REGION 5

Mid-Columbia Region*

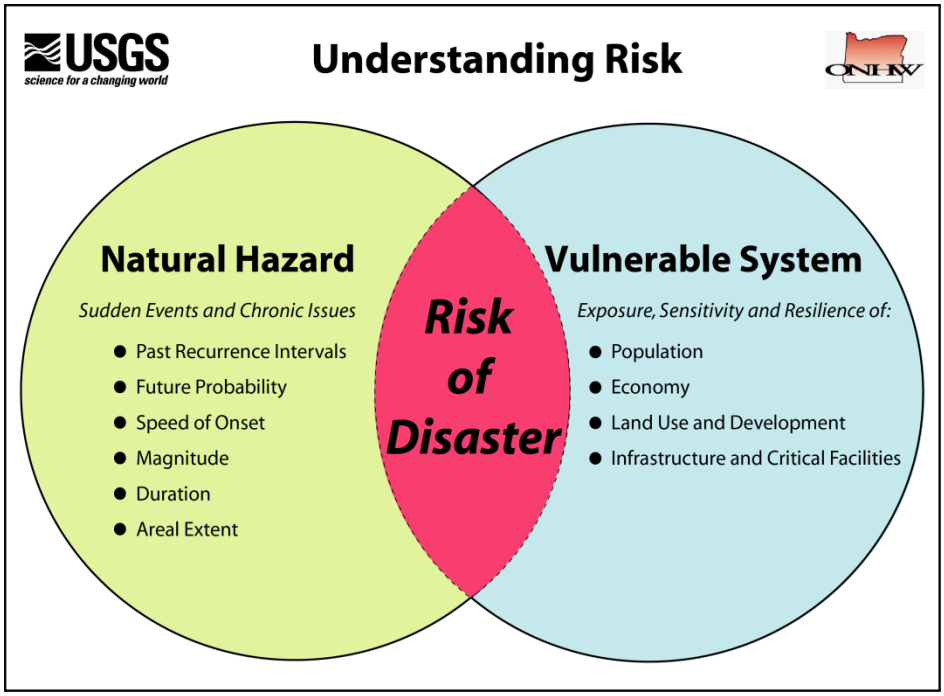
Regional Profile

* Gilliam, Hood River, Morrow, Sherman, Umatilla, and Wasco counties. Note: Jefferson and Wheeler County data is included in some of the DOGAMI-produced hazard maps.

Introduction and Purpose

Oregon faces a number of natural hazards with the potential to cause loss of life, injuries and substantial property damage. A natural disaster occurs when a natural hazard event interacts with a vulnerable human system. The following quote and graphic summarizes the difference between natural hazards and natural disasters:

> Natural disasters occur as a predictable interaction among three broad systems: natural environment (e.g., climate, rivers systems, geology, forest ecosystems, etc.), the built environment (e.g., cities, buildings, roads, utilities, etc.), and societal systems (e.g., cultural institutions, community organization, business climate, service provision, etc.). A natural disaster occurs when a hazard impacts the built environment or societal systems and creates adverse conditions within a community. *1*



It is not always possible to predict exactly when natural disasters will occur or the extent to which they may impact the community. However, communities can minimize losses from disaster events through deliberate planning and mitigation. A report submitted to Congress by the National Institute of Building Science's Multihazard Mitigation Council (MMC) highlights that for every dollar spent on mitigation society can expect an average savings of $4.00.[2]

How to use this Report

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center developed this report as part of the regional planning initiative funded by the Pre-Disaster Mitigation Grant.[†] In addition to serving as a regional resource for local planning initiatives, this also serves as the regional profile for the State's enhanced natural hazard mitigation plan. This report is intended to be used as a planning process document by communities developing local natural hazard mitigation plans. This regional report should be reviewed and updated by locals using the best available local data as the local plans serve as the foundation for the State Plan.

The information in this report should be paired with local data to identify issues for which mitigation action items can be developed. The report can be used in conjunction with assistance from *Partnership* staff to develop and document community specific action items. For more information on *The Partnership* or the training series see: www.oregonshowcase.org.

Regional Overview

The Mid-Columbia region (Region 5 as identified in the state's natural hazard mitigation plan) includes Hood River, Wasco, Sherman, Gilliam, Morrow, and Umatilla Counties. This region is at relatively high risk from wildfires, winter storms, and windstorms. It also faces moderate to high risk from drought and from flooding along tributaries of major rivers, though the major rivers of the Columbia, John Day, and Lower Deschutes are all fairly resistant to flooding because of dams. The Mid-Columbia region is also at risk from landslides in steep sloped areas, with Wasco and Hood River counties being particularly vulnerable. Other risks for the region, though with less frequent occurrence, are the effects of earthquakes and Mt. Hood volcanic eruptions.

Organization of Report

This report includes four sections that present a comprehensive profile of the region and its sensitivity to natural hazards.

Regional Maps

Critical Infrastructure Map

Using 2003 data from Oregon Department of Transportation, this map shows the approximate location of critical infrastructure, including schools, hospitals, bridges, dams, and power stations. Knowing the location of critical infrastructure is important when determining the sensitivities of the region.

County Hazard Risk Analysis Maps

These maps depict the counties' perceived risk for each natural hazard. Data for these maps comes from the County Hazard Risk Analysis in which each county

[†] FEMA Pre-Disaster Mitigation Grant PDM-C-PL-10-OR2005-003

develops risk scores for Oregon's major natural hazards. Scores are current as of March 2006.

Regional Profile and Natural Hazard Sensitivity Analysis

Using the best available secondary data, the regional profile includes a *Geographic Profile*, that provides a physical geographic description of the region, a *Demographic Profile* that discusses the population in the Mid-Columbia region, an *Infrastructure Profile* that addresses the region's critical facilities and systems of transportation and power transmission, and an *Economic Profile* that discusses the scale and scope of the regional economy with a focus on key industries. In addition to describing characteristics and trends, each profile section identifies the traits that indicate sensitivity to natural hazards.

The data sources used in this section are all publicly available. This report examines the Mid-Columbia region as a whole and by individual counties when possible.

Regional Natural Hazard Risk Assessment

The regional natural hazard risk assessment section describes historical impacts, general location, extent, and severity of past natural hazard events as well as the probability for future events. This information is aggregated at the regional level and provides counties with a baseline understanding of past and potential natural hazards.

These assessments were based on best available data from various state agencies related to historical events, repetitive losses, county hazard analysis rankings, and general development trends. The risk assessment was written in 2003 as part of the State Natural Hazard Mitigation Plan and updated in 2012.

Regional State Facilities Tables

The state of Oregon has prepared an analysis of state owned and managed facilities. This analysis is a first step at assessing which state owned structures are most vulnerable to the various hazards identified by region. From this overview, it is clear that a more detailed assessment in the future will yield a clearer picture of those structures specifically threatened by certain disasters and the potential damage that may occur.

Mid-Columbia Region

The Mid-Columbia region has experienced a 7% increase in population since 2000. This growth pattern is projected to continue at a moderate rate over the next 20 years. Sixty-five percent of the region's population lives in incorporated areas with the other 35% living in unincorporated areas. Thirty-five percent of the region's houses were built before 1960, 31% between 1960 and 1980, and 34% were built after 1980. The impact of a disaster can disrupt automobile traffic and shut down local transit systems across the region, making evacuation difficult. This is particularly important in this region where hazardous materials are being transported along Interstate 84 and nearby railroad lines. The average commute for workers in this region is 19 minutes each way. Seventy-seven percent of the region's workers drive alone to work. Thirteen percent carpool, five percent walk or use other means, and five percent work at home. Most bridges in the area have not been seismically retrofitted, creating significant risk to the commuting population in areas at risk from earthquakes.

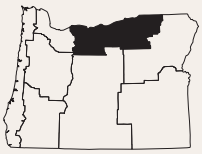
REGION FACTS

Population: 2010 Census

Total	138,257
Rural	48,390
Urban	89,867

Housing:

Single-Family	66%
Multi-Family	16%
Mobile Homes	18%
Boat, RV, Van, etc	1%

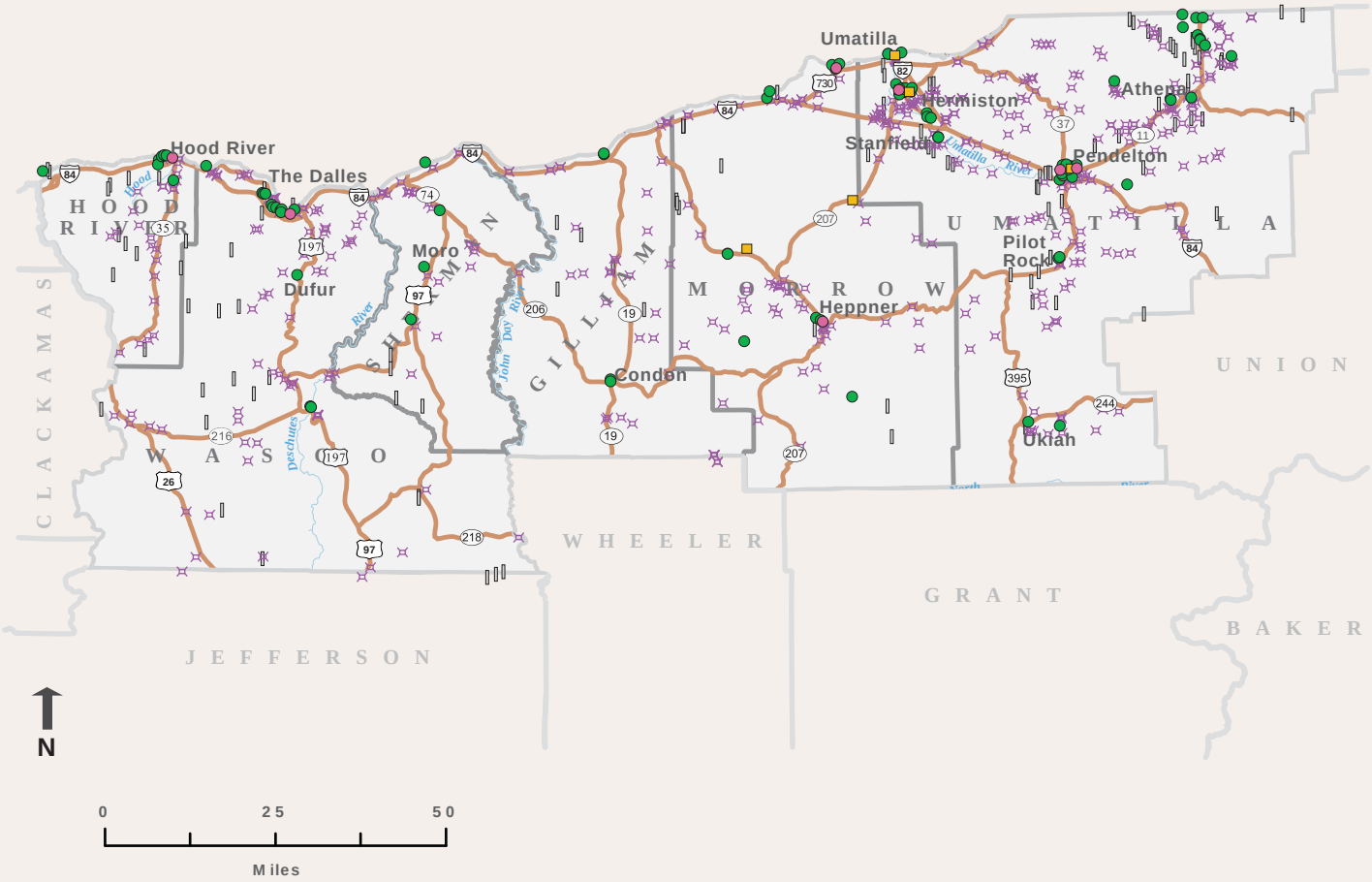


County	# of Hospitals	# of Hospital Beds	Police Stations	Fire & Rescue Stations	Power Plants	Dams*	Bridges
Gilliam	0	0	3	4	3	0	37
Hood River	1	25	2	6	0	1	54
Morrow	1	21	4	4	4	1	69
Sherman	0	0	1	5	1	1	44
Umatilla	2	50	11	4	4	3	308
Wasco	1	49	3	7	0	8	123

* "High" Hazard Dams

Critical Infrastructure

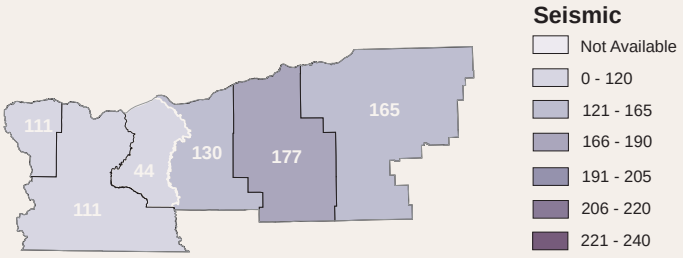
- School
- Hospital
- Bridge
- Power Substation
- Dam



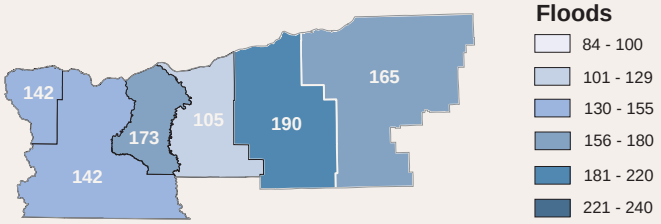
As part of the County Hazard Risk Analysis, each county develops risk scores for Oregon's major natural hazards. This score, ranging from 24 (low) to 240 (high), reflects the County's perceived risk for the particular hazard. Scores are current as of November 2008.

To obtain the most current scores, see http://www.oregonshowcase.org or contact Oregon Military Department – Office of Emergency Management http://www.oregon.gov/OMD/OEM.

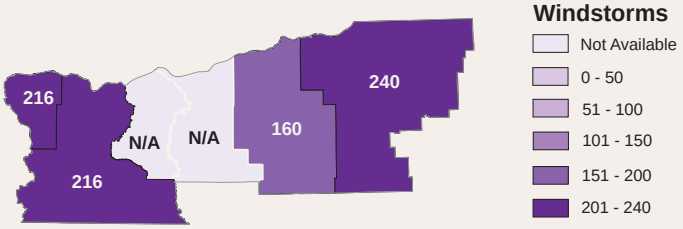
Seismic



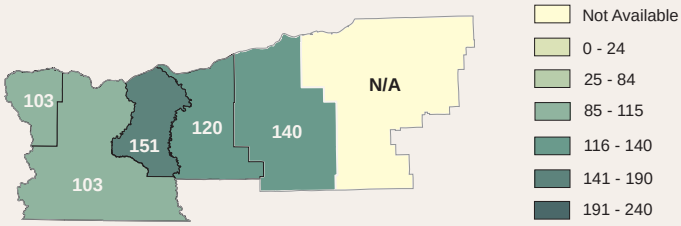
Floods



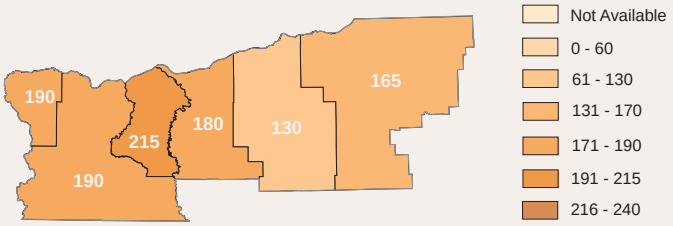
Windstorms



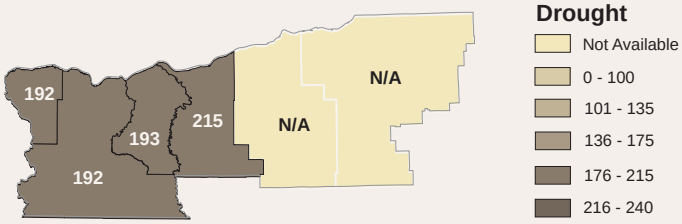
Landslides



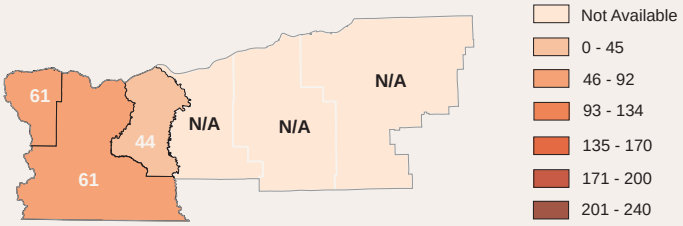
Wildfires



Drought



Volcanic



Regional Profile and Sensitivity

Section 1: Geography and Climate

The six-county area of the Mid-Columbia region is approximately 10,178 square miles in area. The Mid-Columbia region trends east-west and is bordered by the Columbia River to the north, high desert to the south, the Blue Mountains to the east, and the Cascade Mountains to the west. The Cascades receive considerable rainfall annually from storms and low-pressure systems coming in from the Pacific Ocean. Annual precipitation ranges from over 40 inches in western Hood River County to less than 10 inches in parts of Morrow and Umatilla Counties on the east side. The Cascades are volcanic in origin and are drained by hundreds of creeks, streams, rivers and lakes. Major rivers in the region include the Columbia, Deschutes, John Day, and Umatilla.3

Section 2: Demographic profile

This section describes the Mid-Columbia region in terms of its population, demographics and development trends. Data is followed by a discussion of characteristics that indicate community vulnerability to natural hazards. Identifying populations that are particularly vulnerable enables communities to design targeted strategies to reduce their risk. Reviewing development trends provides further guidance on how communities can accommodate growth in a manner that increases resilience to natural hazards.

Population and Demographics

In 2010, the estimated population of the Mid-Columbia region was 138,257, representing an increase of 6.7% since 2000. This growth pattern in the Mid-Columbia region is projected to continue at a moderate rate over the next 20 years, according to the Oregon Office of Economic Analysis.[4] Table 1 displays the population change in each Mid-Columbia county.

Table 1. Population Growth, Mid Columbia Region, 2000-2010

County	2000 Population	20010 Population	2000-2010 Population Change	% Change 2000-2010
Gilliam	1,915	1,871	-44	-1.6%
Hood River	20,411	22,346	1,935	5.9%
Morrow	10,995	11,173	178	14%
Sherman	1,934	1,765	-169	-4.6%
Umatilla	70,548	75,889	5,341	2.6%
Wasco	23,791	25,213	1422	1.6%
Regional Total	129,594	138,257	8,663	6.7%

Source: U.S. Census Bureau: 2000 Census Summary File 1. U.S. Census Bureau: 2010 Census Summary File 1.

The impact in terms of loss and the ability to recover vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the public.[5] Of this number, a disproportionate burden is placed upon special needs groups, particularly minorities, and the poor. Minorities and the poor are more likely to be isolated in communities, are less likely to have the savings to rebuild after a disaster, and less likely to have access to transportation and medical care. Additionally, minorities and the poor are more likely to rent than own homes, and in the event of a natural disaster, where homeowners would gain homeowner insurance, renters often do not have rental insurance. As of 2009, 15% of the region's population was living in poverty.[6] (A large percentage of these people presumably fall into both categories.)

Median household income can be used to compare economic areas as a whole, but does not reflect how the income is divided among area residents. Table 2 displays the median household income for the Mid-Columbia region, which was $42,862 in 2009. This is below the national average of $51,425 and the state's average of $40,033.[7] The 14.5% median household income growth between 2000 and 2009 in the region is less than the 19.8% State and 22.5% National growth over the same time period.

Table 2. Median Household Income, Mid Columbia Region, 2000 and 2009

County	2000	2009	% Change 2000-2003
Gilliam	$35,086	$42,115	20.0%
Hood River	$38,916	$49,795	28.0%
Morrow	$38,331	$43,581	13.7%
Sherman	$35,022	$35,144	0.3%
Umatilla	$35,916	$45,230	25.9%
Wasco	$36,625	$41,307	12.8%
Regional Average:	$36,649	$42,862	14.5%

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

In 2009, 13.5% of the nation's population was living in poverty, a lower percentage than the Mid-Columbia regional poverty level of 15.0%. Oregon's state poverty average was 13.6%, the same as the Mid-Columbia regional average. While the median household incomes are lower in the region than the state as a whole, the similar poverty rate may be due to a lower cost of living. Table 3 details the county and regional poverty rates in 2009.

Table 3. Poverty Rates, Mid Columbia Region, 2009

	Total Population in Poverty		Children Under 18 in Poverty	
County	Number	%	Number	%
Gilliam	175	10.8%	40	11.3%
Hood River	2,386	11.2%	724	12.6%
Morrow	1,909	16.8%	791	24.8%
Sherman	372	21.0%	129	37.0%
Umatilla	10,464	15.5%	3,800	19.4%
Wasco	3,656	15.8%	1,075	19.3%
Regional Average		15%		18.9%

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

For hazard mitigation, low-income populations need special considerations, because they may not have the savings to withstand economic setbacks, and if work is interrupted, housing, food, and necessities become a greater burden. Additionally, low-income households are more reliant upon public transportation, public food assistance, public housing, and other public programs, all which can be impacted in the event of a natural disaster.

The age of the population is also an important consideration in hazard mitigation planning. In 2010, 35% of the regional population was under 14 or over 65 years of age.[8] Table 4 provides a breakdown of the percentages of youth and elderly in the Mid-Columbia region counties.

Table 4. Mid Columbia Region Youth and Senior Populations, 2010

	0-14		65-74		75+	
County	**Number**	**%**	**Number**	**%**	**Number**	**%**
Gilliam	276	14.8%	219	11.7%	196	10.5%
Hood River	4,806	21.5%	11,383	6.2%	1,424	6.4%
Morrow	2,610	23.4%	847	7.6%	574	5.1%
Sherman	286	16.2%	203	11.5%	286	16.2%
Umatilla	16,798	22.1%	5,246	6.9%	4,411	5.8%
Wasco	4,820	19.1%	2,264	9.0%	2,186	8.7%
Regional Total and Average %:	29,596	21.4%	10,162	7.4%	9,0778	6.6%

Source: U.S. Census Bureau. 2010 Census. Summary File 1

The high percentage of elderly individuals, particularly in Gilliam and Sherman Counties, require special consideration due to their sensitivities to heat and cold, their reliance upon transportation for medications, and their comparative difficulty in making home modifications that reduce risk to hazards.

Young people also represent a vulnerable segment of the population. In Hood River, Morrow, and Umatilla counties, at least 20% of the population is within the 0-14 year age range. Special considerations should be given to young populations and schools, where children spend much of their time, during the natural hazard mitigation process. Children are more vulnerable to heat and cold, have fewer transportation options, and require assistance to access medical facilities.

Special consideration should also be given to populations who do not speak English as their primary language. These populations can be harder to reach with preparedness and mitigation information materials. They are less likely to be prepared if special attention is not given to language and culturally appropriate outreach techniques. In the Mid-Columbia region, most citizens speak English as their primary language. However, in every county in Oregon, Spanish is the second most prominent language. As Table 5 shows, 8.9% of the total population in the Mid-Columbia region speaks English less than “very well.”[9]

Table 5. Population over Age 5 that Speaks English Less than "Very Well," Mid Columbia Region, 2009 Region

County	%Population
Gilliam	2.4%
Hood River	15.2%
Morrow	14.1%
Sherman	3.5%
Umatilla	7.3%
Wasco	6.3%
Regional Average:	8.9%

Source: US Census Bureau, 2005-2009 American Community Survey – 5 year estimates

Housing and Development

To accommodate rapid growth, communities engaged in mitigation planning should address infrastructure and service needs, specific engineering standards and building codes. Eliminating or limiting development in hazard prone areas, such as floodplains, can reduce vulnerability to hazards, and the potential loss of life and injury and property damage. Oregon has been successful in developing land use goals that incorporate mitigation while preserving rural and protected lands within urban growth areas. Communities in the process of developing land for housing and industry need to ensure that land-use and protection goals are being met to prevent future risks.

The urban and rural growth pattern impacts how agencies prepare for emergencies as changes in development can increase risks associated with hazards. The Mid-Columbia region's urban population is growing, with 5% population growth in incorporated areas between 2000 and 2010.[10] Table 6 illustrates the trend in urban area population growth in the Mid-Columbia counties between 2000 and 2010.

Table 6. Urban/Rural Populations, Mid Columbia Region, 2000-2010

	% Incorporated Population		% Change
County	2000	2010	2000-2010
Gilliam	69%	75%	6%
Hood River	34%	37%	3%
Morrow	60%	59%	-1%
Sherman	59%	70%	11%
Umatilla	68%	75%	7%
Wasco	57%	63%	6%
Regional Average:	60%	65%	5%

Source: Portland State University Population Estimates, 2010

In addition to location, the character of the housing stock also affects the level of risk that communities face from natural hazards. Table 7 provides a breakdown by county of the various housing types available in 2009. Mobile homes and other non-permanent housing structures, which account for over than 25% of the housing in some Mid-Columbia counties, are particularly vulnerable to certain

natural hazards, such as windstorms, and special attention should be given to securing these types of structures.

Table 7. County Housing Profile, Mid-Columbia Region, 2009

County	Single-Family	Multi-Family	Mobile Homes	Boat, RV, Van, etc.
Gilliam	72.2%	8.5%	19.2%	0%
Hood River	74.4%	15.3%	10.3%	0%
Morrow	57.3%	10.2%	30.9%	1.5%
Sherman	68.8%	2.0%	28.6%	0.6%
Umatilla	64.9%	17.9%	16.5%	0.7%
Wasco	65.9%	13.6%	20.0%	0.4%

Source: U.S. Census Bureau. 2005-2009 American Community Survey – 5 year estimates.

Table 7 shows that the majority of the housing stock is in single-family homes and this trend is continuing with new construction.[11] In 2010, an estimated 70% of new housing was single-family units.[12] This trend suggests that hazard mitigation efforts should provide outreach and information that specifically addresses preparedness in detached housing units.

In addition to location and type of housing, the year housing structures were built has implications for community vulnerability. The older a home is, the greater the risk of damage from natural disaster. This is because structures built after the late 1960s in the Northwest and California used earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot over Base Flood Elevation. Knowing the age of a structure is helpful in targeting outreach regarding retrofitting and insurance for owners of older structures. Table 8 illustrates the percentage of homes built per county during certain periods of time.

Table 8. Housing, Year Built, Mid-Columbia Region

County	1939 or earlier - 1959	1960-1979	1980-2010
Gilliam	53%	25%	21%
Hood River	39%	24%	37%
Morrow	30%	34%	37%
Sherman	49%	29%	22%
Umatilla	33%	33%	34%
Wasco	38%	31%	31%

Source: U.S. Census Bureau. 2005-2009 American Community Survey 5-Year Estimates

Section 3: Infrastructure Profile

This section of the report describes the infrastructure that supports Mid-Columbia communities and economies. Transportation networks, systems for power transmission, and critical facilities such as hospitals and police stations are all vital to the functioning of the region. Due to the fundamental role that infrastructure plays both pre- and post-disaster; it deserves special attention in the context of creating more resilient communities. The information that is provided in this section of the profile can provide the basis for informed decisions about how to reduce the vulnerability of Mid-Columbia infrastructure to natural hazards.

TRANSPORTATION

The Mid-Columbia region is an important freight corridor for the entire Pacific Northwest. The Columbia Gorge provides the only river-grade pass (i.e., the corridor does not include any major grades) through the Cascade Mountains from the Canadian border to California. The ability to pass through the Cascade Mountain Range on a relatively flat and straight surface is taken advantage of by many forms of transportation and shipping. There are three primary modes of transportation through the region: highways, railroad, and barges. There are also many small airports scattered throughout the region that are used primarily for passenger service.

Roads and Bridges

There are two major highways that run through the Mid-Columbia region. I-84 is a major transportation corridor that connects Portland with eastern Oregon and beyond. I-84 is one of the few major east-west roads in Oregon, Washington, and Northern California that provides drivers with a river-grade crossing of the Cascades. U.S. 97 runs north-south through Sherman and Wasco Counties. U.S. 97 is the most important north-south transportation corridor east of the Cascades.[13]

Many commercial entities make use of the highways in the Mid-Columbia region. Trucks transported over 10 million tons of freight along I-84 in 2002 and the average daily truck volume was more than 3,000.[14] Trucks on the section of U.S. 97 between the I-84 junction and Shaniko in Wasco County transported between 4 and 9.99 million tons of freight in 2002. Truck volume averaged between 500 and 1,499 trucks per day.[15] U.S. 97 also serves as an important alternative route to I-5.

The recent population growth in the region has contributed to an increase of automobiles on the roads:

Average daily traffic volume on I-84 recorded six miles west of The Dalles increased by about 8.8% between 2001 and 2010. Farther east on I-84, at about 4 miles west of Pendleton, the average daily traffic for the same time period increased by 3.4%. Judging from these trends, traffic levels will continue to increase.[16]

Average daily traffic counts also increased by 6.6% between 2001 and 2010 on U.S. 97, one-half mile north of Moro in Sherman County.[17]

A large increase of automobiles can place stress on roads, bridges and infrastructure within the cities, and also in rural areas where there are fewer

transit roads. Natural hazards can disrupt automobile traffic and shut down local transit systems across the area or region and make evacuations difficult. This is particularly important in this region, where hazardous materials are being transported along Interstate 84 and nearby railroad lines. An accident involving these hazardous materials could result in a dangerous situation.

The condition of bridges in the region is also a factor that affects risk from natural hazards. Most bridges are not seismically retrofitted, which is a particularly important issue for the Mid-Columbia region because of its risk from earthquakes. Incapacitated bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients. Table 9 shows the number of state, county, and city maintained bridges and culverts, and the number of historic covered bridges in the region. The bridges in the region are part of the state and interstate highway and maintained by the Oregon Department of Transportation.

Table 9. Bridges and Culverts

County	State Highway Bridges	State Highway Culverts	County Highway Bridges	County Highway Culverts	City/ Municipal Highway Bridges	City/ Municipal Highway Culverts	Historic Covered Bridges	2011 Total
Gilliam	19	35	17	0	1	0	0	72
Hood River	38	38	16	0	0	0	0	92
Morrow	24	35	34	1	11	1	0	106
Sherman	35	46	9	1	0	1	0	92
Umatilla	117	105	169	7	22	0	0	420
Wasco	53	46	65	24	5	0	0	193

Source: Oregon Department of Transportation, 2011.

Railroads

Railroads are major providers of regional and national cargo and trade flows. Railroads that run through the Mid-Columbia region provide vital transportation links from the Pacific to the rest of the country. The Burlington Northern Santa Fe Railroad (BNSF) and the Union Pacific Railroad (UP) are the two major railroads in the region.

BNSF owns the tracks that run north-south along the Deschutes River which borders Sherman and Wasco Counties. The tracks run through Oregon to Southern California where the tracks turn east and continue to Texas.[18]

UP's tracks run east-west along the Columbia River. A major classification yard and a diesel locomotive maintenance shop are located in Hinkle near Hermiston in Umatilla County. [19]

Sixteen million tons of goods produced in Oregon are shipped out of state by railroad per year. The goods include lumber and wood products, pulp and paper, and miscellaneous mixed shipments. [20] Over 23 million tons of products originating in other states are annually shipped into Oregon by rail including wood, farm products, coal, and waste materials. [21] More than 22 million tons of products are shipped through Oregon annually by rail. More than 6 million tons of these products include grains and soybeans transported from the Northern Midwest to Washington. [22]

Rails are sensitive to icing from the winter storms that are common in the Mid-Columbia region. For industries in the region that utilize rail transport, these disruptions in service can result in economic losses. As mentioned above, the potential for rail accidents caused by natural hazards can also have serious implications for the local communities if hazardous materials are involved.

Barges

Five of the seven counties that make up the Mid-Columbia region border the Columbia River. The Columbia meets the Snake River in Kennewick, Washington. The two rivers are frequently combined into one transportation system and are

referred to as the Columbia/Snake River System. The Columbia/Snake region consists of all of the Columbia River east of Portland and the Snake River. The Columbia/Snake region generated 1,100 jobs directly related to waterborne cargo activity in 2000 with another 1,500 jobs created indirectly. Waterborne cargo activities created $39 million of direct payroll and $80 million in income from direct, indirect, and induced effects.[23] In addition, products shipped from the region reach Pacific Rim countries one day faster than those shipped from California and 10 days faster than those shipped from the Gulf Coast.[24]

Wheat and barley are the primary products transported by barge in the Columbia/Snake River system. In 2000, 5.3 million tons of grain were shipped down the Columbia River. [25] Barges also transported 1.1 million tons of forest products, 1.8 million tons of liquids, and 1.1 million tons of crude materials and miscellaneous products in 2000.[26]

Barge transport is sensitive to disruption from natural hazards that affect all forms of ground transportation. Barges are dependent upon ground transportation for loading and unloading goods and continuing their transportation supply chain. Barge transportation is also vulnerable to large-scale natural disasters, such as volcanic eruptions, which would result in channel infill and sediment in the Columbia River.

Airports

The Mid-Columbia region has ten small public airports. The Eastern Oregon Regional Airport in Pendleton, Umatilla County is the only commercial airport in the region. Horizon Air provides passenger service and Horizon Air, Federal Express, and United Parcel Service use the airport to provide scheduled freight services.[27] The Eastern Oregon Regional Airport transported 200 tons of freight in and out of the airport in 2000. In comparison, the La Grande airport handled 100 tons, Eugene-Mahlon Sweet Field handled 2,000 tons and Portland International transported 165,000 tons of freight in 2000.[28]

Flights face the potential for closure from a number of natural hazards that are common in the Mid-Columbia region, including windstorms and winter storms. Airports have strict guidelines regarding when conditions are safe for flight.

Critical Facilities

Critical facilities are those facilities that are essential to government response and recovery activities (e.g., police and fire stations, public hospitals, public schools). Critical facilities in the Mid-Columbia region are displayed in Table 10 by county.

Table 10. Mid Columbia Region Critical Facilities by county

County	Hospitals # of Hospitals	Hospitals # of Beds	Police Station	Fire & Rescue Station	School Districts & Colleges
Gilliam	0	0	2	4	2 Districts
Hood River	1	25	2	6	1 District
Morrow	1	21	3	4	2 Districts
Sherman	0	0	1	5	1 District
Umatilla	3*	110*	11	14	10 Districts, 1 Community College
Wasco	1	49	3	7	3 Districts, 1 Community College

*These totals include one psychiatric hospital with a 60-bed capacity.

Sources: State Hospital Licensing Department, Local Sheriff Offices, Oregon State Fire Marshall, Oregon Department of Education. Table updated January 2012.

In addition to those listed in Table 10, there are other critical and essential facilities that are vital to the continued delivery of key governmental services or that may significantly impact the public's ability to recover from emergencies. Some of these facilities, such as correctional institutions, public services buildings, law enforcement centers, courthouses, juvenile services buildings, public works facilities, and other public facilities should be detailed in the local and regional mitigation plans.

Power Generation and Transmission

The Mid-Columbia region is an important throughway for oil and gas pipelines and electricity transmission lines. In addition, the region is also a major producer of hydropower. The infrastructure associated with power generation and transmission plays a critical role in supporting the regional economy.

There are four major dams on the Columbia River in the Mid-Columbia region: the Bonneville, the McNary, The Dalles, and the John Day. The McNary has the lowest maximum generation capacity at 1,120 megawatts (mw). The John Day Dam has the highest maximum generation capacity at 2,480 mw. These dams are, by far, the largest hydropower producers in Oregon. The next largest hydropower producing dam in Oregon is the Brownlee Dam on the lower Snake River. Its maximum power generation is 585 mw.[29]

Dam failures can occur at any time and are quite common. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage and fatalities does exist, and the National Inventory of Dams (NID) has developed a listing of High Threat Potential Hazard dams for the nation. The state has developed a complementary inventory of dams in Oregon. Table 11 lists the dams included in these inventories.

Table 11. Mid-Columbia Region Power Plants and Dams by County

County	Power Plants	Dams Dams‡ (State)	Threat Potential
Gilliam	4 power plants, 1046 MW	0	0 High Threat
Hood River	0	11	1 High Threat
Morrow	4 power plants, 1380 MW	6	1 High Threat
Sherman	2 power plants, 750 MW	11	1 High Threat
Umatilla	4 power plants, 1437 MW	19	3 High Threat
Wasco	0	30	8 High Threat

Sources: Oregon Department of Energy, National Inventory of Dams. Table updated January 2012.

The electric, oil, and gas lines that run through the Mid-Columbia region are privately owned. A network of electricity transmission lines running through the Mid-Columbia region allows Oregon utility companies to exchange electricity with other states and Canada.[30] Most of the natural gas Oregon uses originates in Alberta, Canada. Two natural gas transmission pipelines run through the Mid-Columbia region. In addition, an oil pipeline runs through Umatilla County connecting Oregon with supplies of oil from the Rocky Mountain States and Canada.[31] These lines may be vulnerable to severe, but infrequent natural hazards, such as earthquakes.

Section 4: Economic Profile

The following economic profile addresses the regional economy and its sensitivities to natural hazards. The sensitivities that are relevant to the Mid-Columbia region are a function of the types and diversity of industries and the composition of businesses that are present. To highlight key industries, this report will look at:

The largest revenue sectors, since interruptions to these industry sectors would result in significant revenue loss for the region.

The largest employment industries, since interruptions to these industry sectors would result in high unemployment in the region.

‡ Note: The National Inventory of Dams includes all dams with either:

a) a high or significant hazard rating

b) a low hazard dam that exceeds 25 feet in height AND 15 acre-feet storage

c) a low hazard dam that exceeds 6 feet in height AND 50 acre-feet storage

The industry sectors with the most businesses, since interruptions to these industry sectors would result in damage to the most businesses regionally.

By examining these key industry sensitivities and other economic sensitivities, such as industry diversity and the number of small businesses that exist in the Mid-Columbia region, informed decisions can be made about how to mitigate risk.

Economic Overview

The Mid-Columbia region enjoys many economic advantages due to its location. The region's proximity to the Portland area, the Southern Pacific, Union Pacific and Burlington Northern railroad lines that run across the western edge of the region, and I-84 provide good opportunities for the transportation of manufactured and agricultural goods. In addition, the region's close proximity to the Columbia River, the Cascade Mountains, and the high desert terrain provide year-round sporting and tourism activities. Furthermore, the area's prominence as a producer of hydroelectric power represents a significant asset in the form of cheap electricity.

According to the Oregon Employment Department, the Mid-Columbia region experienced economic problems due to the downturn in the lumber, wood products and aluminum industries during the 1990's. However, the region has been able to offset the loss of jobs in these industries by the addition of new manufacturing companies, especially food processing companies, in Hood River, Morrow, Umatilla, and Wasco counties. As of 2010, the region employed 57,789 people with a combined payroll of over one and a half billion dollars. Table 12 displays the payroll and employee figures per county.

Table 12. Mid-Columbia Employment and Payroll by County, 2010

County	# of Employees	Annual Payroll	Average Pay
Gilliam	896	$35,673,719	$39,814
Hood River	12,435	$353,319,141	$28,413
Morrow	4,210	$160,090,590	$38,026
Sherman	723	$26,039,961	$36,017
Umatilla	28,851	$983,141,286	$34,077
Wasco	10,674	$334,221,890	$31,312
Total	57,789	$1,892,486,587	$32,748

Source: Oregon Employment Department.[32]

In 2010, there were 4,085 businesses in the Mid-Columbia region. Of these, 90%, or 3665, were small businesses with less than 20 employees.33 The prevalence of small businesses in the Mid-Columbia region is an indication of sensitivity to natural hazards because small businesses are more susceptible to financial uncertainty.34 When a business is financially unstable before a natural disaster occurs, financial losses (resulting from both damage caused and the recovery process) may have a bigger impact than they would for larger and more financially stable businesses.35

Although the Mid-Columbia region has a high percentage of small businesses, as a whole, the Mid-Columbia region has a more homogeneous economy than other

Oregon regions. Many of the small businesses fall into the same categories of industry sectors. This low economic diversity means that certain industries are dominating the economic structure of the community, and are therefore extremely important to the Mid-Columbia region. Table 13 displays the diversity ranking for each county with 1 being the most diverse economic county in Oregon, 36 being the least diverse economic county in Oregon.

Table 13. County Economic Diversity Ranking, 2009

	Economic Diversity Index	
County	**Ranking**	**Value**
Gilliam	35	.066
Hood River	22	.306
Morrow	31	.103
Sherman	36	.064
Umatilla	18	.357
Wasco	17	.357

Source: Oregon Employment Department[36]

An economy that is heavily dependent upon a few key industries may have a more difficult time recovering after a natural disaster than one with a more diverse economic base. While a community with a diverse economic base may suffer from an industry sector being damaged during a natural disaster, they have a broader base of operating industry sectors to continue to rely upon. However, a community that relies upon specific key industry sectors may have a harder time recovering their economic base if one of those key industry sectors is damaged. Recognizing that economic diversification is a long-term issue, more immediate strategies to reduce vulnerability should focus on risk management for the dominant industries.

KEY INDUSTRIES

Key industries are those that represent major employers, major revenue generators, and for the purposes of hazard mitigation planning, industries that are represented by a high number of businesses. Different industries face distinct vulnerabilities to natural hazards, as illustrated by the industry specific discussions below. Identifying key industries in the region enables communities to target mitigation activities towards those industries' specific sensitivities.

It is important to recognize that the impact that a natural hazard event has on one industry can reverberate throughout the regional economy. The effect is especially great when the affected businesses belong to basic sector industries. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health and social assistance.

Basic sector businesses have a multiplier effect on a local economy, whereby the jobs and income they bring to a community allow for the creation of new non-basic sector jobs. Their presence can therefore help speed the recovery process following a natural disaster. If, on the other hand, basic sector industry production is hampered by a natural hazard event, the multiplier effect could be experienced in reverse. In this case, a decrease in basic sector purchasing power results in lower profits (and potentially job losses) for the local non-basic businesses that are dependent on them.

High Revenue Sectors

The Mid-Columbia region's top revenue generating industries are a mix of basic and non-basic sectors. In 2007, the three sectors in the Mid-Columbia region with the highest average revenue were Retail Trade (44%), Wholesale Trade (17%), and Health Care/Social Assistance (14%).[37]

Within the individual counties in the Mid-Columbia, however, the industries' relative contribution to revenue differs. Table 14 shows the percent of total county revenue that is contributed by various sectors.

Table 14. Percent of Revenue in Mid-Columbia Counties by Industry, 2007

	Industry									
County	**Retail Trade**	**Wholesale Trade**	**Accommodation and Food Services**	**Health Care/ Social Assistance**	**Professional, Scientific and Technology**	**Other (except Public Admin)**	**Real Estate and Rental and Leasing**	**Arts/ Entertainment**	**Administrative/ Waste Services**	**Farm and Ranch**
Gilliam	29%	68%	3%	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hood River	27%	20%	5%	10%	5%	2%	1%	2%	1%	n/a
Morrow	15%	43%	6%	10%	n/a	2%	1%	n/a	23%	n/a
Sherman	76%	16%	8%	0%	n/a	n/a	n/a	n/a	n/a	n/a
Umatilla	49%	18%	10%	16%	n/a	2%	2%	n/a	2%	n/a
Wasco	62%	n/a	8%	22%	n/a	2%	2%	1%	n/a	n/a

Source: U.S. Census 2007, Oregon Department of Agriculture 2007

The *retail trade sector* is primarily composed of small businesses (89%) that tend to be more sensitive to hazard induced costs due to prior financial instability. Retail trade is also largely dependent on wholesale trade and the transportation network for the delivery of goods for sale. Disruption of the transportation system could have severe consequences for retail businesses. Retail trade typically relies on local residents and tourists and their discretionary spending ability. Residents' discretionary spending diminishes after a natural disaster when they must pay to repair their homes and properties. In this situation, residents will likely concentrate their spending on essential items that would benefit some types of retail (e.g. grocery) but hurt others (e.g. gift shops). The potential income from tourists also diminishes after a natural disaster as people are deterred from visiting the impacted area. In summary, depending on the type and scale a disaster could affect specific segments of retail trade, or all segments.

Wholesale trade is closely linked with retail trade but it has a broader client base than retail trade, with local and non-local businesses as the typical clientele. Local business spending will be likely to diminish after a natural disaster, as businesses repair their properties and wait for their own retail trades to increase. Distanced clients may have difficulty reaching local wholesalers due to transportation disruptions from a natural disaster. Both would adversely impact the profitability of this sector.

The *farm and ranch sector* is inherently dependent on the weather and is susceptible to a variety of natural hazards that afflict the Mid-Columbia region, including flood, drought, and summer and winter storms. These natural hazards have the capacity to devastate seasonal crops, representing a significant financial loss for the year. The western part of the region is known for its high quality fruit, including pears, apples, and cherries. The eastern part of the region is the state's principal wheat producing area.

In the Mid-Columbia region, a substantial ripple effect through the economy can be anticipated following agricultural loss. This is due both to the number of people who could lose employment in the wake of crop failure and the number of supporting industries (e.g., food processing manufacturers, wholesale trade, and retail trade) that could be affected. Even if not directly impacted by a disaster, agricultural producers are also sensitive to the disruption of regional transportation networks from natural disasters; they need seasonal laborers to access the area and it is imperative that perishable products are moved to market in a timely manner.

Major employment sectors

Economic resilience to natural disasters is particularly important for the major employment sectors in the region. If these sectors are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. Thus, understanding and addressing the sensitivities of these sectors is a strategic way to increase the resiliency of the entire regional economy.

The four sectors in the Mid-Columbia region with the most employees in 2010 were Government (21%), Natural Resources and Mining (13%), Retail Trade (11%), and Health and Social Assistance (11%).[38]

Within the seven Mid-Columbia counties, the percent of county employment by various sectors differs. For example, in Morrow County, manufacturing is the largest employer, though across the region, manufacturing accounts for a smaller percent of total employment. Table 15 shows the distribution of each county's employees across the five largest regional employment sectors.

Table 15. Percent of County Employment by the Five Largest Regional Employment Sectors, Mid-Columbia Region, 2010

County	Federal, State, and Local Government	Health Care and Social Services	Retail Trade	Manufacturing	Accommodation and Food Services
Gilliam	30%	8%	6%	n/a	n/a
Hood River	11%	14%	10%	10%	n/a
Morrow	21%	3%	4%	26%	n/a
Sherman	42%	n/a	11%	n/a	n/a
Umatilla	25%	10%	11%	11%	7%
Wasco	21%	16%	15%	5%	n/a

Source: Oregon Employment Department, 2010.[39]

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process.

Between 2005 and 2014, the largest job growth in the Mid-Columbia region is expected to occur in the Information, Local Government, and Educational and Health Services sectors.[40]

The *information sector*, as defined by the North American Industry Classification System, includes publishing industries, motion picture and sound recording industries, broadcasting industries, telecommunications industries, internet service providers, data processing industries, and information services industries. The information sector is sensitive to a loss of power from a disaster and to disruptions of physical transmission cables (phone lines, etc.). There may also be a disruption of employees' ability to work as a result of damages/problems at home.

If prepared and organized, however, this sector has the potential to have high resilience to many disasters due to its unique characteristics. First, as a basic sector, information businesses are frequently not dependant on the local community for revenue. Many of the targeted consumers of the products are located outside the region and their purchasing power would not be impacted by a localized natural disaster. Second, the sector is more insulated from disruptions to the transportation network than others because there is a potential for many of the employees to work from home and because some products are transmitted via internet.

The *health care and social assistance sector* ranges from physicians and chiropractors to family planning and kidney dialysis centers to emergency food and housing organizations and child day care services. This sector is growing in the Mid-Columbia, partly as a result of the large retirement age population.

The demand for health care and social assistance following a severe natural disaster may increase in the short term as extra health care and housing services may be necessary. Services that are privately subsidized and sensitive to interruptions of funding may suffer following a disaster. However, the long-term economic viability of this sector should not be adversely affected by a natural disaster. The facilities' ability to withstand the physical impacts of a disaster and the services' ability to cope with a potential influx of people requiring attention after a disaster may be concerns for this sector.

Common Business Types

Identifying sectors that are represented by a large number of businesses can guide the development of targeted mitigation strategies for those sectors. Approximately 39% of all businesses in the Mid-Columbia region fall into three industry sectors. 12% (528) of all businesses are engaged in Health Care and Social Assistance, another 12% (520) of all businesses are engaged in Retail Trade, and 8% (381) of all businesses are engaged in Construction.[41]

However, in the event of wildfires, floods, earthquakes, or other types of destructive natural disasters, the demand for reconstruction services may be expected to increase. Business from local residents looking to re-build their homes and businesses may boost construction revenue. If transportation routes have been affected, construction businesses may

have difficulty accessing necessary supplies from outside the impacted area. Protecting infrastructure and transportation will help to enable the construction sector to continue operating and re-building communities after a natural disaster.

Regional Profile and Sensitivity Conclusion

Information presented in the Community, Infrastructure, and Economic Profiles can be used to help communities identify areas of sensitivity and vulnerability to natural hazards. Once the areas of sensitivity are identified, communities should identify appropriate, corresponding action items.

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[3] Loy, William G., ed. Atlas of Oregon. 2001. University of Oregon Press.

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[5] Hazards Workshop. Session Summary #16. Disasters, Diversity, and Equity. Annual Hazards Workshop, (July 12, 2000). University of Colorado, Boulder. Peggy Stahl, FEMA Preparedness, Training and Exercise Directorate.

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[7] Ibid.

[8] US Census Bureau, "Age Groups and Sex," 2010 Census. http://www.census.gov

[9] US Census Bureau, "Social Characteristics," 2005-2009 American Community Survey 5-Year Estimates, http://www.census.gov.

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[21] Ibid.

[22] Ibid.

[23] Ibid.

[24] Ibid.

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[26] Ibid.

[27] Oregon Department of Transportation Trip Check. http://www.tripcheck.com/Pages/AirNorth.asp; Pendleton Airport website. http://www.pendleton.or.us/airport.htm.

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[29] Loy, W.G., ed. 2001. *Atlas of Oregon*, 2nd Edition. Eugene: University of Oregon Press.

[30] Ibid.

[31] Ibid.

[32] Oregon Employment Department, "2010 Covered Employment and Wages Summary Report," (multiple counties), http://www.qualityinfo.org/olmisj/CEP, January 2, 2012.

[33] Ibid.

[34] Alesch, Dan, et al. 2001. Organizations at Risk: What Happens When Small Businesses and Non-for-Profits Encounter Natural Disasters. http://www.riskinstitute.org/uploads/ptrdocs/Organizations_at_Risk.pdf.

[35] Ibid.

[36] Oregon Employment Department, Hachman Diversity Index 2009, 2006, 2003, 2001, and 1999,

[37] US Census Bureau Economic Census 2007, Oregon Agriculture Information Network, 2007.

[38] Oregon Employment Department, "2010 Covered Employment and Wages Summary Report," (multiple counties) http://www.qualityinfo.org/olmisj/CEP, accessed January 2, 2012.

[39] Ibid.

[40] Oregon Employment Department, Workforce Analysis, 2005

[41] Oregon Employment Department, "2010 Covered Employment and Wages Summary Report," (multiple counties), http://www.qualityinfo.org/olmisj/CEP, accessed January 2, 2012.

REGION 5

Mid-Columbia Region[1]

Hazards Assessment

[1] Gilliam, Hood River, Morrow, Sherman, Umatilla, and Wasco counties. Note: Jefferson and Wheeler County data is included in some of the DOGAMI-produced hazard maps.

DROUGHT

Characteristics and Brief History

Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, and in both summer and winter months. Droughts appear to be cyclic and they can have a profound effect on the state's economy, particularly the hydro-power and agricultural sectors. The environmental consequences also are far-reaching. They include insect infestations in Oregon forests and the lack of water to support endangered fish species. Severe drought conditions preceded the four disastrous Tillamook fires (1933, 1939, 1945, 1951) and pitted farmer against fish propagation groups during the Klamath Basin drought of 2001. It is estimated that the losses from this drought in 2001 included about 1200 jobs and $150 million dollars in goods and services. Local farmers maintain that the cost was considerably more. Water allocation continues to be controversial. In recent years, the state has addressed drought emergencies through the Oregon Drought Council. This interagency (state / federal) council meets to discuss forecasts and to advise the Governor as the need arises. Significant Oregon droughts are listed in Table 1.

TABLE 1. SIGNIFICANT DROUGHTS

DATE	DESCRIPTION
1904-1905	A statewide drought period of about 18 months
1917-1931	A very dry period throughout Oregon punctuated by brief wet spells in 1920-21 and 1927
1939-1941	A three-year intense drought in Oregon
1959-1964	Primarily affected eastern Oregon
1985-1997	Generally a dry period, capped by statewide droughts in 1992 and 1994
2005	Governor issued drought declaration for Gilliam, Hood River, Morrow, Sherman, and Umatilla counties

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book*.

Source: Oregon Emergency Management, State Natural Hazard Mitigation Plan, 2012, Drought chapter.

Probability

Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8 and 12 years.

The probability that Region 5 will experience drought is depicted in Table 2 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 2. Probability Assessment of Drought

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	H	H	-	H	-	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

The region's vulnerability to drought is depicted in Table 3 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 3. Vulnerability Assessment of Drought

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	M	H	-	M	-	H

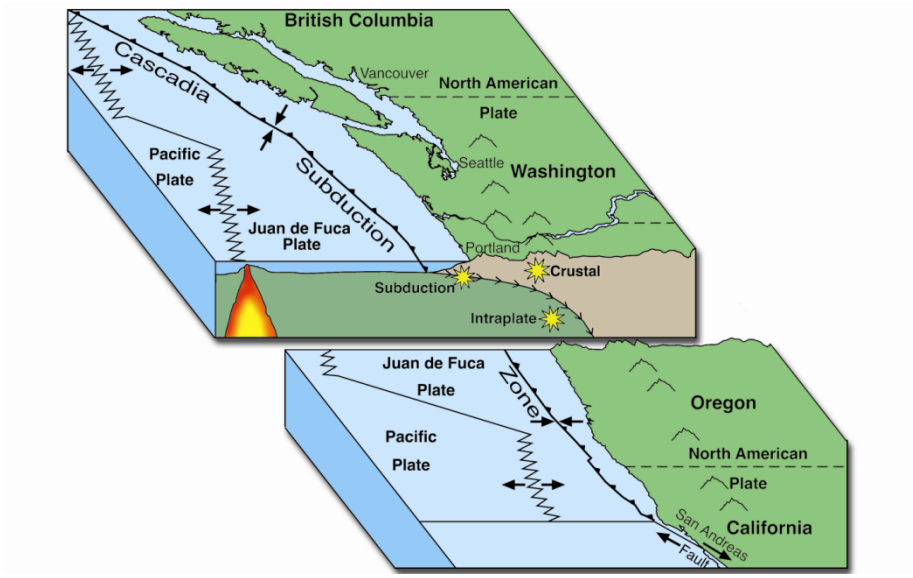
Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

EARTHQUAKES

Characteristics

The geographical position of this region makes it susceptible to earthquakes from three sources: subduction zone, intraplate, and crustal events. The map below displays a schematic three dimensional diagram with the generalized locations of the three types of earthquake sources.

FIGURE 1. Schematic 3-D map showing the general source areas for subduction zone, intraplate, and crustal earthquakes



Source: Image from the Oregon Department of Geology and Mineral Industries.

Great *subduction zone earthquakes* occur around the world where two tectonic plates meet and move towards one another, with one sliding underneath the other. In these subduction zones one plate is shoved ("subducts") beneath the other, where it is melted and reabsorbed into the mantle. The huge faults that separate the plates in these zones produce some of the most powerful earthquakes ever recorded, often having moment magnitudes of 8.0 to over 9.0. The 1960 Chilean (M_w 9.5) and the 1964 Great Alaska (M_w 9.2) earthquakes were subduction zone earthquakes which both produced large tsunamis.[2]

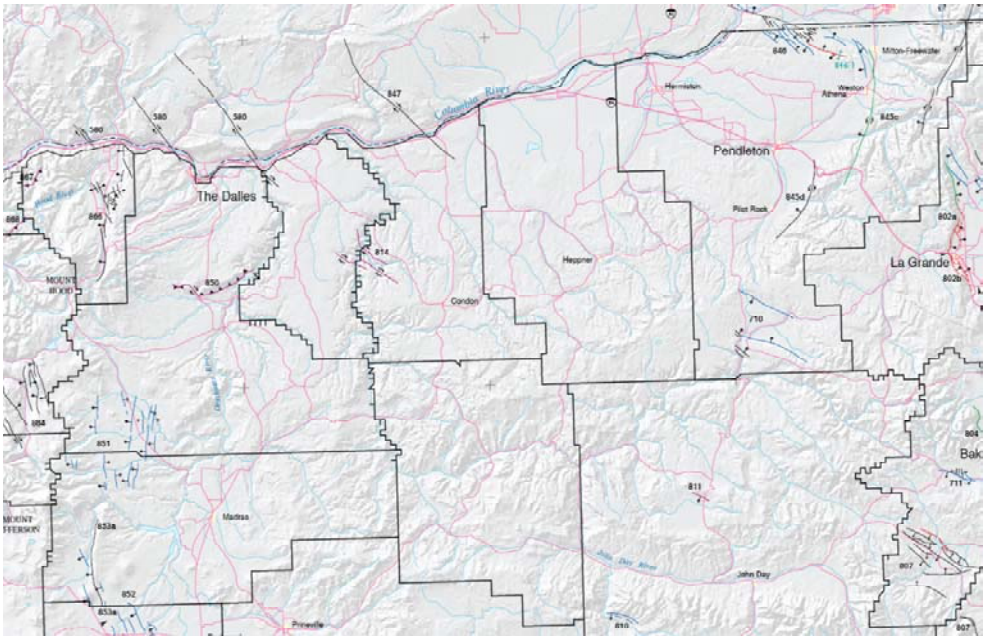
Intraplate earthquakes occur within the remains of the Juan de Fuca plate as it subducts beneath the North America plate. Intraplate earthquakes have caused damage in the Puget Sound region in 1949, 1965, and in the 2001 magnitude 6.8 Nisqually Earthquake. These types of earthquakes typically occur at depths of 40–60 km (25–37 mi).

Crustal earthquakes occur in the North American plate at relatively shallow depths of 10–20 km (6–12 mi) below the surface. Earthquakes related to volcanic activity can also affect the region. Generally, crustal faults can produce earthquakes with magnitudes up to roughly M7.0. The map on the following

[2] Kanamori, H., 1977, The energy release in great earthquakes: Journal of Geophysical Research, v. 82, p. 29812987.

page shows the location of the known crustal faults which could affect the region. Since only certain faults have been studied in detail and determined to be active, there may be many more crustal faults in the region capable of producing earthquakes which have not yet been identified.

FIGURE 2. USGS map of Quaternary Faults and Folds in the region.

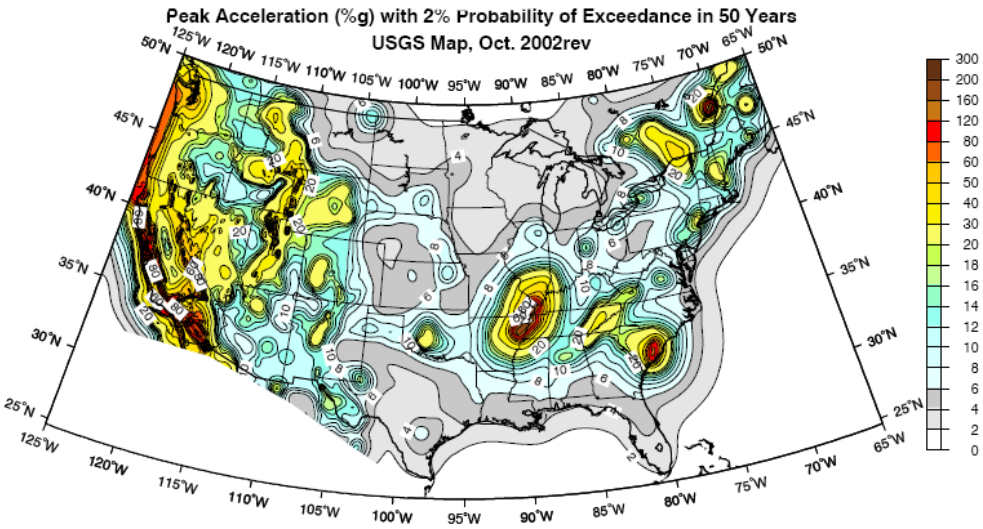


Details on the faults and folds such as fault type, slip rate, and most recent event are available by fault id number in the original USGS publication.

Source: Personius et al., 2003

When all of these earthquakes sources are added together, the general earthquake hazard in the region can be displayed as a whole and is reflected in the USGS national seismic hazard maps. When compared to the rest of the United States, most of the region is within a relatively moderate seismicity area, except for Hood River and Wasco Counties which are mostly within relatively high zones as shown in the map below.

FIGURE 3. National USGS Seismic Hazard Map.



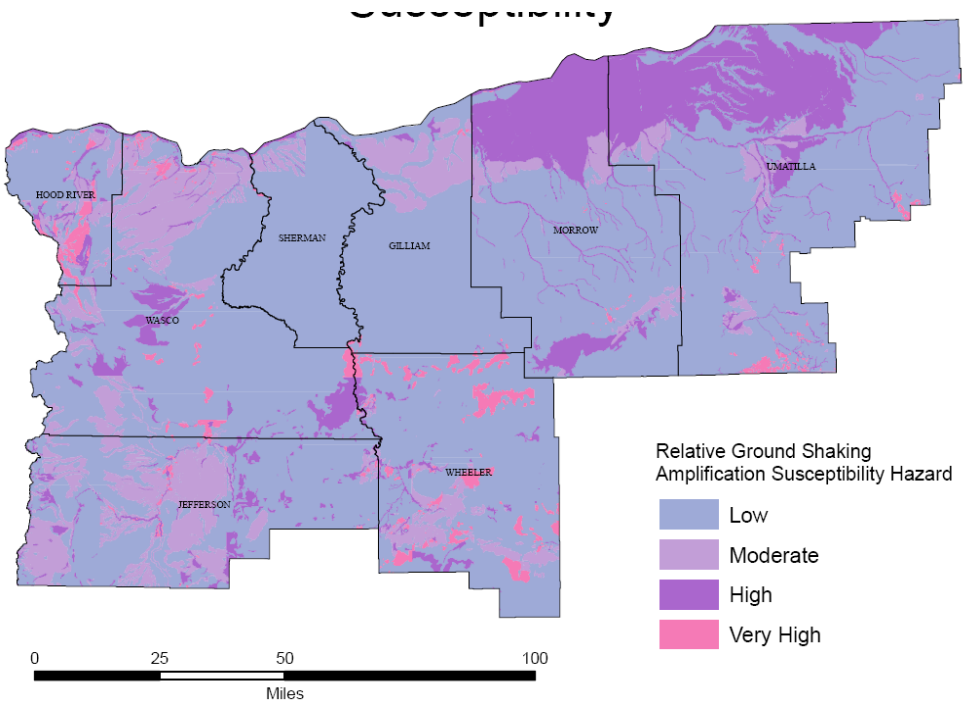
Source: Frankel, A.D., Petersen, M.D., Mueller, C.S., Haller, K.M., Wheeler,R.L., Leyendecker, E.V., Wesson, R.L, Harmsen, R.C., Cramer, C.H., Perkins, D.M., and Rukstales, K.S., 2002. 2002 Update of the National Seismic Hazard Maps. USGS Open File Report OFR 02-420.

Note: Seismic hazard is displayed through peak acceleration (percent force of gravity) with a 2% probability of exceedance in 50 years on rock. The hotter colors indicate higher ground motions or more intense shaking.

Earthquake ground motions can also cause associated hazards. Some of the earthquake associated hazards include: severe ground shaking, liquefaction of fine-grained soils, and landsliding.

As seismic waves travel through bedrock, some energy propagates through surface soils to the ground surface. It is during this propagation through these surface soils that the shaking can be greatly influenced. Soil deposits can either deamplify (weaken) or amplify the shaking based on the characteristics of the deposit. This phenomenon is generally referred to as ground shaking amplification (GSA). The map below displays the areas in the region with greater and lesser ground shaking amplification hazard.

FIGURE 4. Map of the relative ground shaking amplification hazard.

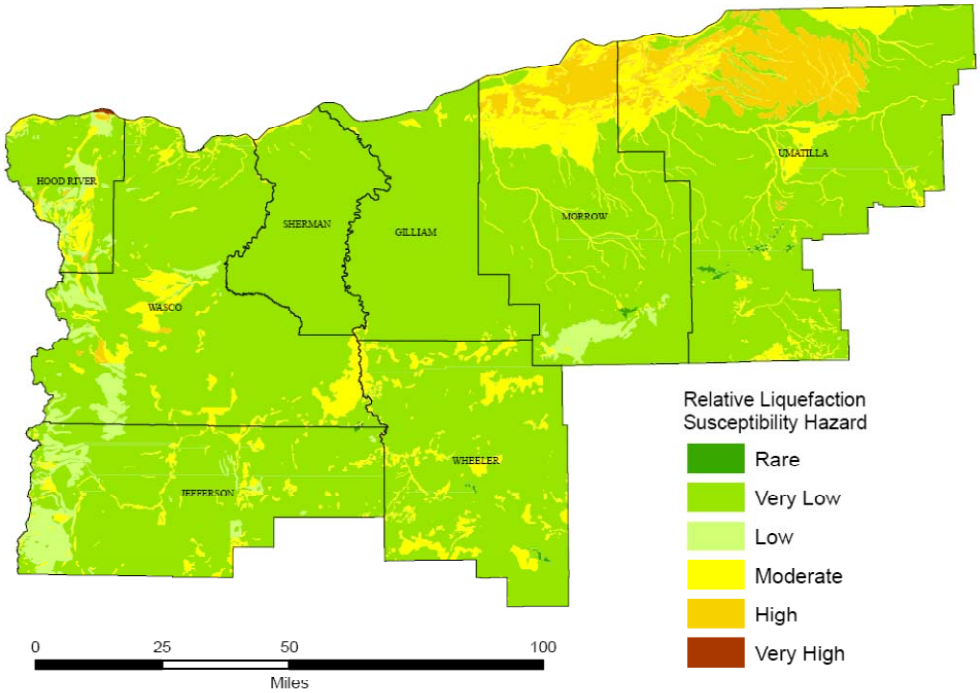


The five class scale of hazard generally corresponds to the NEHRP soil class scale: None (not depicted on map), Low, Moderate, High, and Very High.

Source: Burns, 2007

During seismic shaking, deposits of loose saturated sands can be subjected to contraction resulting in an increase in pore water pressure. If the increase in pore water pressure is high enough, the deposit becomes "liquefied," losing its strength and thus its ability to hold support loads. Figure 5 displays the areas in the region with greater and lesser liquefaction hazard.

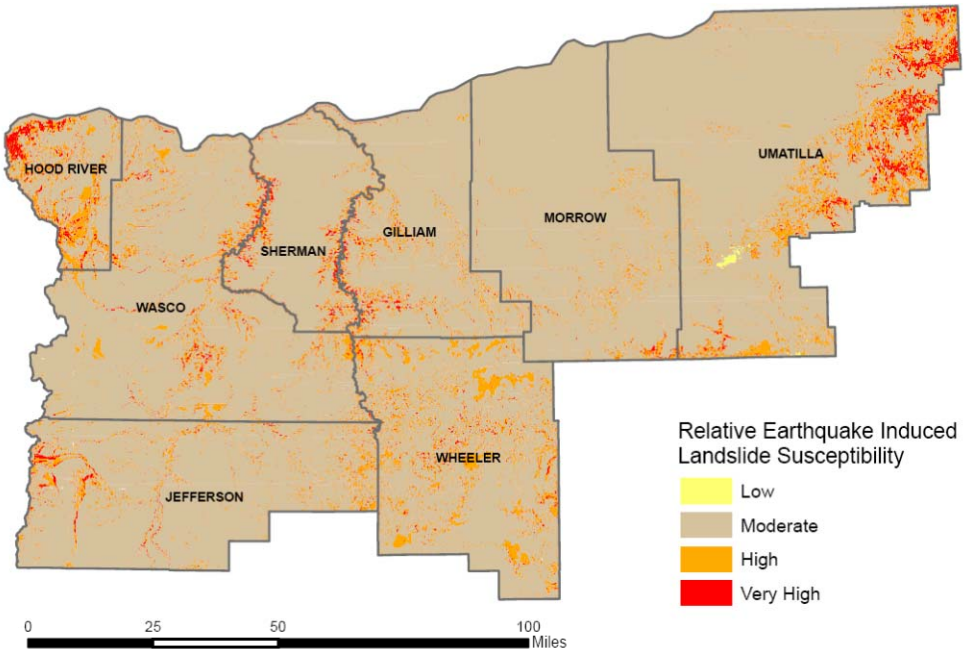
FIGURE 5: Map of the relative liquefaction susceptibility hazard



Source: Burns, 2007

Strong ground shaking can also cause landslides and reactivate dormant landslides. Commonly, slopes that are marginally stable prior to an earthquake become unstable and fail. Some landslides result from liquefaction that causes lateral movement of soil, or lateral spread. Figure 6 displays the areas in the region with greater and lesser earthquake induced landslide hazard.

FIGURE 6: Map of the relative earthquake induced landslide susceptibility hazard

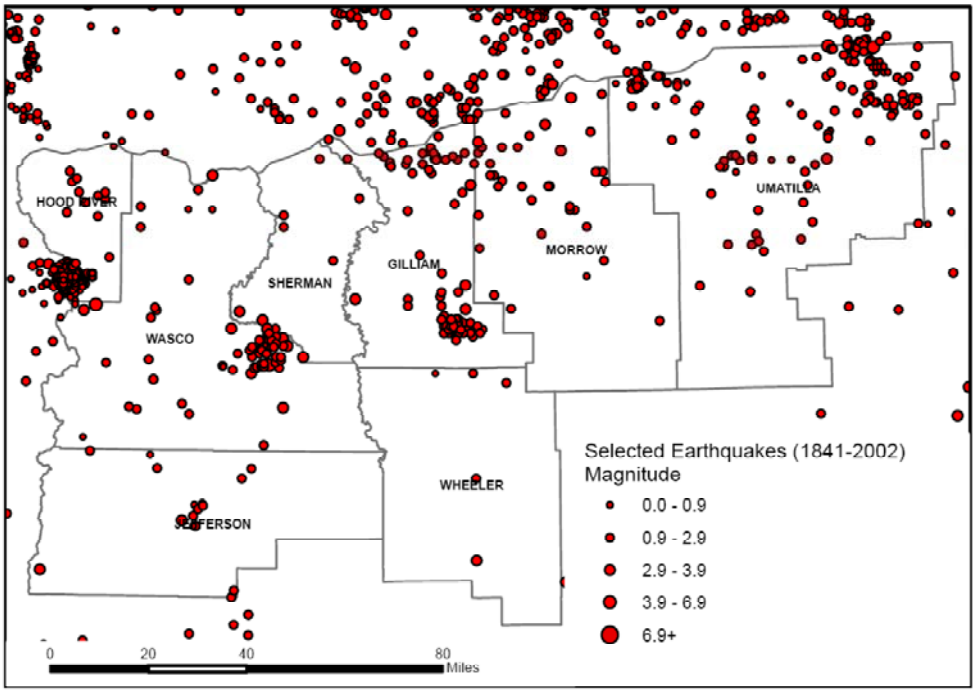


Source: Burns, 2007

History

Region 5 has experienced many earthquakes as shown in Figure 7 and Table 4 below. Three historic earthquakes of significance that were centered in the region include: the 1893 Umatilla, 1936 Milton-Freewater (M6), 1951 Hermiston, and the 1976 Maupin area (M4.8), all shallow crustal earthquakes. There are also identified faults in the region that have been active in the last 20,000 years. The region has also been shaken historically by crustal and intraplate earthquakes and prehistorically by subduction zone earthquakes centered outside the area.

FIGURE 7. Selected earthquakes in the Region, 1841 - 2002



The map displays over 1,000 earthquakes that have been recorded in the region during the last century. Since the instrument network in the region has been very sparse until the mid 2000's it is likely that thousands of earthquakes have occurred in the region, but were not recorded and thus do not appear on this map.

Source: Niewendorp, C.A., Neuhaus, M.E., 2003

TABLE 4. Significant Earthquakes in Region 5 and Oregon

Date	Location	Magnitude (M)	Comments
Approximate years: 1400 BCE 1050 BCE 600 BCE 400, 750, 900	Offshore, Cascadia subduction zone	Probably 8-9	Researchers Brian Atwater and Eileen Hemphill-Haley have dated earthquakes and tsunamis at Willapa Bay, Washington; these are the midpoints of the age ranges for these six events.
January 26, 1700	Offshore, Cascadia Subduction zone	Approx-imately 9	Generated a tsunami that struck Oregon, Washington and Japan; destroyed Native American villages along the coast.
November 23, 1873	Oregon/California border, near Brookings	6.8	Felt as far away as Portland and San Francisco; may have been an intraplate event because of lack of aftershocks.
March, 1893	Umatilla	VI-VII (Modified Mercalli Intensity)	Damage unknown
July 15, 1936	Milton-Freewater	6.4	Two foreshocks and many aftershocks felt; $100,000 damage (in 1936 dollars).
April 13, 1949	Olympia, Washington	7.1	Eight deaths and $25 million damage (in 1949 dollars); cracked plaster, other minor damage in northwest Oregon.
January, 1951	Hermiston	V (Modified Mercalli Intensity)	Damage unknown
November 5, 1962	Portland/Vancouver	5.5	Shaking lasted up to 30 seconds; chimneys cracked, windows broke, furniture moved.
1968	Adel	5.1	Swarm lasted May through July, decreasing in intensity; increased flow at a hot spring was reported.
April 12, 1976	Near Maupin	4.8	Sounds described as distant thunder, sonic booms, and strong wind.
April 25, 1992	Cape Mendocino, California	7.0	Subduction earthquake at the triple-junction of the Cascadia subduction zone and the San Andreas and Mendocino faults.
March 25, 1993	Scotts Mill	5.6	On Mount Angel-Gates Creek fault; $30 million damage, including Molalla High School and Mount Angel church.
September 20, 1993	Klamath Falls	5.9 and 6.0	Two deaths, $10 million damage, including county courthouse; rockfalls induced by ground motion.

Notes: * BCE: Before the Common Era

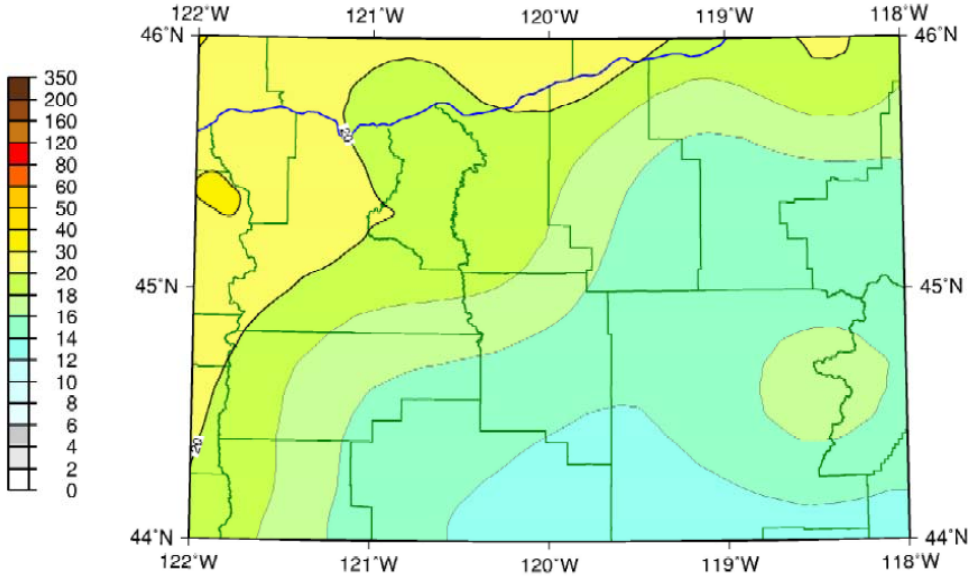
Probability

Scientists estimate the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent, assuming that the recurrence is on the order of 400 +/- 200 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. The last CSZ event occurred approximately 300 years ago.

Establishing a probability for crustal earthquakes is more difficult given the paucity of historic events in the region. Earthquakes generated by volcanic activity in Oregon's Cascade Range are possible, but likewise unpredictable.

Again, the general earthquake hazard in the region is reflected in the USGS national seismic hazard maps as shown in Figure 8. Most of the region is within a relative moderate seismicity area, except for Hood River and Wasco Counties which are mostly within a relative high zone as shown on the 2% probability of exceedance in 50 years map of peak ground acceleration (PGA). One can think of this as a 1 in 2500 year chance of exceedance of shaking at a site.

FIGURE 8: USGS Seismic Hazard Map



Map displays a 2% probability of exceedance in 50 years of peak ground acceleration (PGA) in percent of the force of gravity. As shown on the map, most of the region is predicted to have ground motions or shaking between roughly 10% to 40% g. Again, these seismic hazard maps are a combination of all three seismic sources previously discussed.

The probability that Region 5 will experience earthquakes is depicted in Table 5 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 5. Probability Assessment of Earthquakes

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	M	M	L	L	H	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

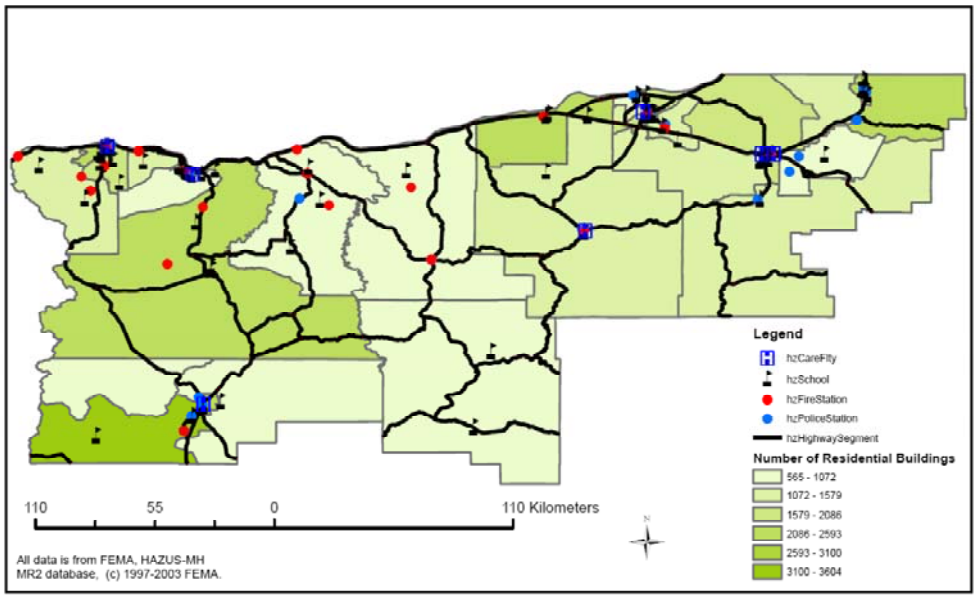
Vulnerability

The Mid-Columbia Gorge Region is moderately vulnerable to earthquake hazards from earthquake-induced landslides in the Cascades and ground shaking.

The region is vulnerable to earthquakes and earthquake-induced hazards. Most of the people and infrastructure are along the I-84 corridor which runs along the northern portion of the region. This multimodal transportation corridor is vital to Oregon's economy and includes a major Interstate Highway, I-84, two transcontinental rail lines, Union Pacific and Burlington Northern Santa Fe, the Columbia River inland water navigation, major electric power and gas lines, and communication conduits. In a study by Wang and Chaker in 2004, they found that roughly $14 billion worth of goods are carried through the corridor each year.[3] The map below displays the general exposure of the region.

[3] Wang and Chaker, 2004

FIGURE 9. Map of the generalized exposure of the region. Data is from HAZUS-MH MR2 database



Source: Burns, 2007

The geographical size of the region is roughly 13,700 square miles and contains 36 census tracts. There are over 54,000 households in the region and it has a total population of over 150,000 people (FEMA, 2006). There are an estimated 52,000 buildings in the region with a total building replacement value (excluding contents) of $8,527,000,000 ($8.5 billion). Approximately 99.00 % of the buildings (and 84% of the building value) are associated with residential housing. The replacement value of the transportation system is estimated to be roughly $16,494,000,000 (~$16.5 billion) and utility lifeline systems and $4,823,670,000 (~$4.8 billion), respectively.

Since Oregon adopted the International Building Code 2003 (IBC 2003), it no longer uses the seismic zones to define the hazard. The IBC 2003 uses the maps from the USGS earthquake program, which depict a much more accurate spatial distribution of the hazard. The old Uniform Building Codes (UBC) maps displayed the hazard as spatially changing along county boundaries.

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI surveyed a total of 3,349 buildings, giving each a 'low,' 'moderate,' 'high,' or 'very high' potential of collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore *approximate* rankings.[4] To

[4] State of Oregon Department of Geologic and Mineral Industries, Implementation of 2005 Senate Bill 2 Relating to Public Safety, Seismic Safety and Seismic Rehabilitation of Public Building, May 22, 2007, iv.

fully assess a building's potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey.

Table 6 below shows the number of buildings surveyed in each county with their respective rankings.

TABLE 6. REGION 5 BUILDING COLLAPSE POTENTIAL

County	Level of Collapse Potential			
	Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100 %)
Gilliam	4	2	5	4
Hood River	18	14	7	13
Morrow	11	10	7	5
Sherman	5	4	3	-
Umatilla	40	24	46	16
Wasco	23	7	10	-

Source: DOGAMI 2007. Open File Report 07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.

The Oregon Department of Geology and Mineral Industries (DOGAMI) has also developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) a M 6.5 Arbitrary Crustal event and (2) a 2500 year mean return period probabilistic earthquake scenario (2500-year Model). Both models are based on HAZUS-MH, a computer program currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. The arbitrary crustal event is based on a potential M6.5 earthquake generated from an arbitrarily chosen fault using the HAZUS software, and assuming a worst-case scenario. The 2500-Year crustal model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a 2% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time.

DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models do provide some approximate estimates of damage. Results are found in Tables 7 to 9.

TABLE 7. TOTAL BUILDING, TRANSPORTATION, AND UTILITY EXPOSURE AND POTENTIAL LOSSES FROM A 2500 YEAR RETURN INTERVAL GROUND MOTIONS

REGION 5 COUNTIES	BUILDING EXPOSURE	TRANSPORTATION EXPOSURE	UTILITY EXPOSURE	TOTAL EXPOSURE	
Gilliam	148,000,000	1,777,000,000	153,000,000	2,078,000,000	
Hood River	1,282,000,000	1,413,000,000	702,000,000	3,397,000,000	
Jefferson	1,009,000,000	1,185,800,000	405,910,000	2,600,710,000	
Morrow	517,000,000	1,592,600,000	740,040,000	2,849,640,000	
Sherman	124,000,000	1,299,700,000	117,520,000	1,541,220,000	
Umatilla	3,837,000,000	4,956,900,000	1,390,340,000	10,184,240,000	
Wasco	1,513,000,000	3,305,400,000	1,162,950,000	5,981,350,000	
Region Total	8,430,000,000	15,530,400,000	4,671,760,000	28,632,160,000	
	BUILDING LOSSES	**TRANSPORTATION LOSSES**	**UTILITY LOSSES**	**TOTAL LOSSES**	**LOSS % OF TOTAL**
Gilliam	6,300,000	12,700,000	6,040,000	25,040,000	1.2%
Hood River	153,510,000	85,900,000	102,990,000	342,400,000	10.1%
Jefferson	54,580,000	15,600,000	16,790,000	86,970,000	3.3%
Morrow	178,540,000	49,300,000	106,800,000	334,640,000	11.7%
Sherman	5,600,000	45,300,000	5,810,000	56,710,000	3.7%
Umatilla	736,640,000	200,600,000	135,480,000	1,072,720,000	10.5%
Wasco	191,010,000	82,400,000	116,890,000	390,300,000	6.5%
Region Total	1,326,180,000	491,800,000	490,800,000	2,308,780,000	8.0%

Source: Burns, 2007. Unpublished Report. Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for Seven Couties in the Mid-Columbia River Gorge Region Including Hood River, Wasco, Sherman, Gilliam, Morrow, Umatilla, Jefferson, and Wheeler, DOGAMI Open File Report..

TABLE 8. ESTIMATED LOSSES ASSOCIATED WITH AN ARBITRARY M6.5 CRUSTAL EVENT

REGION 5 COUNTIES:	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
INJURIES (5 pm Time Frame)	3	120	126	4	208	220
DEATHS (5 pm Time Frame)	0	6	7	0	10	13
DISPLACED HOUSEHOLDS	3	419	521	6	1,048	720
ECONOMIC LOSSES FOR BUILDINGS	$9.21 million	$189.96 million	$109.9 million	$8.4 million	$248.68 million	$307.09 million
OPERATIONAL THE DAY AFTER THE EVENT						
Fire stations	100%	60%	50%	0%	75%	50%
Police stations	100%	0%	100%	0%	79%	0%
Schools	100%	21%	43%	33%	88%	27%
Bridges	100%	100%	100%	88%	99%	98%
ECONOMIC LOSSES TO INFRASTURCTURE						
Highways	$0.1 million	$37.2 million	$43.5 million	$33.1 million	$77 million	$35.5 million
Airports	$3.2 million	$7.3 million	$1.7 million	$2 million	$16.5 million	$13.3 million
Communications	0	$0.08 million	0	0	$0.05 million	$0.08 million
DEBRIS GENERATED (million tons)	0	0	0	0	0	0

Source: Burns, 2007. Unpublished Report. Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for Seven Couties in the Mid-Columbia River Gorge Region Including Hood River, Wasco, Sherman, Gilliam, Morrow, Umatilla, Jefferson, and Wheeler, DOGAMI Open File Report.

TABLE 9. ESTIMATED LOSSES ASSOCIATED WITH A 2500-YEAR PROBABLE M6.5 DRIVING SCENARIO

REGION 5 COUNTIES	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
INJURIES (5 pm Time Frame)	2	111	164	2	623	136
DEATHS (5 pm Time Framce)	0	6	8	0	32	8
DISPLACED HOUSEHOLDS	0	303	768	1	2,957	373
ECONOMIC LOSSES FOR BUILDINGS	$6.3 million	$153.51 million	$178.54 million	$5.68 million	$736.64 million	$191.01 million
OPERATIONAL THE DAY AFTER THE EVENT						
Fire stations	100%	20%	0%	66%	25%	75%
Police stations	100%	100%	50%	100%	21%	67%
Schools	100%	14%	14%	100%	28%	33%
Bridges	100%	82%	100%	76%	93%	96%
ECONOMIC LOSSES TO INFRASTRUCTURE						
Highways	$6.3 million	$71.9 million	$36.4 million	$42.2 million	$173.8 million	$63.1 million
Airports	$5.7 million	$7.6 million	$5.2 million	$1.8 million	$19.7 million	$15.8 million
Communications	$0	$0.05 million	$0	$0	$ 0.24 million	$0.05 million
Debris generated (million tons)	0	0	0	0	0	0

Source: Burns, 2007. Unpublished Report. Geologic Hazards, Earthquake and Landslide Hazard Maps, and Future Earthquake Damage and Loss Estimates for Seven Couties in the Mid-Columbia River Gorge Region Including Hood River, Wasco, Sherman, Gilliam, Morrow, Umatilla, Jefferson, and Wheeler, DOGAMI Open File Report.

The region's vulnerability to earthquakes is depicted in Table 10 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 10. Vulnerability Assessment of Earthquakes

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	L	M	H	L	M	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

FIRES IN THE URBAN/WILDLAND INTERFACE

Characteristics and Brief History

Oregon has a very lengthy history of fire in the undeveloped wildlands and in the developing urban/wildland interface. In recent years, the cost of fire suppression has risen dramatically; a large number of homes have been threatened or burned, more fire fighters have been placed at risk, and fire protection in wildland areas has been reduced. These factors have prompted the passage of Oregon Senate Bill (SB) 360 (Forestland / Urban Interface Protection Act, 1997). This bill: (1) establishes legislative policy for fire protection, (2) defines urban/wildland interface areas for regulatory purposes, (3) establishes standards for locating homes in the urban/wildland interface, and (4) provides a means for establishing an integrated fire protection system.

This document defines wildfire as an uncontrolled burning of forest, brush, or grassland. Wildfire always has been a part of these ecosystems and sometimes with devastating effects. Table 11 provides an overview of the significant wildfires in Oregon, an important indicator of the type of fires possible in the region. Wildfire results from natural causes (e.g., lightening strikes), a mechanical failure (Oxbow Fire), or human-caused (unattended campfire, debris burning, or arson). The severe fire season of 1987 resulted in a record setting mobilization of fire fighting resources. Most wildfires can be linked to human carelessness.

Region 5 contains a variety of forest and grassland ecosystems. The Cascade Mountains form the western boundaries of Hood River and Wasco counties. Morrow and Umatilla counties contain large tracts of Blue Mountain forests and all Region 5 counties have extensive grasslands. Each ecosystem is different. Consequently, the probability and management of wildfire would differ from place to place. The build-up of fuel (e.g., brush, dead or dying trees) that leads to devastating wildfires is a very important factor and is the current focus of mitigation strategies.

TABLE 11. SIGNIFICANT WILDFIRES

Year	Name of Fire	Location	Acres Burned	Remarks
1977		Wasco		
1979	Pine Grove/Juniper Flat			
1983	Moro	Sherman		
1985	Maupin	Wasco		
1988		Wasco		
1991	Falls		1,100	Fire along the Columbia Gorge.
1994	Smith Canyon			
1998	Rowena	Wasco	2,208	
1998	Reith Barnhart/Coombs Canyon	Umatilla	45,000	
2000	Willow Creek	Morrow and Gilliam	27,000	
2000	Antelope	Wasco		
2001	Two Rivers	Umatilla	7,011	
2001	Bridge Creek	Umatilla	9,230	
2002	Sheldon Ridge	Wasco	12,681	
2003	Herman Creek	Wasco	300	3 structures were lost in this fire that affected Cascade Locks *excerpted from the State Plan, 2006
2003		Umatilla County		$40,000 in property damage, $200,000 in crop damage
2003		Umatilla County		$15,000 in property damage, $500 in crop damage
2004		Gilliam, Morrow, Umatilla Counties		$6,000 in property damage

Source: Oregon Emergency Management, State Natural Hazard Mitigation Plan, 2003, Wildland/Urban Interface Chapter. State Interagency Hazard Mitigation Team (2006). The State of Oregon Natural Hazards Mitigation Plan. Available from http://www.oregonshowcase.org/index.cfm?mode=stateplan

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

Note: This list is representative of a lengthy wildfire history. There have been many fires, named and unnamed. Statistics differ, depending on the source.

TABLE 11. SIGNIFICANT WILDFIRES (con't.)

Year	Name of Fire	Location	Acres Burned	Remarks
2005		Sherman, Wasco Counties		$1000 in property damage *damage estimate includes Jefferson County
2005		Morrow, Umatilla Counties		$2500 in property damage and $11,500 in crop damage
March 2005		Gilliam, Morrow, Umatilla Counties		$113,900 in crop damage
July 2005		Umatilla, Morrow Counties		$5000 in property damage, $23,000 in crop damage
May 2006		Gilliam, Morrow, Umatilla Counties		$10,000 in property damage
June 2006		Gilliam, Morrow, Umatilla Counties		$500,000 in property damage
August 2010		Wasco County		Fire threatened Maupin, burned 2 residences

Source: Oregon Emergency Management, State Natural Hazard Mitigation Plan, 2003, Wildland/Urban Interface chapter. State Interagency Hazard Mitigation Team (2006). The state of Oregon Natural Hazards Mitigation Plan. Available from http://csc.uoregon.edu/opdr/

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

Note: This list is representative of a lengthy wildfire history. There have been many fires, named and unnamed. Statistics differ, depending on the source.

Probability

The probability of a wildland urban interface fire occurrence in this region has been assessed at the local level; each of the counties in this region considers the likelihood of an event to be high.

The probability that Region 5 will experience interface fires is depicted in Table 12 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 12. Probability Assessment of Fires in Interface Areas

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	H	H	H	H	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

An understanding of risk begins with the knowledge that wildfire is a natural part of forest and grassland ecosystems. Past forest practices included the suppression of all forest and grassland fires. This practice, coupled with hundreds of acres of dry brush or trees weakened or killed through insect infestation, has fostered a dangerous situation. Present state and national forest practices include the reduction of understory vegetation through thinning and prescribed (controlled) burning.

Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. In Oregon, there are about 240,000 homes worth around $6.5 billion within the urban/wildland interface. Such development has greatly complicated firefighting efforts and significantly increased the cost of fire suppression. Interface communities at risk in Region 5 are listed in Table 13. A number of these communities are grassland communities rather than forest.

A detailed community inventory of factors that affect vulnerability is important in assessing risk and is beyond the scope of the statewide assessment.

When assessing the risks from natural hazards, established mitigation practices already provide benefits in reduced disaster losses. It is important for communities to understand the benefits of past mitigation practices when assessing their risks, being mindful of opportunities to further reduce losses.

Possible mitigation practices include:

- Identify and map current hazardous forest conditions such as fuel, topography, etc.;
- Identify forest / urban interface communities - List of interface communities, Federal Register, 08/17/01. V. 66, N. 160;
- Identify and map Forest Protection Districts;
- Identify and map water sources;
- Implement effective addressing system in rural forested areas;
- Clearly mark evacuation routes;
- Identify and locate seasonal forest users. Initiate information program through schools, summer camps, forest camping grounds, lodges, etc;

- Identify and map bridges that can (and can not) support the weight of emergency vehicles. This is a basic requirement for fire suppression;
- Form committees to implement Oregon Senate Bill 360. This is required in Oregon Senate Bill 360; and
- Create road standards in interface areas to reflect fire suppression needs. Roads must be wide enough for fire suppression vehicles to turn around. Road grades cannot be too steep for large, heavy vehicles.

TABLE 13. WILDLAND/URBAN INTERFACE COMMUNITIES

GILLAM COUNTY	HOOD RIVER COUNTY	MORROW COUNTY	SHERMAN COUNTY	UMATILLA COUNTY	WASCO COUNTY
Arlington	Cascade Locks	Blake's Addition	Biggs Junction	Gibbon	Antelope
Condon	Dee	Boardman	Grass Valley	Hermiston	Bear Springs
Mayville	Hood River	Cutsforth Park	Kent	Lehman Springs	Big Muddy Ranch
	Mt. Hood	Hardman	Moro	McNary	Boyd
	Oak Grove	Heppner	Rufus	Meacham	Chenoweth
	Odell	Ione	Wasco	Meacham Lake	Cherry Heights
	Parkdale	Irrigon		Mill Creek	Clarno
	Pine Grove	Lexington		Milton-Freewater	Durur
	Rockford	Pentland Lake		Mission	Kahneeta Hot Springs
	Summit			Pendleton	Maupin
	Trout Creek			Pilot Rock	Mosier /7 Mill Hill
	Viento			Poverty Flats	North Junction
	Westside			Power City	Oak Springs
	Wyeth			Rieth	Pine Grove
				Stanfield	Rowena
				Thorn Hollow	Shaniko
				Tollgate	Sidwalter
				Ukiah	Simnasho
				Umatilla	Taylorville/Sportsmans Park
				Weston	The Dalles/Mill Cr/7 Mile Hill
				Weston Mountain	Tygh Valley
					Wamic/ Pine Hollow /
					Wapintia

Source: August 17, 2001, Federal Register, v.66, n.160.

The region's vulnerability to fires in the interface is depicted in Table 14 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 14. Vulnerability Assessment of Fires in Interface Areas

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	M	M	M	M	M	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

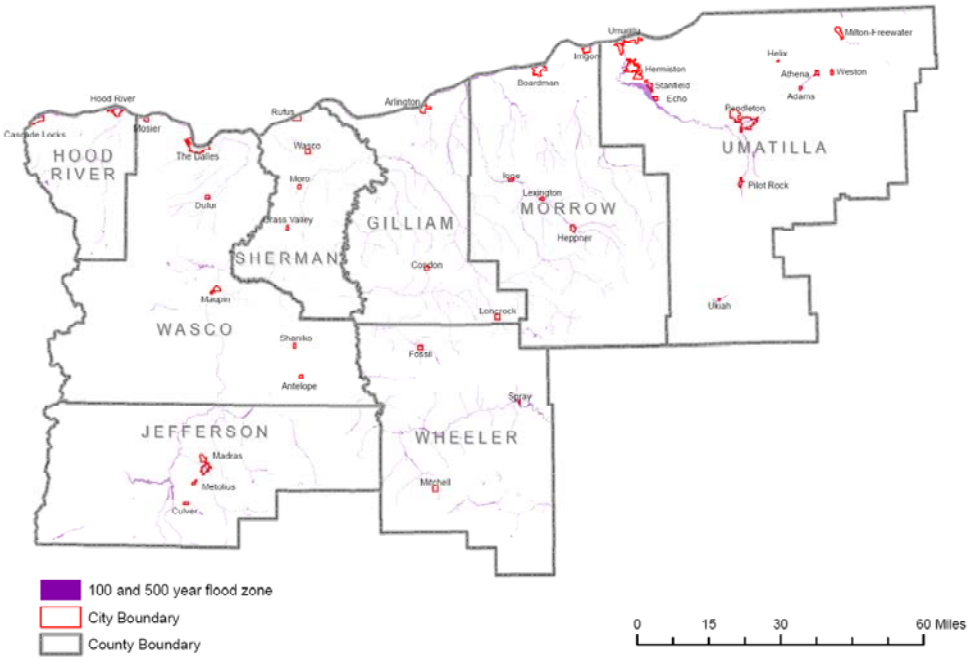
FLOOD

Characteristics

Region 5 is subject to a variety of flood conditions. The most common type of flooding is associated with unseasonably warm weather during the winter months, which can quickly melt snow. This condition has produced devastating floods throughout the region. The warm weather events usually occur December through February, and can affect the entire state. Flash floods are almost always a summer phenomenon and are associated with intense local thunderstorms. The flash flood of June 1903 in the City of Heppner (Morrow County) is a benchmark event. No flood in Oregon has been more lethal: 247 fatalities. Heppner's vulnerability to flash flood hazards has since been reduced through the construction of the Willow Creek Dam. The region's other flood events are linked to normal seasonal snowmelt and run-off from agricultural fields.

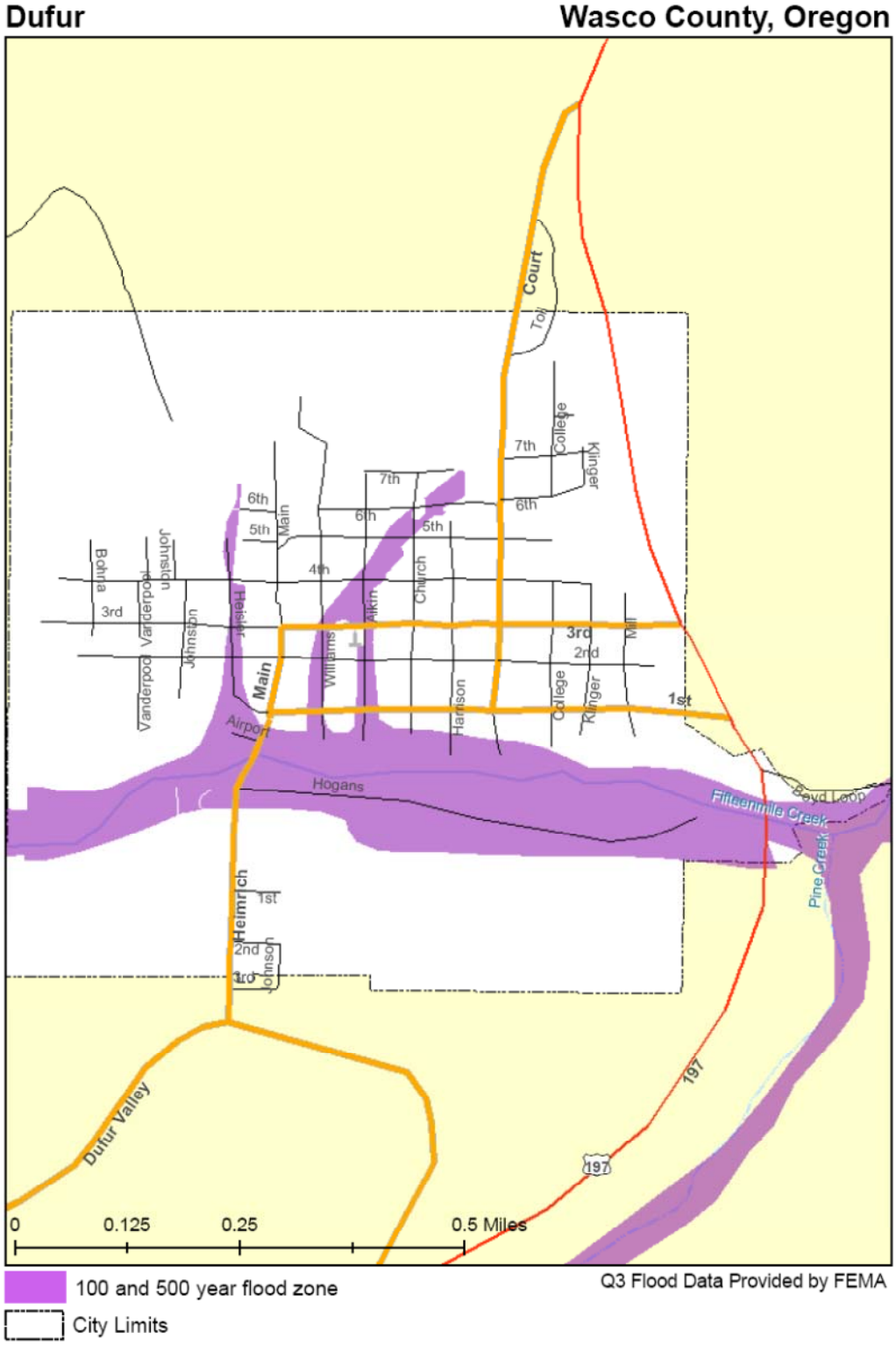
The hazard is primarily located with the 100 year and 500 year flood zones on the FEMA flood insurance rate maps. The probability of the hazard occurring within these zones is 1 in 100 years and 1 in 500 years. Base flood elevations have also been determined for the 100 year flood zone. The extent of the hazard can be viewed spatially on the flood hazard maps (FIRM). Figure 10 shows the general flood hazard of the region.

FIGURE 10. Map of the 100 and 500 year flood zones



Source: FEMA Q3 database

Figure 10: Map of the 100 and 500 year flood zones in Dufur, Wasco County, OR.



Source: FEMA Q3 database

History

There are several rivers in the region that produce natural extreme flood conditions. Surprisingly, the Columbia is not one of them, nor is the lower Deschutes or the John Day. The Columbia is regulated by up-stream dams, so it does not present much of a problem. This is partly reflected in the federal flood insurance rate maps for the various communities along the river. However, a swollen Columbia can back up tributary streams to the point where they constitute a significant hazard. This has occurred on a number of occasions. The lower Deschutes and John Day (Columbia River tributaries) are confined to fairly deep canyons with small floodplains. Consequently, they do not present the flood problems associated with smaller rivers, such as the Umatilla, the Walla Walla, and their tributaries. Table 15 details significant historic floods and Table 16 details the rivers that cause principle flood hazards in the region.

TABLE 15. SIGNIFICANT FLOODS

DATE	LOCATION	DESCRIPTION	TYPE OF FLOOD
June, 1894	Main stem Columbia River (Region 5 communities)	Largest flood observed on the Columbia River (1,200,000 cfs). City of Umatilla inundated. Widespread damage.	Snow melt (SM)
June, 1903	Morrow County (Willow Creek)	Very devastating flash flood. Forty-foot wall of water in City of Heppner. 247 Fatalities; 141 homes destroyed.	Flash flood (FF)
Jan., 1923	Mid-Columbia region	Widespread flooding. Unusually warm weather, intense rain.	Rain-on-snow (ROS)
Jan., 1933	Mid-Columbia region	Widespread flooding. Heavy mountain snow pack followed by rain and mild temperatures.	ROS
Dec., 1955	Mid-Columbia region	Mild temperatures and rain. Farms, highways flooded.	ROS
Dec., 1964	Entire State	Record-breaking floods throughout state. Heavy snow in mountains followed by intense rain. Considerable flood damage	ROS
July, 1965	Lane / Spears Canyons (Umatilla Co.)	Thunderstorm. Eight to ten-foot wall of water from canyon. Considerable damage. One fatality; several people injured	FF
Dec., 1980	Polallie Creek (Hood River Co.)	Debris flow from vicinity of Mt. Hood. Debris dam formed a small lake that was later breeched. Damage to highways and utilities.	Debris flow
Feb., 1985	Umatilla County	Warm rain on snow at higher elevations. Flooding throughout county.	ROS
Feb., 1986	Entire state	Warm rain on snow. Widespread flooding. Considerable damage	ROS
May, 1998	Central and eastern Oregon	Widespread flooding. Rain melting mountain snow.	ROS
Aug., 2003	Gilliam County	$7,000 in property damage	
Aug., 2003	Sherman County	Flash Flood (Gerking Canyon) * excerpted from State Plan, 2006	
April, 2005	Morrow County	$2,000 in property damage	
April, 2005	Umatilla County	$170,000 in property damage	

Source: Taylor, George and Raymond Hatton, 1999, The Oregon Weather Book. Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org Source: State Interagency Hazard Mitigation Team (2006). The state of Oregon Natural Hazards Mitigation Plan. National Climatic Data Center, Storm Events, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

TABLE 15. SIGNIFICANT FLOODS (con't.)

DATE	LOCATION	DESCRIPTION	TYPE OF FLOOD
March 2006	Morrow	Flash flood from a collapsed irrigation dike embankment floods the south side of I-84 near Boardman, closing down the road.	Flash Flood
Nov. 2006	Hood River	Hood River near the City of Hood River caused extensive damage on Highway 35 closing the highway for a month. Moderate damage done to irrigation works. Total $30 million in damage	Riverine
May/June 2011	Morrow	Intense rainfall in the Heppner and Lexington areas resulting in damage to roads, bridges, and the Morrow County Fairgrounds. Total of $164,000 in damage	Flash Flood

Source: Taylor, George and Raymond Hatton, 1999, The Oregon Weather Book. Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org Source: State Interagency Hazard Mitigation Team (2006). The state of Oregon Natural Hazards Mitigation Plan. National Climatic Data Center, Storm Events, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

TABLE 16. PRINCIPAL FLOOD SOURCES

Gilliam County	Hood River County	Morrow County	Sherman County	Umatilla County	Wasco County
Columbia River*	Columbia River*	Columbia River*	Columbia River*	Columbia River*	Columbia River*
Thirty Mile Creek	Hood River	Hinton Creek		Birch Creek	Spanish Hollow Creek
	Indian Creek	Little Blackhorse Canyon Cr.		McKay Creek	Fifteen Mile Creek
		Shobe Creek		Mill Creek	Mosier Creek
		Willow Creek		Patawa Creek	
		Rhea Creek		Stage Gulch	
				Tutuilla Creek	
				Umatilla River	
				Walla Walla River	
				Waterman Gulch	
				Pine Creek	
				Greasewood Creek	

Source: FEMA Flood Insurance Studies for Gilliam, Hood River, Morrow, Sherman, Umatilla, and Wasco counties.

Notes: *The Columbia River flow is controlled by a series of up-stream dams. However, it still constitutes a flood hazard. The failure to regulate properly during high water conditions could worsen flood conditions

Probability

The probability of an occurrence has been assessed by FEMA and is displayed on the Federal Insurance Rate Maps (FIRM). Based on these maps, it is very likely that future flooding will occur in the Mid-Columbia Region.

The Federal Emergency Management Agency (FEMA) has mapped most flood-prone streams in Oregon. The maps depict the 1% flood (100-year) upon which the National Flood Insurance Program is based. All of the Region 5 counties have Flood Insurance Rate Maps (FIRM); however, some of the maps are old and could be outdated. The FIRM maps were issued at the following times:

Gilliam, September 24, 1984;

Hood River, September 24, 1984;

Morrow, December 18, 2007;

Sherman, September 24, 1984;

Umatilla, September 8, 1999;

Wasco, September 24, 1984;

A cursory examination of Table 15 above provides some indication of flooding in Region 5. Significant flooding occurs on a fairly regular basis, at least once every 5-7 years (not all flooding is shown in Table 15).

The probability that Region 5 will experience flooding is depicted in Table 17 below. These scores are based on the perceptions of area emergency managers.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 17. Probability Assessment of Flood

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	M	H	H	H	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores

Vulnerability

Region 5 is exposed to flood hazards. Most of the people and infrastructure are along the I-84 corridor which runs along the northern portion of the region. This multimodal transportation corridor is vital to Oregon's economy and includes a major Interstate Highway, I-84, two transcontinental rail lines, Union Pacific and Burlington Northern Santa Fe, the Columbia River inland water navigation, major electric power and gas lines, and communication conduits. In a study by Wang

and Chaker in 2004, they found that roughly $14 billion worth of goods are carried through the corridor each year.[5]

The vulnerability from the hazard can be examined through the spatial relationship of the percent of a city's total area versus the percent of the city's area within the 100 yr and 500 yr flood zones.

The region's vulnerability to floods is depicted in Table 18 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 18. Vulnerability Assessment of Flood

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	L	L	H	M	M	L

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

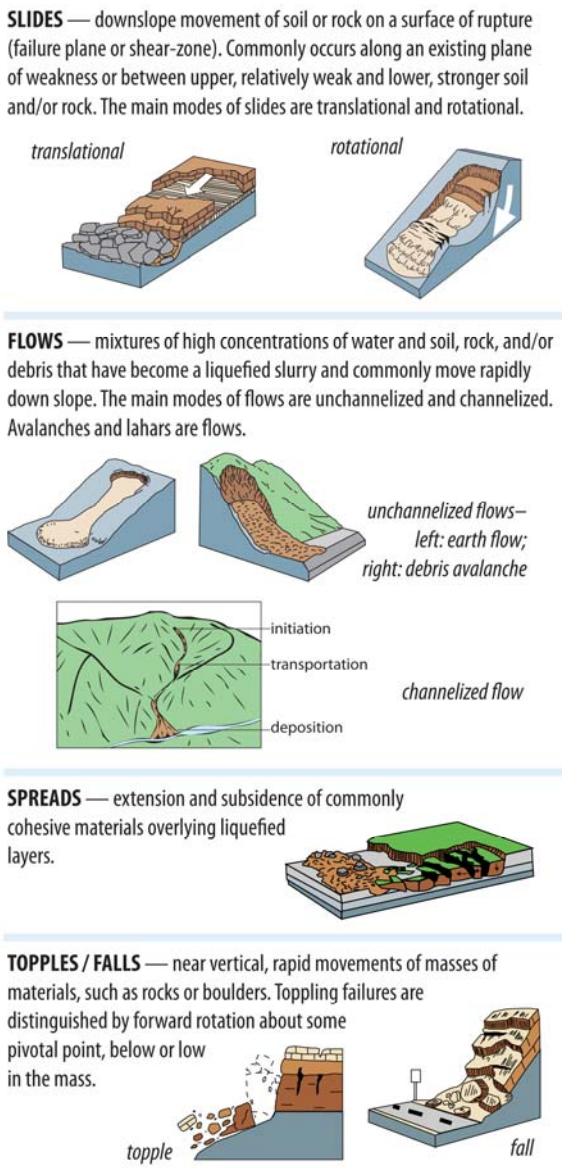
[5] Wang and Chaker, 2004. Geologic Hazards Study for the Columbia River Transportation Corridor. Oregon Department of Geology and Mineral Industries Open File Report OFR O-04-08.

LANDSLIDES/DEBRIS FLOWS

Characteristics

The general term *landslide* refers to a range of geologic failures including slides, flows, falls, topples, and spreads. Most slope failures in the Mid-Columbia Region are complex combinations of these distinct types, but the generalized groupings provide a useful means for framing discussion of slide characteristics, identification methods, and potential mitigation alternatives. These basic types are combined with the type of geologic material to form the common landslide names such as debris flow and rock fall.

FIGURE 11. Schematic of F*ive Common Landslide Types*



Source: Oregon Department of Geology and Mineral Industries, Landslide Fact Sheet, 2006

Prior to a landslide, the slope may be affected by several factors that reduce the stability without causing failure. Some of the most common factors include:

Relatively weak materials (e.g. loose silt)

Steep slopes

Degree of weathering and/or fracturing

Existing landslides

Removal of vegetation (e.g. fire or timber harvest)

Existing moisture content (e.g. from months of rainfall)

Existing planes of weakness (e.g. paleosols or bedding planes)

Once the slope reaches a critical state of stability, it usually can be easily triggered into a landslide. Some common triggering factors include:

Intense rainfall

Rapid snowmelt

Freeze thaw

Human-induced:

Grading/removing material from bottom/top of slope

Adding fill/loads to the top/crest of the slope

Concentration of water onto a slope (agriculture/landscape irrigation roof downspouts, broken water/sewer lines)

Earthquakes

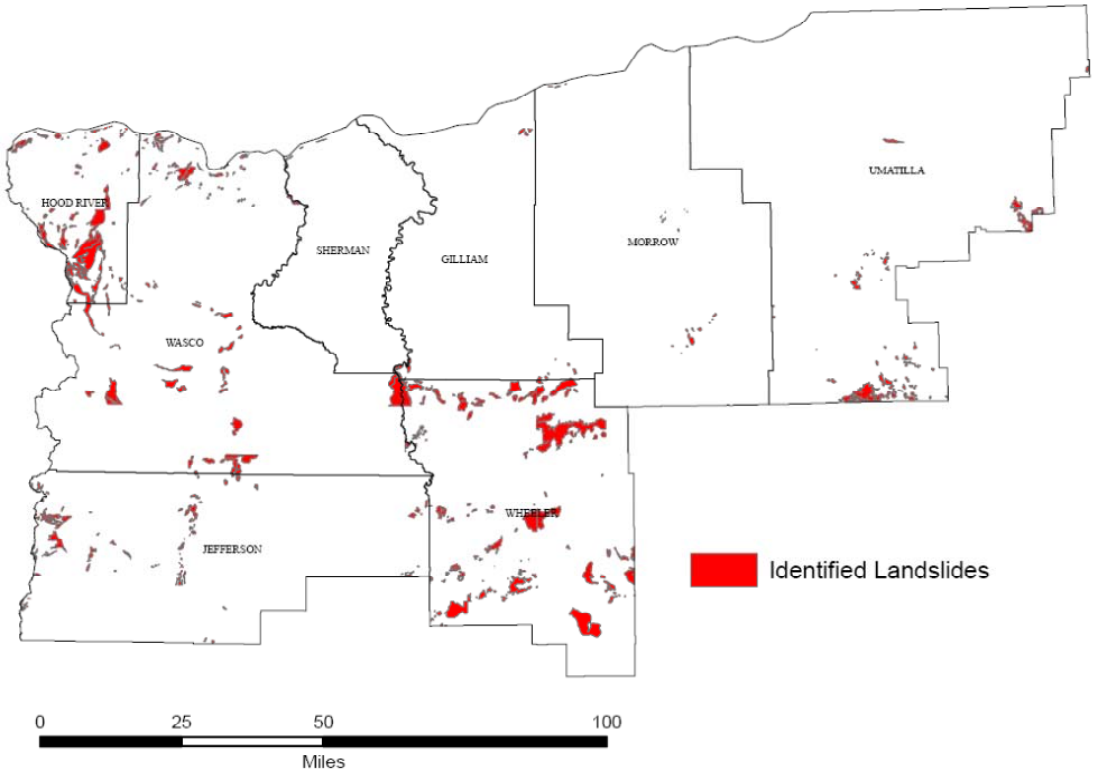
Volcanic eruptions

Some landslides can move at rapid rates and thus pose life threats. These are commonly channelized debris flows, debris avalanches, and rock falls. These types of rapidly moving landslides are common throughout the region, especially along the steep slopes in the Columbia River Gorge.

In order to reduce the risk of impact from future landslides, identification of areas with unstable slopes is a crucial step. One of these factors, existing identified landslides, is displayed spatially in Figure 12.

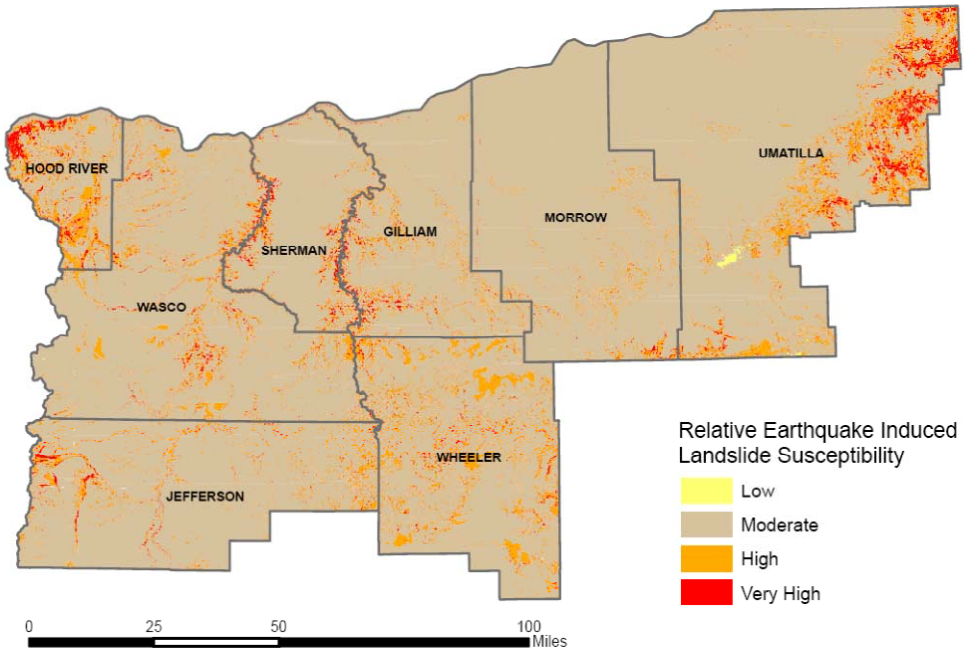
A way to view the general landslide susceptibility is by combining the slope with the relative strength of the underlying geologic material. This was done in Figure 13 for earthquake induced landslide susceptibility, which also displays the general landslide susceptibility of the region.

FIGURE 12. Compilation map of identified landslides from previous geologic and hazard maps in the region



Source: Burns, 2007

FIGURE 13. Map of the Relative Earthquake Induced Landslide Susceptibility Hazard



Source: Burns, 2007

History

Since the region has experienced landslides throughout geologic time and in historic time, it is likely the landslides will continue to occur in the future.

The Columbia River Gorge is known for its landslide topography, and many of the landslides are very ancient. Landslide / debris flow conditions are worsened by the same weather conditions that produce severe flooding throughout Oregon: rain-on-snow. In short, it is not uncommon in the Pacific Northwest for mild rainy conditions to follow an abundant snowfall. Such was the case in February 1996, when similar weather conditions produced over 700 landslides/ debris flows throughout the state. During that period three landslides closed Interstate Highway 84 along the Columbia River for a period of time.

Landslides / debris flows in Oregon were particularly noteworthy in 1964, 1982, 1966, 1996, and 1997. Research undertaken by the Oregon Department of Forestry has linked many of these landslides to weather and forest management practices (e.g., roads and harvesting); other research efforts have associated landslides with soil types (e.g., loess in the Blue Mountain region or marine sediments in the Columbia River Gorge) and underlying structure (i.e., type and attitude of rocks, etc.). No doubt all of these things are factors. The most universal link, however, appears to be precipitation, which is the basis of Oregon's debris flow warning system.

Most of Oregon's landslide damage has been associated with severe winter storms where landslide losses can exceed $100 million in direct damage such as the February 1996 event. Landslides in Oregon were particularly noteworthy in

1964, 1982, 1966, 1996, 1997, and 2006. Annual average maintenance and repair costs for landslides in Oregon are over $10 million.[6] During 1996 and 1997, heavier than normal rains caused thousands of landslides throughout Oregon of which roughly 9,500 were identified and added to a database. Some of these slides were the reactivation of ancient and historically active landslides and some were new failures.

TABLE 19. SIGNIFICANT LANDSLIDES

DATE	LOCATION	DESCRIPTION
2005	Sherman and Wasco Counties	$35,000 in property damage estimate includes Jefferson County as well
2009	Hood River County	$78,571 in property damage

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

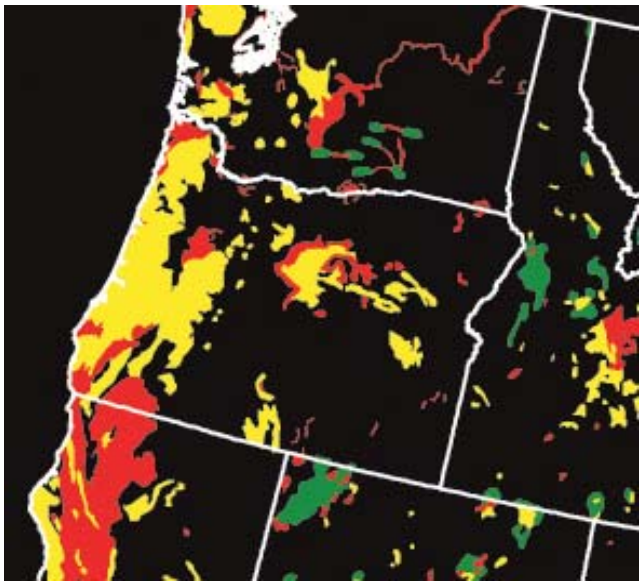
Probability

The probability of future landslides in the Mid-Columbia Gorge Region is moderate to high. The probability of an area to have a landslide is increased depending on the factors that reduce the stability without causing failure (previously discussed). When several of these factors are combined, such as an area with steep slopes, weak geologic material, and previous landslide movement, the probability of future landsliding is increased. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows).

The USGS National Landslide Hazard Map (Figure 14) shows significant portions of the region in a low to moderate landslide potential zone with some isolated areas in the moderate and high potential categories.

[6] Wang and Chaker, 2004. Geologic Hazards Study for the Columbia River Transportation Corridor. Oregon Department of Geology and Mineral Industries Open File Report OFR O-04-08.

FIGURE 14. USGS National Landslide Hazard Map of Landslide Potential



Source: U.S. Geological Survey Fact Sheet 2005-3156, Landslide Hazards—A National Threat

Note: Red areas have very high potential, yellow areas have high potential, and green areas have moderate potential. Landslides can and do occur in the black areas, but the potential is low.

The probability that Region 5 will experience landslides is depicted in Table 20 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 20. Probability Assessment of Landslides

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	-	M	H	M	-	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

The Mid-Columbia Gorge Region is moderate to highly vulnerable to landslide hazards. Most of the people and infrastructure are along the I-84 corridor which runs along the northern portion of the region. This multimodal transportation corridor is vital to Oregon's economy and includes a major Interstate Highway, I-84, two transcontinental rail lines, Union Pacific and Burlington Northern Santa Fe, the Columbia River inland water navigation, major electric power and gas lines, and communication conduits. In a study by Wang and Chaker in 2004, they found that roughly $14 billion worth of goods are carried through the corridor each year.[7]

Many parts of Oregon, including this region are susceptible to landslides, particularly in the portions with moderate to steep slopes and a wet climate. Landslides pose significant threats to people and infrastructure. Landslides have caused damage and loss in the region and it is very likely that they will again. As population growth continues to expand and development on steeper terrain occurs, greater losses from landslides are likely to result. The level of risk from landslides can be determined through the comparison of the overlap of hazard and exposure.

Preliminary analyses indicate a high likelihood of damage and losses from future landslides in the region. Action should be taken to reduce the damage and losses through pre-disaster mitigation and prepare for effective emergency response after the disaster. Special action should be taken for critical facilities including schools and emergency facilities and infrastructure such as roadways.

The region's vulnerability to landslides is depicted in Table 21 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 21. Vulnerability Assessment of Landslides

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	-	M	M	M	-	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

[7] Wang and Chaker, 2004. Geologic Hazards Study for the Columbia River Transportation Corridor. Oregon Department of Geology and Mineral Industries Open File Report OFR O-04-08.

VOLCANO-RELATED HAZARDS

Characteristics

The western boundary of the region coincides with the Cascade Range, which are mountains derived from volcanic activity. Within this range of mountains are several active and potentially active volcanoes. Mount Saint Helens is an active volcano in this chain, which erupted violently in 1980 and began to erupt steam and ash again during fall 2004 and spring 2005. Mt Hood, Mt. Jefferson, and Mt. Adams are all potentially active volcanoes close to the region.

Volcanic activity can produce many types of hazardous events including landslides, fallout of tephra (volcanic ash), lahars, pyroclastic flows, and lava flows.[8] Pyroclastic flows are fluid mixtures of hot rock fragments, ash, and gases that can move down the flanks of volcanoes at speeds of 50 to more than 150 kilometers per hour (30 to 90 miles per hour).[9] Lahars or volcanic debris flows are water-saturated mixtures of soil and rock fragments and can travel very long distances (over 100 km) and travel as fast as 80 kilometers per hour (50 miles per hour) in steep channels close to a volcano.[10] These hazards can affect very small local zones (only meters across) to areas hundreds of kilometers downwind.[11]

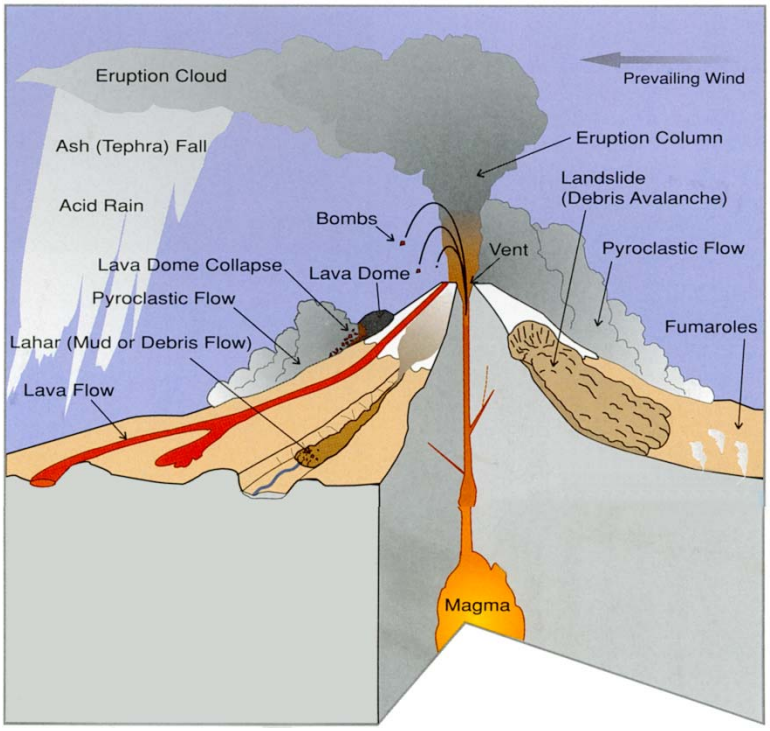
[8] W.E. Scott, R.M. Iverson, S.P. Schilling, and B.J. Fischer, *2001. Volcano Hazards in the Three Sisters Region, Oregon:* U.S. Geological Survey Open-File Report 99-437, 14p.

[9] W.E. Scott, R.M. Iverson, S.P. Schilling, and B.J. Fischer, *2001. Volcano Hazards in the Three Sisters Region, Oregon:* U.S. Geological Survey Open-File Report 99-437, 14p.

[10] Scott, W.E., Gardner, C.A., Sherrod, D.R., Tilling, R.I., Lanphere, M.A., and Conrey, R.M., 1997, *Geologic History of Mount Hood Volcano, Oregon -- A Field-Trip Guidebook*: U.S. Geological Survey Open-File Report 97-263, 38p.

[11] Walder and others, 1999.

FIGURE 15. Volcanic Hazard From a Composite Type Volcano



Source: Scott and others, 2001.

The communities which are closer to the cone, such as the City of Hood River, are at risk from the proximal as well as the distal hazards, such as lahars and ash fall. The communities which are farther away, such as Pendleton, are only at risk from the distal hazards such as ash fall.

History

Mt. Hood's eruptive history can be traced to late Pleistocene times (15-30,000 years ago) and will no doubt continue. But the central question remains: When? The most recent series of events (1900-2000) consisted of small lahars and debris avalanches; Steam explosions and minor tephra falls occurred between 1856 and 1865. Mt. Hood's recent history also includes tephra falls, dome building, lahars, pyroclastic flows and steam explosions. These occurred about 200 years ago.

Figure 16. Notable Geologic Events Near Mt. Hood, Oregon

Text Version

Mount Hood, Oregon
Notable Geologic Events Near Mount Hood, Oregon
-- In the Past 50,000 Years --

-- Excerpt from: Scott, Gardner, Sherrod, Tilling, Lanphere, and Conrey, 1997, Geologic History of Mount Hood Volcano, Oregon -- A Field-Trip Guidebook: U.S. Geological Survey Open-File Report 97-263, p.7.

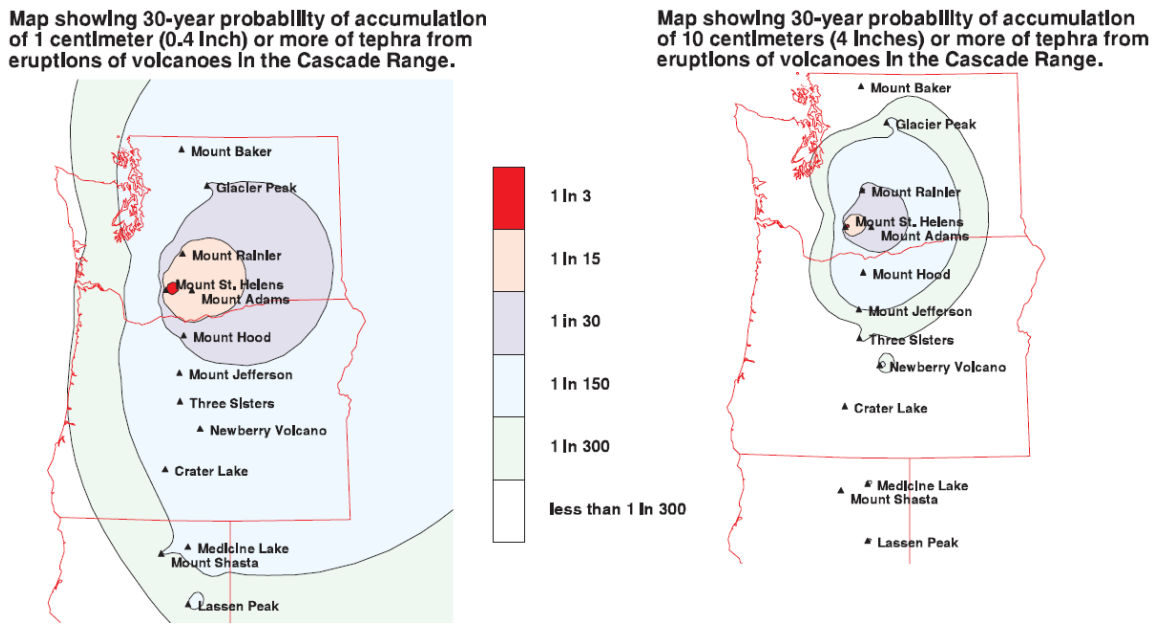
Date or Age	Event	Deposits
A.D. 1859, 1865, 1907?	Minor explosive eruptions of Mount Hood	Scattered pumice
late 19th century	Late neoglacial advance	Prominent, sharp-crested moraines
late 18th century	Old Maid eruptive period	Lava dome, pyroclastic-flow and lahar deposits, tephra
about 500 years ago	Debris flows in Zigzag River	Debris-flow deposits
1,000 years ago	Debris flows in upper Sandy River	Debris-flow deposits
1,500 years ago	Timberline eruptive period	Lava dome, pyroclastic-flow and lahar deposits, tephra
7,700 years ago	Eruptions from vent near Parkdale; Mount Mazama ashfall	Basaltic andesite of Parkdale lava flow; about 5 centimeters of Mazama ash
11-20,000 years ago	Waning phases of Evans Creek glaciation	Moraines
13-20,000 years ago	Polallie eruptive period	Lava domes, pyroclastic-flow and lahar deposits, tephra
20-25,000 years ago	Maximum of Evans Creek glaciation	Belts of moraines in most valleys
20-30,000 years ago	Mount Hood dome eruptions	Lava domes, pyroclastic-flow and lahar deposits
30(?)-50,000(?) years ago	Mount Hood lava-flow eruptions	Andesite lava flows of Cathedral Ridge and Tamanawas Falls

Source: Scott, W.E., Gardner, C.A., Sherrod, D.R., Tilling, R.I., Lanphere, M.A., and Conrey, R.M., 1997, Geologic History of Mount Hood Volcano, Oregon -- A Field-Trip Guidebook: U.S. Geological Survey Open-File Report 97-263, 38p.Scott, 1997.

Probability

Mt. St. Helens remains a probable source of air borne tephra. It has repeatedly produced voluminous amounts of this material and has erupted much more frequently in recent historic time than any other Cascade volcano. It blanketed Yakima and Spokane, Washington during the 1980 eruption and it continues to be a concern. The location, size and shape of the area affected by tephra fall are determined by the vigor, and duration of the eruption and the wind direction. Because wind direction and velocity vary with both time and altitude, it is impossible to predict the direction and speed of tephra transport more than a few hours in advance.

FIGURE 17. Probability of Tephra Accumulation



Source: W.E. Scott, R.M. Iverson, J.W. Vallance, and W. Hildreth, 1995

Voicano Hazards in the Mount Adams Region, Washington: U.S. Geological Survey Open-File Report 95-492

Geoscientists have provided some estimates of future activity in the vicinity of Crater Rock, a well-known feature on Mt. Hood. They estimate a 1 in 300 chance that some dome activity will take place in a 30-year period (1996-2026). For comparison, the 30-year probability of a house being damaged by fire in the United States is about 1 in 90.

The probability of 1 cm or more of tephra fall-out from eruptions anywhere in the Cascade Range, include:

- Gilliam County: 1 in 1,000
- Hood River County: Between 1 in 500 and 1 in 1,000
- Morrow County: 1 in 1,000
- Sherman County: 1 in 1,000
- Umatilla County: Between 1 in 1,000 and 1 in 5,000
- Wasco County: Between 1 in 500 and 1 in 1,000

The probability that Region 5 will experience volcano-related hazards is depicted in Table 22 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 22. Probability Assessment of Volcano-Related Hazards

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Probability	-	L	-	L	-	L

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

Region 5 is exposed to volcanic hazards. Most of the people and infrastructure are along the I-84 corridor which runs along the northern portion of the region. This multimodal transportation corridor is vital to Oregon's economy and includes a major Interstate Highway, I-84, two transcontinental rail lines, Union Pacific and Burlington Northern Santa Fe, the Columbia River inland water navigation, major electric power and gas lines, and communication conduits. In a study by Wang and Chaker in 2004, they found that roughly $14 billion worth of goods are carried through the corridor each year.[12]

The volcanic hazard in the region is reflected in the USGS volcanic hazard maps of Mt. Saint Helens, Mt. Hood, Mt. Jefferson, and Mt. Adams, which are all potentially active volcanoes close to the region. The regions total exposure for buildings and transportation systems alone is roughly 25 million dollars. The level of risk from volcanic hazards can be determined through the comparison of the overlap of hazard and exposure.

The region's vulnerability to volcano-related hazards is depicted in Table 23 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

[12] Wang and Chaker, 2004. Geologic Hazards Study for the Columbia River Transportation Corridor. Oregon Department of Geology and Mineral Industries Open File Report OFR O-04-08).

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 23. Vulnerability Assessment of Volcano-Related Hazards

	Gilliam	Hood River	Morrow	Sherman	Umatilla	Wasco
Vulnerability	-	L	-	L	-	L

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

WINDSTORMS

Characteristics and Brief History

Extreme winds are experienced in all of Oregon's eight regions. The most persistent high winds occur along the Oregon Coast and the Columbia River Gorge, so much so that these areas have special building code standards. All manufactured homes in Region 5 that are within 30 miles of the Columbia River must meet special anchoring (i.e., tie-down) standards (Section 307: Wind Resistance). High winds in this area of Oregon are legendary. The Columbia Gorge is the most significant east-west gap in the mountains between California and Canada. It serves as a funnel for east and west winds, where direction depends solely on the pressure gradient. Once set in motion, the winds can attain speeds of 80 mph, halt truck traffic, and damage a variety of structures and facilities. The average wind speed at Hood River is 13 mph, not much less than the notoriously windy Texas and Kansas plains whose wind speeds average 15 mph.[13]

An historic overview of windstorms affecting Region 5 is listed in Table 24.

Though their occurrence is somewhat less frequent, Region 5 has also experienced tornadoes. For the most part, these tornadoes have not resulted in major damages. Table 25, below, describes the history of tornadoes in the region.

[13] Taylor, George H. and Ray Hatton, 1999, *The Oregon Weather Book.*

Table 24. SIGNIFICANT WINDSTORMS

DATE	AFFECTED AREA	CHARACTERISTICS
Apr., 1931	N. Central Oregon	Unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
Dec., 1935	W. Columbia Gorge	Damage to automobiles. Wind gusts at 120 mph
Nov. 10-11, 1951	Statewide	Widespread damage; transmission and utility lines; Wind speed 40-60 mph; Gusts 75-80 mph
Dec., 1951	Statewide	Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
Dec., 1955	Statewide	Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines
Nov., 1958	Statewide	Wind speeds at 51 mph with 71 mph gusts. Every major highway blocked by fallen trees
Oct., 1962	Statewide	Columbus Day Storm; Oregon's most destructive storm to date. 116 mph winds in Willamette Valley. Estimated 84 houses destroyed, with 5,000 severely damaged. Total damage estimated at $170 million
Mar., 1971	Most of Oregon	Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane Co.
Nov., 1981	Statewide	Severe wind storm
Dec., 1987	Umatilla County	Damaging wind storm; 2 fatalities
Mar., 1991	Mid – Columbia / NE Oregon	Severe wind storm
Dec., 1991	N. Central Oregon	Severe wind storm; Blowing dust.
Jan., 1993	Northern Oregon	Severe wind storm. Damage to utilities
Dec., 1995	Statewide	Severe wind storm. Widespread Damage
Oct., 2003	Umatilla County	$1,000 in property damage
Jan., 2004	Morrow, Umatilla Counties	$2,500 in property damage
Feb., 2004	Umatilla County	$3,000 in property damage *damage estimate includes Jefferson County
April, 2004	Hood River County	$25,000 in property damage
Apr., 2004	Wasco County	$1,000 in property damage

Source: Taylor, George H., and Ray Hatton, 1999, The Oregon Weather Book, p.151-157; and FEMA-1405-DR-OR, February 7, 2002, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon. and Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org and U.S. Department of Commerce. National Climatic Data Center. Available from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

Table 24. SIGNIFICANT WINDSTORMS (con't.)

DATE	AFFECTED AREA	CHARACTERISTICS
Oct., 2004	Gilliam, Morrow, Umatilla Counties	$333.33 in property damage
Dec., 2004	Gilliam, Morrow, Umatilla Counties	$166.66 in property damage
Dec., 2004	Sherman, Wasco Counties	$3,333.33 * damage estimate includes Jefferson County
Feb., 2005	Gilliam, Morrow, Umatilla Counties	$3,000 in property damage
Mar., 2005	Sherman, Wasco Counties	$2,500 in property damage *damage estimate includes Jefferson County
Nov., 2005	Umatilla County	$400 in property damage.
April, 2006	Umatilla County	$10,000 in property damage in Hermiston
May, 2006	Morrow County	$500,000 in property damage with a high wind gust measured at 117 mph. $1 million in crop damage.
May, 2006	Sherman County	$50,000 in property damage in Grass Valley. Winds ranged from 70 to 80 mph.
Nov. 2006	Morrow, Umatilla	$35,000 in property damage from 80 mph winds. Property damage also occurred in Union and Wallowa Counties, for a total storm damage of $70,000.
Jan., 2007	Gilliam, Morrow, Sherman, Wasco, Umatilla Counties	$5,000 in property damage from 64 mph winds. Damage estimate includes Jefferson County.
June 2008	Umatilla	Powerful windstorm with wind speeds at 58 mph caused $10,000 in damage to buildings in Pendleton.
June 2008	Morrow, Umatilla	Wind damage downed several trees and power lines, caused $250,000 in property damage and $100,000 crop damage in Morrow County, and $108,000 in property damage in Umatilla County.
July 2010	Umatilla	64 mph winds caused $40,000 in property damage in the Hermiston area.

Source: Taylor, George H., and Ray Hatton, 1999, The Oregon Weather Book, p.151-157; and FEMA-1405-DR-OR, February 7, 2002, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon. and Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org and U.S. Department of Commerce. National Climatic Data Center. Available from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

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TABLE 25. SIGNIFICANT TORNADOES

DATE	LOCATION	RESULT
June, 1888	Morrow County (Lexington, Sand Hill, Pine City)	30 buildings, including two schools destroyed. Six people killed (including two children); 4 people injured
April , 1925	Gilliam County	Warehouse and automobiles destroyed in Condon. About $10,000 in damages
April , 1957	Gilliam and Morrow Counties	Minor damage (rangeland)
April, 1970	Wasco County	Observed. No damage
May, 1991	Umatilla County	Some damage to wheat fields
July, 1995	Umatilla County	Some damage to wheat fields
May 2006	Morrow County	$20,000 in property damage, F1 intensity.
May 2009	Umatilla	$50,000 in property damage, F1 intensity

Source: Taylor, George Source: Taylor, George H., and and Ray Hatton, 1999, The Oregon Weather Book, pp. 130-136. U.S. Department of Commerce. National Climatic Data Center. Available from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Probability

High windstorms occur yearly. More destructive storms occur once or twice per decade. High wind events on the order of the 1962 Columbus Day storm are thought to have a 100-year recurrence interval.

The probability that Region 5 will experience windstorms is depicted in Table 26 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 26. Probability Assessment of Windstorms

	Gilliam	Hood River*	Morrow	Sherman	Umatilla*	Wasco*
Probability	-	H	M	-	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

*Probability and vulnerability scores combine winter storm and wind storm.

Vulnerability

Many buildings, utilities, and transportation systems within Region 5 are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It also is true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels where trees have been planted or left for aesthetic purposes. Structures most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair. The Oregon Department of Administrative Service's inventory of state-owned and operated buildings includes an assessment of roof conditions as well as the overall condition of the structure. Oregon Emergency Management has arranged this information by county.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, up-rooted or shattered trees can down power and/or utility lines and effectively bring local economic activity and other essential facilities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Uprooted trees growing next to a house have destroyed roofs when they fall as a result of windstorms. In some situations, strategic pruning may be the answer. Prudent counties will work with utility companies in identifying problem areas and establishing a tree maintenance and removal program.

The region's vulnerability to windstorms is depicted in Table 27 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 27. Vulnerability Assessment of Windstorms

	Gilliam	Hood River*	Morrow	Sherman	Umatilla *	Wasco *
Vulnerability	-	H	M	-	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

*Probability and vulnerability scores combine winter storm and wind storm.

WINTERSTORMS

Characteristics and Brief History

Within the State of Oregon, Region 5 communities are known for cold winter conditions. This is advantageous in at least one respect: in general, the region is prepared, and those visiting the region during the winter usually come prepared. However, there are occasions when preparation cannot meet the challenge.

Drifting, blowing snow has brought highway traffic to a standstill. Also, windy and icy conditions have closed Oregon's principal east-west transportation route, Interstate Highway 84, for hours. In these situations, travelers must seek accommodations --- sometimes in communities where lodging is very limited. And local residents also experience problems. During the winter, heat, food, and the care of livestock are everyday concerns. Access to farms and ranches can be extremely difficult and present a serious challenge to local emergency managers. Table 28 provides an historic overview of severe winter conditions within Region 5.

TABLE 28. SIGNIFICANT WINTERSTORMS

DATE	LOCATION	REMARKS
Dec., 1861	Entire state	Storm produced between 1 and 3 feet of snow throughout Oregon
Dec., 1884	Columbia Basin	Heavy snowfall. The Dalles received 29.5 inches in one day.
Dec., 1885	Wasco County	Most snow ever recorded (6-10 feet). Trains had difficulty reaching Portland.
Dec., 1892	Northern counties	Between 15 and 30 inches of snow fell throughout the northern counties
Jan., 1916	Entire state	Two storms. Very heavy snowfall, especially in mountainous areas
Jan., Feb., 1937	Entire state	Deep snow drifts
Jan., 1950	Entire state	Record snow falls; Property damage throughout state.
Mar., 1960	Entire state	Many automobile accidents; Two fatalities
Jan., 1969	Entire state	Heavy snow throughout state
Jan., 1980	Entire State	Series of string storms across state. Many injuries and power outages.
Feb., 1985	Entire state	Two feet of snow in northeast mountains; Downed power lines. Fatalities
Feb., 1986	Central / Eastern Oregon	Heavy snow in Deschutes Basin. Traffic accidents; Broken power lines
Mar., 1988	Entire state	Strong winds; Heavy snow
Feb., 1990	Entire state	Heavy snow throughout state
Nov., 1993	Cascade Mountains	Heavy snow throughout region
Mar., 1994	Cascade Mountains	Heavy snow throughout region
Winter 1998-99	Entire state	One of the snowiest winters in Oregon history (Snowfall at Crater Lake: 586 inches)

Source: Taylor, George and Ray Hatton, 1999, The Oregon Weather Book, p.118-122.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

TABLE 28. SIGNIFICANT WINTERSTORMS (con't.)

DATE	LOCATION	REMARKS
Jan., 2005	Gilliam, Morrow, Umatilla Counties	33 injuries
Nov. 2006	Hood River County	Heavy freezing rain reported along all portions of I-84, closing the highway near Hood River.
Dec. 2006	Hood River County	Freezing rain and sleet caused ice conditions from Cascade Locks to Hood River, and black ice reported on I-84.
Jan. 2008	Hood River County	Heavy freezing rain reported from Bonneville westward through Columbia Gorge caused multiple accidents on I-84, killing one driver.

Source: Taylor, George and Ray Hatton, 1999, The Oregon Weather Book, p.118-122.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

Probability

The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods.

The probability that Region 5 will experience winterstorms is depicted in Table 29 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant concern. These cases are noted with a dash (-) in the table below.

TABLE 29. Probability Assessment of Winterstorms

	Gilliam	Hood River*	Morrow	Sherman	Umatilla *	Wasco *
Probability	-	H	M	-	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

*Probability scores combine winter storm and wind storm.

Vulnerability

The region's vulnerability to winterstorms is depicted in Table 30 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 30. Vulnerability Assessment of Winterstorms

	Gilliam	Hood River*	Morrow	Sherman	Umatilla *	Wasco *
Vulnerability	H	H	-	M	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

*Vulnerability scores combine winter storm and wind storm.

REGION 5

Mid-Columbia Region[1]

State Owned Building Inventory

[1] Gilliam, Hood River, Morrow, Sherman, Umatilla, and Wasco counties. Note: Jefferson and Wheeler County data is included in some of the DOGAMI-produced hazard maps.

Region 5: Mid-Columbia Gorge Region State Owned Building Inventory

Building Name	County	Replacement Value	Contents Value	Total Bldg Value	Usage	Earthquake		Fire/WUI		Flood		Landslide		Windstorms		Winterstorm	
						Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.
CAPTIVE BROODSTOCK BLDG	Hood River	2,200,000	250,000	2,450,000	FISH REARING	M	M	H	M	H	L	M	M	H	H	H	H
HATCHERY BLDG	Hood River	4,735,075	1,000,000	5,735,075	FISH HATCHERY	M	M	H	M	H	L	M	M	H	H	H	H
MECHANICAL	Hood River	2,377,517	330,000	2,707,517	MECHANICAL	M	M	H	M	H	L	M	M	H	H	H	H
Hood River ARMORY	Hood River	1,984,521	5,000	1,989,521	ARMORY	M	M	H	M	H	L	M	M	H	H	H	H
Bennett Pass Equip Shed	Hood River	696,211	348,105	1,044,316	Garage Service	M	M	H	M	H	L	M	M	H	H	H	H
Parkdale New Maint Station Bldg	Hood River	741,442	370,721	1,112,163	Maintenance Station Bldg	M	M	H	M	H	L	M	M	H	H	H	H
Cascade Locks POE Inspect Bldg	Hood River	1,191,713	595,856	1,787,569	Inspect Scale, Weigh Stat	M	M	H	M	H	L	M	M	H	H	H	H
HATCHERY	Morrow	1,075,680	200,000	1,275,680	FISH HATCHERY	L	H	H	M	H	H	H	M	M	M	M	-
Heppner Maint Station Bldg	Morrow	746,011	373,006	1,119,017	Maintenance Station Bldg	L	H	H	M	H	H	H	M	M	M	M	-
OMS	Umatilla	3,897,010		3,897,010	MAINTENANCE SHOP	H	M	H	M	H	M	-	-	H	H	H	H
HERMISTON ARMORY	Umatilla	3,837,273	0	3,837,273	ARMORY	H	M	H	M	H	M	-	-	H	H	H	H
MILTON-FREEWATER ARMORY	Umatilla	2,249,976	5,000	2,254,976	ARMORY	H	M	H	M	H	M	-	-	H	H	H	H
STORAGE BUILDING	Umatilla	1,964,900	59,369	2,024,269	CARPENTER SHOP/CLOTHING/AUTO SHOP	H	M	H	M	H	M	-	-	H	H	H	H
	Umatilla	11,000,000	520,861	11,520,861	PSYCHIATRIC CARE FACILITY	H	M	H	M	H	M	-	-	H	H	H	H
EMIGRANT	Umatilla	1,175,000	84,375	1,259,375	32-BED RESIDENTIAL	H	M	H	M	H	M	-	-	H	H	H	H
PENDLETON ST OFFICE BLDG (NEW)	Umatilla	3,382,341	18,000	3,400,341	OFFICE	H	M	H	M	H	M	-	-	H	H	H	H
PENDLETON ARMORY	Umatilla	5,308,245	14,787	5,323,032	ARMORY	H	M	H	M	H	M	-	-	H	H	H	H
PENDLETON LAASF	Umatilla	9,317,014	5,000	9,322,014	HANGAR	H	M	H	M	H	M	-	-	H	H	H	H
MAIN FACILITY	Umatilla	72,506,800	1,229,321	73,736,121		H	M	H	M	H	M	-	-	H	H	H	H
POWERHOUSE	Umatilla	1,417,600	42,970	1,460,570		H	M	H	M	H	M	-	-	H	H	H	H
SEGREGATION DORM	Umatilla	8,843,200	77,026	8,920,226		H	M	H	M	H	M	-	-	H	H	H	H
DINING FACILITY	Umatilla	2,114,400	298,617	2,413,017		H	M	H	M	H	M	-	-	H	H	H	H
LAUNDRY	Umatilla	1,881,075	236	1,881,311	INMATE LAUNDRY	H	M	H	M	H	M	-	-	H	H	H	H
CREATIVE ARTS SHOP	Umatilla	1,013,400	14,681	1,028,081	ARTS & CRAFTS	H	M	H	M	H	M	-	-	H	H	H	H
PHYSICAL PLANT	Umatilla	2,520,000	153,228	2,673,228	MAINTENANCE	H	M	H	M	H	M	-	-	H	H	H	H
MULTIPURPOSE	Umatilla	3,240,000	18,756	3,258,756		H	M	H	M	H	M	-	-	H	H	H	H
GARMENT FACTORY	Umatilla	8,225,000	0	8,225,000	DENIS PROD MANUFACTURING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 10	Umatilla	5,018,000	15,725	5,033,725	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 11	Umatilla	5,018,000	28,367	5,046,367	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 12	Umatilla	5,018,000	31,424	5,049,424	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 13	Umatilla	5,018,000	17,757	5,035,757	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 14	Umatilla	5,018,000	18,053	5,036,053	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 15	Umatilla	9,302,000	108,562	9,410,562	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
PHYSICAL PLANT BLDG	Umatilla	5,402,000	364,316	5,766,316	MAINTENANCE	H	M	H	M	H	M	-	-	H	H	H	H
FOOD SERVICE BLDG 17	Umatilla	4,668,000	661,990	5,329,990		H	M	H	M	H	M	-	-	H	H	H	H
INMATE PROCESSING BLDG 18	Umatilla	2,600,000	115,671	2,715,671		H	M	H	M	H	M	-	-	H	H	H	H
CORE OPERATIONS BLDG 19	Umatilla	2,768,000	62,112	2,830,112		H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 2	Umatilla	5,018,000	20,839	5,038,839	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
RELIGIOUS SERVICES	Umatilla	1,514,000	84,283	1,598,283		H	M	H	M	H	M	-	-	H	H	H	H
MEDICAL SERVICES	Umatilla	4,200,000	201,984	4,401,984		H	M	H	M	H	M	-	-	H	H	H	H
WORKFORCE BLDG	Umatilla	18,444,000	107,812	18,551,812		H	M	H	M	H	M	-	-	H	H	H	H
GATEHOUSE & SALLY PORT	Umatilla	1,272,000	463,248	1,735,248		H	M	H	M	H	M	-	-	H	H	H	H

Source: DAS data 2005

Region 5: Mid-Columbia Gorge Region State Owned Building Inventory

Building Name	County	Replacement Value	Contents Value	Total Bldg Value	Usage	Earthquake		Fire/WUI		Flood		Landslide		Windstorms		Winterstorm	
REGIONAL TRANSPORT	Umatilla	1,365,000	895,578	2,260,578		H	M	H	M	H	M	-	-	H	H	H	H
WAREHOUSE	Umatilla	3,200,000	144,627	3,344,627	STORAGE WAREHOUSE	H	M	H	M	H	M	-	-	H	H	H	H
MINIMUM HOUSING UNIT	Umatilla	3,143,875	49,319	3,193,194	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
ADMINISTRATION	Umatilla	4,552,100	681,987	5,234,087	OFFICE	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 3	Umatilla	5,018,000	33,001	5,051,001	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 4	Umatilla	5,018,000	24,885	5,042,885	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 5	Umatilla	5,018,000	18,384	5,036,384	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 6	Umatilla	5,018,000	16,239	5,034,239	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 7	Umatilla	5,018,000	32,920	5,050,920	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 8	Umatilla	5,018,000	25,642	5,043,642	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 9	Umatilla	5,018,000	17,722	5,035,722	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
GENERAL HOUSING UNIT 1	Umatilla	5,018,000	19,610	5,037,610	INMATE HOUSING	H	M	H	M	H	M	-	-	H	H	H	H
Meacham Maint Station Bldg	Umatilla	860,931	430,466	1,291,397	Maintenance Station Bldg	H	M	H	M	H	M	-	-	H	H	H	H
Hermiston New Maint Station Bldg	Umatilla	712,549	356,275	1,068,824	Maintenance Station Bldg	H	M	H	M	H	M	-	-	H	H	H	H
THE DALLES ARMORY	Wasco	1,880,863	5,000	1,885,863	ARMORY	M	M	H	M	H	L	M	M	H	H	H	H
OREGON VETERANS HOME	Wasco	14,500,000	1,100,000	15,600,000	NURSING HOME	M	M	H	M	H	L	M	M	H	H	H	H
THE DALLES SCREEN SHOP	Wasco	2,782,731	500,000	3,282,731	CONSTRUCTION OF SCREENS	M	M	H	M	H	L	M	M	H	H	H	H
THE DALLES MS DIST OFFICE	Wasco	913,654	456,827	1,370,481	OFFICE/ADMIN	M	M	H	M	H	L	M	M	H	H	H	H
THE DALLES MAINT STA BLDG	Wasco	1,115,562	557,781	1,673,343	MAINT STATION BLDG	M	M	H	M	H	L	M	M	H	H	H	H
Regional Totals		**163,674,265**	**7,668,406**	**171,342,671**													

Source: DAS data 2005