to slide events on state highways.

**Contact:** ODOT Transportation Building

**Address:** 355 Capitol St. NE, Salem, OR 97310

**Phone:** (888) 275-6368

**Website:** <http://www.odot.state.or.us>

## **Federal Resources and Programs**

### **Federal Emergency Management Agency (FEMA), Landslide Fact Sheet**

FEMA's website contains information on strategies to reduce risk and prevent loss from landslides and debris flows.

**Contact:** Federal Regional Center, Region 10

**Address:** 130-228<sup>th</sup> St. SW, Bothell, WA 98021-9796

**Phone:** (425) 487-4678

**Website:** <http://www.fema.gov/library/landslif.htm>

### **Natural Resource Conservation Service (NRCS)**

The NRCS produces soil surveys. These may be useful to local governments who are assessing areas with potential development limitations including steep slopes and soil types. They operate many programs dealing with the protection of natural resources.

**Contact:** Resource Conservationist

**Address:** 251 NE Garden Valley Blvd., Roseburg, Oregon 97470

**Phone:** (541) 673-6071

**Website:** <http://www.nrcs.usda.gov/>

### **US Geological Survey, National Landslide Information Center (NLIC)**

The NLIC website provides good information on the programs and resources regarding landslides. The page includes information on the National Landslide Hazards Program Information Center, a bibliography, publications, and current projects. USGS scientists are working to reduce long-term losses and casualties from landslide hazards through better understanding of the causes and mechanisms of ground failure both nationally and worldwide.

**Contact:** National Landslide Information Center

**Phone:** (800) 654-4966

**Website:** <http://landslide.usgs.gov>

### **Additional Resources**

#### **Oregon State Senate Bill 12**

The 1997 Legislature passed Senate Bill 12 to address problems caused by landslides and debris flows. Provisions include:

- Allowing the Oregon State Forester to prevent timber harvest or road construction in or below areas identified by the Department of Forestry as "high risk sites" and where homes or highways are in precarious locations;
- Allowing road officials to close roads that pose risk to human life because of landslides;
- Requiring State agencies to develop, and local officials to distribute, information about hazards of construction on sites that are vulnerable to landslides;

Establishing a 10-member Task Force on Landslides and Public Safety to assess the problem and develop a solution. It includes legislators and representatives from state natural resource agencies, boards of commissions, local government, and the public



# Douglas County

## Natural Hazards Mitigation Plan

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### Appendix D:

#### Natural Hazard Preparedness Survey and Focus Group Report For Douglas County

(Natural Hazard Preparedness Survey and Focus Group Report for Douglas County is not available in Electronic Format, for a copy please contact the Douglas County Planning Department at 541-440-4289, or contact the Oregon Natural Hazards Workgroup at [onhw@uoregon.edu](mailto:onhw@uoregon.edu).)



# **Douglas County**

## **Natural Hazards Mitigation Plan**

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### **Appendix E:**

#### **Douglas County Incorporated Areas Sample Natural Hazard Mitigation Plan Template**

## **Incorporated Jurisdiction Natural Hazards Mitigation Plan Addendum**

### **Table of Contents**

#### **Section 1: Planning Process**

Who Participated In Developing The Plan?

What Is The Plan Mission?

What Are The Plan Goals?

How Will The Plan Be Implemented, Monitored, And Evaluated?

#### **Section 2: Community Profile**

Geography And The Environment

Population And Demographics

Land And Development

Housing And Community Development

Employment And Industry

Transportation And Commuting Patterns

#### **Section 3: Hazard Assessment**

What Is A Hazard Assessment?

Federal Requirements For Hazard Assessment

Community Assets And Vulnerability Assessment

#### **Section 4: Natural Hazards (Type To Vary By Community)**

Flooding

Landslide

Wildfire

Severe Storm: Wind & Winter

Earthquake

Tsunami

Multi-Hazard

#### **Section 5: Mitigation Planning Priority System**

Action Item Prioritization Methodology

#### **Section 6: Resource Directory**

## Section 1: Planning Process

The **Incorporated Jurisdiction** Natural Hazards Mitigation Plan includes resources and information to assist city residents, public and private sector organizations, and others interested in participating in planning for natural hazards. The mitigation plan provides a list of activities that may assist **Incorporated Jurisdiction** in reducing risk and preventing loss from future natural hazard events.

### Who Participated in Developing the Plan?

The **Incorporated Jurisdiction** Natural Hazards Mitigation Plan is the result of a collaborative effort between **Incorporated Jurisdiction public agencies, non-profit organizations, the private sector, and regional and state organizations**. A project Steering Committee guided the process of developing the plan. The Steering Committee was comprised of representatives from:

- **List Steering Committee Members**

### Public Participation

Public participation is a key component to strategic planning processes. Citizen participation offers citizens the chance to voice their ideas, interests, and opinions. **Insert local public involvement process here.**

### What is the Plan Mission?

**Incorporated Jurisdiction agrees with the mission statement developed during the Douglas County planning process. Insert mission if different from county.**

### What are the Plan Goals?

**Incorporated Jurisdiction agrees with the goals developed during the Douglas County planning process. Insert Goals if different from county.**

### How Will the Plan be Implemented, Monitored, and Evaluated?

The plan maintenance process includes a schedule for implementing, monitoring, evaluating, and reviewing this plan addendum. It is essential to have this process to ensure plan sustainability.

### Plan Adoption

The **Municipality Governing Body** will be responsible for adopting the **Municipality** Natural Hazards Mitigation Plan. This governing body has the authority to promote sound public policy regarding natural hazards.

### Coordinating Body

**Insert coordinating body for plan implementation: steering committee.**

### Implementation through Existing Programs

**Incorporated Jurisdiction** addresses statewide planning goals and legislative requirements through its Comprehensive Land Use Plan, Capital Improvement Plans, and Building Codes. The Natural Hazard Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. **Incorporated Jurisdiction** will have the

opportunity to implement recommended mitigation action items through existing programs and procedures.

### **Economic Analysis of Mitigation Projects**

The Federal Emergency Management Agency’s accepted methods for determining the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the **Incorporated Jurisdiction** will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the **Incorporated Jurisdiction** may use other approaches to understand the costs and benefits of each action item and develop a prioritized list.

### **Formal Review Process**

The **Incorporated Jurisdiction** Addendum to the Douglas County Natural Hazards Mitigation Plan will be evaluated on an **insert time-frame** basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. This addendum will be submitted to FEMA every five years for review and approval.

### **Continued Public Involvement**

#### **Special Service Districts**

The following special service districts, associations, and agencies provide services within to **Incorporated Jurisdiction** residents. These districts will have an opportunity to provide feedback on the Plan during the public participation process. Contact information for the following can be found in the Resource Directory portion of this document.

## **Section 2:**

### **Community Profile**

- Geography and the Environment
  - Major Rivers
  - Climate
  - Minerals and Soils
  - Other Significant Geologic Features
- Population and Demographics
- Land and Development
  - Housing and Community Development
  - Employment and Industry
  - Transportation and Commuting Patterns

## Section 3: Hazard Assessment

### What is a Hazard Assessment?

Conducting a risk assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Hazard assessments are subject to the availability of hazard-specific data. **Incorporated Jurisdiction** conducted a hazard assessment for all of the hazards for which data was available. The three levels of a risk assessment are as follows:

- 1) **Hazard Identification** identifies the geographic extent and intensity of the hazard, the intensity of the hazard, and the probability of its occurrence. Maps are frequently used to display hazard identification data. **Incorporated Jurisdiction** identified seven major hazards that consistently affect this geographic area. These hazards – floods, landslides, wildfires, earthquakes, severe winter storms, windstorms, and Tsunami – were identified through an extensive process that utilized input from the Douglas County Natural Hazard Mitigation Steering Committee
- 2) **Vulnerability Assessment/Inventorying Assets** combines hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. Additionally, a more detailed description of the vulnerability of these assets is located in the specific hazard sections.
- 3) **Risk Analysis/Estimating Potential Losses** involves estimating the damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Unfortunately, there is insufficient data for conducting a risk analysis for the natural hazards affecting Incorporated Jurisdiction. However, this need is identified in our action plan, and will complete a risk assessment will be conducted when the resources are available.

### Federal Requirements for Hazard Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201 include a requirement for hazard assessment. This risk assessment requirement is intended to provide information that will help communities to identify and prioritize mitigation activities that will reduce losses from the identified hazards. There are seven hazards profiled in the mitigation plan, including floods, landslides, wildfires, earthquakes, winter storms, windstorms, and volcanic eruptions. The Federal criterion for risk assessment and information on how the **Incorporated Jurisdiction** Natural Hazard Mitigation Plan meets those criteria is outlined in Table 3-1 below.

**Table 3-1. Federal Criteria for Hazard Assessment**

Section 322 Requirement	How is this addressed?
Identifying Hazards	Each hazard section includes a map illustrating the geographic extent of the hazards affecting <b>Incorporated Jurisdiction</b> using the best available data.
Profiling Hazard Events	The hazard sections of the Douglas County Natural Hazard Mitigation Plan provide documentation for all of the large-scale hazard events affecting the region. Where data is available, <b>Incorporated Jurisdiction</b> has provided local impacts from historical hazard events.
Assessing Vulnerability: Identifying Assets	Table 3.3 documents the community assets that are vulnerable to natural hazards. A more detailed description of the vulnerability of these assets is located in the specific hazard sections.
Assessing Vulnerability: Estimating Potential Losses	Using the best available data, an estimate of potential losses from natural hazards is located in the hazard specific sections.
Assessing Vulnerability: Analyzing Development Trends	The Community Profile Section of this plan provides a description of the development trends in <b>Incorporated Jurisdiction</b> .

## Community Assets and Vulnerability Assessment

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and environmental integrity of **Incorporated Jurisdiction**. The community assets were defined as follows:

**Critical Facilities:** Those facilities and infrastructure necessary for emergency response efforts.

- **Insert Local Critical Facilities Here**

**Essential Facilities:** Those facilities and infrastructure that supplement response efforts.

- **Insert Local Essential Facilities Here**

**Infrastructure:** Infrastructure that provides services for **Incorporated Jurisdiction**.

- **Insert Local Infrastructure Here**

**Vulnerable Populations:** Locations serving populations that have special needs or require special consideration.

- **Insert Vulnerable Populations Here**

**Cultural or Historical Assets:** Those facilities that augment or help define community character, and if lost, would represent a significant loss for the community.

- **Insert Local Cultural or Historical Assets Here**

**Economic Assets/ Population Centers:** **Economic Centers** are those businesses that employ large numbers of people, and provide an economic resource to **Incorporated Jurisdiction**. If damaged, the loss of these economic centers could significantly affect economic stability and prosperity. **Population Centers** usually are aligned with economic centers, and will be if particular concern for evacuation/notification during a hazard event.

- [Insert Local Economic Assets/ Population Centers Here](#)

**Environmental Assets:** Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic and functional service for the community.

- [Insert Local Environmental Assets Here](#)

**Hazardous Materials:** Those sites that store, manufacture, or use potentially hazardous materials.

- [Insert Local Haz Mat Sites here](#)

## Section 4: Natural Hazards

### Flooding

[Incorporated Jurisdiction](#) has several large rivers and smaller tributaries that are susceptible to annual flooding events. Flooding poses a threat to life and safety, and can cause severe damage to public and private property.

### Flooding History

The historical large-scale flooding events have been described in the county plan, and are applicable to [Incorporated Jurisdiction](#). As such, the events will not be repeated here.

[Insert local history if information and data available.](#)

### Flooding Hazard Assessment

[Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.](#)

[Hazard Identification](#)

[Vulnerability Assessment](#)

[Risk Analysis](#)



### Existing Flood Mitigation Activities

Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by [Incorporated Jurisdiction](#) agencies or organizations.

[Incorporated Jurisdiction Codes Pertaining to Flooding](#)

[Flood Mitigation Projects](#)

### Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that organizations and residents in [Incorporated Jurisdiction](#) can undertake to reduce risk and prevent loss from flood events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.



#### Action Item 1

*Ideas for Implementation*

**Coordinating**

**Organization:**

**Timeline:**

**Plan Goals Addressed:**

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## Landslide

### Landslide History

The historical landslide events have been described in the county plan, and are applicable to **Incorporated Jurisdiction**. As such, the events will not be repeated here. Insert local history if information and data available.

### Landslide Hazard Assessment

Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.

#### Hazard Identification

#### Vulnerability Assessment

#### Risk Analysis


### Existing Landslide Mitigation Activities

Landslide mitigation activities listed here include current mitigation programs and activities that are being implemented by **Incorporated Jurisdiction** agencies or organizations.

#### Incorporated Jurisdiction Codes Pertaining to Landslides

#### Landslide Mitigation Projects

### Landslide Mitigation Action Items

The landslide mitigation action items provide direction on specific activities that organizations and residents in **Incorporated Jurisdiction** can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. 

#### Action Item 1

##### *Ideas for Implementation*

**Coordinating**

**Organization:**

**Timeline:**

**Plan Goals Addressed:**

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## Wildfire

### Wildfire History

The historical landslide events have been described in the county plan, and are applicable to **Incorporated Jurisdiction**. As such, the events will not be repeated here. Insert local history if information and data available.

### Wildfire Hazard Assessment

Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.




**Hazard Identification  
Vulnerability Assessment  
Risk Analysis**

**Existing Wildfire Mitigation Activities**

The Incorporated Jurisdiction Fire Department works to mitigate problems regarding wildfire issues when they arise.

**Incorporated Jurisdiction Codes Pertaining to Wildfires  
Local Fire Prevention/education Programs**

**Wildfire Mitigation Action Items**

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Incorporated Jurisdiction can undertake to reduce risk and prevent loss from wildfire events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. 

**Action Item 1**

***Ideas for Implementation***

- Coordinating Organization:**
  - Timeline:**
  - Plan Goals Addressed:**
- 

**Severe Storm: Wind & Winter**

**Severe Storm History**

The historical severe storm events have been described in the county plan, and are applicable to Incorporated Jurisdiction. As such, the events will not be repeated here. Insert local history if information and data available.

**Severe Storm Hazard Assessment** 

Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.

**Hazard Identification  
Vulnerability Assessment  
Risk Analysis**

**Existing Severe Wind & Winter Storm Mitigation Activities**

- Water Districts**
- Utilities**

**Severe Storm Mitigation Action Items**

The severe winter storm mitigation action items provide direction on specific activities that organizations and residents in Incorporated Jurisdiction can undertake to reduce risk and prevent loss from storm events. Each action item

is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.



**Action Item 1:**

***Ideas for Implementation***

**Coordinating Organization:**  
**Timeline:**  
**Plan Goals Addressed:**

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## Earthquake

### Earthquake History

The historical windstorm events have been described in the county plan, and are applicable to **Incorporated Jurisdiction**. As such, the events will not be repeated here. **Insert local history if information and data available.**

### Earthquake Hazard Assessment



**Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.**

#### **Hazard Identification**

#### **Vulnerability Assessment**

#### **Risk Analysis**

### Existing Earthquake Mitigation Activities

**Incorporated Jurisdiction Codes**  
**Businesses/School Preparedness**

### Earthquake Mitigation Action Items

The earthquake mitigation action items provide direction on specific activities that organizations and residents in **Incorporated Jurisdiction** can undertake to reduce risk and prevent loss from earthquake events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.



**Action Item 1:**

***Ideas for Implementation***

**Coordinating Organization:**  
**Timeline:**  
**Plan Goals Addressed:**

## Tsunami

### Tsunami History

The historical windstorm events have been described in the county plan, and are applicable to **Incorporated Jurisdiction**. As such, the events will not be repeated here. **Insert local history if information and data available.**

### Tsunami Hazard Assessment

Insert best available hazard assessment data here. If the county plan contains the hazard assessment data that is applicable to your jurisdiction, note that here.

**Hazard Identification**


**Vulnerability Assessment**

**Risk Analysis**

### Existing Tsunami Mitigation Activities

Probably will not have any locally: refer to county plan.

### Tsunami Mitigation Action Items

The Tsunami mitigation action items provide direction on specific activities that organizations and residents in **Incorporated Jurisdiction** can undertake to reduce risk and prevent loss from tsunami events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. 

#### Action Item 1:

*Ideas for Implementation*

**Coordinating**

**Organization:**

**Timeline:**

**Plan Goals Addressed:**

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## Multi-Hazard

### Multi-Hazard Action Items

Multi-hazard action items are those activities that pertain to all seven hazards in the mitigation plan: flood, landslide, wildfire, severe winter storm, windstorm, earthquake, and Tsunami, sudden unexpected disasters (Acts of God) would also be in this section

#### Action Item 1:

*Ideas for Implementation*

**Coordinating**

**Organization:**

**Timeline:**

**Plan Goals Addressed:**

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# Section 5:

## Mitigation Planning Priority System

### Action Item Prioritization Methodology

As **Incorporated Jurisdiction** works toward action item implementation, the Hazard **Incorporated Jurisdiction** has prioritized the identified mitigation strategies in order to better allocate resources for implementation. The criteria used for prioritizing the action items are the plan goals, hazards addressed, criticality of need, population served, and likelihood of success.

Although this methodology provides a guide for the **Incorporated Jurisdiction** in terms of implementation, the **Incorporated Jurisdiction** has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new situations arise, such as capitalizing on funding sources that could pertain to an action item that is not the highest priority.

#### Step 1: Prioritize Plan Goals

The **Incorporated Jurisdiction** mitigation goals were considered during each phase of the mitigation planning process. As the mitigation action items were developed, the **Incorporated Jurisdiction** identified which plan goals were addressed by each action item. The **Incorporated Jurisdiction** ranked the plan goals to determine the priorities for Incorporated Jurisdiction, and each goal ranked, in ascending order.

#### Step 2: Prioritize Hazards

The natural hazards addressed by the **Incorporated Jurisdiction** Natural Hazard Mitigation Plan were prioritized using the FEMA-accepted hazard analysis methodology for Emergency Operations Plans. This methodology considers the history of the hazard, the vulnerability to the hazard, the maximum threat of the hazard (worst case scenario), and the probability of the hazard. Each of these criteria are weighted, and the final score was used for prioritizing the hazards. The following is a full description of the methodology used:

#### Categories Considered:

<b>HISTORY:</b>	The record of occurrences of previous major emergencies or disasters (weight factor = 2).
LOW	0 - 1 event per 100 years
MEDIUM	2 - 3 events per 100 years
HIGH	4 + events per 100 years
<b>VULNERABILITY:</b>	The percentage of population and property likely to be affected (weight factor = 5).
LOW	< 1% affected
MEDIUM	1 - 10% affected
HIGH	> 10% affected

**MAXIMUM THREAT:** The maximum percentage of population and property that could be impacted under a worst case scenario (weight factor = 10).

- LOW < 5% affected
- MEDIUM 5 - 25% affected
- HIGH > 25% affected

**PROBABILITY:** The likelihood of occurrence within a specified period of time (weight factor = 7).

- LOW > 1 chance per 100 years
- MEDIUM > 1 chance per 50 years
- HIGH > 1 chance per 10 years

**Severity Ratings:**

- LOW = 1 - 3 points
- MEDIUM = 4 - 6 points
- HIGH = 7 - 10 points

Although the methodology used allows the **Incorporated Jurisdiction** to quantify and compare natural hazards, it is flawed in that it compares hazards with high probabilities and relatively low consequences with hazards that have high probabilities and low consequences.

**Table 5-1. Natural Hazard Prioritization Score**

Hazard	History	Vulnerability	Max. Threat	Probability	Total
<b>Earthquake</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Flood</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Wildfire</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Landslide</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Severe Winter Storm</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Windstorm</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	
<b>Tsunami</b>	Score: Weight:	Score: Weight:	Score: Weight:	Score: Weight:	

**Step 3: Incorporate Criticality of Need, Large Number of Population Served, Likelihood of Success**

The final score for each action items was computed by summing the plan goal score and the hazard score.

**Table 5-2. Action Item Prioritization Score**

<i>Existing Resources</i>		<i>Funding Required</i>	

**Section 6:  
Resource Directory**

Insert any local agencies, organizations, and departments that may deal with natural hazard mitigation, and could be potential partners in implementation of mitigation action items.

**Suggestions:**

- Fire**
- Utilities**
- Planning**
- Building**
- Geographic Information Systems**
- Emergency Services**
- Watershed Councils**
- Neighborhood Organizations**
- Chamber of Commerce**
- Media**