

Multnomah County *Multi-Jurisdictional* Natural Hazards Mitigation Plan

July 25, 2017



Prepared by:
Multnomah County Emergency Management

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021



FEMA

June 13, 2017

Ms. Angie Lane
State Hazard Mitigation Officer
Oregon Military Department
Office of Emergency Management
P.O. Box 14370
Salem, Oregon 97309

Dear Ms. Lane:

As requested, on June 6, 2017, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, completed a pre-adoption review of the ***Multnomah County Multi-Jurisdictional Natural Hazards Mitigation Plan***. This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by the communities. The plan successfully contains the required criteria, excluding the adoption, for hazard mitigation plans, as outlined in Code of Federal Regulation Title 44 Part 201.

Once FEMA approves the plan, the communities are eligible for mitigation project grants.

Please contact our Regional Mitigation Planning Program Manager, Brett Holt, at (425) 487-4553 with any questions.

Sincerely,

6/13/2017

X *Tamra Biasco*

Signed by: TAMRA D BIASCO

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

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Acknowledgements

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Chris Voss, Multnomah County Emergency Management
Christopher Blanchard, Multnomah County Emergency Management
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We appreciate the excellent work of Atkins North America, Inc., which developed **Annex I: Human-Caused and Technological Hazards Identification and Risk Assessment** for this plan.

Thank you, also, to the many others listed throughout the plan who provided data, technical support and guidance on best practices.

1 Introduction

Local hazard mitigation planning forms the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage after the next disaster. The plan creates a framework for risk-based decision-making to reduce future damages and losses to property, people and the economy.



1.1 What is Hazard Mitigation?

Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is taking action now — before the next disaster — to reduce human and financial consequences later. It is most effective when carried out on a comprehensive, community-wide, and long-term basis. Implementing coordinated mitigation activities over time is the best way to ensure that communities will be physically, socially and economically resilient to future hazard impacts (Federal Emergency Management Agency [FEMA], 2013a).

Hazard mitigation helps to build a more disaster-resilient community by reducing risk before and after a disaster. Often, damaging events occur in the same locations over time (e.g., flooding along rivers) and cause repeated damage. Because of this, hazard mitigation is often focused on reducing repetitive loss, thereby breaking the disaster cycle.

Hazard mitigation activities can reduce existing risks (e.g., relocating a structure out of a floodplain) and ensure future development is not vulnerable to hazards (e.g., restricting new development in a floodplain). Involving stakeholders from a wide range of disciplines and perspectives in the mitigation planning process ensures plans are aligned. Likewise, integrating hazard mitigation into other planning efforts (e.g., comprehensive plans, climate adaptation plans and capital improvement plans) further supports long-term community resilience.

1.2 Purpose

A mitigation plan demonstrates the participating communities' commitment to reduce risks from hazards. It also serves as a strategic guide for decision-makers as they commit resources. In addition, each jurisdiction that adopts a FEMA-approved Natural Hazards Mitigation Plan (NHMP) is eligible to receive federal hazard mitigation funding assistance (FEMA, 2013b).

This plan has been developed to meet the needs of stakeholders and represents our communities' priorities and vulnerabilities. The NHMP Steering Committee ensures the plan meets federal requirements (44 CFR §201.6) for local mitigation plans and follows best practice guidance.

The planning process is as important as the plan itself. The process is stakeholder-driven and includes hazard identification and risk assessment leading to the development of a comprehensive mitigation strategy for reducing risks to life and property. Key to the process is continued plan implementation and maintenance.

1.3 Participating Jurisdictions

Local governments may choose to develop a single jurisdiction mitigation plan or participate in a multi-jurisdictional mitigation plan. For the first time, Multnomah County and the cities of Fairview, Gresham, Troutdale and Wood Village have collaborated on a multi-jurisdictional plan. Previously, each of these jurisdictions had developed single-jurisdiction plans. Merging planning efforts resulted in format and content changes to the plan and organizational changes to the steering committee. See section **5.1 Developing the Plan** for a description of the plan update process and changes made during this update. Merging plans allowed the jurisdictions to plan cooperatively while meeting the following requirements (44 CFR §201.6(c)):

- The **Hazard Identification and Risk Assessment** addresses variations of each jurisdiction's level of risk.
- The **Mitigation Strategy** includes action items specific to each jurisdiction.
- Each jurisdiction formally adopts the plan.

The City of Portland has a standalone Mitigation Action Plan (MAP) that is being updated concurrent to this plan update. Though the Multnomah County Multi-Jurisdictional NHMP does not include information about Portland's hazards and risk, project managers for both plans have been involved in each other's steering committees. The result is a coordination of data, planning processes and mitigation strategies to ensure regional alignment of hazard awareness and mitigation strategies. See section **5.1 Developing the Plan** for more information on regional mitigation collaboration.

1.4 Roles and Responsibilities

Resilience depends on the whole community — individuals, families, and households; communities; nongovernmental organizations; private-sector entities; local governments; regional agencies; state governments; and the federal government. Inclusiveness and partnership across the whole community ensures the best use of available knowledge, resources and efforts (FEMA, 2013a). The result is a comprehensive mitigation program that is integrated throughout the community. Some ways the whole community enhances mitigation planning include:

- **Individuals, Families and Households:** Mitigation begins with individual awareness and action. Many mitigation activities, such as making safety improvements to your home and maintaining insurance coverage, require individuals to take initiative and invest in risk reduction if they have the means to do so.
- **Communities/Neighborhoods:** Communities provide opportunities for sharing local hazard information, promoting collective action, and providing realistic perspective on what mitigation actions work for that particular group. They have the ability to promote and implement mitigation activities without necessarily holding a formal position of authority.

Benefits of a Multi-Jurisdictional Plan

Improves communication and coordination among jurisdictions and other regional entities

Enables comprehensive mitigation approaches to reduce risks that affect multiple jurisdictions

Maximizes economies of scale by leveraging individual capabilities and sharing costs and resources

Avoids duplication of efforts

Provides an organizational structure that local jurisdictions may find supportive

— *Beyond Basics, no date*

- **Nongovernmental Organizations (NGOs):** NGOs — including voluntary organizations, faith-based organizations, national and professional associations, and educational institutions — can represent a wide cross section of priorities and values. NGOs often represent populations who historically have been underserved or underrepresented in emergency management planning processes and disproportionately impacted by disasters. Bringing these perspectives to the planning table is one step toward developing a plan that is equitable for everyone impacted by hazards and by the plan itself.
- **Private Sector:** Mitigation is a sound business practice that enables a reduction in disaster losses and a quicker restoration of normal operations. Private-sector investments in continuity and vulnerability reduction have broad benefits by helping to sustain economic vitality and ensuring the continued delivery of goods and services in the aftermath of a disaster.
- **Local and Regional Governments:** Local and regional governments work to protect the health, safety and welfare of the people and property they represent. They assess risk, develop strategies, and implement projects to reduce risk. Local and regional governments also develop community plans, regulate development, and construct and maintain infrastructure, which can greatly influence the resilience of a community.
- **State Government:** State government can promote resilience through its legislative bodies by implementing legislation that facilitates mitigation at the local level, such as laws governing local land use, development decisions and building codes. Several state departments develop hazard data at the local, regional and state level that inform emergency management decisions across the Disaster Cycle. The state also updates the Oregon NHMP, which assesses risk at state and local levels, determines statewide mitigation goals and objectives, and prioritizes mitigation actions to reduce risk. Several state departments provide technical assistance for hazard mitigation. Furthermore, the state is the conduit for federal hazard mitigation grants.
- **Federal Government:** The Federal Emergency Management Agency (FEMA) coordinates federal mitigation policy and determines the effectiveness of mitigation capabilities across the nation. FEMA provides guidance for and approves state and local Hazard Mitigation Plans and administers mitigation funding assistance. Many other federal agencies also play a role in hazard mitigation, from setting national policy to providing funding. For example, the Department of Housing and Urban Development has been integral to many risk reduction initiatives through the use of Community Block Grants.

1.5 How the Plan Is Organized

Each section of the plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing the citizens, businesses and the environment in the five participating jurisdictions: unincorporated Multnomah County and the cities of Fairview, Gresham, Troutdale and Wood Village. Throughout this plan, these jurisdictions are referred to as the *Planning Area*.

The sections work together to create a mitigation plan that furthers the Planning Area's ability to foster a disaster-resilient community. This plan structure enables stakeholders to use the section(s) of interest to them.

- **1 Introduction** briefly defines mitigation and the purpose of an NHMP. This section also defines the Planning Area, and the roles and responsibilities of the whole community in developing a comprehensive mitigation plan.

- **2 Community Profile** describes the Planning Area’s trends in geography, environment, demography, economy, housing, transportation, utilities, historic and cultural resources, critical facilities and infrastructure, land use and development, and community connectivity. Trends identified in this section indicate the people and places more likely than others to experience greater impacts from natural hazards.
- **3 Hazard Identification and Risk Assessment** describes the risk assessment process and summarizes best available hazard data. It is organized according to federal requirements for a risk assessment: hazard overview, history, probability and vulnerability. In this section, hazards and risk that are common to all jurisdictions in the Planning Area and those that are unique to each jurisdiction are described.
- **4 Mitigation Strategy** defines the mitigation vision, goals and objectives for the Planning Area. This section also includes a list of mitigation actions prioritized by each jurisdiction, and articulates how each action may be funded and implemented.
- **5 Planning Process** explains how the plan was developed, who was involved — including public participation — and how the plan will be maintained during the five-year update cycle.

1.6 References

Beyond the Basics: Best Practices in Local Mitigation Planning. (no date). Retrieved from <http://mitigationguide.org/about-us/>

Federal Emergency Management Agency (FEMA). (2013a, May). National Mitigation Framework. Retrieved from <https://www.fema.gov/national-mitigation-framework>

FEMA. (2013b, August 19). Restrictions on Grant Obligations to State, Tribal, and Local Governments without a Federal Emergency Management Agency (FEMA)-approved Mitigation Plan. Federal Insurance and Mitigation Administration (FIMA) Policy. FP 306-112-1.

2 Community Profile

People and places are not equally affected by natural hazards. People with more economic, social or political capital are likely to better withstand disaster events and to bounce back more quickly. Structures outside hazard areas and constructed to higher building standards are more resilient¹ to natural hazards. Looking at our community through the lens of equity — how people and places are differently situated — increases our understanding of the disproportionate vulnerability² to hazards across the Planning Area.

*The **Community Profile** takes a closer look at trends in geography, environment, demography, economy, housing, transportation, utilities, historic and cultural resources, critical facilities and infrastructure, land use and development, and community connectivity. The trends indicate that some people and places are more likely than others to experience greater impacts from natural hazards. These vulnerability trends ultimately inform the mitigation strategy.*

A Note About Data in the Community Profile

While this plan does not include the City of Portland overall, some data for the Community Profile was available only at the Multnomah County level, which includes the City of Portland. As such, for consistency, the Community Profile includes data for all unincorporated areas and cities within the county, including the City of Portland. When available, data are categorized by each city and unincorporated area. Census data for the county's unincorporated areas are divided into these Rural Planning Areas: West Hills, Sauvie Island & West Hills, West of Sandy River, and East of Sandy River.

2.1 Political and Physical Geography

2.1.1 Geopolitical Boundaries

Multnomah County was created on December 24, 1854, from the eastern part of Washington County and the northern part of Clackamas County. Multnomah County is bordered by Columbia County and the Columbia River on the north, Hood River County on the east, Clackamas County on the south, and Washington County on the west. Multnomah is the smallest county in Oregon, with a total area of 466 square miles.

Multnomah County contains six incorporated cities (Portland, Gresham, Maywood Park, Fairview, Wood Village and Troutdale) and part of a seventh city, Lake Oswego, which is predominantly in Clackamas County. Portland and Gresham are the first and fourth largest cities in Oregon, respectively. The county

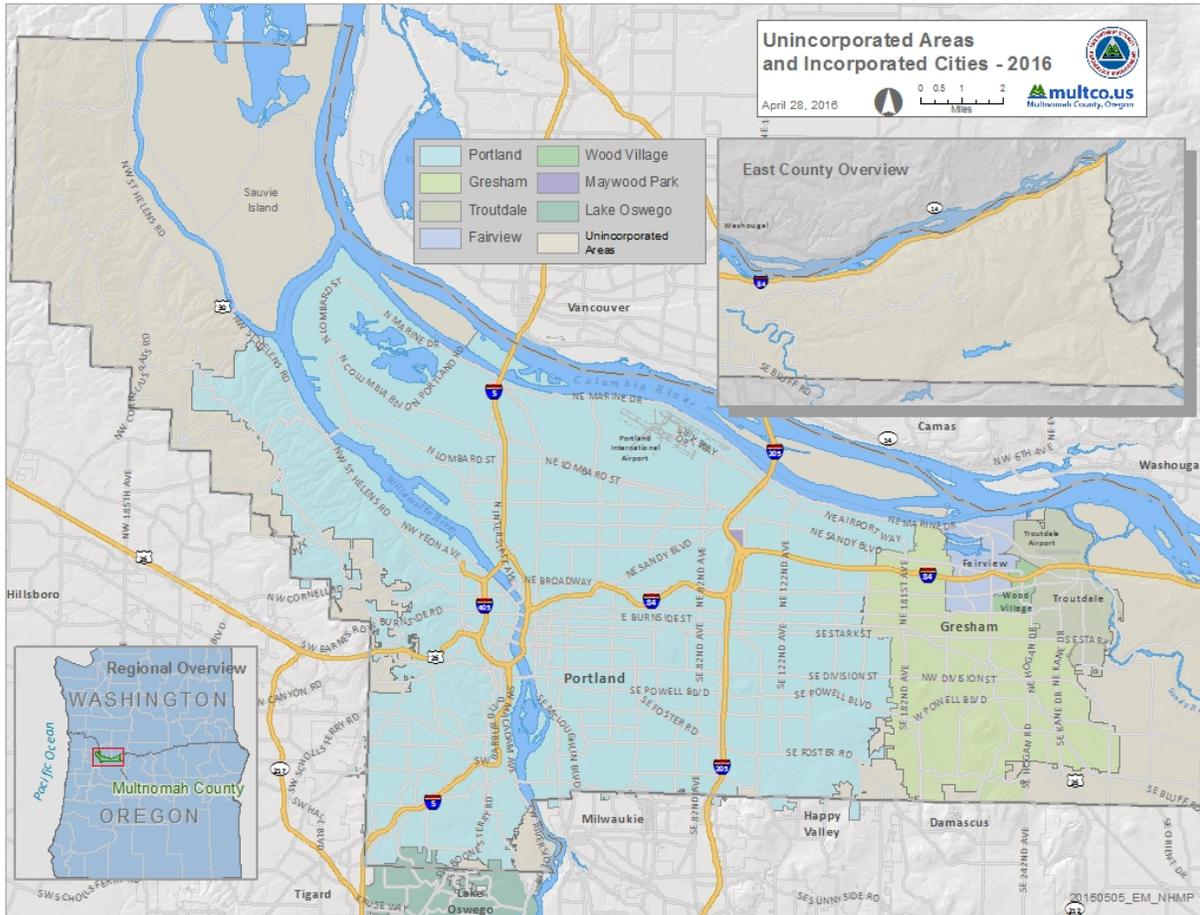
¹ Resilience is essentially the flip side of vulnerability. It is the ability to “survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it” (The Rockefeller Foundation, no date).

² Vulnerability is the degree to which people, property, resources, systems and cultural, economic, environmental and social activity is subject to harm, degradation or destruction. (PBEM, 2012)

also contains large unincorporated areas in the northwest and eastern parts of the county. **Figure 2.1-1** shows the locations of the cities and the unincorporated portions of the county, which are divided into Rural Planning Areas. The year of incorporation and area occupied by cities covered in this plan include:

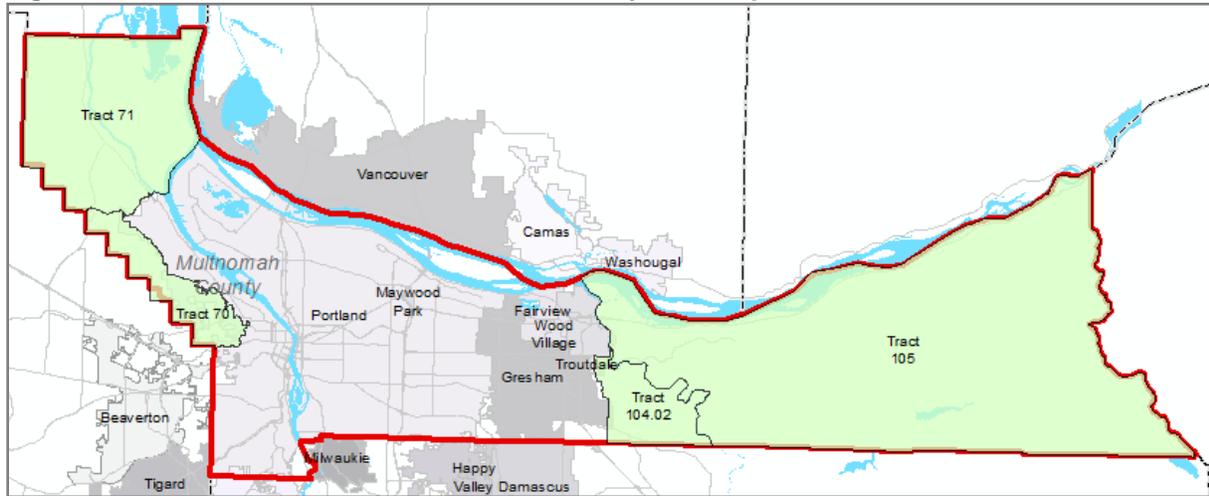
- Gresham, incorporated in 1905, is 23.4 square miles
- Troutdale, incorporated in 1907, is 5.0 square miles
- Fairview, incorporated in 1908, is 3.5 square miles
- Wood Village, incorporated in 1951, is 1.0 square mile

Figure 2.1-1: Multnomah County Incorporated Cities and Unincorporated Areas



Source: Multnomah County, 2016

Because the unincorporated area of the county is made up of distinct community areas, this analysis reports demographic data to align as closely as possible to the county’s Rural Planning Area boundaries. The census tract is the smallest geographic unit at which the majority of the demographic data is available. The following census geographies are used, as shown in **Figure 2.1-2**: West Hills = Tract 70; Sauvie Island & West Hills = Tract 71; West of Sandy River = Tract 104.02; and East of Sandy River = Tract 105.

Figure 2.1-2: Census Tracts for Multnomah County Unincorporated Areas

Source: U.S. Census Bureau

2.1.2 Geography and Geology

The topography of Multnomah County varies from flat to gently hilly terrain along the Willamette River and along the lower reaches of the Columbia River, to hilly in Portland's West Hills. Much of eastern Multnomah County from the Sandy River watershed eastward is hilly to mountainous. The highest location in Multnomah County is Buck's Peak, near Lost Lake, with an elevation of 4,751 feet. Areas with steep slopes may be susceptible to landslides. See **3.3 Landslide** for more information about steep slopes. The vegetation and trees in these areas may also make them more vulnerable to wildfires. See section **3.6 Wildfire** for more information.

Multnomah County is located in a geologically active area. There are several active earthquake faults within the county and many other faults nearby, including the Cascadia Subduction Zone. A Cascadia Subduction Zone earthquake of a magnitude of 8.0 or higher is projected for the Pacific Northwest, and its impact will be catastrophic. The county also is close to active volcanoes, including Mount Hood in Clackamas County, Oregon, and Mt. St. Helens in Washington State. Earthquakes and volcanic hazards are addressed in sections **3.1** and **3.5** respectively.

The two major rivers in Multnomah County are the Columbia River, which forms much of the northern boundary of the county, and the Willamette River, which flows through Portland. There are levees on the Columbia River that protect the area from most flooding. The levees are in Multnomah County and are maintained by the Multnomah County Drainage District.

The Sandy River, a tributary of the Columbia River, is another significant river in the county. There are floodplains mapped by the Federal Emergency Management Agency (FEMA) along these three rivers, as well as along many smaller streams. See **3.2. Flood** for more information about floodplain maps.

There are several small lakes in the county, including Blue Lake, Fairview Lake, Fairview Creek and its tributaries, Salish Ponds, Sturgeon, and Bybee and Smith Lakes, which are remnants of old channels of the Columbia River.

2.1.3 Climate

The climate across Multnomah County is moderate, and generally consists of wet winters and dry summers. Several climactic factors contribute to hazard vulnerability in Multnomah County, particularly during the wet winter months. Heavy winter rains can result in flooding and contribute to landslide vulnerability. Cold snaps can result in ice and snowstorms. High winds often accompany winter storms. All of these climactic events are regional in nature, typically affecting all of Multnomah County.

Temperature and Precipitation

Temperature and precipitation vary significantly across the county, depending on elevation. Higher elevations have lower temperatures and substantially higher precipitation. Mean daily temperatures range from highs around 81° Fahrenheit (F) and lows around 54° F in July and August to highs around 45° F and lows around 34° F in December and January.

Most of the precipitation falls between October and May (personal communication with Tyree Wilde, National Weather Service, 2016). **Table 2.1-1** shows average annual precipitation ranges from about 37 to 45 inches. However, parts of the West Hills may average 70 inches, and high elevations in eastern Multnomah County may average 150 inches. Precipitation is significantly higher in the West Hills and the high elevation areas in eastern Multnomah County than in the lower elevation areas within the Willamette and Columbia River valleys. Monthly precipitation averages vary from about 6 to 7 inches in November through January to about 0.75 inches in July. See **3.4 Severe Weather** for additional information about precipitation.

Table 2.1-1: Precipitation in Multnomah County

Location	Average Annual Precipitation (inches)	Period of Record	Lowest Annual Precipitation (inches)	Highest Annual Precipitation (inches)	Period of Record
Portland Airport (Portland WFSO station 356751)	37.53	11/1/1941 to 12/31/2005	22.48	63.20	1940-2015
Troutdale Airport (Troutdale station 358654)	44.68	7/1/1948 to 12/31/2005	29.52	66.43	1948-2015

Source: Western Regional Climate Center, no date; Tyree Wilde, National Weather Service, 2016

Snow

On average, the region experiences only five days per year of measurable snow. While snow is relatively rare in western Oregon, the Columbia Gorge provides a low-level passage through the mountains. Cold air, which lies east of the Cascades, often moves westward through the gorge and funnels cold air into the area. If a wet Pacific storm reaches the area at the same time as cold westward winds from the gorge, significant snows storms, and even ice storms, may result (Taylor and Hannan, 1999). Ice storms can take the form of freezing rain, sleet, and hail (Taylor and Hannan, 1999).

Average annual snowfall is about 5 inches, although many years have had no measurable snowfall. Snowfall is significantly higher in the West Hills and much higher in the high elevation areas in eastern Multnomah County. Section **3.4 Severe Weather** provides additional details on snow and ice.

Climate Change

According to the Oregon Natural Hazards Mitigation Plan (2015), the most reliable information on climate change is at the state level. Based on state-level data, hazards in Multnomah County projected to be impacted by climate change include drought, wildfire, flooding and landslides. Climate models project the following for areas within Multnomah County (Oregon Department of Land Conservation and Development [DLCD], 2015):

- Warmer drier summers and a decline in mean summer precipitation
- Decreases in mountain snowpack due to warmer winter temperatures
- Increased incidence of drought and wildfire
- More frequent flooding and landslides
- Increases in extreme precipitation for some areas
- Greater risk of flooding in certain basins, including an increased incidence of stronger floods occurring more frequently (increased magnitude and return interval)
- Increased incidence of landslides due to increased [extreme] rainfall events

There is little research on how climate change influences winter storms in the Pacific Northwest (DLCD, 2015).

Additional information about the projected impacts of climate change on individual hazards is found in each hazard risk assessment included in **3 Hazard Identification and Risk Assessment**.

2.2 Demography

2.2.1 Population

Multnomah County's estimated population for 2015 was 777,490 people, making it the most populated county in Oregon (**Table 2.2-1**). The county's population has grown at a more rapid rate in the past five years than the state as a whole. Other counties in the Portland metropolitan area, including Washington and Clackamas counties, also have had large increases in population (Population Research Center, 2015). About 56% of Multnomah County's population increase has been a natural increase (births minus deaths), while the remainder has been from net migration (Population Research Center, 2015). The Office of Economic Analysis (2013) forecasts Multnomah County will increase its population by another 38,500 people between 2015 and 2020, a 0.9% annual growth rate.

Table 2.2-1: Population and Estimated Change, 2010-2014/2015

	2010		2014/2015		Population Change 2010-2014/2015		Average Annual Growth Rate
	Population	% of County	Population	% of County	Population Change	Percent Change	
Oregon	3,831,074	-	4,013,845	-	182,771	4.8%	1.2%
Multnomah County	735,334	100%	777,490	100%	42,156	5.7%	1.4%
Incorporated	718,882	97.8%	750,040	96.5%	31,158	4.3%	1.1%
Fairview	8,920	1.2%	8,940	1.1%	20	0.2%	0.1%
Gresham	105,594	14.4%	107,065	13.8%	1,471	1.4%	0.3%
Maywood Park	752	0.1%	750	0.1%	-2	-0.3%	-0.1%
Portland	583,776	79.4%	613,355	78.9%	29,579	5.1%	1.2%
Troutdale	15,962	2.2%	16,020	2.1%	58	0.4%	0.1%
Wood Village	3,878	0.5%	3,910	0.5%	32	0.8%	0.2%
Unincorporated ¹	16,452	2.2%	27,450	3.5%	10,998	66.8%	18.6%
West Hills ²	8,181	1.1%	8,104	1.0%	-77	-0.9%	-0.3%
Sauvie Island & West Hills	2,759	0.4%	2,650	0.3%	-109	-4.0%	-1.3%
West of Sandy River	6,135	0.8%	6,181	0.8%	46	0.8%	0.2%
East of Sandy River	3,926	0.5%	4,308	0.6%	382	1.0%	2.3%

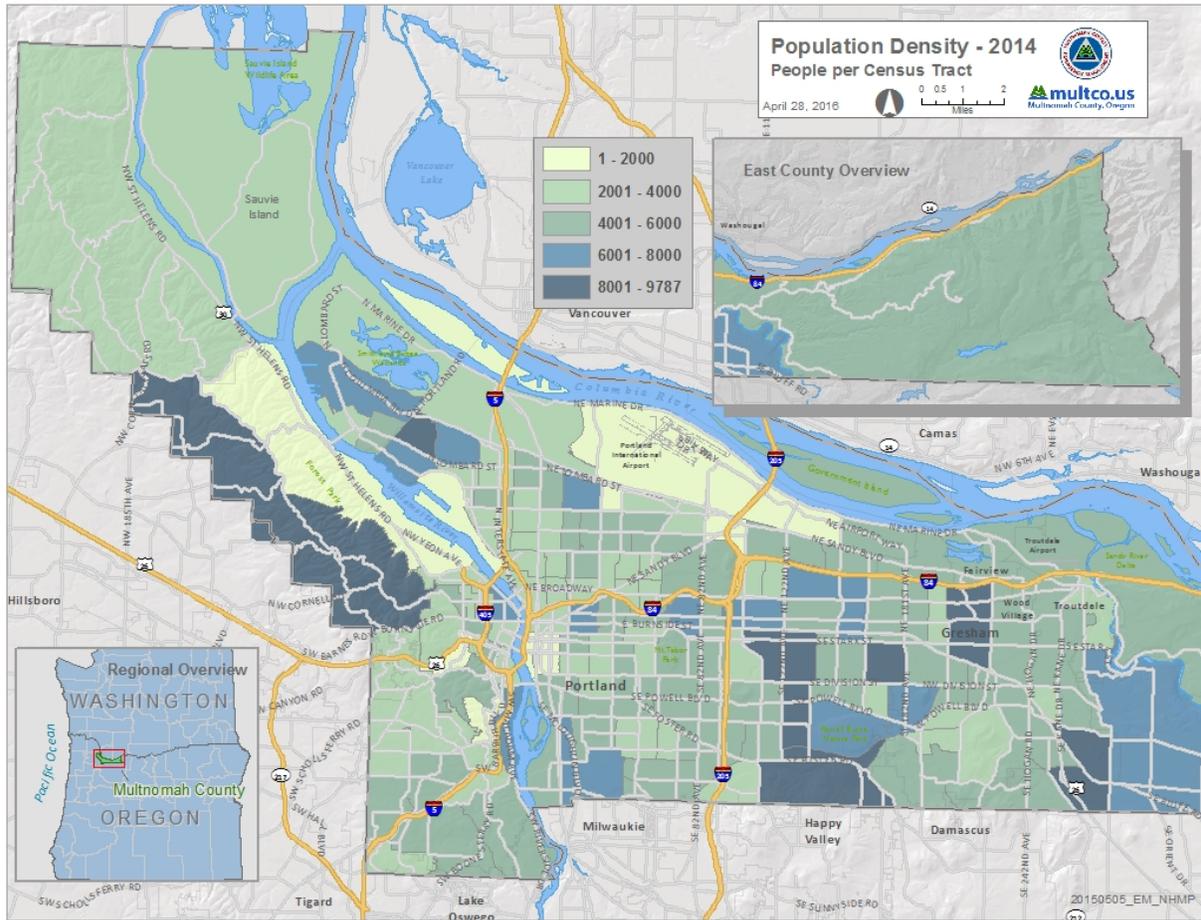
Source: U.S. Census Bureau, 2010 Census; U.S. Census Bureau, 2010-2014 American Community Survey, 5-Year Estimates (for West and East County subareas); Population Research Center Portland State University, Certified Population Estimates 2015.

The majority of Multnomah County's residents, approximately 96.5%, reside within incorporated cities. The most populated cities in Multnomah County are Portland (613,355) and Gresham (107,065). Approximately 29,620 people reside in the four smaller cities, Fairview, Maywood Park, Troutdale and Wood Village, and another 27,450 people live in unincorporated communities, which are defined by Rural Planning Areas (**Figure 2.2-1**).

¹ Unincorporated totals are calculated by subtracting incorporated totals from Multnomah County totals. The census tracts used to report data for the unincorporated Planning Areas overlap slightly with incorporated areas, resulting in overestimates of rural populations. The unincorporated Planning Areas as presented do not equal the unincorporated totals.

² Because the unincorporated area of the county is made up of distinct community areas, this analysis reports demographic data to align as closely as possible to the county's Rural Planning Area boundaries.

Figure 2.2-1: Total Population



Source: U.S. Census, 2014

2.2.2 Individuals Experiencing Homelessness

In 2015, Multnomah County conducted a study to count the number of individuals and families without shelter. The study found that 1,887 individuals were without shelter, 872 were sleeping in emergency shelters, and 1,042 were in transitional housing. Among these 3,801 individuals: 41% were people of color, 17% were families with children (including 369 children), 31% were women, 7% were youth ages 24 and younger, 12% were veterans, 57% had disabling conditions, and 46% were chronically homeless (Kristina Smock Consulting, 2015).

People experiencing homelessness have limited resources to evacuate, stockpile food, store medications and shelter in place. They also may lack access to mainstream modes of emergency notification (Edgington, 2009). The circumstances of homelessness also contribute to high rates of mental illness, addiction, and poor physical health (Edgington, 2009). People without shelter have likely had past exposure to traumatic events and therefore

“About 4,000 people sleep on the streets, in cars, in shelters or in temporary housing each night because they cannot afford a permanent place to live in Multnomah County.”

— Multnomah County and City of Portland’s Joint Office on Homeless Services, 2016

may be at higher risk of adverse psychological reactions following a disaster (Public Health Emergency, 2013). Mitigation planning for this population should include subject matter experts who provide services to people experiencing homeless.

2.2.3 Tourists

Multnomah County has the largest estimated overnight visitor volume of Oregon counties. Approximately one-third of tourist visits occur between July and September (Longwoods International, 2013). In 2014, 4.8 million people made a trip to Multnomah County that included an overnight stay (Dean Runyan Associates, 2015). A majority of those visits were spent in hotel/motel accommodations (3 million), while 1.7 million people stayed in a private home and another 137,000 stayed in other overnight accommodations (Dean Runyan Associates, 2015). The eastern portion of Multnomah County has seen larger increases in tourism from 2013 to 2014 than the western portion of the county (Dean Runyan Associates, 2015). The number of tourists in Multnomah County has been increasing steadily since 1991.

Tourists may not know about local hazards or emergency notification and response practices. They usually are not equipped with emergency supplies. As such, tourists can quickly become vulnerable in emergency situations.

2.2.4. Migrant and Seasonal Farm Workers

It is extremely difficult to estimate the number of migrant and seasonal farm workers at the county level, as the number of individuals employed in agricultural occupations changes each season. In addition, migrant and seasonal farm workers often are accompanied by family members and others. A recent study attempted to estimate the number of farm workers in Oregon. In Multnomah County, the study identified approximately 1,700 workers accompanied by 1,238 non-farm workers present in the household, for a total of 2,938 persons (Larson, 2013). Migrant and seasonal farm workers may be especially vulnerable to disasters for a number of reasons, including immigration status, limited English proficiency, low income and quality of housing. Like tourists, most migrant and seasonal workers may not be aware of local hazards and emergency notification and response practices, and may not have emergency supplies.

2.2.5 Daytime Population

Multnomah County is an employment center for the region. As such, many workers commute to the county from other areas. The 2013 American Community Survey estimated 465,290 workers in Multnomah County commute from a residence outside the county. People commuting to Multnomah County for work may be aware of the hazards in the area, but are unlikely to be travelling with emergency supplies.

2.2.6 Age

In Multnomah County, 20.1% of the population is under the age of 18 and 11.2% is 65 years or older (**Table 2.2-2**). By 2025, the percentages of children and elders are forecast to increase as follows: 22.8% of the population will be 18 years of age or younger and 16.4% will be 65 years or older (Office of Economic Analysis, 2013). Wood Village and Troutdale have a large percentage of the population under 18 years of age (30.7% and 27.4% respectively). Sauvie Island and the area east of the Sandy River have a high percentage of older residents and also high percentages of elders living alone.

Children and elders are the most vulnerable age groups in a disaster. Children can have difficulty coping with a disaster situation. Often communities have not planned for the resources necessary to care for children after a disaster. Many older adults have physical, sensory or cognitive challenges. This is

especially a concern for elders living alone. Family or neighbors might be less able to assist an elder during a crisis (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011).

Table 2.2-2: Children, Elders and Elders Living Alone

Community	Under 18 years	Percent of Total Population	65 years and older	Percent of Total Population	Householder living alone, 65 years and older	Percent of Total Households
Oregon	860,089	22.1%	582,273	14.9%	159,817	10.5%
Multnomah	152,034	20.1%	84,865	11.2%	26,818	8.7%
Fairview	2,033	22.4%	1,140	12.5%	288	7.5%
Gresham	27,550	25.5%	12,745	11.8%	3,608	9.4%
Maywood Park	178	19.9%	140	15.7%	32	8.7%
Portland	113,246	18.8%	66,043	11.0%	21,883	8.7%
Troutdale	4,480	27.4%	1,373	8.4%	236	4.1%
Wood Village	1,212	30.7%	307	7.8%	68	5.3%
Unincorporated Planning Areas						
West Hills	2,154	26.2%	934	11.3%	140	4.5%
Sauvie Island & West Hills	350	13.8%	448	17.7%	138	12.1%
West of Sandy River	1,427	23.1%	672	10.9%	201	9.2%
East of Sandy River	1,009	23.4%	731	17.0%	172	11.1%

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

2.2.7 Individuals with a Disability

Individuals with disabilities may require the assistance of others or special resources in a disaster. The American Community Survey estimates disability status based on the following six disability types:

- **Hearing difficulty:** Deaf or having serious difficulty hearing
- **Vision difficulty:** Blind or having serious difficulty seeing, even when wearing glasses
- **Cognitive difficulty:** Because of a physical, mental or emotional problem, having difficulty remembering, concentrating or making decisions
- **Ambulatory difficulty:** Having serious difficulty walking or climbing stairs
- **Self-care difficulty:** Having difficulty bathing or dressing
- **Independent living difficulty:** Because of a physical, mental or emotional problem, having difficulty doing errands alone such as visiting a doctor's office or shopping

Approximately 12.2% of the non-institutionalized population in Multnomah County has a disability (**Table 2.2-3**). Of the population 65 years and older, 39.1% have one or more disabilities. Notably, more than half the elderly population in Fairview, 536 people, have a disability. A small percentage of children within the county have a disability and a majority of those children reside in Portland and Gresham.

Table 2.2-3: Persons with a Disability

Community	Total Civilian Non-institutionalized	With a Disability	Percent of Total Population	Under 18 Years with a Disability	Percent Under 18 Years	65 Years and Over with a Disability	Percent of 65 Years and Over Population
Oregon	3,829,588	526,868	13.8%	38,775	4.5%	207,477	37.7%
Multnomah	741,593	90,223	12.2%	6,475	4.3%	31,015	39.1%
Incorporated	725,887	88,730	12.2%	6,359	4.3%	30,385	39.8%
Fairview	9,003	1,457	16.2%	91	4.1%	536	51.3%
Gresham	106,480	15,753	14.8%	1,781	6.4%	4,788	41.9%
Maywood Park	939	105	11.2%	12	5.6%	30	22.4%
Portland	589,506	68,974	11.7%	4,336	3.9%	24,300	39.0%
Troutdale	16,071	1,933	12.0%	88	2.2%	606	47.1%
Wood Village	3,888	508	13.1%	51	4.1%	125	48.6%
Unincorporated Planning Areas							
West Hills	8,104	360	4.4%	12	0.6%	154	19.7%
Sauvie Island & West Hills	2,650	236	8.9%	0	0.0%	84	19.4%
West of Sandy River	6,014	663	11.0%	25	1.8%	296	45.3%
East of Sandy River	4,538	637	14.0%	80	7.3%	220	33.1%

Source: U.S. Census Bureau, 2009-2013 American Community Survey 5-Year Estimates

The U.S. Department of Health and Human Services provides aggregated data on Medicare beneficiaries who rely on electricity-dependent medical and assistive equipment, such as ventilators or electric wheelchairs, and are therefore at increased risk from power outages. There are 3,740 persons in Multnomah County who are electricity-dependent. The east Portland area and Gresham have higher concentrations of individuals who rely on such medical and assistive equipment compared to other areas in the county (U.S. Department of Health and Human Services, no date).

2.2.8 Minority Status

The social and economic marginalization of certain racial and ethnic groups, including real estate discrimination, makes these populations more vulnerable at all stages of disaster (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). Historically, African Americans, Native Americans, and populations of Asian, Pacific Islander or Hispanic origin have been strongly correlated with higher vulnerability before and after disasters (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011).

In Multnomah County, the majority of the population, 78%, is white (**Table 2.2-4**). Asian and African American racial minority groups are the largest in the county, 6.8% and 5.7% respectively. The highest percentages of people of color reside in the county’s incorporated area, with Wood Village and Portland having the highest percent non-white population. Hispanic or Latino persons make up 10.9% of the county’s population. Wood Village has the highest percent of Hispanic/Latino persons, 34.6%, followed by Gresham, Fairview and Sauvie Island. (**Figure 2.2-2**)

The county’s racial and ethnic diversity has increased over the past decade. Between 2000 and 2011, the Latino population increased by 8% (Multnomah County Health Department, 2014). During this same time, the African American, Asian/Pacific Islander and American Indian/Alaska Native populations remained approximately the same size. Conversely, the non-Latino white population decreased (Multnomah County Health Department, 2014).

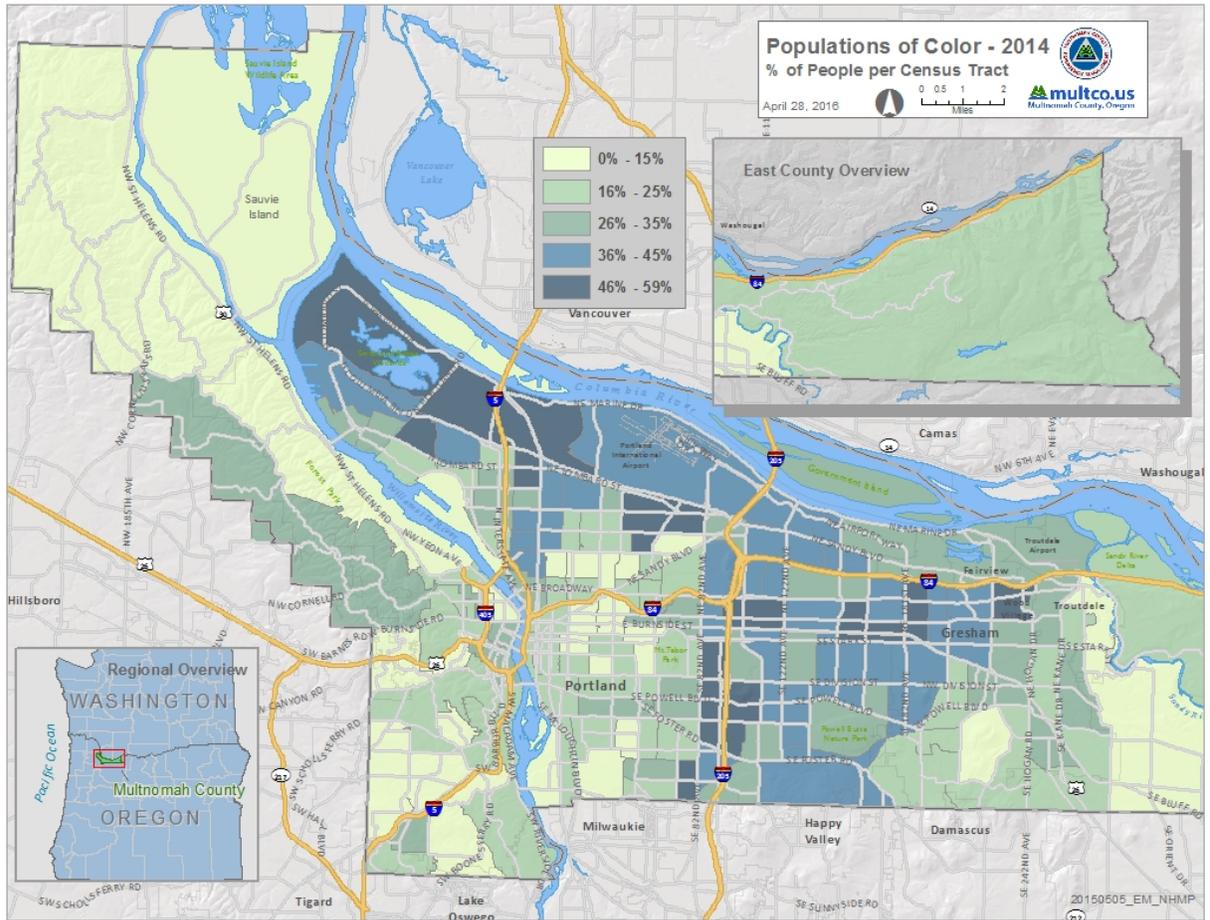
Table 2.2-4: Race and Ethnicity

Community	Race							Ethnicity	
	African American	American Indian & Alaskan Native	Asian	Native Hawaiian & Pacific Islander	Other Race	Two or More Races	White	Hispanic or Latino	
Oregon	1.8%	1.2%	3.8%	0.4%	3.7%	3.8%	85.2%	11.9%	
Multnomah County	5.7%	0.9%	6.8%	0.6%	3.5%	4.3%	78.3%	10.9%	
Incorporated	5.8%	0.9%	6.9%	0.6%	3.5%	4.3%	78.0%	11.0%	
Fairview	5.8%	2.5%	5.6%	1.9%	0.2%	5.1%	78.8%	17.7%	
Gresham	3.6%	1.2%	3.8%	1.1%	6.3%	3.9%	80.1%	19.2%	
Maywood Park	12.2%	0.0%	1.2%	0.1%	0.0%	3.5%	83.0%	1.1%	
Portland	6.3%	0.8%	7.5%	0.6%	3.1%	4.4%	77.4%	9.4%	
Troutdale	2.8%	0.1%	6.0%	0.0%	1.0%	2.8%	87.2%	7.1%	
Wood Village	1.6%	1.5%	3.7%	2.1%	8.0%	8.4%	74.8%	34.6%	
Unincorporated ¹	0.6%	0.9%	1.6%	0.0%	1.3%	3.2%	92.4%	4.9%	
West Hills	1.8%	0.6%	9.7%	0.0%	1.5%	3.0%	83.3%	4.3%	
Sauvie Island & West Hills	0.0%	0.0%	0.0%	0.0%	0.0%	14.5%	85.5%	16.4%	
West of Sandy River	4.5%	0.7%	0.1%	0.0%	1.0%	0.6%	93.0%	8.5%	
East of Sandy River	0.5%	1.7%	3.0%	0.0%	0.5%	7.6%	86.7%	6.4%	

Source: U.S. Census Bureau, 2009-2013 American Community Survey 5-Year Estimates

¹ Unincorporated totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

Figure 2.2-2: Populations of Color

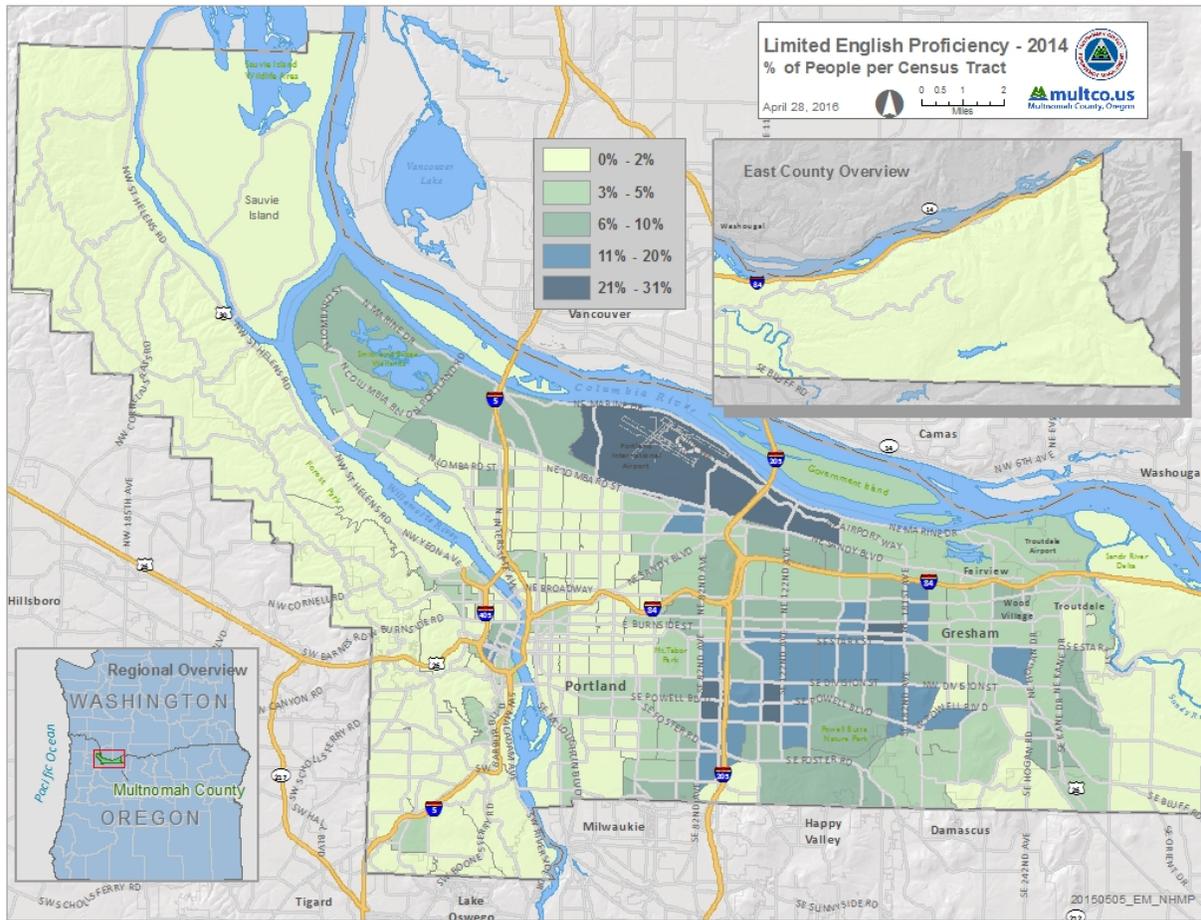


Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

2.2.9 Language

About 14% of Multnomah County’s population, 107,805 people are foreign-born. Many immigrants are not fluent in English, and literacy rates for some groups are low (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). There are 66,175 county residents who speak English less than “very well” (U.S. Census Bureau). **Figure 2.2-3** shows the distribution of percentage of people with limited English proficiency per census tract. All but an estimated 342 people who speak English less than “very well” live in the incorporated cities of the county, with a majority living in Portland (50,270) and Gresham (13,391) (U.S. Census Bureau, 2013).

Figure 2.2-3: Limited English Proficiency



Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Disaster communication can be difficult for immigrants with limited English proficiency, especially for communities whose first language is neither English nor Spanish and for whom accurate translations of emergency and preparedness messaging may be scarce (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). These groups are more likely to rely on relatives and local social networks for information (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011).

Table 2.2-5 provides a breakdown of the population with limited English proficiency by the language spoken in their home. Of the population 5 years of age and older that speaks English less than “very

well,” 40% speak Spanish or Spanish Creole in their homes. Other top languages include Vietnamese (14.6%), Chinese (9.3%), Russian (7.6%), African languages (3.8%), and other Slavic languages (3.4%).

Table 2.2-5: Estimated Population 5 Years and Older Who Speak English Less Than “Very Well” by Language Spoken at Home

Language Spoken at Home*	Multnomah County	Fairview	Gresham	Maywood Park	Portland	Troutdale	Wood Village	West Hills	Sauvie Island & West Hills	West of Sandy River	East of Sandy River
Spanish or Spanish Creole	26,948	587	8,634	4	16,938	267	336	185	0	84	33
Vietnamese	9,660	169	623	0	8,834	80	42	20	0	30	0
Chinese	6,130	13	34	4	5,927	150	0	40	0	0	0
Russian	5,047	0	945	0	3,993	34	38	0	0	0	37
African languages	2,510	0	276	0	2,234	0	0	0	0	0	0
Other Slavic languages	2,248	87	259	0	1,799	85	18	0	0	0	0
Other Indo-European languages	1,872	0	460	0	1,379	33	0	27	0	0	0
Other Asian languages	1,695	0	453	0	1,226	16	0	0	0	0	0
Other Pacific Island languages	1,381	0	515	0	866	0	0	0	0	0	0
Tagalog	893	0	169	0	660	34	0	0	0	8	0
Other Indic languages	891	0	10	0	881	0	0	0	0	0	0
Korean	861	0	68	3	698	14	6	15	0	0	0
Japanese	766	0	20	0	740	0	6	12	0	0	0
Arabic	716	0	213	0	471	0	0	0	0	32	0
Mon-Khmer, Cambodian	597	0	45	0	504	48	0	0	0	0	0
Serbo-Croatian	555	0	35	0	520	0	0	0	0	0	0
Laotian	544	0	21	0	502	21	0	0			0
Hmong	404										0
Other and unspecified languages	287										0
French (incl. Patois, Cajun)	275										0
Thai	271										0
Persian	237										0
German	231										0
Hindi	224										0
Portuguese or Portuguese Creole	170										0
Italian	138										13
Greek	116										0
Hungarian	102										0
Other Native North American languages	96										0
Urdu	84										0
French Creole	73										0

*If there were less than 50 people in the county estimated to speak English less than “very well,” the language was not included in this table. (Languages excluded: Armenian, Gujarati, Hebrew, Navajo, Other West Germanic languages, Polish, Scandinavian languages and Yiddish).

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

2.2.10 Education

The relationship between education and vulnerability to disaster is not well understood, although education is associated with both income and poverty. People with higher levels of education are more likely to have access to and act upon hazard information (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011).

In Multnomah County, about 90% of the population over 25 years old are high school graduates or equivalent, and 40% have a bachelor’s degree or higher (**Table 2.2-6**). Wood Village, Gresham and Fairview have the highest percentages of residents without a high school degree (25%, 15.8% and 13.2% respectively). In the unincorporated areas of the county, Sauvie Island has the highest percentage of population that did not graduate from high school (11.9%).

Table 2.2-6: Educational Attainment

Community	Population 25 years & over	Not a High school graduate	High school graduate or GED	Some college, no degree	Associate's degree	Bachelor's degree	Graduate or professional degree
Oregon	2,643,833	10.6%	24.6%	26.9%	8.2%	18.7%	11.0%
Multnomah	526,883	10.2%	19.2%	23.6%	7.0%	24.2%	15.7%
Incorporated	514,830	10.4%	6.0%	23.6%	7.0%	24.1%	15.5%
Fairview	6,028	13.2%	26.5%	32.1%	9.7%	14.2%	4.4%
Gresham	68,312	15.8%	28.5%	28.4%	8.5%	13.1%	5.7%
Maywood Park	704	4.4%	17.3%	35.1%	7.7%	22.6%	12.9%
Portland	427,180	9.5%	17.6%	22.5%	6.6%	26.3%	17.5%
Troutdale	10,379	9.0%	25.0%	32.9%	9.8%	18.5%	4.8%
Wood Village	2,227	25.0%	29.7%	26.1%	7.7%	7.7%	3.8%
Unincorporated Planning Areas							
West Hills	5,818	0.5%	6.1%	13.8%	3.4%	41.3%	34.9%
Sauvie Island & West Hills	2,087	5.6%	13.8%	26.9%	6.3%	25.7%	21.7%
West of Sandy River	3,931	5.6%	26.0%	34.3%	7.5%	17.8%	8.8%
East of Sandy River	3,145	7.2%	29.4%	26.5%	10.5%	17.6%	8.7%

Source: U.S. Census Bureau, 2009-2013 American Community Survey 5-Year Estimates

2.2.11 Household Composition

The number of households with children and two parents has decreased in the United States. Single-parent households are usually associated with lower socioeconomic status. Households with lower incomes and only one daily caretaker are especially vulnerable to the economic impacts that follow disaster events (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011).

Table 2.2-7 shows that 8.3% of households in Multnomah County are single-parent households. The majority of the single-parent households are female-led. Fairview and Wood Village have the highest percentage of female single-parent households (11.6% and 11.4% respectively).

Table 2.2-7: Family Household Composition

Community	Total Households	Family Households with Children	Percent	Single Parent (male)	Percent	Single Parent (female)	Percent
Oregon	1,516,456	414,003	27.3%	36,021	2.4%	94,499	6.2%
Multnomah	305,939	76,197	24.9%	6,274	2.1%	19,122	6.3%
Incorporated	299,769	74,889	25.0%	6,199	2.1%	18,969	6.3%
Fairview	3,815	1,197	31.4%	140	3.7%	441	11.6%
Gresham	38,392	12,739	33.2%	1,059	2.8%	3,637	9.5%
Maywood Park	376	96	25.5%	6	1.6%	9	2.4%
Portland	250,133	58,249	23.3%	4,842	1.9%	14,220	5.7%
Troutdale	5,812	2,073	35.7%	112	1.9%	521	9.0%
Wood Village	1,241	535	43.1%	40	3.2%	141	11.4%
Unincorporated ¹	6,170	1,308	21.2%	75	1.2%	153	2.5%
West Hills	3,883	1,321	34.0%	83	2.1%	66	1.7%
Sauvie Island & West Hills	378	73	19.3%	27	7.1%	0	0.0%
West of Sandy River	2,087	767	36.8%	53	2.5%	87	4.2%
East of Sandy River	1,515	431	28.4%	0	0.0%	133	8.8%

Source: U.S. Census Bureau, 2009-2013 American Community Survey 5-Year Estimates

2.3 Economy

2.3.1 Income

History has shown that people who are economically disadvantaged are disproportionately affected by disasters. People with fewer financial resources are less likely to have the income or assets needed to prepare for or recover from a disaster. For example, people unable to afford homeowner's or renter's insurance are especially vulnerable to property damage and losses incurred from a disaster (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). They may also have limited resources to stockpile food, store medications, shelter in place or evacuate.

The median household income in Multnomah County has been slightly higher than for Oregon (**Table 2.3-1**). Accounting for inflation, the county median income decreased between 2010 and 2013. The West Hills area has had the highest median income while the City of Wood Village has had the lowest.

¹ Unincorporated Rural Planning Area totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

Table 2.3-1: Median Household Income

Community	2010*	2013	Percent Change
Oregon	\$52,626	\$50,229	-4.6%
Multnomah County	\$53,009	\$52,511	-0.9%
Fairview	\$54,734	\$50,897	-7.0%
Gresham	\$50,729	\$47,417	-6.5%
Maywood Park	\$65,181	\$68,889	5.7%
Portland	\$52,168	\$52,657	0.9%
Troutdale	\$67,388	\$62,326	-7.5%
Wood Village	\$50,413	\$41,007	-18.7%
Unincorporated Rural Planning Areas			
West Hills	\$151,215	\$133,775	-11.5%
Sauvie Island & West Hills	\$88,230	\$72,464	-17.9%
West of Sandy River	\$83,003	\$71,213	-14.2%
East of Sandy River	\$72,591	\$66,210	-8.8%

*2010 dollars are adjusted for 2013 using Bureau of Labor Statistics' Consumer Price Index Inflation Calculator.

Source: U.S. Census Bureau, 2006-2010 and 2009-2013 American Community Survey

2.3.2 Poverty

More than one-third of county residents do not have enough income to be able to meet their basic needs¹ (Kristina Smock Consulting, 2014). The number of people in poverty has increased over the past two decades at a rate much higher than the growth in population (Kristina Smock Consulting, 2014). In Multnomah County, 12.8% of all people and 18.5% of all families are estimated to be living below the Federal Poverty Level (**Table 2.3-2**). Wood Village has the highest percentage of families and people living in poverty relative to its population. However, Portland and Gresham have much higher total numbers of families and individuals living in poverty.

The distribution of poverty across the county has shifted eastward, where almost one-quarter of the residents in outer east Portland are at or below the Federal Poverty Level (Kristina Smock Consulting, 2014). The unincorporated areas have fewer persons living in poverty overall. However, the area east of the Sandy River has a higher concentration than the other unincorporated areas (**Figure 2.3-1**).

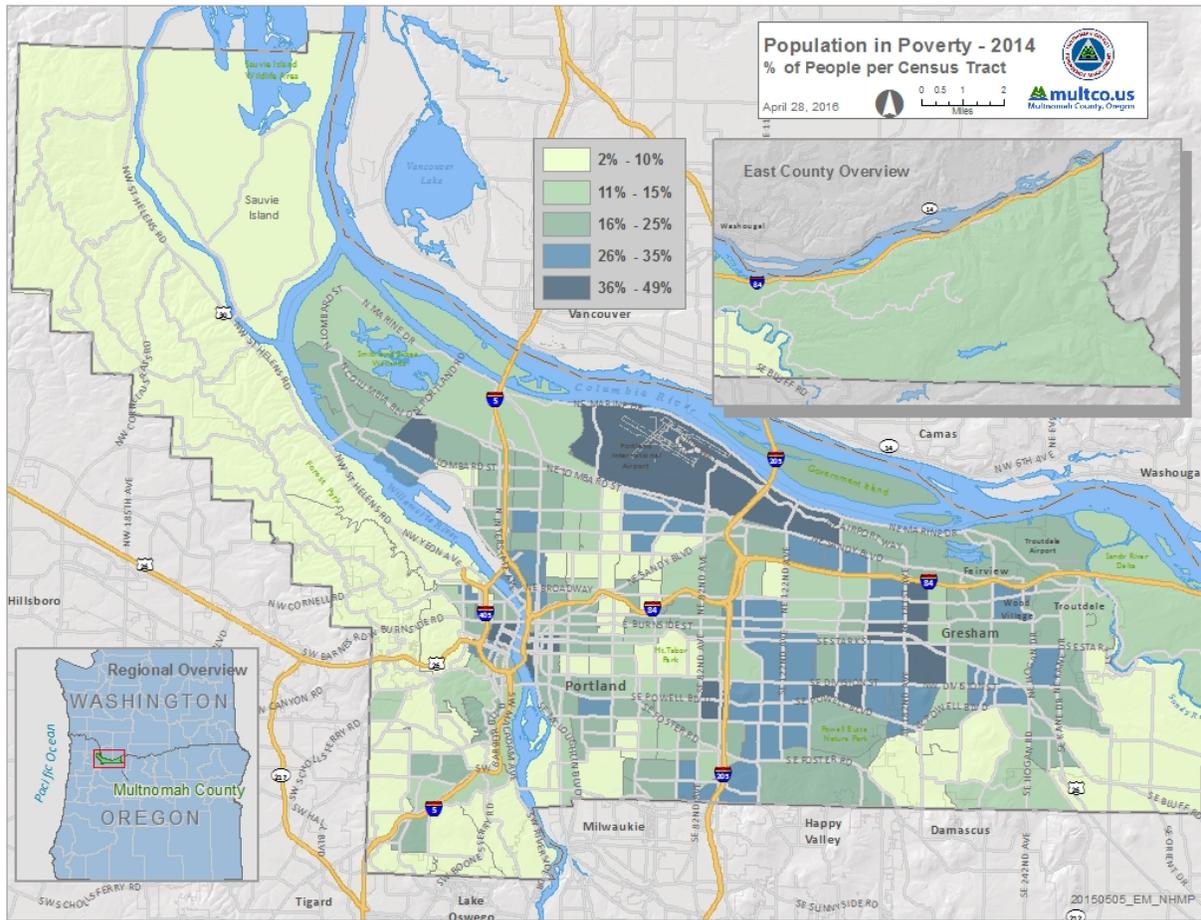
¹ Official measures of poverty (e.g., the U.S. Census Bureau) significantly undercount the number of people who are unable to meet their basic needs. For more information on how poverty is defined, see Multnomah County's 2014 report "Poverty in Multnomah County."

Table 2.3-2: Percentage of Families and People With Income Below the Poverty Level, 2014

Community	All families	Families with female householder, no husband present	All people	Under 18 years	65 years & over
Oregon	11.5%	32.5%	16.7%	22.1%	8.2%
Multnomah	12.8%	32.7%	18.5%	24.9%	10.4%
Fairview	13.8%	45.2%	17.0%	24.0%	3.9%
Gresham	17.7%	39.8%	21.6%	31.5%	8.5%
Maywood Park	2.5%	21.4%	4.8%	8.4%	2.9%
Portland	12.1%	30.7%	18.3%	23.7%	11.4%
Troutdale	10.7%	31.4%	16.4%	21.7%	4.8%
Wood Village	26.3%	72.9%	30.3%	46.5%	5.9%
Unincorporated Planning Areas					
West Hills	4.7%	0.0%	5.1%	6.3%	1.1%
Sauvie Island & West Hills	0.5%	0.0%	5.6%	0.9%	11.4%
West of Sandy River	2.7%	16.5%	6.5%	1.4%	0.0%
East of Sandy River	9.8%	30.0%	14.5%	22.6%	2.9%

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Figure 2.3-1: Poverty



Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Communities of color, immigrants and refugees, children, single-parent households, and persons with disabilities are disproportionately impacted by poverty (Kristina Smock Consulting, 2014).

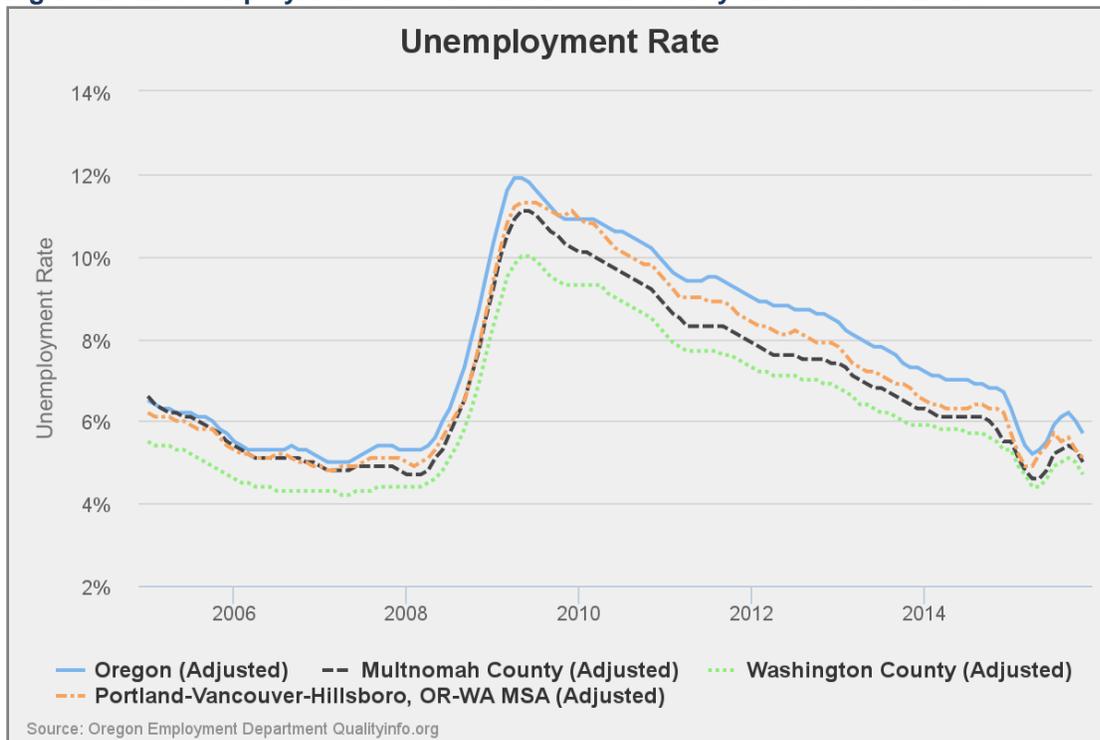
- Communities of color: 44% of the county's population in poverty belong to communities of color, and 26% of individuals in the county's communities of color are in poverty.
- Immigrants and refugees: 19% of the county's population in poverty is foreign born, and 23% of the county's foreign-born population is in poverty.
- Single-parent households: 22% of the county's households in poverty are single-parent households, and 42% of the county's single-parent households are in poverty.
- Women: 53% of the county's population in poverty is female, and 18% of the county's females are in poverty.
- Children: 28% of the county's population in poverty is made up of children under age 18, and 23% of the county's children under age 18 are in poverty.
- Persons with disabilities: 19% of the county's population in poverty have a disability, and 27% of persons with disabilities are in poverty.

Feeding America, a nationwide network of food banks, food pantries and meal programs, defines food insecurity as not always knowing where you will find your next meal. As of July 2015, there were 6,496 families in Multnomah County receiving benefits from the Temporary Assistance for Needy Families (TANF) program and 92,993 households receiving Supplemental Nutritional Assistance Program (SNAP) benefits. Those numbers are 18% lower for TANF and 5% lower for SNAP than in 2014 (Sabatino, 2015). In Multnomah County, 17% of the population is food insecure (Kristina Smock Consulting, 2014). This insecurity could be amplified in the event of a disaster.

2.3.3 Unemployment

Unemployment, like low income, is an indicator of vulnerability. In addition to lower or no income, people who are unemployed may not have employee benefit plans that provide income and health cost assistance to offset the costs of injury or loss resulting from a disaster (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). The Oregon Employment Department shows that unemployment rates have been decreasing in Oregon, Multnomah County and the Portland metro area over the past several years (**Figure 2.3-2**). There were 25,468 people unemployed, or 6.1%, in Multnomah County in 2014 (Oregon Employment Department). According to the American Community Survey¹, unemployment rates are highest in the unincorporated area east of Sandy River (18.6%) and in Wood Village (14.1%) (U.S. Census Bureau, 2013).

Figure 2.3-2: Unemployment Rates for Multnomah County and Portland Metro



Source: Oregon Employment Department, 2014

¹ The American Community Survey estimates a higher rate of unemployment for the county at 9.8% in 2014 than the Oregon Employment Department, however, the state’s data is not provided at a sub-county level.

2.3.4 Employment Growth and Key Industries

Oregon added 49,500 jobs between October 2014 and September 2015, with more than 39,000 of those in the Portland Metropolitan Statistical Area (MSA) (Seidman, 2015). Employment growth in Multnomah County over the past five years has been led by strong growth in the construction, professional and business services, leisure and hospitality, and information industries (**Table 2.3-4**). In 2014, the trade, transportation and utilities industry had the largest share of the county's workforce, 18.3%. Employment forecasts by industry for Multnomah County project large increases in the construction, professional and business services, and education and health services industries.

Job growth in the Portland MSA has been weighted heavily toward high-wage positions. Nearly 70% of job growth between 2010 and 2014 came from those earning \$75,000 or more per year, and 35% came from those earning \$100,000 or more (Seidman, 2015). Many of these new jobs are found in the high-tech manufacturing sector, professional and business services, and education and health services (Seidman, 2015). Job growth in Oregon and the Portland MSA is expected to continue; the Oregon Office of Economic Analysis projects a 3.1% annual growth from 2015 to 2017 (Seidman, 2015).

Table 2.3-4: Employment by Industry, 2014, and Forecasted Growth

Industry	Multnomah County, 2014				Percent Change in Employment (2010-2014)	Employment Forecast* (2012-2022)
	Firms	Employees	Percent Workforce	Average Pay		
Total Payroll Employment	30,751	465,696	100%	\$51,741	10.5%	16%
Total Private	30,083	393,804	84.6%	\$50,323	12.3%	17%
Natural Resources & Mining	81	1,745	0.4%	\$36,369	0.9%	14%
Construction	1,770	20,113	4.3%	\$66,303	28.7%	29%
Manufacturing	1,223	34,008	7.3%	\$53,555	8.4%	9%
Trade, Transportation & Utilities	5,794	85,030	18.3%	\$42,705	8.4%	12%
Information	788	10,639	2.3%	\$73,104	11.9%	12%
Finance Activities	2,706	28,109	6.0%	\$72,277	2.0%	12%
Professional & Business Services	6,211	74,151	15.9%	\$68,054	21.0%	24%
Education & Health Services	3,584	67,439	14.5%	\$48,493	10.1%	24%
Leisure & Hospitality	3,270	52,813	11.3%	\$22,458	16.0%	17%
Other Services	4,606	19,724	4.2%	\$33,191	9.1%	16%
Unclassified	46	27	0.0%	\$39,452	-79.5%	-
Total Government	667	71,892	15.4%	\$59,507	1.4%	10%
Federal	100	12,196	2.6%	\$76,779	-2.1%	-5%
State	101	11,424	2.5%	\$43,527	9.0%	11%
Local	465	48,271	10.4%	\$58,926	0.6%	13%

* Employment forecast is for the Portland metro region including Multnomah and Washington counties.

Source: Oregon Employment Department, "2010 and 2014 Covered Employment and Wages Summary Reports" and "Regional Employment Projections by Industry & Occupation 2012-2022"

2.4 Housing

2.4.1 Housing Type

Housing type and quality are important factors in determining disaster vulnerability. A majority of Multnomah County’s housing is single-family structures (**Table 2.4-1**), particularly in the unincorporated areas. Fairview, Portland and Gresham have the highest percent of multi-family housing. A study of the 1994 earthquake in Northridge, California, found that persons living in multi-family structures were more likely to have been injured than those in single-family homes (Centers for Disaster Control, no date). People living in large multi-family buildings are vulnerable to overcrowding in limited exit stairwells. This type of dense housing can result in large numbers of people exiting into the street, making safe evacuation more difficult (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). Populations living in group quarters pose another concern for evacuation. In Multnomah County, there are an estimated 18,076 persons living in group quarter facilities, including correctional facilities, nursing facilities and college/university housing (U.S. Census Bureau).

Mobile homes are considered a vulnerable housing type because they are not designed to withstand severe weather, such as high winds or flooding, and are more likely to shift off of their foundations during earthquakes (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011; State of Oregon, 2015). **Table 2.4-1** shows that mobile homes make up a small percentage of the county’s housing stock, with the largest percentages found in Wood Village (27.9%) and East of Sandy River (18.6%).

Table 2.4-1: Housing Type

Community	Total Housing Units	Single-Family		Multi-Family		Mobile Homes	
		Number	% of Total	Number	% of Total	Number	% of Total
Oregon	1,677,363	1,144,051	68.1%	389,356	27.5%	139,379	8.3%
Multnomah	325,163	197,461	60.7%	120,428	37.0%	6,734	2.1%
Incorporated	318,362	191,573	60.2%	120,012	37.7%	6,313	2.0%
Fairview	4,024	2,105	52.3%	1,567	38.9%	338	8.4%
Gresham	40,030	23,388	58.4%	15,193	38.0%	1,411	3.5%
Maywood Park	376	351	93.4%	25	6.6%	0	0.0%
Portland	266,581	160,601	60.2%	101,562	38.1%	4,006	1.5%
Troutdale	6,083	4,474	73.5%	1,405	23.1%	204	3.4%
Wood Village	1,268	654	51.6%	260	20.5%	354	27.9%
Unincorporated ¹	6,801	5,888	86.6%	416	6.1%	421	6.2%
West Hills	3,283	3,065	93.4%	218	6.6%	0	0.0%
Sauvie Island & West Hills	1,250	1,080	86.4%	0	0.0%	111	8.9%
West of Sandy River	2,176	2,105	96.7%	54	2.5%	0	0.0%
East of Sandy River	1,614	1,242	77.0%	72	4.5%	300	18.6%

Source: U.S. Census Bureau, Census 2009-2013 American Community Survey 5-Year Estimates

¹ Unincorporated totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

The overall quality of housing is difficult to measure but is closely tied to personal wealth. Low-income households are more likely to live in substandard housing or mobile homes, which are more vulnerable to hazards (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). In Multnomah County, there is a deficit of 21,910 housing units affordable to the lowest income renters (Kristina Smock Consulting, 2014). The American Housing Survey (2011) found that the rate of severe and moderate physical problems with housing in the Portland metropolitan area was lower than national rates.

2.4.2 Housing Age

The age of a structure is a good indicator of its ability to withstand certain hazards. In general, most homes built after the mid 1990s are expected to be more resilient due to higher building standards related to hazards. Seismic building standards were first introduced in the Oregon building code in 1974. More rigorous standards were passed in 1995 that required designs that would accommodate shaking from a Cascadia Subduction Zone earthquake, almost doubling the earthquake forces used in earlier codes. This means that the majority of buildings in Oregon have not been designed to resist the shaking from a magnitude 9.0 Cascadia earthquake (OSSPAC, 2013). See **3.1 Earthquake** for more details on seismic risk.

Flood maps and standards to regulate building in floodplains were introduced in Multnomah County between 1979 and 1988. **Table 2.4-2** shows that approximately 23.4% of the housing stock in Multnomah County was built after 1990. See **3.2 Flood** for more details on flood risk.

Table 2.4-2: Housing Age

Community	Total Housing Units	Pre 1970		1970 to 1989		1990 or later	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Oregon	1,677,363	603,869	36.0%	519,154	31.0%	554,340	33.0%
Multnomah	325,163	180,189	55.4%	68,944	21.2%	76,030	23.4%
Incorporated	318,362	177,118	55.6%	66,539	20.9%	74,705	23.5%
Fairview	4,024	386	9.6%	841	20.9%	2,797	69.5%
Gresham	40,030	8,762	21.9%	17,419	43.5%	13,849	34.6%
Maywood Park	376	360	95.7%	6	1.6%	10	2.7%
Portland	266,581	166,695	62.5%	45,520	17.1%	54,366	20.4%
Troutdale	6,083	576	9.5%	2,172	35.7%	3,335	54.8%
Wood Village	1,268	339	26.7%	581	45.8%	348	27.4%
Unincorporated¹	6,801	3,071	45.2%	2,405	35.4%	1,325	19.5%
West Hills	3,283	508	15.5%	212	6.5%	2,563	78.1%
Sauvie Island & West Hills	1,250	463	37.0%	401	32.1%	386	30.9%
West of Sandy River	2,176	659	30.3%	524	24.1%	993	45.6%
East of Sandy River	1,614	666	41.3%	648	40.1%	300	18.6%

Source: U.S. Census Bureau, Census 2008-2013 American Community Survey 5-Year Estimates

¹ Unincorporated totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

2.4.3 Housing Tenure

Housing tenure is often closely related to household income and quality of housing. Much of the damage resulting from the 1994 Northridge earthquake in Southern California involved low and moderate income rental housing units that were older (Insurance Institute for Business and Home Safety, no date). Renters have less control over mitigating risks because they typically cannot make improvements to the structure, and are less likely to have insurance or personal financial resources to assist with recovery (State of Oregon, 2015). As witnessed after the 1987 Whittier-Narrows earthquake in California, low-income tenants may find it difficult to return to the same home or neighborhood after a disaster (Insurance Institute for Business and Home Safety). **Table 2.4-3** shows that 45.8% of occupied housing units in Multnomah County are renter-occupied. The percent of rental units is much higher in the incorporated areas (46.5%) than it is in the unincorporated areas (15.5%). **Figure 2.4-1** shows patterns of greater percentages of home ownership northwest and southwest of downtown Portland, in the City of Fairview and parts of Troutdale, in southeast County and in unincorporated areas. Greater percentages of renter housing, shown in **Figure 2.4-2**, are in downtown Portland, north Portland, inner northeast and southeast Portland, areas east of Interstate 205, and most of Gresham and Wood Village

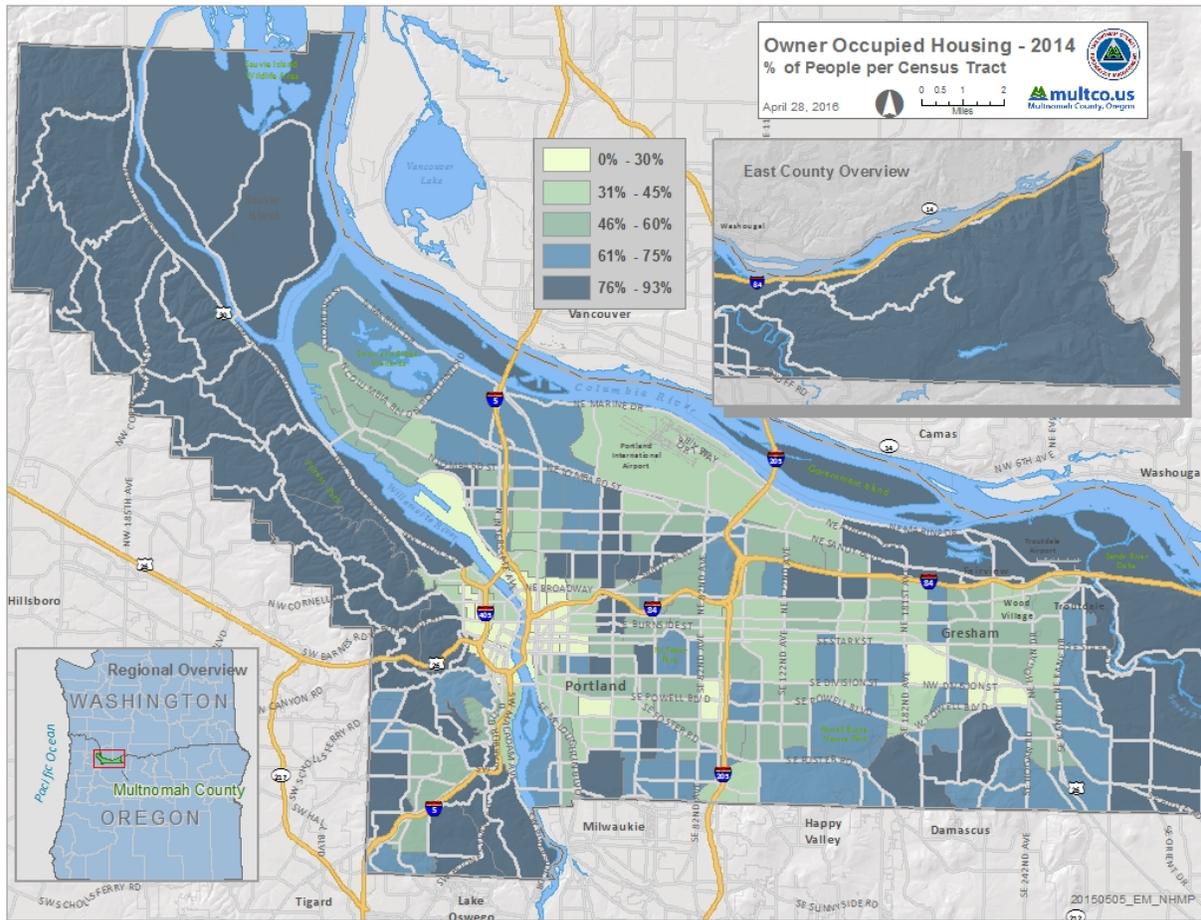
Table 2.4-3: Housing Occupancy and Tenure

Community	Occupied Units	Owner-occupied		Renter-occupied	
		Estimate	Percent	Estimate	Percent
Oregon	1,516,456	940,143	62.0%	576,313	38.0%
Multnomah	305,939	165,713	54.2%	140,226	45.8%
Incorporated	299,769	160,498	53.5%	139,271	46.5%
Fairview	3,815	1,981	51.9%	1,834	48.1%
Gresham	38,392	20,146	52.5%	18,246	47.5%
Maywood Park	376	323	85.9%	53	14.1%
Portland (part)	250,133	133,467	53.4%	116,666	46.6%
Troutdale	5,812	3,838	66.0%	1,974	34.0%
Wood Village	1,241	743	59.9%	498	40.1%
Unincorporated ¹	6,170	5,215	84.5%	955	15.5%
West Hills	3,104	2,648	85.3%	456	14.7%
Sauvie Island & West Hills	1,157	1,005	86.9%	152	13.1%
West of Sandy River	2,087	1,655	79.3%	432	20.7%
East of Sandy River	1,515	1,191	78.6%	324	21.4%

Source: U.S. Census Bureau, Census 2008-2013 American Community Survey 5-Year Estimates

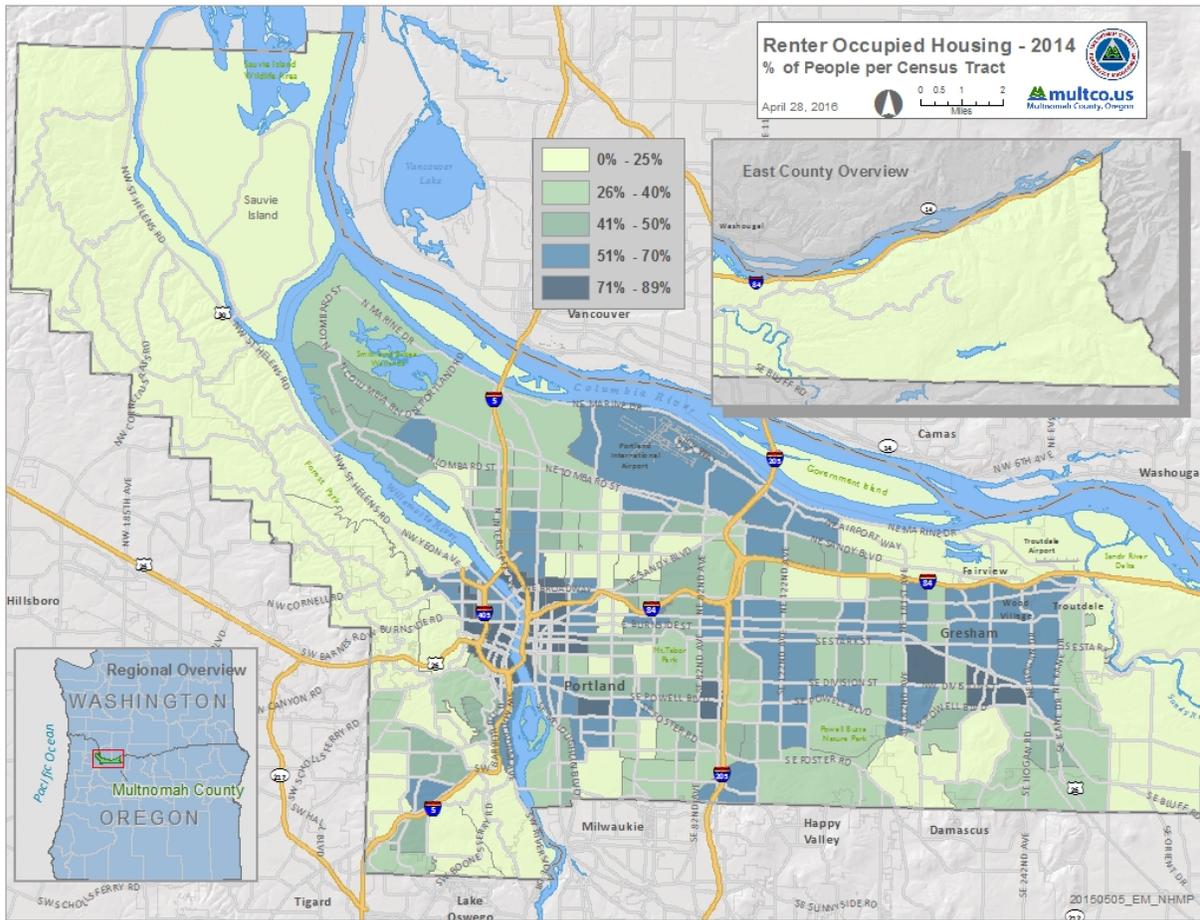
¹ Unincorporated totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

Figure 2.4-1: Owner Occupied Housing



Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Figure 2.4-2: Renter Occupied Housing



Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

2.5 Transportation

2.5.1 Roads

Multnomah County is served by an extensive network of interstate highways, state highways, and local roads and streets. The major interstates include I-5, which runs north-south through the county and is the major route connecting Oregon with Washington and California. I-84 is the major route from Multnomah County eastward to Idaho, other Rocky Mountain states, and the central and eastern United States. I-205 is a bypass highway east of Portland that connects with I-5 south of Portland in Clackamas County and north of Portland in Washington State. I-405 is a short bypass highway off I-5 that connects to State Highway 26.

Major state highways include Highway 26, which runs east-west, connecting the county to central and eastern Oregon (east) and the Oregon Coast (west). Highway 30 connects Multnomah County to Columbia County on the northwest and runs eastward generally parallel to I-84. Highway 99 runs north-south from I-5 near the Columbia River south to Clackamas County near Milwaukie. NW Cornelius Pass Road, which connects Highway 26 and Highway 30 through the West Hills, is an important commuter route. Burnside Street is another major corridor that runs east-west across the county.

Key transportation system elements for each community in the Planning Area are shown in **Table 2.5-1**.

Table 2.5-1: Key Transportation System Elements

Multnomah County	Fairview	Gresham	Troutdale	Wood Village
I-84	I-84, including the off ramp to Fairview Parkway	I-84, including on-off ramp to NE 181 st	I-84, including on-off ramps at NE 238th Drive	I-84, including on-off ramps at NE 238th Drive
I-5	223rd Avenue	181 st Avenue/182 nd Avenue	Marine Drive	238th Drive
I-45	Fairview Parkway, a.k.a. 207th Avenue	US Highway 26, a.k.a. Powell Boulevard	Columbia River Highway	NE Glisan Street
State Highway 26	Glisan Street	Division Street	257th Avenue	NE Halsey Street
State Highway 30	Halsey Street	Burnside Street	Stark Street	NE Arata Road
Historical Columbia Gorge Highway	Sandy Boulevard	Hogan Road	Cherry Park Road	NE Sandy Boulevard
NW Cornelius Pass Road	Marine Drive	Kane Road, a.k.a. 257 th Avenue	Buxton Road	
	Fairview Lake Road	Eastman Parkway, a.k.a 223 rd Avenue Stark Street Glisan Street Halsey Street Pleasant View Drive, a.k.a. 190 th	Troutdale Road	

Source: Natural Hazards Mitigation Plan Steering Committee

2.5.2 Bridges

The landscape across Multnomah County is defined by rivers and the bridges that span them. Our residents, workers and those who travel through our communities depend on safe, convenient river crossings for their daily lives and livelihood. Many bridges also carry critical services, including water distribution pipes, telecommunications and electrical lines across the Willamette River. If bridges are damaged, these lines could break and disrupt service to parts of the city.

There are 504 bridges within the county, including:

- 333 state highway bridges
- 44 county highway bridges
- 126 municipal bridges
- 1 historic covered bridge



In 2015, Multnomah County published a 20-year Willamette River Bridges Capital Improvement Plan (Bridge CIP) that focused on maintaining and seismically retrofitting the county’s six bridges that span the Willamette River: Broadway, Burnside, Hawthorne, Morrison, Sauvie Island and Sellwood. These bridges connect the community and currently serve approximately 200,000 people daily. According to the Bridge CIP, the county’s four historic movable bridges — Hawthorne, Broadway, Burnside, and Morrison — lack the necessary seismic resiliency to withstand moderate to major earthquakes. Three steps were taken to address seismic resiliency within the Bridge CIP (Multnomah County, 2015):

- Step 1: A review of prior seismic retrofit projects constructed by Multnomah County determined that the only seismic retrofit work constructed for any of the Willamette River bridges was a partial Phase 1 retrofit on the Burnside Bridge.
- Step 2: The development of seismic performance criteria, including:
 - Burnside Bridge: This bridge should remain fully operational to vehicles and river traffic following a Magnitude 9.0 Cascadia Subduction Zone earthquake.
 - Broadway, Morrison and Hawthorne bridges: The bridge superstructure, defined as its longitudinal spans, should not collapse due to small (Magnitude 4 +/-) earthquakes.
- Step 3: Develop Seismic Resiliency Project Bundles for each of the bridges.

The Bridge CIP identified the following 20-year Bridge Seismic Resiliency Plan for the four movable bridges in downtown Portland: “Within the next 20 years, the Burnside Bridge, as a designated regional lifeline route, should receive a major seismic upgrade in the form of either a Phase I and II seismic retrofit or bridge replacement. The other three downtown movable bridges should receive a Phase I retrofit. Beyond the 20-year CIP horizon, the county may choose to augment the Phase I retrofits with Phase II seismic retrofits for these three bridges at an estimated cost of \$1.36 billion, assuming construction in the 2040–2044 time interval” (Multnomah County, 2015).

Two new bridges — the Sauvie Island Bridge (2008) and the Sellwood Bridge (2016) — are constructed to current seismic standards. For more information on bridge infrastructure and a map of county-maintained bridges, see **Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment**.

2.5.3 Public Transportation

A regional transit system (Tri-Met) provides both bus and light rail service through the greater Portland metropolitan area. The light rail system (MAX) provides mass transportation connecting downtown Portland with Gresham to the east and Hillsboro to the west (in Washington County). The small cities in the county are relatively well-connected to employment centers in downtown Portland via light rail and bus, though travel time can be a disincentive. Buses and light rail service can be disrupted by natural hazards such as winter storms, flooding, landslides and earthquakes.

Residents living in the rural areas outside the Tri-Met service area rely on automobiles and state and county roads.

2.5.4 Alternative Transportation

Alternative transportation involves the use of many different modes of transportation, such as walking, biking, taking public transportation and carpooling. All of these transportation modes support active living, save money and reduce traffic congestion. Multnomah County is part of the tri-county region, which has an extensive focus on alternative transportation modes. The region has earned a national and global reputation as a walking- and biking-friendly community.

In Multnomah County, one of the popular paths for alternative transportation is the Springwater Trail Corridor. It runs from Portland through Gresham to Boring. This 40-mile loop trail system extends across the region.

All modes of public transportation are subject to impacts from natural hazard events.

2.5.5 Rail

Passenger rail service to/from Portland is operated by Amtrak, which operates three routes through Portland:

- Amtrak Cascades between Vancouver, British Columbia, and Eugene, Oregon
- Coast Starlight between Seattle, Portland and Los Angeles
- Empire Builder between Portland and Chicago

Freight rail service in Multnomah County is provided by two long-haul railroads: Burlington Northern and Santa Fe (BNSF) and Union Pacific (UP). BNSF provides service north to Seattle, south to California and east via Spokane, Washington. UP provides service south to California and east via Boise, Idaho. In addition, there are two short-line railroads serving Multnomah County. Portland & Western provides service from Astoria, Oregon, to Portland, and the Portland Terminal Railroad provides connections from Portland's marine terminals to other carriers.

2.5.6 Marine, Riverine, Air

Marine and air transport to/from Multnomah County is provided by facilities operated by the Port of Portland (Port). The Port operates four marine terminals that provide service via ocean-going ships and barges, including:

- One terminal on the Columbia River
- Three terminals on the Willamette River near the confluence with the Columbia River

The Port also operates the Portland International Airport (PDX), the main commercial airport for northwest Oregon and vicinity. The Port also operates three much smaller commercial airports, including Troutdale Airport in Multnomah County, Hillsboro Airport in Washington County and Mulino Airport in Clackamas County. The Port owns and operates the dredge Oregon to help maintain the shipping channel on the lower Columbia River. The Port oversees five industrial/business parks and is the Portland area's largest owner of industrial land.

2.5.7 Access to Transportation

Limited access to vehicles and public transit has implications on the everyday movement of people and things, as well as during an emergency evacuation. The rate of vehicle access is higher in the unincorporated Rural Planning Areas than in the cities (**Table 2.5-1**). The overall cost of car ownership, such as purchase price, maintenance, insurance and fuel costs, can limit the ability of people to own vehicles (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). In the Portland metro area, like in many communities, people of color, women, and people with limited incomes or mobility rely disproportionately on public transit (Metro, 2015). However, public transit access is limited in some of the areas east of I-205 that have high percentages of populations of color and low-income (Kristina Smock Consulting, 2014).

Table 2.5-1: Vehicles Available

Community	Occupied Housing Units	No. Vehicles Available	Percent of Households
Oregon	1,522,988	121,892	8.0%
Multnomah	308,595	42,673	13.8%
Incorporated	302,044	42,572	14.1%
Fairview	3,856	362	9.4%
Gresham	38,556	3,932	10.2%
Maywood Park	369	19	5.1%
Portland	252,185	37,882	15.0%
Troutdale	5,784	263	4.5%
Wood Village	1,294	114	8.8%
Unincorporated ¹	6,551	101	1.5%
West Hills	3,114	47	1.5%
Sauvie Island & West Hills	1,136	54	4.8%
West of Sandy River	2,191	23	1.0%
East of Sandy River	1,551	31	2.0%

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

2.6 Utilities

2.6.1 Water

Potable Water

Surface sources for drinking water are vulnerable to pollutants caused by non-point sources and natural hazards. Non-point source pollution may include stormwater runoff from roadways, agricultural operations, timber harvest, erosion and sedimentation. Landslides, flood events, and earthquakes and resulting liquefaction can cause increased erosion and sedimentation in waterways (DLCD, 2015).

Underground water supplies and aging or outdated infrastructure such as reservoirs, treatment facilities, and pump stations can be severed during a seismic event. These types of infrastructure damages could result in a loss of water pressure in municipal water supply systems, thus limiting access to drinking water. Lack of clean drinking water can threaten human health and impact industry (DLCD, 2015).

The communities in this plan rely on both surface water and groundwater for potable water. The following public water agencies supply our drinking water:

- Burlington Water District
- Corbett Water District
- Lusted Water District
- Plainview Water District
- Pleasant Home Water District
- Portland Water Bureau

¹ Unincorporated totals are calculated by subtracting incorporated totals from the Multnomah County total. The census tracts representing the unincorporated Rural Planning Areas overlap slightly with incorporated areas and therefore do not equal the unincorporated totals presented in this row.

- Rockwood Water People's Utility District
- Springdale Water District
- West Slope Water District

The most critical components in potable water systems are raw water sources, pumping plants, treatment plants and transmission mains. Local distribution systems, while important, are less important than the critical components listed above because damage to distributions systems results in outages to fewer customers and is often easier and quicker to repair than damage to critical components.

Stormwater and Wastewater

Stormwater and wastewater systems are vulnerable to severe precipitation events that cause flooding and lead to stormwater runoff. A non-point source of water pollution, stormwater runoff can adversely impact drinking water quality and habitat health. Large volumes of fast-moving stormwater that enter surface waterways can cause erosion. Leaves and other debris can be carried into storm drains and pipes, which can clog stormwater systems. In areas where stormwater systems are combined with wastewater systems (combined sewers), flooding events can lead to combined sewer overflows (CSOs). CSOs present a heightened health threat as sewage can flood urban areas and waterways. Underground stormwater and wastewater pipes also are vulnerable to damage by seismic events.

Stormwater Systems

As part of the state and federal requirements, local jurisdictions are generally required to have stormwater management plans. Multnomah County has a 2010 Stormwater Management Plan (updated in 2011). The plan includes several urban pocket areas; the unincorporated area of Interlachen; and the roadways in Fairview, Troutdale and Wood Village (approximately 28 miles). The City of Gresham has a 2011 Stormwater Management Plan. The City of Fairview has a 2011 Stormwater Management Plan. The City of Troutdale has a 2007 Stormwater Management Plan. In 2007, the City of Wood Village was directed by the state to create a stormwater management plan (DEQ, 2007).

Drainage Districts

The Multnomah County Drainage District No. 1 (MCDD) provides flood protection for people, property and the environment within a 25-square-mile managed floodplain along the Columbia River in northeast Portland, Gresham and Fairview. MCCD also manages and controls three other drainage districts in the managed floodplain: Peninsula Drainage District #1 (PEN1), Peninsula Drainage District #2 (PEN2), and the Sandy Drainage Improvement Company (SDIC). The Portland International Airport (PDX), the Troutdale Airport, and Marine Terminals 2, 4, 5 and 6 are located within this consortium of floodplain districts (part of the Columbia River Basin).

The SDIC manages the levee and canal system on the southern half of Sauvie Island. It is surrounded by the Columbia and Willamette rivers, the Multnomah Channel and Sturgeon Lake. The levee protects 11,200 acres from flooding. It is approximately 18 miles long and divided into four segments. The elevation of the levee ranges from 33 to 36 feet.

Wastewater Systems

Except for the cities of Gresham and Troutdale, the majority of wastewater collection and treatment for the communities in the Planning Area is provided by the City of Portland's Bureau of Environmental Services (BES). The City of Gresham's Department of Environmental Services treats wastewater for Gresham, Fairview and Wood Village. A number of moorages provide wastewater collection and

treatment for floating homes. In rural areas, many residents rely on individual septic systems. Maintenance of individual septic systems is the responsibility of the respective property owner. The most critical components for wastewater systems are the treatment plants, large pump stations and large diameter collection pipes.

2.6.2 Energy

Our energy sources include electricity, natural gas, diesel, gasoline, and other sources such as light fuel oil, green electricity, propane, ethanol, heavy fuel oil and biodiesel (Portland Bureau of Emergency Management [PBEM], 2012). The primary energy sources described below are electric, petroleum and natural gas, and hydropower. Petroleum and natural gas share similarities in methods of extraction, fuel cycles and transport, but the facilities and commodities are regulated separately and have multiple stakeholders and trade associations. Energy assets and critical infrastructure components are owned by private, federal, state and local entities, and by some energy consumers, such as large industries and financial institutions, often for backup power purposes (Oregon Department of Energy [ODOE] and Oregon Public Utilities Commission [PUC], 2015).

Maps showing the locations of several types of pipeline infrastructure, including gas transmission lines, hazardous liquid lines, liquefied natural gas (LNG) plants and breakout tanks, can be found in **Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment (HIRA) Figures 1, 2, 3, and 4**. Potential failures and impacts to these systems are also analyzed in the HIRA.

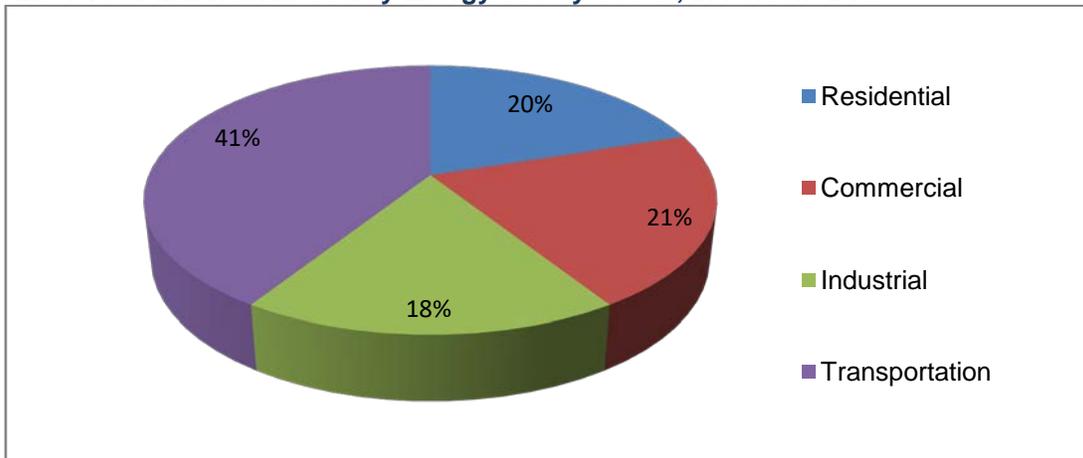
Electric

Electric power is provided by Portland General Electric (PGE) and PacifiCorp (Pacific Power), both of which are private, investor-owned utilities. Wholesale power to both PGE and Pacific Power is provided by the Bonneville Power Administration, a federal agency. PGE is the largest investor-owned utility in the region, serving large areas of Clackamas, Multnomah, and Washington counties (DLCD, 2015). Pacific Power is another investor-owned utility company serving a small portion of Multnomah County (Oregon Office of Emergency Management [OEM], 2015). Much of the Portland Urban Area's (PUA) electrical power supply is managed by the Bonneville Power Administration's control center located in the PUA (PBEM, 2012).

For electric power utilities, the most critical components are generation facilities (hydroelectric dams, fossil fuel power plants and others), transmission lines and high voltage substations. Local distribution systems — including distribution lines and low-voltage substations — while important are less important than the major components.

The Northern Willamette Valley/Portland metro area has eight power-generating facilities, six of which are hydroelectric and two natural gas. In total, these facilities have the ability to produce up to 1,121 megawatts (MW) of electricity (DLCD, 2015). Though none of these facilities is located within Multnomah County, communities in the Planning Area rely on them for everyday activities and to support the local economy.

In 2014, Multnomah County (all cities and unincorporated areas) used a total of 102,120,348 British Thermal Units (BTU) (Portland Bureau of Planning & Sustainability, personal communication, April 29, 2016). **Figure 2.6-1** shows the transportation sector as the highest energy user, at 41 percent of the total BTUs. With a combined total of 41 percent of the BTUs, the residential and commercial sectors together used the same amount of energy as the transportation sector. The fourth category is the industrial sector, which used 18 percent of the BTUs.

Figure 2.6-1 Total Multnomah County Energy Use by Sector, in Percent BTU

Source: Portland Bureau of Planning & Sustainability, personal communication, April 29, 2016

Petroleum and Natural Gas

Notably, Multnomah County and the entire State of Oregon import 100 percent of their petroleum and natural gas. Puget Sound refineries provide more than 90 percent of Oregon's refined petroleum products (PBEM, 2012). Although natural gas does not provide the most energy to the region, it does contribute a significant amount of energy to the region's energy portfolio (DLCD, 2015). Natural gas in Multnomah County is provided by Northwest Natural Gas, a private, investor-owned utility. The most critical components for the natural gas system are large, high-pressure transmission mains. Local distribution systems, while important, are less important than the major components. Petroleum, like natural gas, is distributed via pipeline, marine vessels and trucks.

Pipelines that provide natural gas servicing Oregon travel along these routes (PBEM, 2012):

- From Washougal, Washington, to the Portland area
- From the Willamette Valley to Grants Pass
- From British Columbia and the Rocky Mountain region to the Portland area
- From British Columbia, entering the U.S. near Sumas, Washington, and roughly following Interstate 5 through Washington through to the Portland area
- From the Rocky Mountain region entering Oregon near Ontario
- From Alberta, Canada, entering the U.S. near Kingsgate, Idaho, through eastern Oregon, and leaving the state near Malin, before traveling to California and Nevada
- From Klamath Falls to Medford, Oregon, meeting with a pipeline in Stanfield, Oregon

Williams Northwest Pipeline and the TransCanada Gas Transmission Northwest are the main companies transporting natural gas into Oregon (ODOE and PUC, 2012).

There are no refineries or crude (unrefined) oil resources in Oregon (PBEM, 2012).

The Trans-Mountain pipeline brings petroleum from British Columbia. The Olympic and Chevron pipelines transport petroleum into Washington and Oregon.

Hydropower

Bonneville Power Administration (BPA) provides hydro-generated electricity to the state's consumer-owned utilities. The Bonneville Dam is BPA's major dam in the region, located on the Columbia River. Other dams in the region are located on the Willamette, Clackamas, and Sandy rivers (DLCD, 2015). In Multnomah County, there are 26 dams. Of those dams, there are seven with a high potential threat, five with a significant threat, and 14 with a low threat (DLCD, 2015). Hydropower dams on the Columbia River provide 27 percent of Multnomah County's electricity (PBEM, 2012).

Critical Energy Infrastructure Hub (CEI Hub)

A six-mile stretch of the Willamette River in Portland's Northwest Industrial Area contains the bulk of Oregon's critical energy infrastructure for petroleum, natural gas, liquefied natural gas and electricity. This area is also a regional crossroads for pipelines, transmission lines, rail, shipping and trucking (PBEM, 2012), and is commonly referred to as the Critical Infrastructure Hub (CEI Hub). The CEI Hub includes the following energy sector facilities (Pipelines International, 2009):

- All of Oregon's major liquid fuel port terminals
- Liquid fuel transmission pipelines and transfer stations
- Natural gas transmission pipelines
- A liquefied natural gas storage facility
- High-voltage electric substations and transmission lines
- Electrical substations for local distribution

The three energy sources – electricity, natural gas and liquid fuel – depend on each other; if one system is inoperable, it impacts another. For example, all sources rely on electricity to operate their systems. In addition, energy companies have operational interdependencies in the transportation and telecommunication sectors.

"In 2013, the Oregon Department of Geology and Mineral Industries (DOGAMI) conducted a study of the CEI Hub's earthquake risk entitled Earthquake Risk Study for Oregon's Critical Energy Infrastructure Hub (DOGAMI Open-File Report O-13-09). The study determined (a) the vast majority of facilities are constructed on soils susceptible to liquefaction and (b) significant seismic risk exists within the various energy sector facilities. The CEI Hub was identified as being highly vulnerable to a Cascadia Subduction Zone (CSZ) event" (DLCD, 2015).

Given the paramount importance of the CEI Hub to all the cities and unincorporated areas of Multnomah County, the State of Oregon and the Pacific Northwest region, it is extremely important to continue to assess current conditions of the CEI Hub and to continue an enhanced focus on the development of disaster resilience in this area. The City of Portland is presently conducting a risk assessment for the CEI Hub. Draft recommendations from that study inform the mitigation strategy for this plan update. Final results from that study will inform the next update of this plan.

2.6.3 Telecommunications

Telecommunications across the county, including but not limited to voice, data and internet services, are provided by several private, investor-owned companies, including:

- Quest
- Century Link
- Comcast
- Frontier
- Reliance Connects

For telecommunications, the most critical system components are the central offices, which contain the switch gear necessary to connect telephone calls. For data and internet services, the most critical system components are high-capacity fiber-optic links and peering facilities, which transfer traffic between carriers.

2.7 Critical Facilities

For the development of **Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment**, critical facilities were identified by the Natural Hazards Mitigation Plan Steering Committee as facilities needed to maintain government functions and protect the life, health, safety and welfare of citizens. Critical facilities are divided into three groups in Annex I: emergency services critical facilities (**Table 2.7-1**), administrative critical facilities (**Table 2.7-2**), and special population critical facilities (**Table 2.7-3**). Locations of the primary critical facilities in Multnomah County are show in **Figures 2.7-1, -2 and -3**. A complete list of the critical facilities by name, as well as the hazards that affect each facility, is included in **Table 64 in Annex I**. This list is not all-inclusive and includes only information that was readily available in geospatial format.

Table 2.7-1: Emergency Services Critical Facility Inventory in Multnomah County^{1,2}

Community	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Multnomah	4	44	12	60	35	20
Fairview	0	0	0	0	1	0
Gresham	0	6	1	5	2	3
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	31	11	54	31	17
Troutdale	0	1	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	8	0	1	0	0

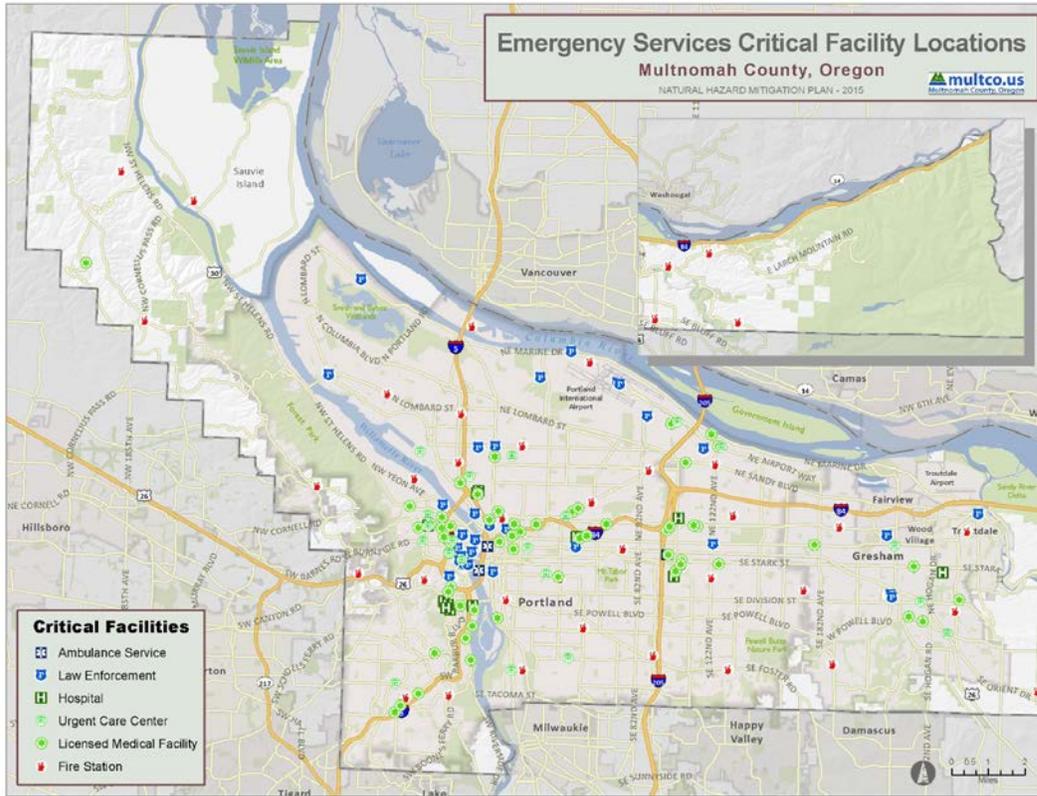
Sources: Ambulance Services – Multnomah County GIS; Law Enforcement – Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, Oregon Incident Response Information System (IRIS) Version 2; Hospitals – Metro’s Regional Land Information System; Licensed Medical Facilities – Oregon Health Authority; Urgent

¹ Emergency shelters also were identified as critical facilities; however, work is currently underway to update the list of these sites. The new emergency shelter data will be included in future updates.

² Table 2.7-1 Emergency Services Critical Facility Inventory in Multnomah County corresponds with Table 4 in Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment.

Care Centers – Oregon Department of Environmental Quality; Fire Stations – Metro’s Regional Land Information System

Figure 2.7-1: Emergency Services Critical Facility Locations in Multnomah County



Sources: Ambulance Services – Multnomah County GIS; Law Enforcement – Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, Oregon Incident Response Information System (IRIS) Version 2; Hospitals – Metro’s Regional Land Information System; Urgent Care Centers – Oregon Department of Environmental Quality; Fire Stations – Metro’s Regional Land Information System

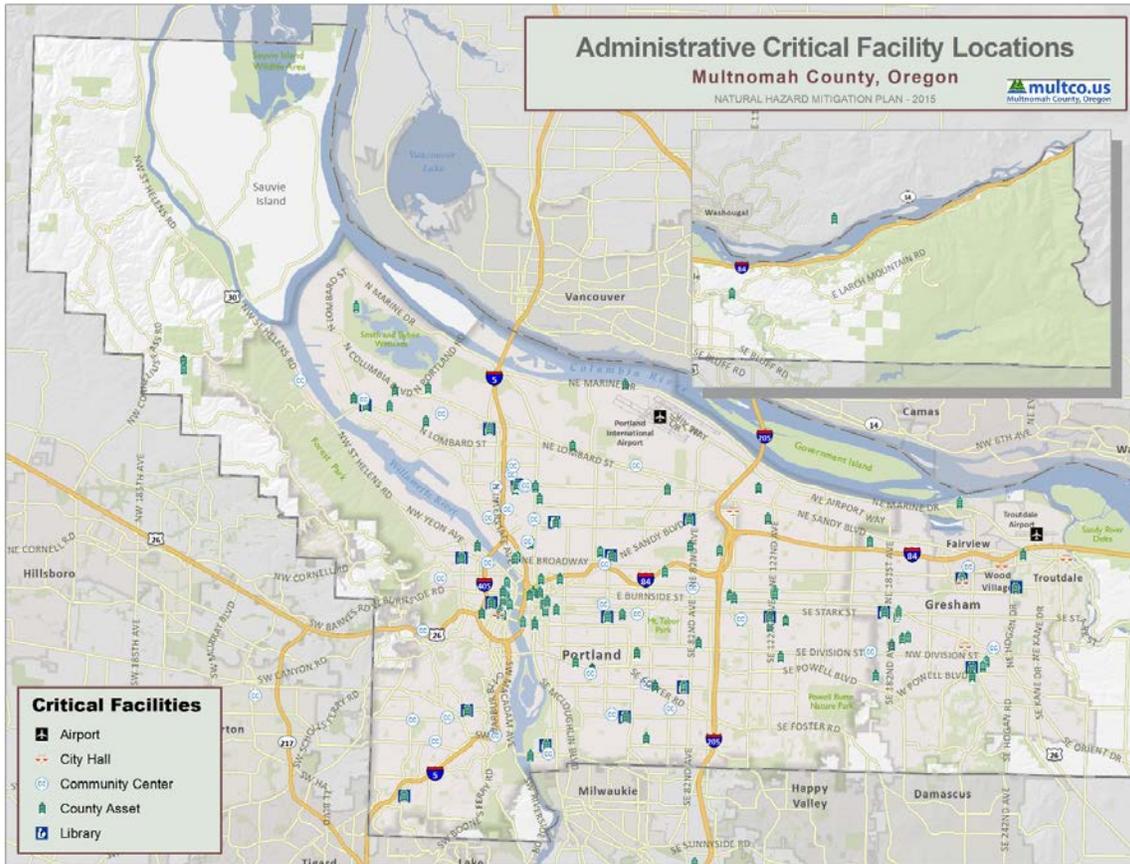
Table 2.7-2: Administrative Critical Facility Inventory in Multnomah County¹

Community	Airports	City Halls	Community Centers	County Assets	Libraries
Multnomah	2	6	34	136	19
Fairview	0	1	1	4	1
Gresham	0	1	0	18	2
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	1	1	31	99	15
Troutdale	1	1	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	1	10	0

Sources: Airports – Metro’s Regional Land Information System; City Halls – Metro’s Regional Land Information System; Community Centers – Metro’s Regional Land Information System Parks Layer; County Assets – Metro’s Regional Land Information System; Libraries – Metro’s Regional Land Information System

¹ Table 2.7-2 Administrative Critical Facility Inventory in Multnomah County corresponds with Table 5 in Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment.

Figure 1-7-2: Administrative Critical Facility Locations in Multnomah County



Sources: Airports – Metro’s Regional Land Information System; City Halls – Metro’s Regional Land Information System; Community Centers – Metro’s Regional Land Information System Parks Layer; County Assets – Metro’s Regional Land Information System; Libraries – Metro’s Regional Land Information System

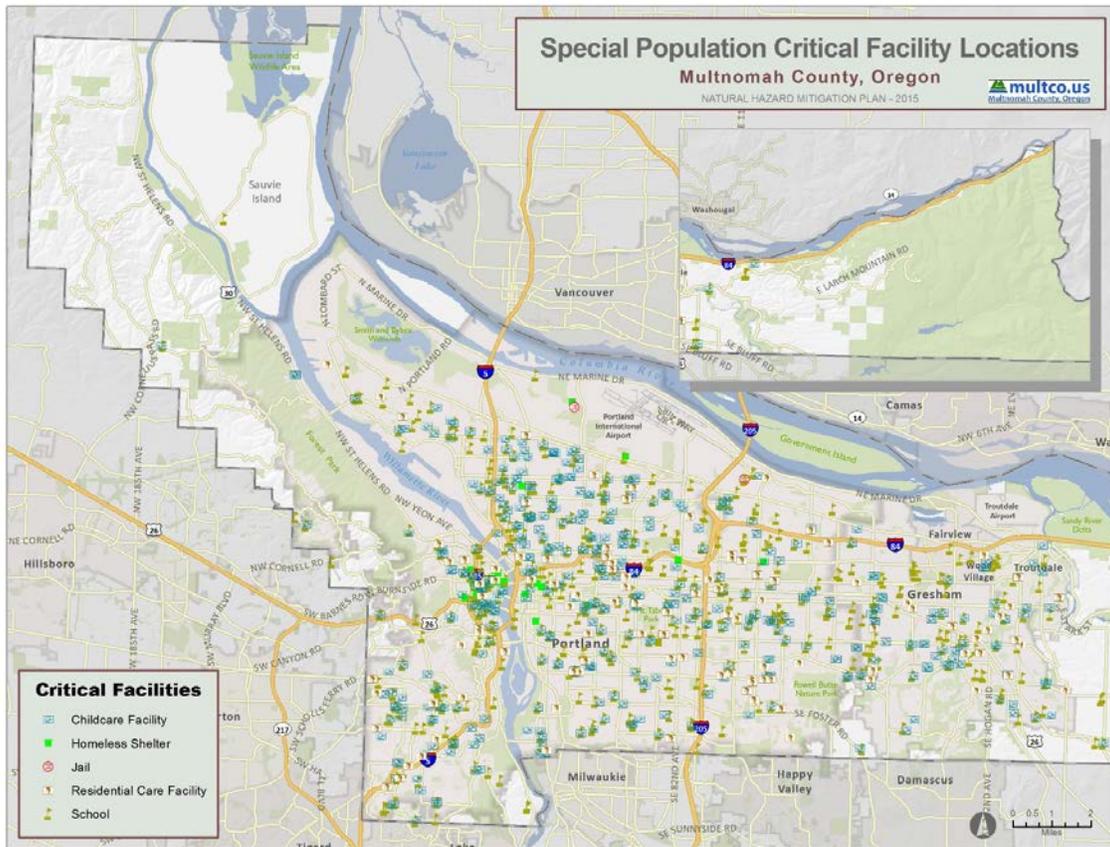
Table 2.7-3: Special Population Critical Facility Inventory in Multnomah County¹

Community	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Multnomah	397	29	2	193	423
Fairview	1	0	0	0	11
Gresham	47	0	0	32	55
Lake Oswego	2	0	0	0	4
Maywood Park	2	0	0	0	2
Portland	333	29	2	156	325
Troutdale	5	0	0	3	10
Wood Village	2	0	0	2	0
Unincorporated Area	5	0	0	0	16

Sources: Childcare Facilities – Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters – Multnomah GIS; Jails – Multnomah GIS; Residential Care Facilities – Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools – Oregon Department of Education Open Institution List

¹ Special Population Critical Facility Inventory in Multnomah County corresponds with Table 6 in Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment.

Figure 2.7-3: Special Population Critical Facility Locations in Multnomah County



Sources: Childcare Facilities – Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters – Multnomah GIS; Jails – Multnomah GIS; Residential Care Facilities – Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools – Oregon Department of Education Open Institution List

2.8 Historic and Cultural Resources

Historic and cultural resources are important to our community because they provide unique information and insight about our past societies and environments. It is important to all communities in the Planning Area to protect these resources from disaster events. Historic and cultural resources include structures, objects, sites and districts. Examples include unique architecture on buildings, prehistoric artifacts, burial sites, roads and bridges, earthworks, artwork, landforms and battlefield sites. These may be designated as historic and cultural resources by local, state and federal jurisdictions.

The National Register of Historic Places is an official registry for the preservation of historic and cultural resources. More information is available on the Oregon Parks & Recreation website: http://www.oregon.gov/oprd/HCD/NATREG/pages/nrhp_natreglist.aspx. To be listed on the National

Historic buildings and structures, artwork, monuments, family heirlooms, and historic documents are often irreplaceable, and may be lost forever in a disaster if not considered in the mitigation planning process.

— Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning, FEMA 2005

Register of Historic Places, a district, site, building, structure or object must be 50 years or older, in general. Eligible properties also must have "integrity," or closely resemble their historic appearance. Integrity includes location, design, setting, materials, workmanship, feeling and association. Most importantly, a resource must be significant or physically connected with an important part of the past (Oregon Parks and Recreation, no date).

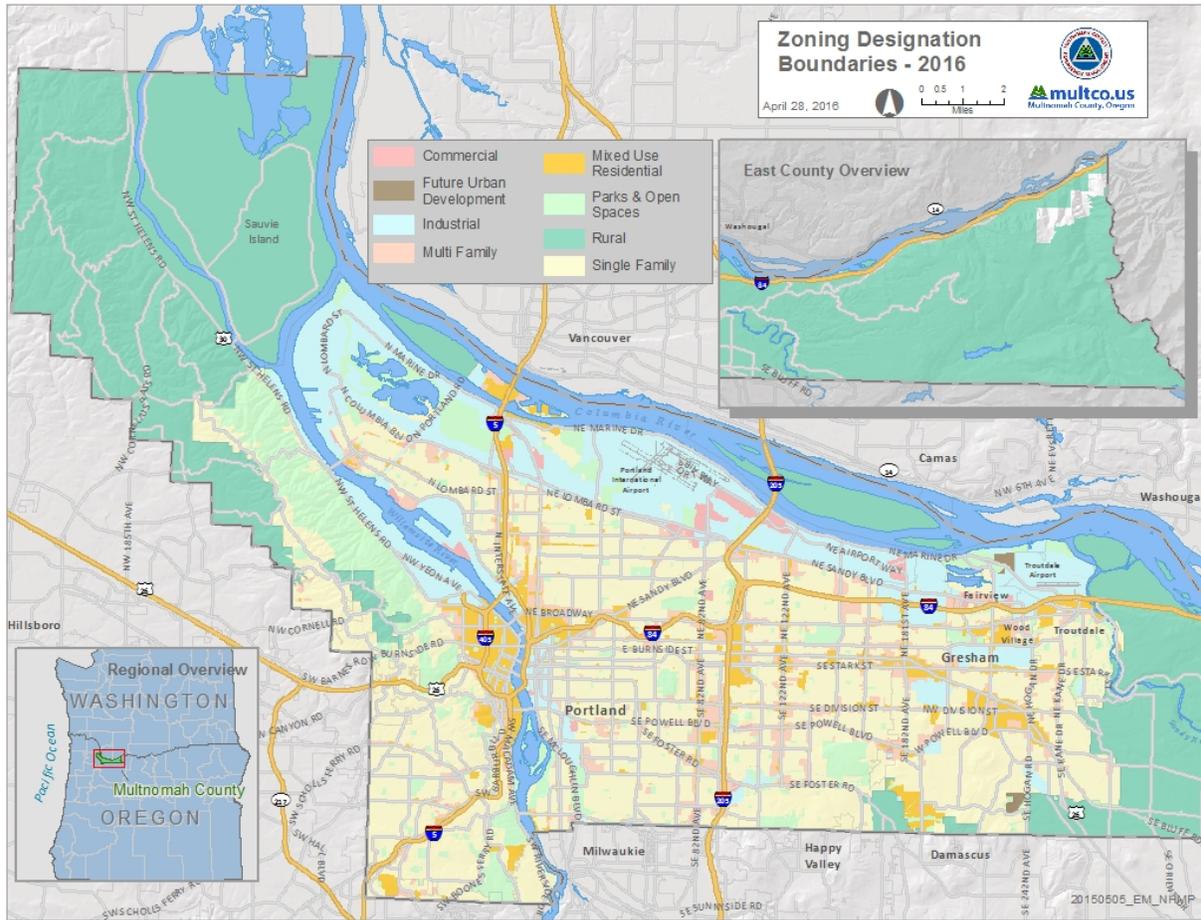
Gresham, Troutdale and the unincorporated areas of Multnomah County have several historic and cultural resources listed on the National Register of Historic Places. Wood Village and Fairview do not have any listed historic and cultural resources.

2.9 Land Use and Development

2.9.1 Land Use

The overall pattern of land use and development in Multnomah County varies from the large urban areas of Portland and Gresham to the smaller incorporated cities of Maywood Park, Fairview, Wood Village, Troutdale and Lake Oswego (a small part of which is in Multnomah County). The unincorporated parts of Multnomah County cover about half of the county by area, but only contain about 2% of the county's population. The unincorporated areas range from lightly developed areas in or near the urban growth boundaries of the cities to very small unincorporated communities in rural areas. Zoning for Multnomah County is shown in **Figure 2.9-1**.

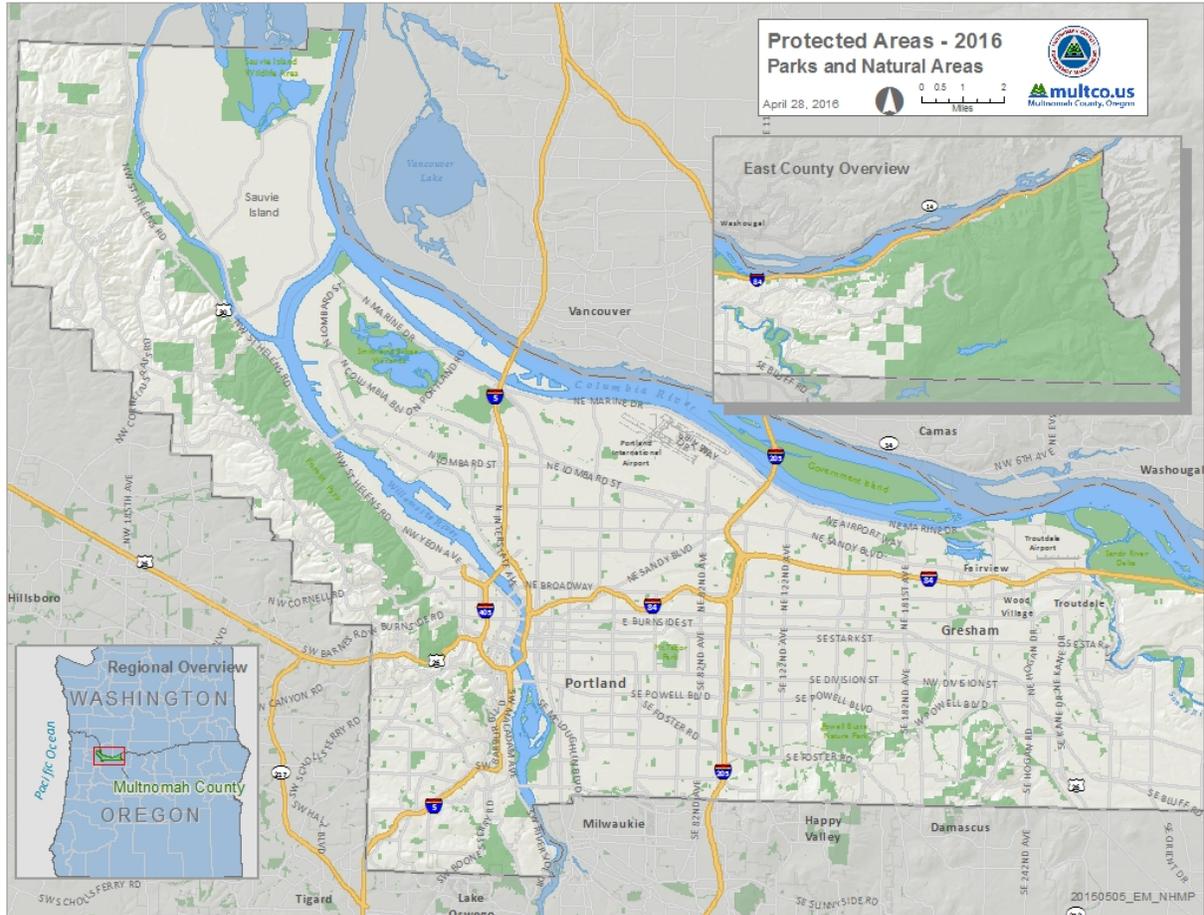
Figure 2.9-1: Zoning



Source: Metro, Regional Land Information System (RLIS), 2016

Eastern Multnomah County includes large forested areas that include both privately owned lands and National Forest lands, as well as the Columbia River Gorge National Scenic Area. Protected areas in and near Multnomah County are shown in **Figure 2.9-2**.

Figure 2.9-2: Protected Areas Source: Metro, Regional Land Information System (RLIS), 2016

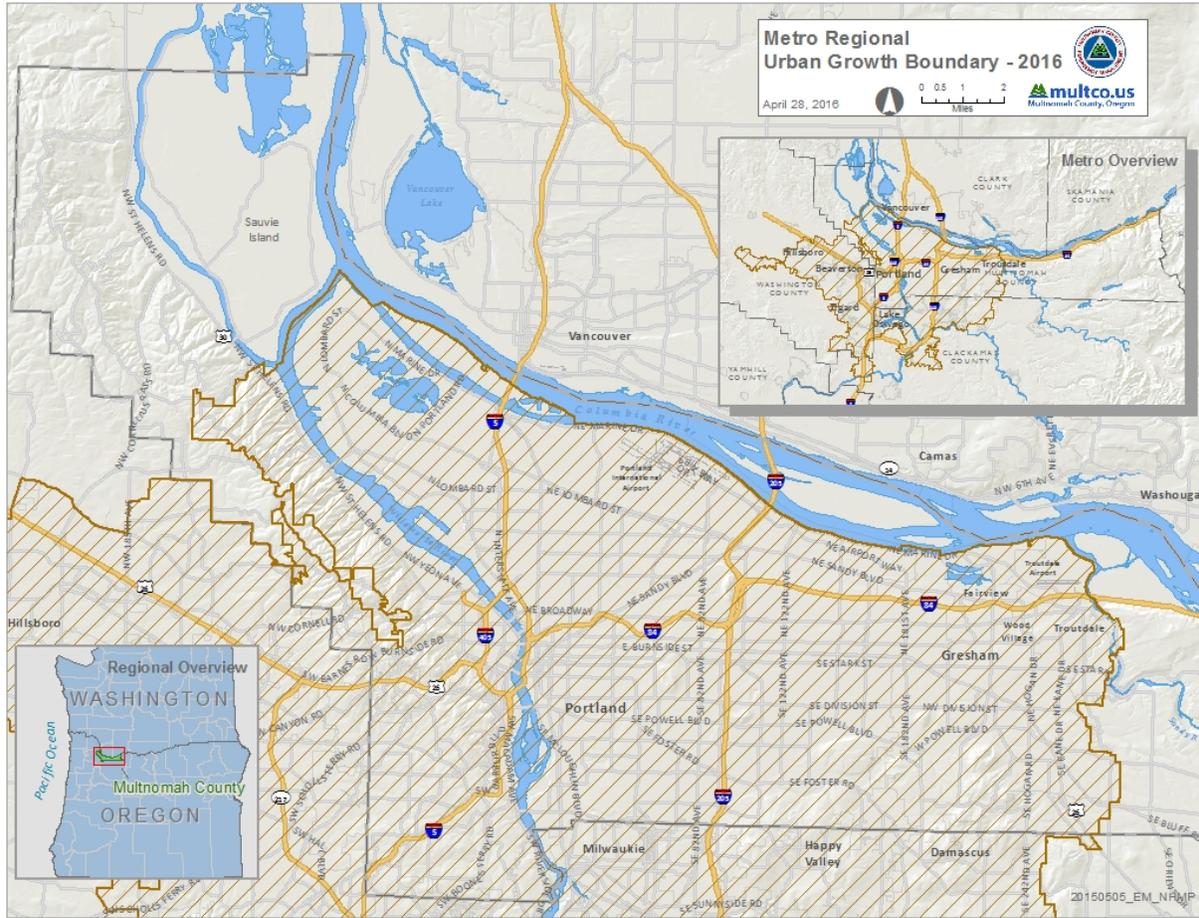


Source: Metro, Regional Land Information System (RLIS), 2016

2.9.2 Urban Growth Boundary

The Portland metropolitan area's urban growth boundary (UGB) controls urban expansion onto farm and forest lands (**Figure 2.9-3**). Every six years, the Metro Council reviews land supply in relation to population and employment forecasts for the next 20 years. In 2015, the Metro Council recognized that communities in the region have planned for expected growth inside the existing boundary, and therefore decided to not expand the UGB. The next review of the UGB will occur in 2018 (Metro, no date).

Figure 2.9-3: Urban Growth Boundary



Source: Metro, Regional Land Information System (RLIS), 2016

2.9.3 New Development

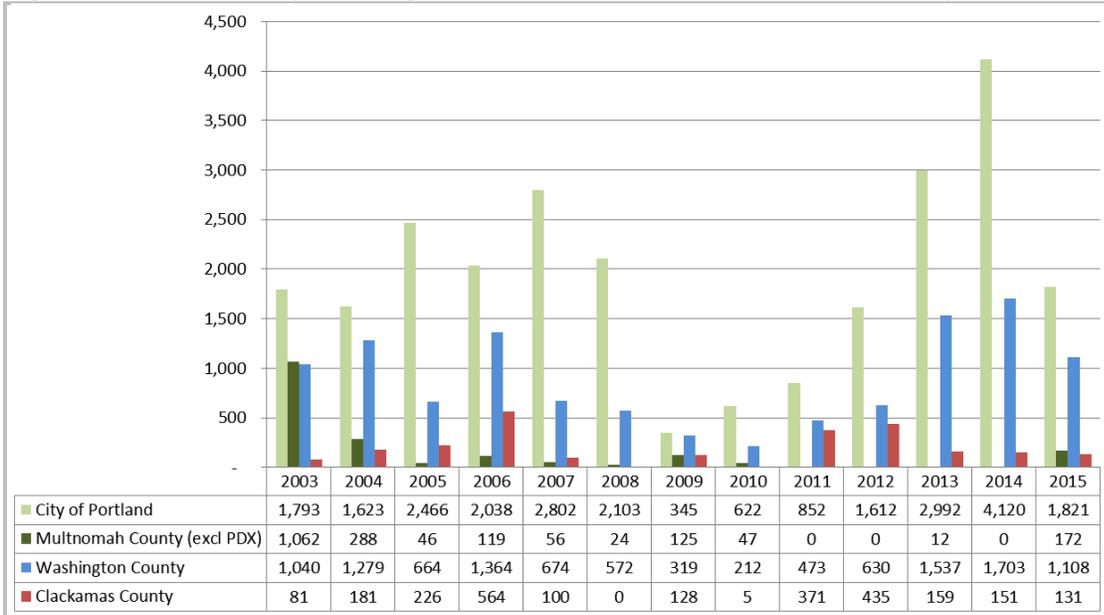
New development in the Portland metro area has picked up after the Great Recession, as illustrated by an uptick in building permits issued in 2012 and 2013 (**Figure 2.9-4**). Between 2010 and 2014, Multnomah County had 3,459 single-family residential building permits and 10,515 multi-family residential permits issued (U.S. Census Bureau). A majority of the multi-residential development has been in the City of Portland, but permits are again starting to be issued for multi-family projects outside of Portland (**Figure 2.9-5**).

Figure 2.9-4: Building Permits for New Private Housing, Portland-Vancouver-Hillsboro MSA, Seasonally Adjusted



Source: Terry, 2015

Figure 2.9-5: Multifamily Building Permits Issued, Number of Units, YTD Sept. 2015



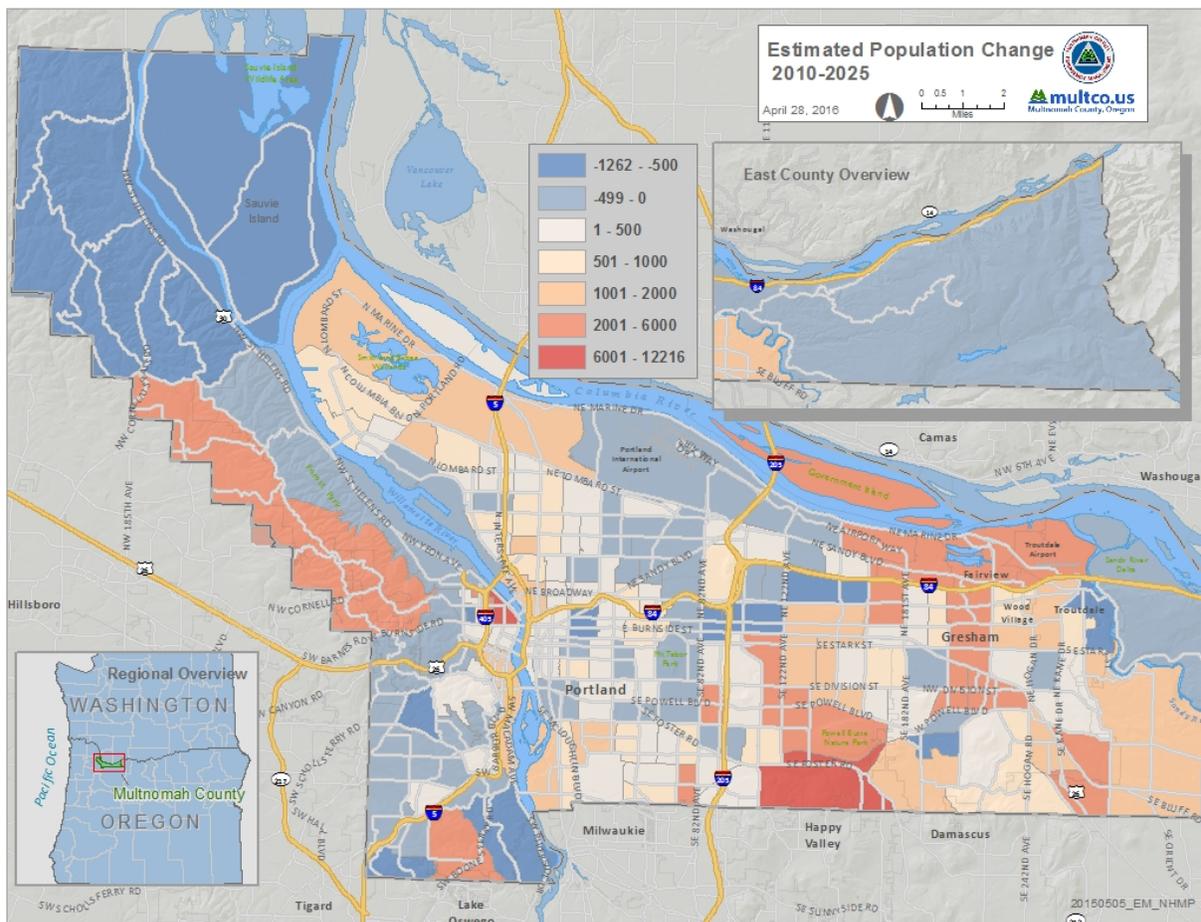
Source: Terry, 2015

2.9.4 Projected Development and Demographic Patterns

Demographers at Portland State University’s Population Research Center have produced projections of change in racial/ethnic composition by census tract through 2025 (Figures 2.9-6, -7, -8, and -9). The greatest changes are expected to be a result of infill development and rapidly increasing property values. Future population growth may strain transportation systems; however, relative to other regions, the region has been aggressive in its plans for public transportation systems.

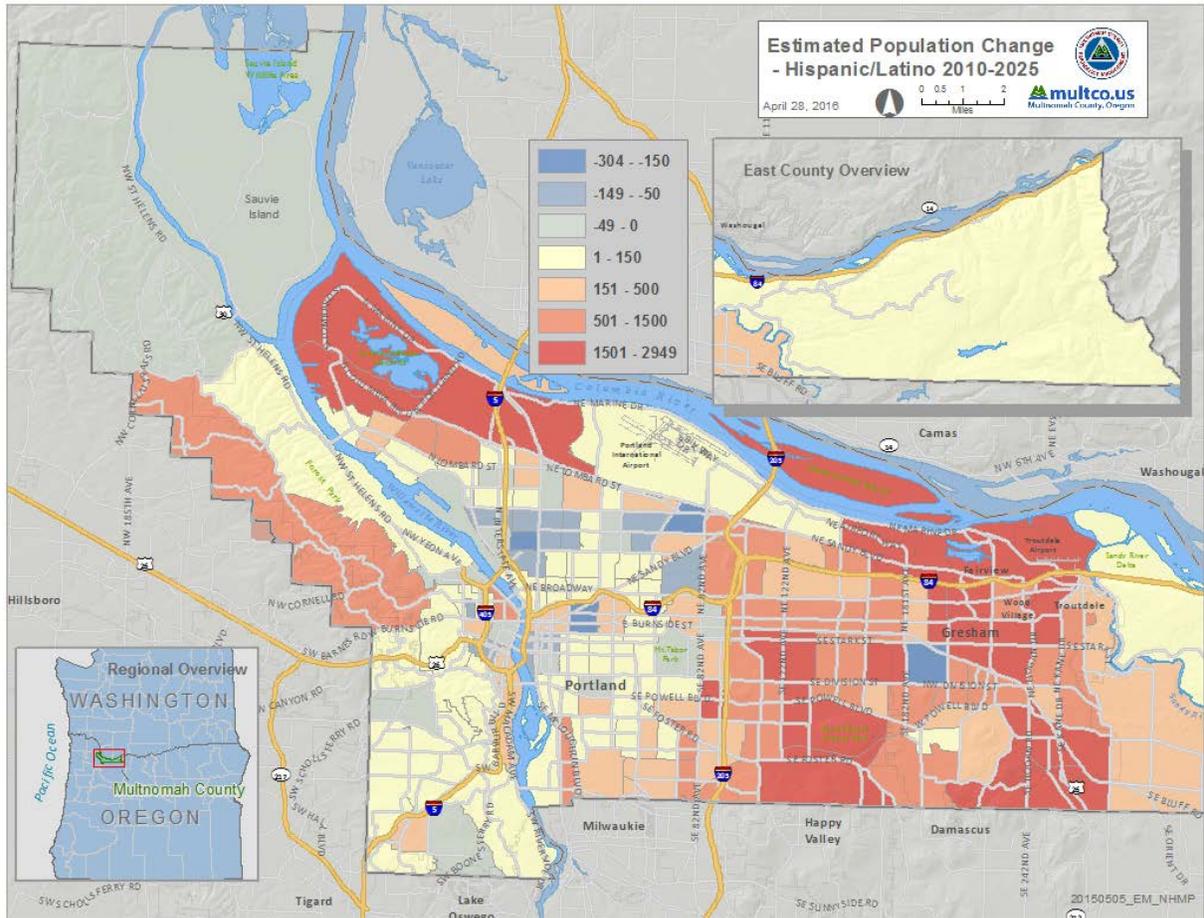
Forecasts predict that long-term residents may be displaced from some neighborhoods due to rising property values. Many displaced residents from inner neighborhoods are expected to move to areas with lower-cost housing, such as east Portland and Gresham. For example, demographers predict fewer Black/African American communities in north Portland and more in areas east of Interstate 205. In addition, a rise in new development near Mount Scott and Happy Valley is expected to bring more minority groups to those areas (Multnomah County Health Department, 2014).

Figure 2.9-6: Total Estimated Population Change, 2010–2025



Source: Population Research Center, 2016

Figure 2.9-9: Hispanic/Latino Estimated Population Change, 2010–2025



Source: Population Research Center, 2016

2.9.5 How Development Is Impacting Our Vulnerability

Balancing growth with hazard mitigation is key to planning resilient communities. Each jurisdiction has strategies to reduce impacts to people, property, structures, and natural resources from natural hazards. One tool to help Oregon communities balance the demands of growth with the need to reduce our risks to hazards is statewide land use Goal 7: Areas Subject to Natural Hazards. Goal 7 requires cities and counties to adopt Comprehensive Plan policies and implementation measures to reduce risks associated with a variety of natural hazards. See **4.3 Implementation** for a comprehensive list of how each jurisdiction is integrating natural hazard mitigation into existing planning mechanisms.

The impacts of existing and potential future development trends on each jurisdiction’s vulnerability include the following.

- Unincorporated Multnomah County:** Within the unincorporated areas of Multnomah County, there has been no major shift in development trends since the last NHMP update. Development remains low intensity due to land use regulations. The main focus for managing risk in unincorporated areas has been driven by maps for areas subject to landslides and areas in a one percent flood zone.

It is a priority for the county to enhance its hazard mapping in unincorporated areas. Over the next one to three years, the county is anticipating beginning mapping other hazards such as channel migration zones (CMZ) and increased wildfire risk due to climate change. More robust data for CMZs and wildfire will likely result in mapped hazard areas becoming more expansive. Based on the data, the county may adopt more strict regulations related to hazard mitigation as part of this legislative effort.

- **Gresham:** Growth within the City of Gresham since the last NHMP update has been primarily within the Pleasant Valley Community. This community includes Kelley Creek and its tributaries and a small area along Johnson Creek. Johnson Creek floods with some regularity. Plans are in place to set aside the floodplain as open space. There are some steep slopes within Pleasant Valley that may be subject to landslides. Elevations in the area range from 1,230 feet to the east to 238 feet at the junction with Johnson Creek to the west. This community is also within a wildfire urban interface, and as such may be susceptible to wildfire. To minimize the impact of new construction, development permits are consistent with Gresham's Development Code and in accordance with the Pleasant Valley Plan District,

The Springwater Community remains an Urban Reserve Area without improvements. Like Pleasant Valley, flooding, landslides and wildfire can impact the Springwater Community. The Springwater area is designated by Metro as a Regionally Significant Industrial Area (RSIA). The purpose of RSIA is to provide and protect a supply of sites for employment by limiting the types and scale of non-industrial uses. Developing Springwater will be very difficult with the RSIA designation given its lack of large parcels of land, protected natural areas, and lack of transportation connection to I-84.

- **Fairview:** Recent development within the City of Fairview has been relatively minor, including mostly single family and mixed use infill units and one industrial construction yard. All are outside the one percent flood zone. Impact to riparian zones, drainage streams and flooding are major components of all development reviews. In the future, increased market pressure to expand multifamily development could increase vulnerability in Fairview.
- **Troutdale:** Since the last NHMP update, residential development within the City of Troutdale has been relatively minor, including mostly single family and mixed use infill units. All are outside the one percent flood zone. Industrial and commercial development is increasing in and near one percent flood zones. Troutdale works closely with the Multnomah County Drainage District and Levee Ready Columbia to insure development in those areas is not at risk. Impact to riparian zones, drainage streams and flooding are major components of all development reviews.
- **Wood Village:** The City of Wood Village's hazardous areas, those vulnerable to landslides on or near steep slopes, are neither more nor less vulnerable than in the past. The area is nearly completely built out except for one platted private subdivision which was never constructed and that plat is expired at this time. Any development from this point will be looked at critically from a planning standpoint and will require rigorous geotechnical investigations on-site and below prior to acceptance for development as well as any storm water concerns. Wood Village has no additional areas of concern that are undeveloped and in the steep slope overlay.

2.10 Community Connectivity

2.10.1 Civic Engagement

Civic engagement is an important indicator of community connectivity, and is often measured by voter turnout in political elections. In Multnomah County, 82.5% of registered voters cast ballots for the 2012 Presidential General Election, which was similar to the statewide turnout rate (Multnomah County no date).

However, meaningful engagement encompasses more than voter registration and turnout rates, such as public engagement in local planning processes and policy decisions. It should be noted that marginalized communities, such as immigrant, refugee and low-income communities, do not play on an even social and political field in advocating for their own interests (Metro, 2015). There are often many institutional barriers that serve to exclude or limit participation from these communities, including (Metro, 2015):

- Language and cultural barriers, such as meeting and engagement methods that are not culturally appropriate due to publicizing methods, meeting time or location, or lack of accommodation.
- Differences in power dynamics, such as lack of knowledge of decision-making processes or relationships with decision-makers, and pre-existing mistrust of government based on previous experiences that may have included power imbalances, inauthentic processes or tokenization.
- Limited capacity — leaders from historically underrepresented communities often are asked to participate in numerous processes involving multiple government agencies and must prioritize their communities' needs and their own ability to participate; community members often require new knowledge, tools and experience that may require grassroots capacity building.

The Metro online Opt-In Survey, designed to inform regional policies, illustrates how white, more-affluent and more-educated residents are disproportionately aware of and using this tool, and are therefore more represented in public opinion surveys in the region. For example, close to 90% of respondents were White/Caucasian; over 40% of respondents had a post-graduate education; and over 30% of respondents had a household income of more than \$100,000 (Metro, 2015).

Equity programs in many of the government agencies in Multnomah County are working on mitigating these systemic issues. Until progress is made, equitable civic engagement is a known area of weakness to achieving community resilience.

2.10.2 Social Services

The availability of social services before and after a disaster can impact a community's ability to bounce back, especially for those who do not have the personal resources to recover. In 2013, the Multnomah County Department of County Human Services (DCHS) published a strategic plan based on an assessment of DCHS social services. A goal of the assessment was to determine if county services were adapting to the changing needs of its clients. One component of the changing needs of the county's clients is a change in demographics of its client base. The assessment found DCHS programs are (1) aware of the changing demographics, (2) generally well-positioned to deliver services to the county's changing client base, and (3) using a variety of methods to meet the needs of its clients (Multnomah County, 2013). The audit also noted the most common barrier to reaching clients is limited resources for both county and community partner programs (Multnomah County, 2013).

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3 Hazard Identification and Risk Assessment

In This Chapter

Purpose

The hazard identification and risk assessment identifies and characterizes the Planning Area's natural hazards and describes how each hazard can impact our communities. The risk assessment reveals our vulnerabilities and informs our mitigation strategy.

Hazards

All five jurisdictions in the Planning Area are subject to six natural hazards: earthquakes, floods, landslides, severe weather, volcanic activity, and wildfire. Each hazard is profiled separately. Interrelationships between hazards (e.g., flooding can trigger a landslide) and climate change projections are included in each hazard profile, when applicable.

Human-caused and technological hazards are analyzed in a separate report that can be found in **Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment**. This report profiles the following eight hazards of concern for Multnomah County, as identified by the steering committee: transportation incidents, hazardous materials incidents, pipeline incidents, critical infrastructure failure, utility interruption, terrorism, workplace/school/university violence, and fuel/resource shortage.

Multi-Jurisdictional Plan

This Natural Hazards Mitigation Plan (NHMP) addresses both common risks across the Planning Area and those risks unique to each jurisdiction. Unique observations or relevant anecdotal information noted by the steering committee and other stakeholders are also included.

Format

Each risk assessment includes a profile of the hazard that contains five sections: local risk rankings, an overview, history, probability and vulnerability.

1. **Local Risk Rankings** are determined by local emergency managers and other local leaders and subject matter experts based on a risk analysis methodology developed by the Federal Emergency Management Agency (FEMA) and refined by the Oregon Office of Emergency Management (OEM) called the OEM Hazard Analysis.

The OEM Hazard Analysis is based on partially subjective scoring for each hazard. It is intended to assist local jurisdictions with identifying their risk and hazard priorities. This methodology has four components: history, probability, vulnerability to an average event, and vulnerability to a maximum event. The OEM methodology is further described in **Appendix C Local OEM Hazard Analysis Scores**.

Each hazard profile begins with OEM Hazard Analysis relative risk rankings (high to low) for each jurisdiction, as shown in **Table 3-1**, and a brief justification of those rankings. Each jurisdiction's scoring sheets are located in **Appendix C**.

Table 3-1: OEM Hazard Analysis Risk Rankings by Jurisdiction

	Unincorporated Multnomah County	Gresham	Troutdale	Fairview	Wood Village
HIGH	Earthquake	Earthquake	Severe Weather	Earthquake	Severe Weather
	Flood	Severe Weather		Severe Weather	
	Wildfire				
MODERATE	Severe Weather	Flood	Earthquake	Volcano	Earthquake
		Landslide	Volcano	Flood	Volcano
			Flood		Landslide
			Wildfire		
LOW-MODERATE				Flood	
LOW	Landslide	Wildfire	Landslide	Landslide	Wildfire
	Volcano	Volcano		Wildfire	

Source: Local jurisdictions in the Planning Area

2. The hazard **Overview** describes the types, location (geographic area) and extent (strength or magnitude) of each hazard.
3. The **History** section lists known previous hazard events, including the location and a brief description.
4. **Probability** describes the likelihood of the hazard occurring in the future. Probability is described using historical frequencies or statistical probabilities, depending on the data available.

Included in this section are impacts of a changing climate on the hazard. This section is based on the Oregon Climate Assessment Report (Oregon Climate Change Research Institute, 2010), the Climate Change Adaptation Framework (State of Oregon, 2010), the analysis of these two reports as described in the Oregon NHMP (DLCD, 2015), and the Climate Change Preparation Strategy: Preparing for Local Impacts in Portland and Multnomah County (2014). According to these sources, the most reliable information on climate change to date is at the state level and indicates that hazards projected to be impacted by climate change in the Planning Area include drought, wildfire, flooding and landslides.

5. Each hazard's impact on the Planning Area is described in the **Vulnerability** section, including loss estimates and particular areas of concern for each jurisdiction. The vulnerability analysis helps each community understand its greatest risks. A combination of exposure, historical occurrence, and scenario based methods were used to qualitatively and quantitatively analyze vulnerability.

Comparing State and Local Risk Rankings

The 2015 Oregon NHMP contains a side-by-side comparison table of local and state risk rankings for each hazard, titled “Table 2-39. Local and State Vulnerability Ranking by County.” The local risk rankings in this table for Multnomah County are from an OEM Hazard Analysis completed in 2008, while the state rankings were developed in 2014. The 2008 analysis considered all of Multnomah County, including the City of Portland.

Multnomah County’s OEM Hazard Analysis update in 2016 was conducted differently. Each jurisdiction completed the OEM methodology for its respective community. This resulted in five separate sets of risks scores, as seen in **Table 3-2**. The City of Portland conducted a separate risk assessment in 2016, using a different methodology, during the update of its Mitigation Action Plan (MAP).

As a result, some of the risk rankings for Multnomah County have changed based on the county’s new approach to local risk analysis. Nonetheless, similarities and differences between local and state risk rankings still exist (**Table 3-2**).

Table 3-2: Risk Rankings by Hazard from the State (2015) and from Jurisdictions Within Multnomah County (2016)

	Earthquake	Flood	Landslide	Severe Weather	Volcano	Wildfire
State rankings for Multnomah County	Most Vulnerable	Vulnerable	Most Vulnerable	Most Vulnerable	Most Vulnerable	Vulnerable
Unincorporated Multnomah County	High	High	Low	Moderate	Low	High
Gresham	High	Moderate	Moderate	High	Low	Low
Troutdale	Moderate	Moderate	Low	High	Moderate	Moderate
Fairview	High	Moderate	Low	High	Moderate	Low
Wood Village	Moderate	Low-Moderate	Moderate	High	Moderate	Low

Sources: 2016 Local OEM Hazard Analysis risk rankings and the 2015 Oregon NHMP

How local and state entities identify risk varies greatly, from local to state as well as across all hazards at the state level (DLCD, 2015). As described above and in **Appendix C Local OEM Hazard Analysis Scores**, local risk scores are based on the knowledge of local emergency managers and other local subject matter experts. The methodology identifies risk to each hazard within that particular jurisdiction.

The state risk assessment in the 2015 Oregon NHMP was conducted by one or more subject matter experts for each hazard based on recent data and scientific expertise. They ranked vulnerability for Multnomah County overall, including the City of Portland, which may account for much of the difference between the state and local rankings. In addition, for some hazards, a significant amount of data are available and support detailed damage and loss projections that help the state identify which communities are most vulnerable to each hazard (DLCD, 2015). Hazards for which there are limited data undergo a less rigorous assessment, and identifying which communities are most vulnerable to those hazards may be more challenging (DLCD, 2015).

This method compares the *relative* level of risk among Oregon’s counties. In some instances, cities and local communities are identified as being especially vulnerable — such as the Critical Infrastructure Hub in Portland having a high risk to seismic activity, and the City of Seaside being especially vulnerable to a tsunami. In the risk ranking comparison tables, though, only counties are compared relative to each other. Both methodologies are quasi-subjective.

Given the methods used to assess risk at the local and state levels, it is not surprising that risk rankings sometimes differ greatly for the same hazards, as shown in **Table 3-2**. Comparing state and local risk rankings therefore is difficult. A common risk assessment methodology applied locally and by the state would provide a common picture of our true risk, and would help to better align local and state mitigation action priorities.

A Note About Data in the Hazard Identification and Risk Assessment

The best available data was used to assess risk. However, it is important to note that there is a wide range of data available from hazard to hazard, and from jurisdiction to jurisdiction, each with its own use limitations. For example, a wealth of high resolution data for floods enables us to understand the impact a 100-year flood can have on specific properties. On the contrary, the intended use for volcanic activity data informs general planning, but should not be used for site-specific planning.

Hazard data varies among jurisdictions. A function of merging five plans into one Multi-Jurisdictional NHMP, data available for one community may not be available for another community. Furthermore, the granularity of the data varies among jurisdictions. Coordinating hazard data updates in future iterations of the plan will minimize these variations.

When available, data are categorized by each city and unincorporated area.

While this plan does not include the City of Portland overall, some data for the risk assessment was available only at the Multnomah County level, which includes the City of Portland.

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3.1 Earthquake

Much of the Planning Area is susceptible to earthquake-induced landslides, liquefaction and severe ground shaking. A dense population and built environment in the cities of Gresham and Fairview make these communities especially vulnerable to earthquake hazards. Some unincorporated areas have high susceptibility to earthquake-induced landslides (West Hills and the Columbia River Gorge) and liquefaction (Sauvie Island). Because the vast majority of the building stock in the cities of Troutdale and Wood Village is wood framed — which generally performs fairly well in earthquakes — impacts from ground shaking are likely to be more moderate for these communities.

3.1.1 Overview

Since the 1980s, awareness of seismic risk in Oregon has increased significantly. This is due in large part to local earthquake events such as the M5.6 1993 Scotts Mills earthquake in Clackamas County; global events like the devastating earthquakes and tsunamis in Indonesia (2004) and Japan (2011), and earthquakes in New Zealand (2011), Chile (2014) and Nepal (2015); and new research about the massive fault off the Pacific Northwest coast called the Cascadia Subduction Zone.

Small to moderate earthquakes up to M5 or M5.5 are possible almost anywhere in the Planning Area. There is also a possibility of larger crustal earthquakes in the M6+ range. There is good reason to believe that the most devastating future earthquakes probably would originate along shallow crustal faults in the region and along the Cascadia Subduction Zone (Oregon Department of Land Conservation and Development [DLCD], 2015).

Types

All jurisdictions in the Planning Area are susceptible to impacts from earthquakes from three sources: (a) the offshore Cascadia Subduction Zone, (b) deep intraplate events within the subducting Juan de Fuca plate, and (c) shallow crustal events within the North America Plate, as shown in **Table 3.1-1**. All have some tie to the subducting or diving of the dense, oceanic Juan de Fuca Plate under the lighter, continental North America Plate.

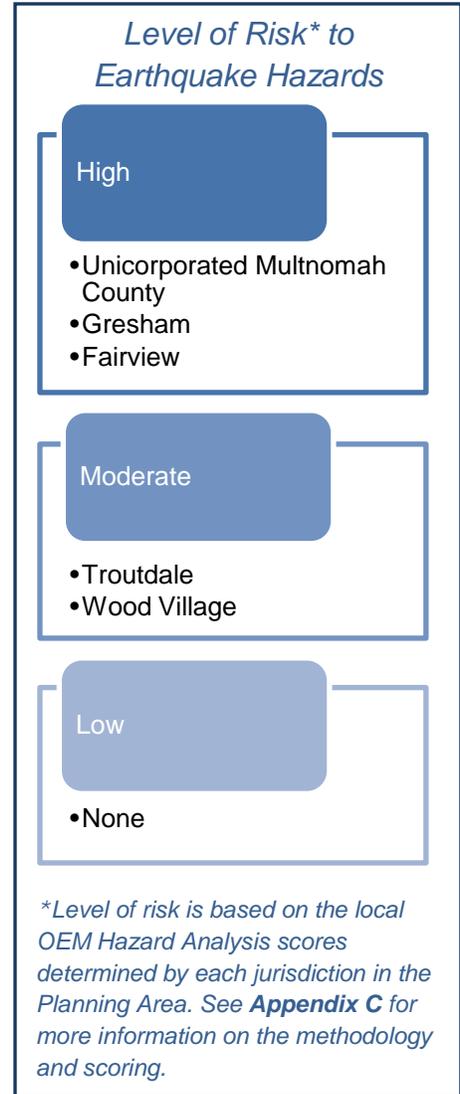


Table 3.1-1 Types of Earthquake Hazards That Impact Each Jurisdiction

Jurisdiction	Cascadia Subduction Zone	Intraplate	Crustal
Unincorporated Multnomah County	✓	✓	✓
Fairview	✓	✓	✓
Gresham	✓	✓	✓
Troutdale	✓	✓	✓
Wood Village	✓	✓	✓

Source: Oregon Department of Land Conservation and Development (DLCD), 2015; NHMP Steering Committee, 2016

Cascadia Subduction Zone Earthquakes

The Cascadia Subduction Zone is a geologically complex area off the Pacific Northwest coast that extends from Northern California to British Columbia. In simple terms, several pieces of oceanic crust (the Juan de Fuca Plate, Gorda Plate and other smaller pieces) are being subducted (pushed under) the crust of North America. This subduction process is responsible for most of the earthquakes in the Pacific Northwest as well as for creating the volcanoes in the Cascades.

Intraplate Earthquakes

Intraplate earthquakes occur within the subducting oceanic plate. These earthquakes occur quite deep in the earth. Ground shaking from such earthquakes would be very strong near the epicenter, and strong ground shaking would be felt throughout all of the Planning Area, with the level of shaking decreasing toward eastern Multnomah County.

Crustal Earthquakes

Crustal earthquakes occur within the North American plate, above the subducting plate. These earthquakes are possible on faults mapped as active or potentially active as well as on unmapped (unknown) faults.

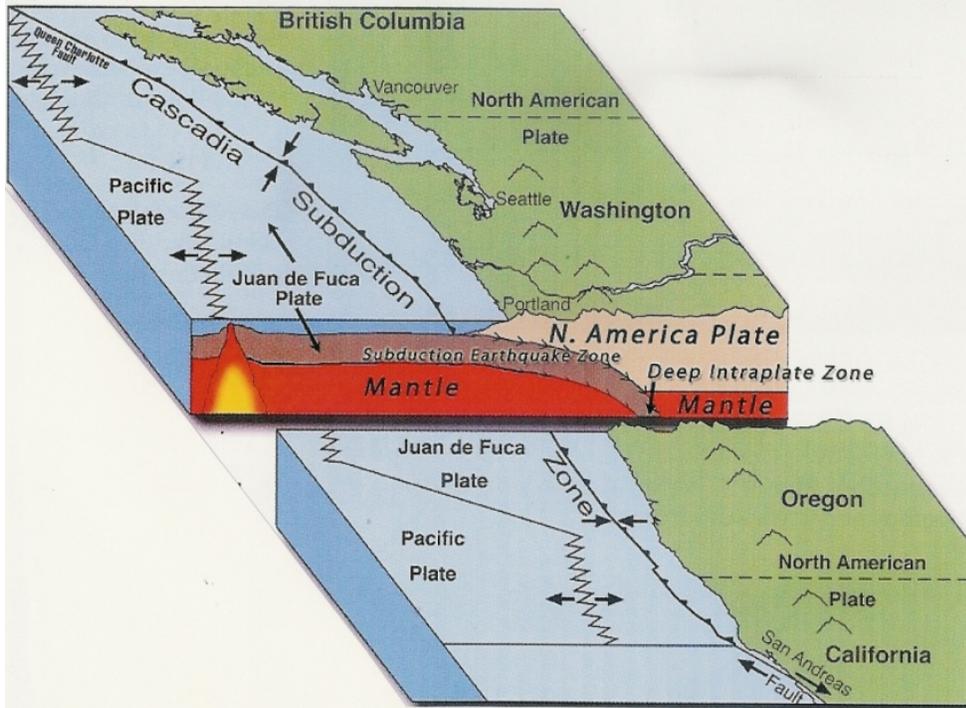
Location and Extent

Earthquake ground motions may be significantly higher for certain soil types. Buildings and infrastructure in the higher-amplification areas will generally suffer more damage in any given earthquake than similar buildings and infrastructure located in low-amplification areas. In general, earthquake-induced ground motions within the Planning Area are higher to the west, and lower to the east. The location and extent of each type of earthquake is described below.

Cascadia Subduction Zone Earthquakes

Figure 3.1-1 shows the geologic (plate-tectonic) setting of the Cascadia Subduction Zone. These earthquakes occur about 20 to 60 kilometers (12 to 40 miles) offshore from the Pacific Ocean coastline.

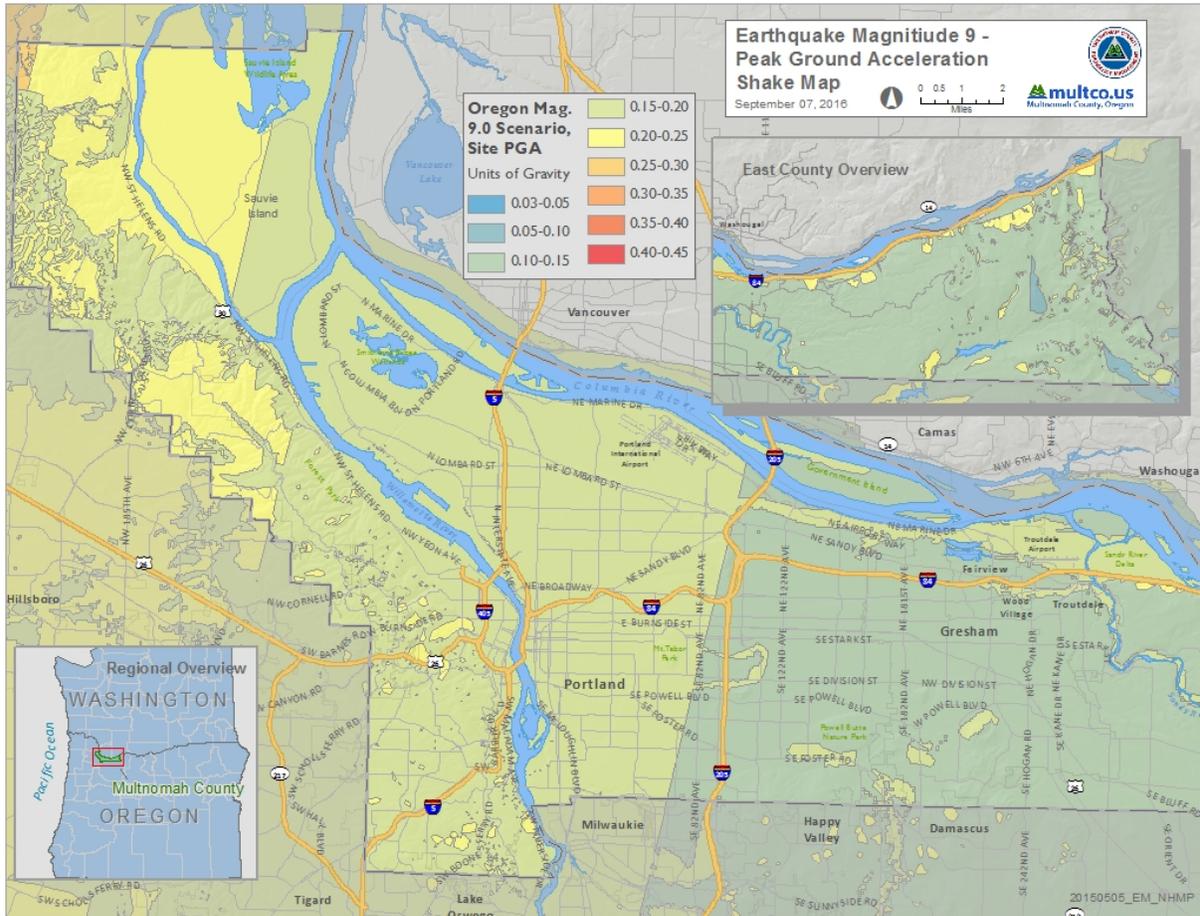
Figure 3.1-1 Cascadia Subduction Zone: Cross Section, A Magnitude 9.0 Earthquake Scenario



Source: Cascadia Region Earthquake Working (CREW) Group, 2005

Figure 3.1-2 shows that ground shaking from a Cascadia Subduction Zone event would be very strong near the coast, and moderately strong ground shaking would be felt throughout the Planning Area, with the level of shaking decreasing toward eastern Multnomah County.

Figure 3.1-2 Cascadia Subduction Zone 9.0 Peak Ground Acceleration Shake Map



Source: Madin and Burns, 2013

Intraplate Earthquakes

Deep-seated intraplate events could generate magnitudes ranging from M6 to as large as M7.5 (Oregon Department of Land Conservation and Development [DLCD], 2015). These earthquakes occur quite deep in the earth, about 30 or 40 kilometers (18 to 25 miles) below the surface, with epicenters that likely would range from near the Pacific Ocean coast to about 50 kilometers (30 miles) inland. Examples of intraplate earthquakes are the 2001 Nisqually earthquake in Washington State and earthquakes near Olympia, Washington, in 1949.

Crustal Earthquakes

The City of Portland has been built on three identified crustal faults that stretch the length of Portland: the Oatfield Fault, the East Bank Fault, and the Portland Hills Fault. Each of these crustal faults is capable of generating large earthquakes of M6.0–6.8 (DLCD, 2015). Three other nearby faults could impact communities in Multnomah County, including the Grant Butte Fault, the Tickle Creek Fault Zone in Damascus, and the Lacamas Lake Fault in Washington. There may also be unknown crustal faults along

which quakes could occur. Unknown faults are statistically possible anywhere in Multnomah County. Most likely, earthquakes on as yet unknown faults would be relatively small, most likely with magnitudes less than M6. However, earthquakes as large as M6 or M6.5 on unknown faults are possible.

Other Aspects of Seismic Hazards in Multnomah County

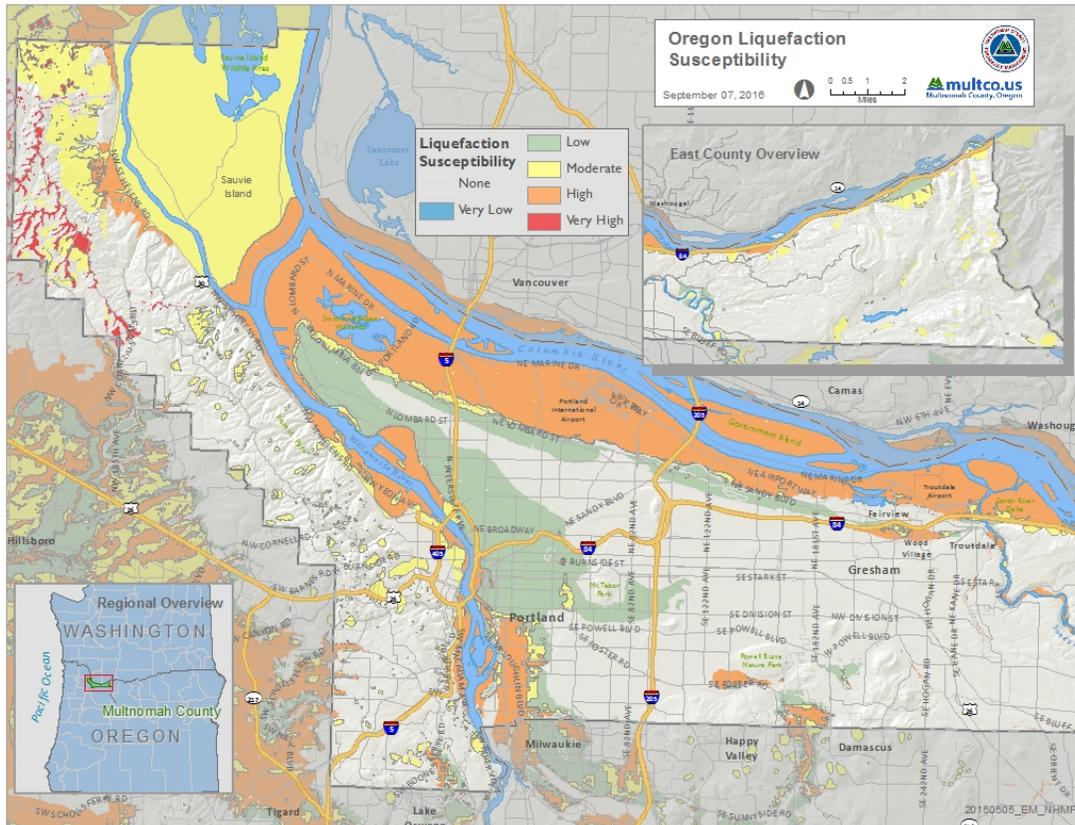
Earthquakes also can trigger liquefaction, settlement, lateral spreading, landslides, volcanic activity, dam failures, levee failures and tsunamis and seiches, which can result in significant damage. Following is a description of the location and extent of these additional seismic-related hazards in the Planning Area.

Liquefaction, Settlement and Lateral Spreading

Liquefaction is a process where loose, wet sediments lose strength during an earthquake and behave similarly to a liquid. Once a soil liquefies, it will tend to settle vertically and/or spread laterally. On even very slight slopes, liquefied soils tend to move sideways downhill creating lateral spreading.

Figure 3.1-6 shows areas in the Planning Area with soils prone to liquefaction in a 9.0 Cascadia Subduction Zone earthquake. The very-high- and high-liquefaction areas include broad areas along the Columbia River, significant areas along both the Willamette and Sandy rivers, and smaller areas along several streams. These areas include Portland International Airport and significant portions of the cities of Portland, Troutdale and Wood Village. Within unincorporated Multnomah County, areas at risk of liquefaction include parts of Sauvie Island, areas along the Columbia River east of Troutdale, and areas along the Sandy River and several streams.

Figure 3.1-6 Liquefaction Potential after a 9.0 Cascadia Subduction Zone Earthquake

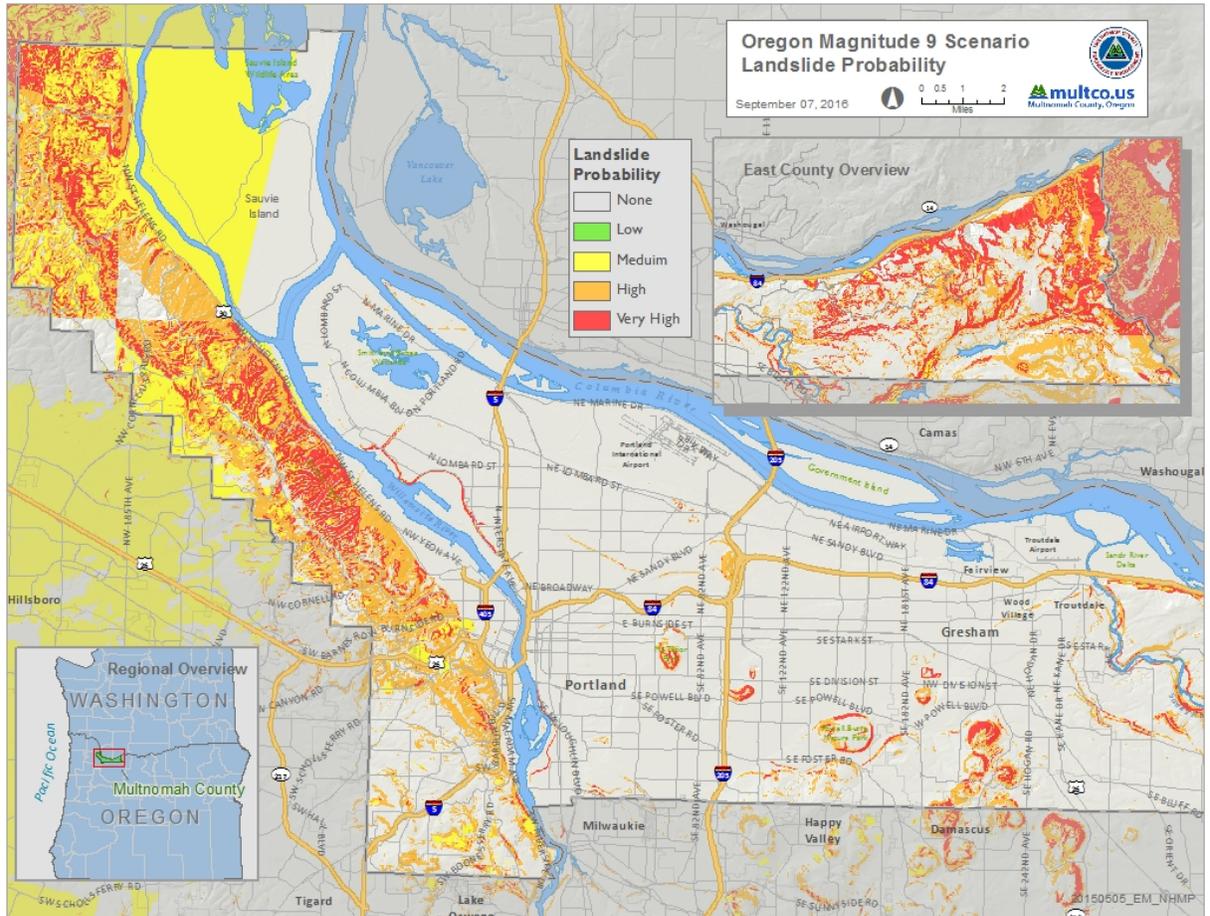


Source: Madin and Burns, 2013
Natural Hazards Mitigation Plan

Landslides

Earthquakes can trigger landslides, especially if an earthquake occurs during the rainy season when soils are saturated with water. The areas prone to earthquake-induced landslides are largely the same as those areas prone to landslides in general. Areas with steep slopes and loose rock or soils are most prone to landslides, including those induced by earthquakes. **Figure 3.1-7** shows areas that may be subject to landslides after a 9.0 Cascadia Subduction Zone earthquake. See section **3.3 Landslides** for a more detailed discussion of landslides.

Figure 3.1-7: 9.0 Cascadia Subduction Zone Earthquake-induced Landslides



Source: Madin and Burns, 2013

Volcanic Activity

Despite the fact that Cascade volcanoes are located some distance away from the Planning Area, earthquake shaking and secondary volcano-related hazards such as lahars could cause major damage to our communities (DLCD, 2015). For more information about volcanic hazards in the Planning Area, see section **3.5 Volcano**.

Dam Failures

Earthquakes can cause dam failures. The most common mode of earthquake-induced dam failure is slumping or settlement of earthfill dams where the fill has not been properly compacted. If slumping occurs when a dam is full, overtopping of the dam can lead to rapid erosion, and dam failure is possible. Strong ground motions also can damage concrete dams. Furthermore, earthquakes can trigger landslides that flow into reservoirs and cause dam failures. More information about dams can be found in **Section 3.2 Floods**.

Levee Failures

Based on the U.S. Army Corps of Engineers 2001 study of the seismic performance of the Columbia River Levee, the levee by itself would not result in interior flooding, unless a major flood event was in progress. The study highlights that there is no known correlation between high water periods and earthquakes. Though not all levees perform the same, and the study considered only a small section of the levee north of the Portland International Airport, the fact remains there is no known correlation between high water periods and earthquakes. Therefore, the likelihood of a major flooding event on the Columbia River and an earthquake occurring at the same time is very low.

Tsunamis and Seiches

Tsunamis result from earthquakes which cause a sudden rise or fall of the ocean floor. These ocean floor movements may produce tsunami waves. The Planning Area would not be directly affected by tsunamis. A tsunami surge could extend up the Columbia River, perhaps as far inland as Multnomah County. However, because of the considerable distance from the coast, the effects would be minimal or zero. That is, the increase in water level would be immeasurable, or perhaps just a few inches, and would not cause damage within the Planning Area.

A similar earthquake phenomenon is seiches — waves from sloshing of inland bodies of waters such as lakes, reservoirs or rivers. Seiches may damage docks, other shorefront structures and dams. Seiches could cause localized damage to reservoirs or tanks within the Planning Area.

3.1.2 History

The Planning Area been shaken by crustal and intraplate earthquakes and, prehistorically, by subduction zone earthquakes centered outside the area (DLCD, 2015). There have been dozens of mostly small earthquakes recorded in or near Multnomah County. **Table 3.1-2** lists the significant historical earthquakes that have impacted the Planning Area.

Table 3.1-2 Significant Historic Earthquakes Affecting the Planning Area

Date	Location	Size (M)	Description
Approximate years: 1400 BCE*, 1050 BCE, 600 BCE, 400, 750, 900	Cascadia Subduction Zone (Offshore)	Probably 8.0–9.0	Based on studies of earthquakes and tsunamis at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
Jan. 1700	Cascadia Subduction Zone	About 9.0	Generated a tsunami that struck Oregon, Washington, and Japan. Destroyed Native American villages along the coast.
Oct. 1877	Portland area	5.2	Two events reported in one day. Estimated affected area was approximately 41,000 square kilometers. Chimney damage.
Feb. 1892	Portland area	5.0	No major damage.
Dec. 1941	Portland area	4.5	Felt by most Portland residents. Shattered windows and cracked plaster in Hillsboro and Sherwood.
Apr. 1949	Olympia, WA	7.1	Significant damage in Washington. Minor damage in NW Oregon.
Dec. 1953	Portland area	4.5	Cracked plaster. Objects fell in Portland.
Nov. 1961	Portland area	5.0	Principal damage from cracked plaster.
Nov. 1962	Portland area	5.5	Shaking up to 30 seconds. Chimneys cracked. Windows broken. Furniture moved.
Dec. 1963	Portland area	4.5	Books and pictures fell in North Plains, OR.
Apr. 1965	Seattle-Tacoma, WA	6.5	Three people killed. Only felt shaking in Multnomah County.
Mar. 1993	Scotts Mills, OR	5.6	DR-985. On Mt. Angel–Gales Creek fault. \$30 million damage (including Oregon Capitol Building in Salem) .
Sep. 1993	Klamath Falls, OR	6.0	DR-1004. Earthquake in Klamath Falls, two people killed.
Feb. 2001	Nisqually, WA	6.8	Felt in the region. No damage reported.

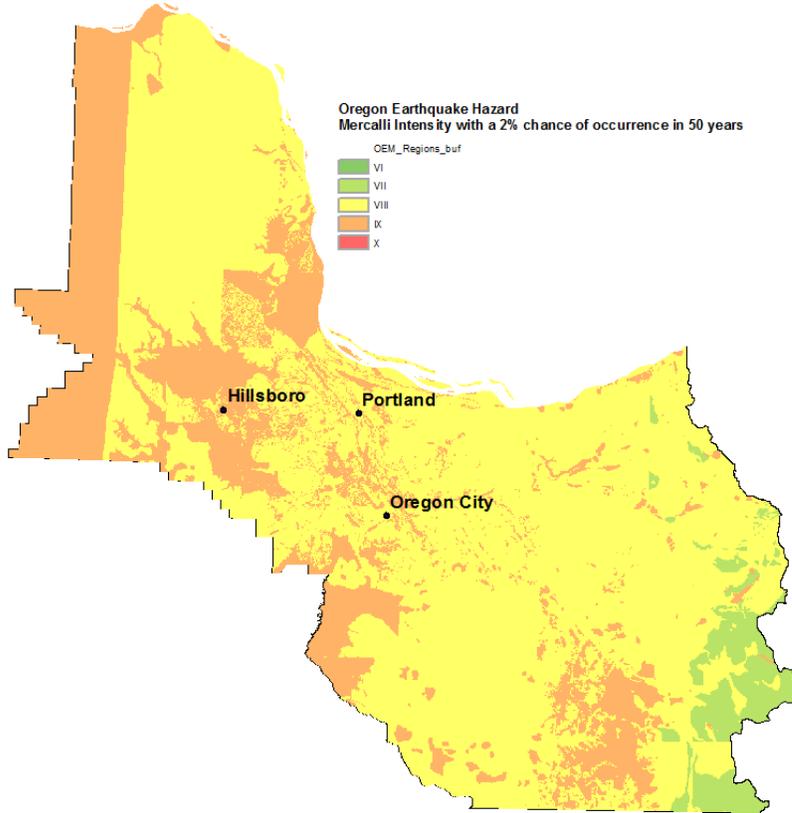
*BCE: Before the Common Era.

Source: Wong and Bolt, 1995

3.1.3 Probability

The map in **Figure 3.1-8** shows the expected level of earthquake damage along all known faults in Oregon that could impact the North Willamette Valley/Portland metropolitan area, including Multnomah County, that have a 2% chance of occurring in the next 50 years (DLCD, 2015). Based on the Simplified Mercalli Levels defined by Madin and Burns (2013), Multnomah County is subject to Level VIII and IX effects of shaking, meaning significant to substantial damage in vulnerable buildings can be expected. These Simplified Mercalli Levels are described in **Table 3.1-3**.

Figure 3.1-8 Oregon Earthquake Hazard Mercalli Intensity, with a 2% Chance Recurrence in 50 Years, North Willamette Valley/Portland Metropolitan Area*



* The North Willamette Valley/Portland metropolitan area includes Columbia, Washington, Multnomah and Clackamas counties.

Source: Madin and Burns, 2013

Table 3.1-3 Simplified Explanation of Mercalli Levels

Color	Mercalli Intensity	Effects of Shaking on People and Structures
Dark Green	VI	Felt by all, weak buildings cracked
Light Green	VII	Chimneys break, weak buildings damaged, better buildings cracked
Yellow	VIII	Partial collapse of weak buildings, unsecured wood-frame houses move
Orange	IX	Collapse and severe damage to weak buildings, damage to wood-frame structures
Red	X	Poorly built structures destroyed, heavy damage in well-built structures

Source: Madin and Burns, 2013

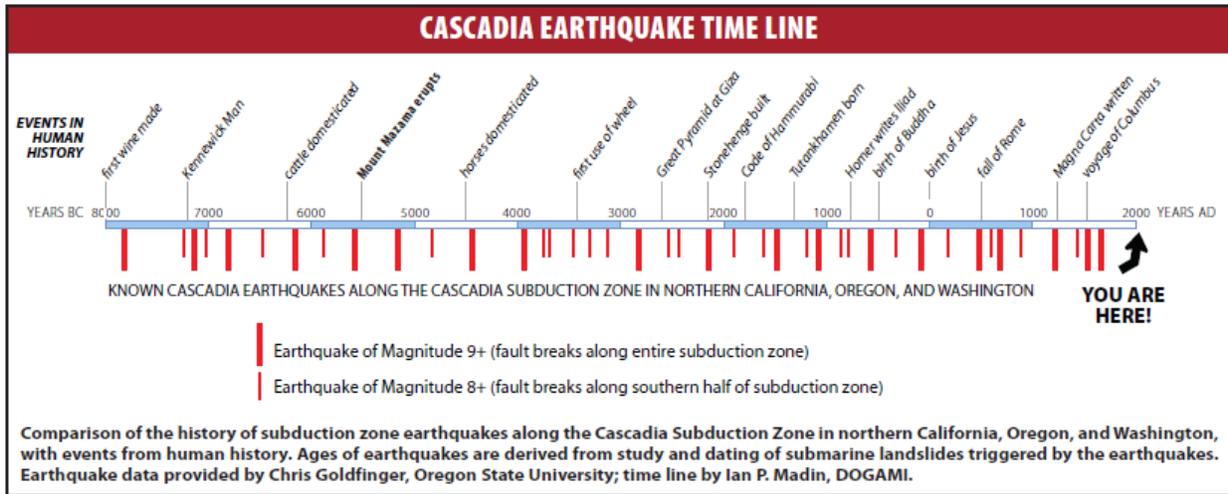
According to Madin and Burns (2013) and the 2015 Oregon Natural Hazards Mitigation Plan (NHMP), the probability of seismic activity for all faults that could affect the North Willamette Valley/Portland metro area is as follows.

For Oregon west of the crest of the Cascades, the [Cascadia Subduction Zone] is responsible for most of the earthquake hazard shown in **Figure 3.1-9**. The paleoseismic record includes 18 magnitude 8.8–9.1 megathrust earthquakes in the last 10,000 years that affected the entire subduction zone. For Multnomah County, a great magnitude 9.0 earthquake on the Cascadia Subduction Zone would result in widespread damage.

The return period for the largest earthquakes is 530 years, and the probability of the next such event occurring in the next 50 years ranges from 7 to 12%. An additional 10 to 20 smaller, magnitude 8.3–8.5, earthquakes affected only the southern half of Oregon and northern California. The average return period for these is about 240 years, and the probability of a small or large subduction earthquake occurring in the next 50 years is 37–43%. These return periods can be seen on the timeline in **Figure 3.1-9**.

[Cascadia Subduction Zone] earthquakes may have magnitudes of up to 9.0 or perhaps 9.2, with probable recurrence intervals of 500 to 800 years. The last major earthquake in this source region occurred in the year 1700, based on current interpretations of Japanese tsunami records. The timeline in **Figure 3.1-9** compares the 10,000-year-long history of Cascadia earthquakes to events in human history. As stated above, the probability of a small or large subduction earthquake occurring in the next 50 years is 37–43%.

Figure 3.1-9 Cascadia Earthquake Time Line



Sources: DOGAMI, 2010; Earthquake data provided by Chris Goldfinger, Oregon State University; timeline by Ian P. Madin, DOGAMI, 2013

While a Cascadia Subduction Zone earthquake would have massive regional impacts for the Planning Area and the surrounding Pacific Northwest, a smaller nearby earthquake, such as a M7.1 on the Portland Hills Fault, would result in higher levels of local ground shaking and local damage in Multnomah County (DLCD, 2015).

Crustal faults that can impact the Planning Area are all listed as “Class A” faults by the U. S. Geological Survey (USGS), which means that there is solid geological evidence for fault movements within the past 1.6 million years. The estimated slip rate on all of these faults is less than 0.2 mm per year.

Return periods for earthquakes on these faults are not well-known, but are probably at least several thousand years and perhaps 10,000 years, or more. Estimates for three crustal scenario earthquakes are summarized in **Table 3.1-4**. The return period for the smaller M6.0 Portland Hills scenario is roughly estimated at about ten times less than that for the M7.05 scenario.

Table 3.1-4 Estimated Return Periods for Scenario Crustal Earthquakes

Scenario Earthquake	Return Period (Years)	Probability in 50 Years	Last Event
M 7.05 Portland Hills*	14,000	0.35%	Unknown
M 6.0 Portland Hills*	1,500	3.50%	Unknown
M 6.8 Mount Angel	14,500	0.34%	Unknown

* Return periods for the M7.05 Portland Hills and M6.8 Mount Angel scenarios are based on 2008 USGS estimates.

Source: HAZUS, for 2012 Multnomah County NHMP

3.1.4 Vulnerability

The Planning Area is especially vulnerable to earthquake hazards for two reasons: (a) much of the area is susceptible to earthquake-induced landslides, liquefaction and severe ground shaking; and (b) the region contains the bulk of Oregon’s population and built environment (DLCD, 2015). Multnomah is one of the 15 counties in the state with the highest expected earthquake induced damages and losses, based on a 500-year model (DLCD, 2015)¹.

The level of damage from ground shaking depends upon the intensity and duration of the shaking. Unreinforced structures, roadbeds and bridges will be damaged to varying extents. It is expected that river crossings and areas with limited surface transportation alternatives will isolate some neighborhoods, hindering rescue and recovery activities (DLCD, 2015).

Projected Losses

The Regional Disaster Preparedness Organization (RDPO) has contracted with the Oregon Department of Geology and Mineral Industries (DOGAMI) to conduct a new HAZUS analysis for earthquakes for the Portland Urban Area Security Initiative Area, which includes Multnomah County. That project began in 2016 and will be completed after this NHMP update cycle. Findings from that analysis will inform the next update of this plan.

Countywide

Until then, the most recent earthquake data reaches back to the mid-1990s, when DOGAMI developed two earthquake loss models for Oregon. Both models are based on the Federal Emergency Management Agency (FEMA) HAZUS software program². Those models include (a) a magnitude 8.5 Cascadia Subduction Zone scenario, and (b) a 500-year probabilistic ground motion scenario, which combines

¹ Earthquake-induced damages and losses include the entire county, including the City of Portland.

² DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning and policy purposes (DLCD, 2015).

Cascadia Subduction Zone, intraplate and crustal events.^{1,2} **Table 3.1-5** shows projected dollar losses for Multnomah County based on those two models.

Table 3.1-5 Project Dollar Losses to Multnomah County¹, M8.5 Cascadia Subduction Zone Event and 500-Year that Combines Cascadia Subduction Zone, Intraplate and Crustal Earthquakes

Impacts	M8.5	500-year ²
Injuries	1,521	8,659
Death	28	186
Displaced households	2,803	13,777
Economic losses for buildings ²	\$1.9b	\$9.2b
Operation "day after" the quake		
Fire stations	78%	NA ³
Police stations	76%	NA
Schools	81%	—
bridges	94%	—
Economic losses to		
Highways	\$21m	\$437m
Airports	\$2m	\$12m
Communications	\$3m	\$31m
Debris generated (thousands of tons)	1,598	6,745

¹ Estimates are for all of Multnomah County, which includes the Planning Area and the City of Portland

² Every part of Oregon is subject to earthquakes. The 500-year model is an attempt to quantify the risk across the state. The estimate does not represent a single earthquake. Instead, the 500-year model includes many faults. More and higher magnitude earthquakes than used in this model may occur (DOGAMI, 1999).

³ "...there are "numerous unreinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat" (Wang, 1998, p. 5).

³ Because the 500-year model includes several earthquakes, the number of facilities operational the "day after" cannot be calculated.

Source: Wang and Clark (1999)

Damage and loss estimates also have been estimated for three crustal scenario earthquakes that could create the biggest impact on Multnomah County:

- Portland Hills Fault M7.05,
- Portland Hills Fault M6.0
- Mount Angel Falls Fault M6.8

These estimates are based on USGS-based earthquake hazard data and ground motion attenuation relationships in HAZUS. They also include all of Multnomah County — the Planning Area and the City of Portland. (See **Table 3.1-6.**)

¹ Neither model considers unreinforced masonry buildings (DLCD, 2015).

² The national inventory data used by HAZUS are estimates for each census tract. In some cases, these data may be incomplete or inaccurate. The results should not be interpreted as indicating the exact damages, losses or casualties for each scenario earthquake — the exact levels of damages, losses and casualties cannot be predicted before an earthquake occurs. Rather, the results illustrate the relative severity of consequences for Multnomah County for each of the four earthquake scenarios and the approximate levels of damages and casualties expected.

Table 3.1-6 Summary Impacts for Multnomah County¹ for Three Crustal Scenario Earthquakes

Category	Portland Hills M7.05	Portland Hills M6.0	Mount Angel M6.8
Damages and Losses			
Number of Damaged Buildings – Total	456,165	180,035	65,711
Number of Damaged Buildings – Slight Damage	198,628	139,249	57,867
Number of Damaged Buildings – Moderate Damage	149,973	33,640	7,140
Number of Damaged Buildings – Extensive Damage	62,256	6,338	660
Number of Damaged Buildings – Complete Damage	45,308	808	44
Buildings – Related Damages and Economic Losses	\$47,345,000,000	\$6,667,000,000	\$2,274,000,000
Transportation Systems Damages	\$4,064,000,000	\$816,000,000	\$180,600,000
Utility Systems Damages ²	\$84,000,000	\$18,290,000	\$9,680,000
Total Damages and Losses	\$51,493,000,000	\$7,501,290,000	\$2,464,280,000
Casualties			
Injuries (2 p.m.)	45,414	2,612	881
Injuries (2 a.m.)	12,074	691	418
Deaths (2 p.m.)	3,417	100	24
Deaths (2 a.m.)	626	12	7

¹ Estimates are for all of Multnomah County, which includes the Planning Area and the City of Portland.

² Utility systems damages are for potable water only.

Source: HAZUS for 2012 Multnomah County NHMP

Estimates differ substantially for the three crustal scenario earthquakes because of the combination of two factors: (1) magnitude of the earthquake and (2) location of the earthquake in relation to Multnomah County.

Because the Portland Hills Fault is located within Multnomah County, the levels of ground shaking and consequent local damages, losses and casualties are projected to be much higher than for the larger, but further away, Cascadia Subduction Zone. The vast majority of these losses are expected within the City of Portland. Low levels of damages, economic losses and casualties are expected for the cities of Fairview, Troutdale and Wood Village. In large part this is because (1) these small cities are located a substantial distance to the east of the fault zone, and (2) the vast majority of the building stock consists of wood-frame buildings, which generally perform fairly well in earthquakes. The low loss estimates may also reflect incomplete incorporation of local soils data in the HAZUS calculations. Thus, these results should be interpreted cautiously. In addition, it is important to note that damages and losses from a Portland Hills Fault event will be more locally concentrated. In contrast, a Cascadia Subduction Zone event will have massive regional impacts that further impact transportation systems and response resources throughout the Pacific Northwest.

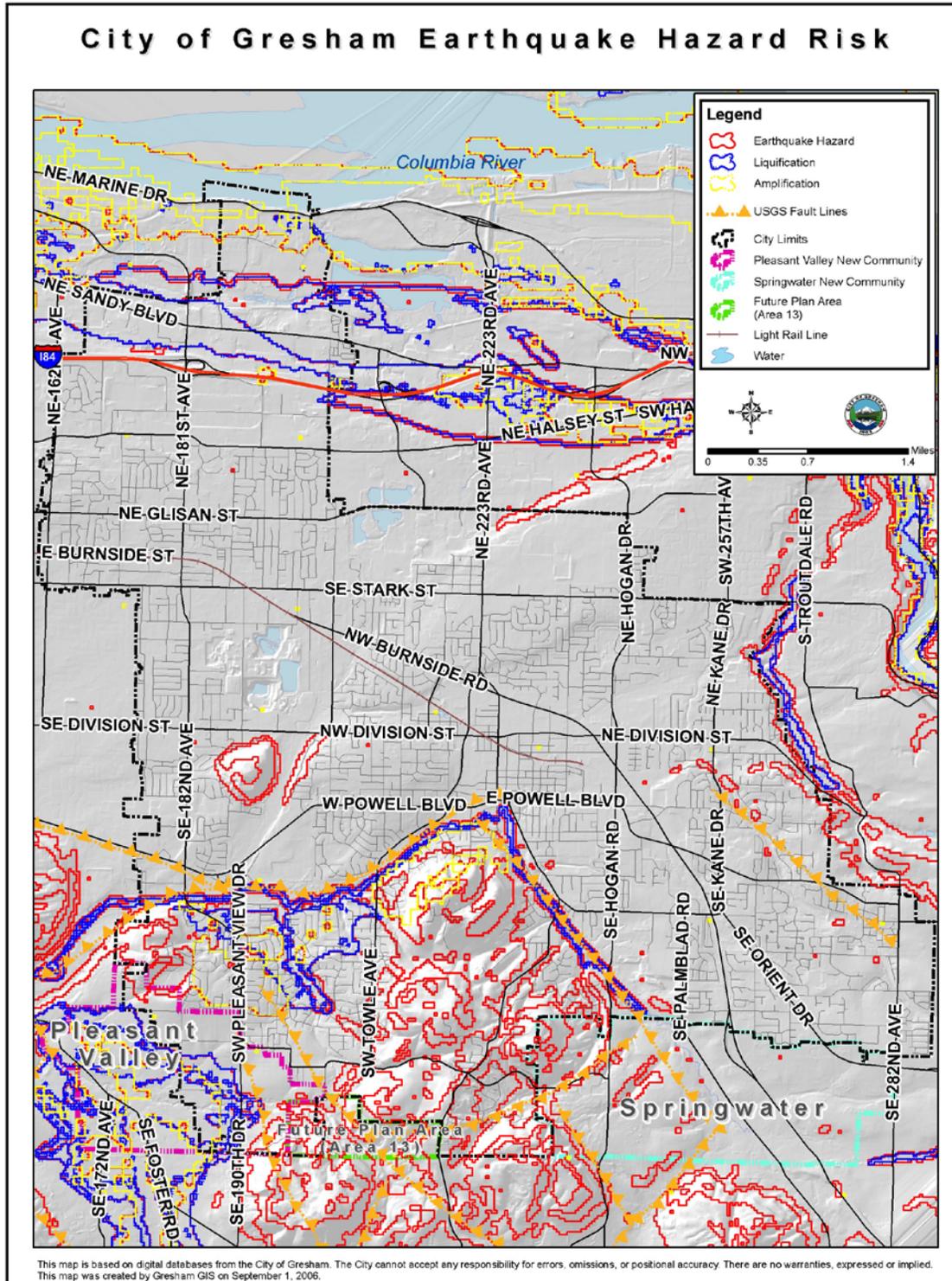
The estimated deaths and injuries are significantly lower during nighttime hours than during daytime hours, because more people are in wood-frame residential buildings, which generally perform reasonably well in earthquakes.

Gresham

All of Gresham's infrastructure (both private and public) and population is vulnerable to earthquakes from crustal faults and from the Cascadia Subduction Zone. **Figure 3.1-10** shows both relative earthquake hazard risk and soils subject to liquefaction. The new communities of Springwater and Pleasant Valley are particularly susceptible, as are the areas at the north end of the City near I-5.

Areas near rivers or other areas with softer soils are more likely to experience liquefaction. Development and infrastructure built on these soils is especially vulnerable to severe damage. Additionally, the steep slopes in the southern part of the City could experience earthquake-induced landslides.

Figure 3.1-10 Relative earthquake hazard risk, City of Gresham, 2006



Source: City of Gresham GIS (Bill Parker), 2006

Fairview, Troutdale, Wood Village

Additional damage and loss estimates were explored by HAZUS for two seismic scenarios for the cities of Fairview, Troutdale and Wood Village:

- M9.0 interplate earthquake on the Cascadia Subduction Zone
- M6.25 crustal earthquake near Fairview

This analysis was conducted for the 2010 update of the NHMPs for the three small cities. At the time of that data run, the City of Gresham had its own NHMP and therefore was not included in those HAZUS scenarios.

HAZUS data was aggregated by census tracts, which do not match city boundaries. Nine census tracts encompass the cities of Fairview, Wood Village and Troutdale, along with adjacent portions of Gresham and surrounding rural areas. These nine census tracts have a total population of 41,848 people (2000 census).

The building and infrastructure inventory is generally similar across these nine census tracts, with about 97% of the buildings being residential. As a reasonable approximation, we assume that damages, economic losses and casualties for the entire nine-census-tract area are distributed among the cities pro-rata by population. Damages, economic losses and casualties for Fairview and Troutdale are estimated to be approximately one-quarter of the totals, at 23.43%. For Wood Village, they are estimated to be approximately 7.5% of the totals.

For the M9.0 Cascadia Subduction Zone earthquake, HAZUS indicates rather low levels of damages, economic losses and casualties (**Table 3.1-7**). In large part, this is because Fairview, Troutdale and Wood Village are located a substantial distance to the east of the fault zone. Also, the vast majority of building stock in both the incorporated cities and the unincorporated areas consists of wood-frame buildings, which generally perform fairly well in earthquakes. Low loss estimates may also reflect incomplete HAZUS calculations based on the incorporation of incomplete local soils data, shaking capped at one minute, and incomplete information about building fragility, so these results should be interpreted cautiously.

Table 3.1-7 Sudden Impacts for Fairview, Troutdale and Wood Village: M9.0 Interplate Cascadia Subduction Zone Earthquake

Category	9 Census Tracts	Fairview	Troutdale	Wood Village
Damages and Losses				
Number of Damaged Buildings – Total	2,504	587	824	189
Number of Damaged Buildings – Moderate Damage	877	205	289	66
Number of Damaged Buildings – Extensive Damage	178	42	59	13
Number of Damaged Buildings – Complete Damage	4	1	1	0
Buildings – Related Damages and Economic Losses ¹	\$69.88	\$16.37	\$23.01	\$5.29
Transportation Systems Damages and Economic Losses ¹	\$7.00	\$1.64	\$2.30	\$0.53
Utility Systems Damages and Economic Losses ¹	\$11.31	\$2.65	\$3.72	\$0.86
Total Damages and Losses ¹	\$68.19	\$20.66	\$29.03	\$6.67
Casualties				
Injuries (2 p.m.)	26	6	9	2
Injuries (2 a.m.)	13	3	4	1
Deaths (2 p.m.)	0	0	0	0
Deaths (2 a.m.)	0	0	0	0

¹ Damage and loss estimates in millions of dollars.

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village

Building-related losses by occupancy, building type and economic losses are shown in **Tables 3.1-8, -9 and -10**. Losses are estimated to be about 25% for Fairview, about 33% for Troutdale, and about 7.5% for Wood Village.

Table 3.1-8 Building Damage by Occupancy for Fairview, Troutdale and Wood Village: M9.0 Interplate Cascadia Subduction Zone Earthquake

Type	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	9	0.08	3	0.15	2	0.27	0	0.25	0	0.23
Commercial	76	0.71	60	4.13	52	5.89	11	6.24	0	8.37
Education	5	0.05	2	0.14	2	0.18	0	0.13	0	0.11
Government	6	0.08	2	0.17	2	6.21	0	0.16	0	0.15
Industrial	28	0.26	22	1.52	26	2.96	6	3.52	0	5.10
Other Residential	934	8.75	606	41.91	765	87.28	159	89.06	3	85.28
Religion	10	0.09	4	0.30	4	0.47	1	0.47	0	0.60
Single-Family	9,614	90.0	747	51.65	24	2.76	0	0.18	0	0.16
Total	10,682		1,446		877		177		3	

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village

Table 3.1-9 Building Damage by Building Type for Fairview, Troutdale and Wood Village: M9.0 Interplate Cascadia Subduction Zone Earthquake

Type	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Wood	9,954	93.18	774	53.52	24	2.77	0	0.04	0	0.04
Steel	29	0.27	25	1.74	43	4.95	12	6.52	0	9.99
Concrete	32	0.30	31	2.15	29	3.34	4	2.29	0	1.61
Precast	19	0.18	15	1.05	26	3.01	8	4.73	0	5.28
Reinforced Masonry	5	0.05	2	0.15	2	0.25	0	0.16	0	0.03
Unreinforced Masonry	156	1.48	60	4.18	18	2.11	1	0.56	0	0.50
MH	487	4.56	538	37.23	733	83.57	153	85.69	3	82.55
Total	10,682		1,445		877		178		4	

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village

Table 3.1-10 Building-related Economic Losses for Fairview, Troutdale and Wood Village: M9.0 Interplate Cascadia Subduction Zone Earthquake

Category and Area	Single-Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses						
Wage	0	0.20	3.47	0.56	0.18	4.41
Capital Related	0	0.09	2.86	0.34	0.08	3.35
Rental	0.06	0.98	2.37	0.31	0.09	3.82
Relocation	0.11	1.94	3.81	1.27	0.88	8.01
Subtotal	0.17	3.21	12.51	2.48	1.22	19.59
Capital Stock Losses						
Structural	0.88	2.27	5.24	2.84	1.09	12.33
Non Structural	8.69	6.11	6.78	3.83	1.50	28.91
Content	4.36	1.05	2.45	2.10	0.58	10.55
Inventory	0	0	0.11	0.37	0.02	0.51
Subtotal	13.93	9.44	14.58	9.15	3.19	50.29
Total	14.11	12.65	27.09	11.63	4.41	69.88

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village

Overall loss estimates for the three smaller cities in the Planning Area after a M9.0 Cascadia Subduction Zone earthquake include:

- **Fairview:** \$20 million damages and economic losses, a small number of injuries, and probably no deaths
- **Troutdale:** \$29 million damages and economic losses, a small number of injuries, and probably no deaths
- **Wood Village:** \$7 million damages and economic losses, a small number of injuries, and probably no deaths

In addition to building damages, there would be significant damages to transportation and utility systems. HAZUS includes rough estimates of expected utility outages. However, especially for an area as small as Fairview, Troutdale and Wood Village, estimating the specific levels of utility damages and outages with

any confidence would require much more detailed analysis of the specific inventory characteristics of utility systems in these cities.

Although much smaller than the megathrust earthquakes, crustal earthquakes may occur much closer to population centers, and are capable of producing severe shaking and damage in localized areas (DLCD, 2015). The worst case scenario earthquake for Fairview, Troutdale and Wood Village is a moderately large crustal earthquake in or very near to Fairview, Troutdale and Wood Village. HAZUS results for a hypothetical M6.25 crustal earthquake with an epicenter near Interstate 84 at latitude 45.539619 and longitude 122.420669 are shown in **Table 3.1-11**.

Table 3.1-11 Summary Impacts: M6.26 Crustal Earthquake near to Fairview, Troutdale and Wood Village

Category	9 Census Tracts	Fairview	Troutdale	Wood Village
Damages and Losses				
Number of Damaged Buildings – Total	10,660	2,498	3,509	806
Number of Damaged Buildings – Moderate Damage	4,258	998	1,402	322
Number of Damaged Buildings – Extensive Damage	2,028	475	668	153
Number of Damaged Buildings – Complete Damage	824	193	271	62
Buildings – Related Damages and Economic Losses ¹	\$989.00	\$231.72	\$325.59	\$74.82
Transportation Systems Damages and Economic Losses ¹	\$38.50	\$9.02	\$12.67	\$2.91
Utility Systems Damages and Economic Losses ¹	\$134.84	\$31.59	\$44.39	\$10.20
Total Damages and Losses ¹	\$1,162.34	\$272.34	\$382.66	\$87.94
Casualties				
Injuries (2 p.m.)	671	157	221	51
Injuries (2 a.m.)	345	81	114	26
Deaths (2 p.m.)	36	8	12	3
Deaths (2 a.m.)	11	3	4	1

¹Damage and loss estimates in millions of dollars.

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village

The HAZUS results shown in the following three tables are for a crustal earthquake for the nine census tracts that encompass Fairview, Wood Village and Troutdale. The pro-rata damages and economic impacts of the values shown in the following tables are estimated to be about 25% for Fairview, 33% for Troutdale, and 7.5% for Wood Village.

**Table 3.1-12 Building Damage by Occupancy for Fairview, Troutdale and Wood Village:
M6.26 Crustal Earthquake**

Type	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	2	.008	2	0.07	4	0.09	3	0.16	2	0.30
Commercial	15	0.58	19	0.54	52	1.23	59	2.93	53	6.47
Education	1	0.05	1	0.03	2	0.06	2	0.12	2	0.23
Government	3	0.11	1	0.03	2	0.06	2	0.12	2	0.26
Industrial	6	0.24	7	0.19	20	0.48	26	1.29	23	2.77
Other Residential	234	9.26	340	9.57	677	15.89	732	36.09	455	58.81
Religion	2	0.10	3	0.05	5	0.12	5	0.24	4	0.47
Single-Family	2,263	89.58	3,177	89.48	3,495	82.06	1,198	59.05	253	30.59
Total	2,528		3,550		4,258		2,028		824	

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village.

**Table 3.1-13 Building Damage by Building Type for Fairview, Troutdale and Wood Village:
M6.26 Crustal Earthquake**

Type	None		Slight		Moderate		Extensive		Complete	
	Count	%	Count	%	Count	%	Count	%	Count	%
Wood	2,323	91.98	3,308	93.18	3,646	85.63	1,226	60.91	239	29.00
Steel	8	0.30	6	0.16	22	0.52	47	1.83	37	4.46
Concrete	8	0.32	9	0.26	26	0.61	31	1.55	22	2.71
Precast	4	0.18	4	0.11	15	0.35	24	1.17	23	2.74
Reinforced Masonry	1	0.04	1	0.02	2	0.05	3	0.16	2	0.29
Unreinforced Masonry	20	0.81	26	0.74	58	1.36	62	3.03	69	8.42
MH	161	6.37	197	5.54	489	11.49	636	31.34	431	52.37
Total	2,526		3,550		4,258		2,028		824	

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village.

**Table 3.1-14 Building Related Economic Losses for Fairview, Troutdale and Wood Village:
M6.26 Crustal Earthquake**

Category and Area	Single-Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses						
Wage	0	3.66	23.31	2.67	1.24	30.88
Capital Related	0	1.54	19.29	1.63	0.45	22.92
Rental	9.11	11.53	11.86	1.27	0.70	34.47
Relocation	33.97	10.99	18.21	3.99	6.05	73.21
Subtotal	43.08	27.72	72.67	9.56	8.45	161.48
Capital Stock Losses						
Structural	59.32	20.56	35.55	16.45	9.08	140.97
Non Structural	241.08	94.02	92.99	58.42	21.85	508.36
Content	58.71	19.43	42.77	38.48	10.25	169.63
Inventory	0	0	1.90	6.51	0.33	8.74
Subtotal	359.12	134.01	173.21	119.86	41.51	827.71
Total	402.20	161.73	245.88	129.42	49.96	989.18

Source: HAZUS for 2010 NHMPs for the Cities of Fairview, Troutdale and Wood Village.

Overall, for Fairview, Troutdale and Wood Village, the HAZUS loss estimate for a M6.25 crustal earthquake near these cities suggests much higher damages, losses and casualties than with the further away 9.0 Cascadia Subduction Zone scenario. The losses are higher for a smaller crustal earthquake because the epicenter is much closer to Fairview, Troutdale and Wood Village, and thus the earthquake ground motions are much higher. As stated above, impacts from a crustal event will be more localized, while a Cascadia Subduction Zone event will have massive impacts across the Pacific Northwest region.

The HAZUS results suggest the following for each jurisdiction:

- **Fairview:** about \$270 million in damages and losses; about 80 to 160 injuries; and approximately 3 to 8 deaths
- **Troutdale:** about \$380 million in damages and losses; about 100 to 200 injuries; and roughly 4 to 12 deaths
- **Wood Village:** about \$90 million in damages and losses; several dozen injuries; and a very small number of deaths

In addition to building damages, there would be significant damages to transportation and utility systems. HAZUS includes rough estimates of expected utility outages. However, as noted for Cascadia Subduction Zone earthquakes, especially for areas as small as Fairview, Troutdale and Wood Village, estimating the specific levels of utility damages and outages with any confidence would require much more detailed analysis of the specific inventory characteristics of utility systems in Fairview, Troutdale and Wood Village. However, as would be the case for building damages, damages and outages for utility systems would be much greater for such a nearby crustal earthquake than for a Cascadia Subduction Zone earthquake.

Liquefaction, Settlement and Lateral Spreading Impacts

Even a few inches of settlement or lateral spreading may cause significant damage to affected buildings or infrastructure. Areas with liquefaction vulnerability are shown in **Figure 3.1-6**, including parts of Troutdale and Wood Village, Sauvie Island, and areas along the Columbia River east of Troutdale, the Sandy River and several streams.

Structures in wetland, estuarine, alluvial and other saturated areas may be subject to liquefaction damage. The total area of such impacts will vary with the extent of saturated soils at the time of the event. Bridge approaches, low-lying roadways, and transportation fuel supplies are all at risk. Columbia and Multnomah counties are the most vulnerable counties in Oregon to water related effects, particularly liquefaction (DLCD, 2015).

Seismic Lifelines

In 2012, the Oregon Department of Transportation (ODOT) conducted the Oregon Seismic Lifeline Routes (OSLR) identification project. Seismic lifelines — state highways identified as most able to serve response and rescue operations, reaching the most people and best supporting economic recovery — were identified. According to ODOT, projected transportation impacts from a seismic event on the Portland metro area, including Multnomah County, involve:

- the potential loss of stored fuels and distribution infrastructure
- interruption of services at Portland International Airport
- interruption of intermodal freight capacity due to river channel changes
- damage to onshore facilities and surface transportation facilities
- bridge or bridge approach failures across both the Willamette and Columbia rivers

Oregon Resilience Plan

The Oregon Seismic Safety Policy Advisory Commission (OSSPAC) developed a report in 2013 titled *The Oregon Resilience Plan: Reducing Risk and Improving Recovery for the Next Cascadia Earthquake and Tsunami (ORP)* that was commissioned by a legislative resolution. In the ORP are estimated impacts of an M9.0 Cascadia Subduction Zone earthquake on Oregon's population, buildings and infrastructure.

Communities within the Willamette Valley are projected to experience moderate widespread damage. The focus will be on restoring services quickly to restart the economy. Restoration of services, as shown in **Table 3.1-15**, typically takes several months, and in some cases a year or more. These results are particularly sobering in the face of the report's finding that where services are not restored within two to four weeks, businesses will either fail or leave (OSSPAC, 2013).

Very large earthquakes will occur in Oregon's future, and our state's infrastructure will remain poorly prepared to meet the threat unless we take action now to start building the necessary resilience.

— Oregon Resilience Plan, 2013

Table 3.1-15 Estimated Times for Restoration of Services after a Cascadia Subduction Zone Earthquake

Critical Service	Zone	Estimated Time to Restore Service
Electricity	Valley	1 to 3 months
Police and Fire Stations	Valley	2 to 4 months
Drinking Water and Sewer	Valley	1 month to 1 year
Top-priority Highways (partial restoration)	Valley	6 to 12 months
Health Care Facilities	Valley	18 months

Source: Oregon Resilience Plan, OSSPAC 2013

The City of Gresham is following recommendations for water systems that are outlined in the ORP. Gresham is developing a Water System Resilience Plan for appropriately investing in its water system to withstand and continue service after a catastrophic earthquake. Gresham's Water System Resilience Plan will inform the next update of this plan.

Critical Energy Infrastructure Hub

The six-mile stretch along the Willamette River in Portland's Northwest Industrial Area known as the Critical Energy Infrastructure (CEI) Hub contains the majority of Oregon's energy infrastructure for petroleum, natural gas, liquefied natural gas, and electricity. A 2013 DOGAMI study, *Earthquake Risk Study for Oregon's Critical Energy Infrastructure Hub* (DOGAMI Open-File Report O-13-09), determined significant liquefaction and seismic risks exist within the CEI Hub. For more information about the CEI Hub, see the **Community Profile** section **2.6.2 Energy** and the **Annex: Human-Caused and Technological Hazard Identification and Risk Assessment** section **7 Utility Interruption/Failure**.

Concurrent to the update of this plan, the City of Portland conducted a study to assess the CEI Hub's exposure and vulnerability to each of Portland's key hazards of concern. The study identified recommendations to improve resilience of the critical infrastructure in the CEI Hub, including (City of Portland, 2016):

1. Establish a CEI Hub Disaster Resiliency Workgroup
2. Update/Enhance the CEI Hub Risk Assessment
3. Amend City of Portland City Council Resolution No. 37168 to allow for the expansion of an existing facility that has been identified as vulnerable to an identified hazard of concern and targeted for retrofit
4. Identify best practices for emergency response/recovery waivers from federal and state regulatory agencies to improve ease of response and recovery efforts, with adequate assurances for environmental protection
5. Establish a suite of best management practices for a range of resilience-related planning efforts
6. Identify backup power needs
7. Develop a CEI Hub-specific training and exercise program through Portland Bureau of Emergency Management
8. Identify a buffer zone around the CEI Hub and identify land use repurposes within that buffer

A report summarizing this study is provided in the draft Portland Mitigation Action Plan (MAP), and the recommendations have been incorporated as appropriate into the MAP action plan. The Portland MAP is currently in public review and will be presented to the Portland City Council for adoption in October 2016.

The CEI Hub has major implications for the Planning Area, the state and the Pacific Northwest region. As such, the Multnomah County Multi-Jurisdictional Steering Committee will stay informed of Portland's progress on these recommendations and will support these efforts as appropriate for each jurisdiction.

Bridge Seismic Resiliency

Many of the bridges carry critical services, including water distribution pipes, telecommunications and electrical lines across the rivers. If bridges are damaged, these lines could break and disrupt service to parts of the cities and unincorporated areas. As mentioned in the **Community Profile** section **2.5.2 Bridges**, Multnomah County's Willamette River Bridges Capital Improvement Plan prioritizes a 20-year Bridge Seismic Resiliency Plan for the four movable bridges in downtown Portland: the Broadway, Burnside, Hawthorne and Morrison bridges. More information on the risk to bridges as critical infrastructure is in the **Annex: Human-Caused and Technological Hazard Identification and Risk Assessment**.

3.1.5 References

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3.2 Flood

Flooding is a common occurrence in Northwest Oregon. All jurisdictions in the Planning Area have rivers with high flood risk called Special Flood Hazard Areas (SFHA), except Wood Village. Portions of the unincorporated area are particularly exposed to high flood risk from riverine flooding.

Developed areas in Gresham, Fairview and Troutdale have moderate levels of risk to riverine flooding. Preliminary Flood Insurance Rate Maps (FIRMs) for the Sandy River developed by the Federal Emergency Management Agency (FEMA) in 2016 show significant additional risk to residents in Troutdale. Channel migration along the Sandy River poses risk to hundreds of homes in Troutdale and unincorporated areas.

Some undeveloped areas of unincorporated Multnomah County are subject to urban flooding, but the impacts are low. Developed areas in the cities have a more moderate risk to urban flooding.

Levee systems protect low-lying areas along the Columbia River, including thousands of residents and billions of dollars in assessed property. Though the probability of levee failure is low, the impacts would be high for the Planning Area.

Dam failure, though rare, can causing flooding in downstream communities in the Planning Area. Depending on the size of the dam, flooding can be localized or extreme and far-reaching.

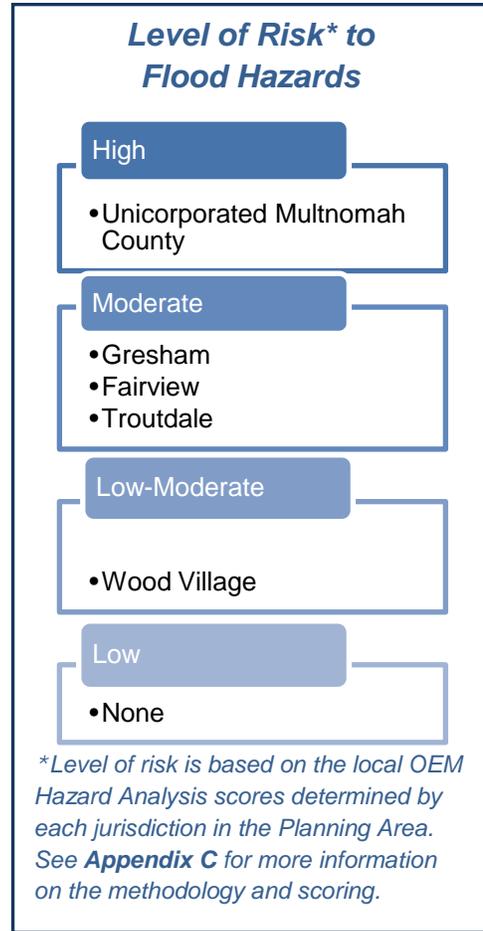
Seasonal shifts in precipitation patterns due to climate change, including more intense winter rain events, could increase the incidence of floods in the future.

3.2.1 Overview

The Planning Area is at risk of flooding between October and April from winter rains and between May and July from spring snowmelt in the Cascades. Typically, the area experiences flooding after more than three days of rain or when heavy rain falls on already saturated soil in a short period of time. Severe or prolonged storms can raise rivers and streams to flood stage and keep them there for several days. Historically, rain-on-snow events between December and February caused the majority of the most-severe flooding.

Types of Flooding

A flood is any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. Floods occur for many reasons, such as long-lasting rainfall over a broad area, locally intense storm-generated rainfall, or rapid melting of a large snow pack with or without accompanying rainfall. Because floods result from many different circumstances, not all floods are equal in magnitude, duration or effect.



The Planning Area is subject to four types of flooding: riverine, levee failure, dam failure, and urban flooding. **Table 3.2-1** provides a summary of the Planning Area’s exposure to flooding, followed by descriptions of each type of hazard.

Table 3.2-1 Types of Flooding Hazards that Impact Each Jurisdiction

Jurisdiction	Riverine Flooding	Levee Failure Inundation Area	Dam Failure Inundation Area	Urban Flooding
Unincorporated Multnomah County	✓	✓	✓	✓
Fairview	✓	✓	✓	✓
Gresham	✓	✓	✓	✓
Troutdale	✓	✓	✓	✓
Wood Village				✓

Source: Oregon Department of Land Conservation and Development (DLCD), 2015; Natural Hazards Mitigation Plan (NHMP) Steering Committee, 2016

Riverine Flooding

River flooding occurs when river or stream water levels rise and spill over the banks. This type of flooding often results from prolonged rainfall over a large geographic area and/or melting snowpack. River flooding is an important natural process that adds sediment and nutrients to fertile floodplain areas.

Rivers also can change course over time, called channel migration, which can change where rivers crest in their banks.

Because the Willamette and Columbia rivers are also influenced by tides, significant coastal storms can exacerbate flooding along these water bodies.

Levee/Dam Failures

A levee is a manmade structure, usually an earthen embankment, designed and constructed according to sound engineering practices to contain, control or divert water flow to provide protection from certain levels of temporary flooding. However, levees can and do decay over time. Levees also can be overtopped or breached during large floods.

A dam is a barrier constructed to hold back water and raise its level, the resulting reservoir being used in various ways. Dams are an important resource in the United States, providing many functions that include recreation, flood management, ecosystem-based functions, irrigation, water supply and hydroelectric power, but they also can be breached with little warning. Levee and dam breaches can result in catastrophic flooding (FEMA, 2015).

Urban Flooding

As land is converted from natural-scape to hardscape, the environment loses its ability to absorb rainfall. This transition from pervious surfaces to impervious surfaces results in more and faster runoff of water. During periods of urban flooding, streets can become swift-moving rivers and storm drains may back up, causing additional nuisance flooding (DLCD, 2015).

Location and Extent

Riverine Flooding

Principal riverine flood sources in the Planning Area are labeled in **Figure 3.2-1** and include:

- Columbia River and tributaries
- Willamette River and tributaries
- Sandy River
- Multnomah Channel
- Johnson Creek
- Fairview Creek
- Columbia Slough
- Beaver Creek
- Kelley Creek
- Mitchell Creek

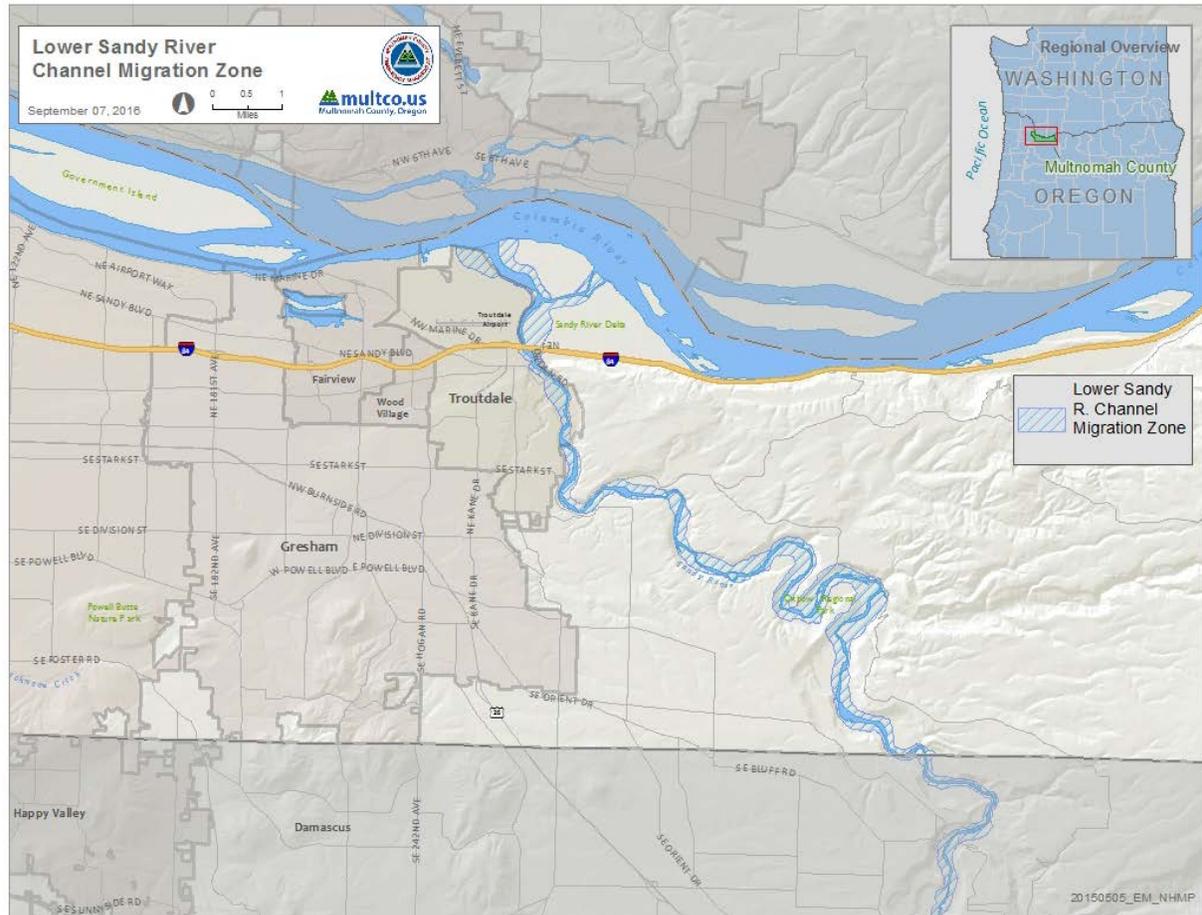
Figures 3.2-1 Principal Riverine Sources in Multnomah County Vicinity



Source: Multnomah County, 2016

The Sandy River has a history of channel migration, and the Oregon Department of Geology and Mineral Industries (DOGAMI) studied areas susceptible to future channel movement and erosion. This study is documented in DOGAMI's Open-File Report O-13-10. **Figure 3.2-3** shows channel migration zones along the lower Sandy River in east Multnomah County. Clackamas County also used Hazard Mitigation Grant Program funding following a 2011 flood event to do a more in-depth study of channel migration on the upper Sandy River.

Figure 3.2-3 Channel Migration along the Sandy River

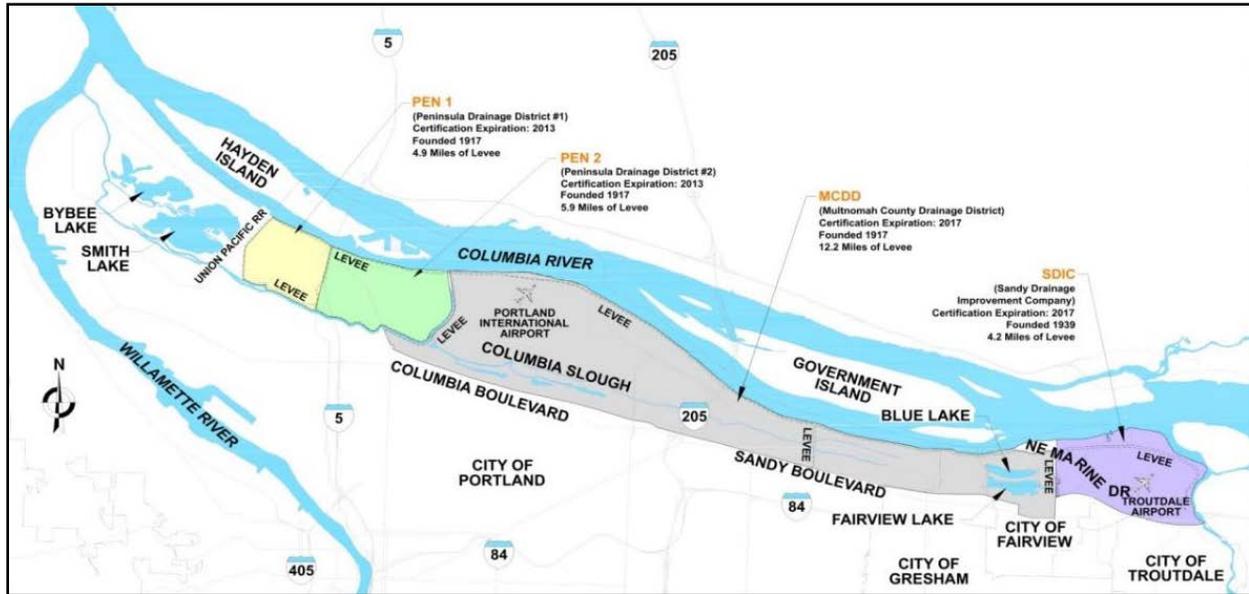


Source: DOGAMI, 2011

Levee Failure

Low-lying areas along the Columbia River in Multnomah County are protected by five drainage districts. Four of the drainage districts make up a levee system stretching 27 miles from Smith Lake to the Sandy River (**Figure 3.2-4**) and are collectively referred to as the Columbia Corridor Drainage Districts. From west to east, these districts are the Peninsula Drainage District No. 1 (PEN 1), Peninsula Drainage District No. 2 (PEN 2), Multnomah County Drainage District No. 1 (MCDD), and Sandy Drainage Improvement Company (SDIC). The fifth district in the county, Sauvie Island Drainage Improvement Company (SIDIC), manages the 18-mile levee system and canal system on the southern half of Sauvie Island (**Figure 3.2-5**).

Figure 3.2-4 Columbia Corridor Drainage Districts



Source: MCDD

Columbia County Drainage Districts

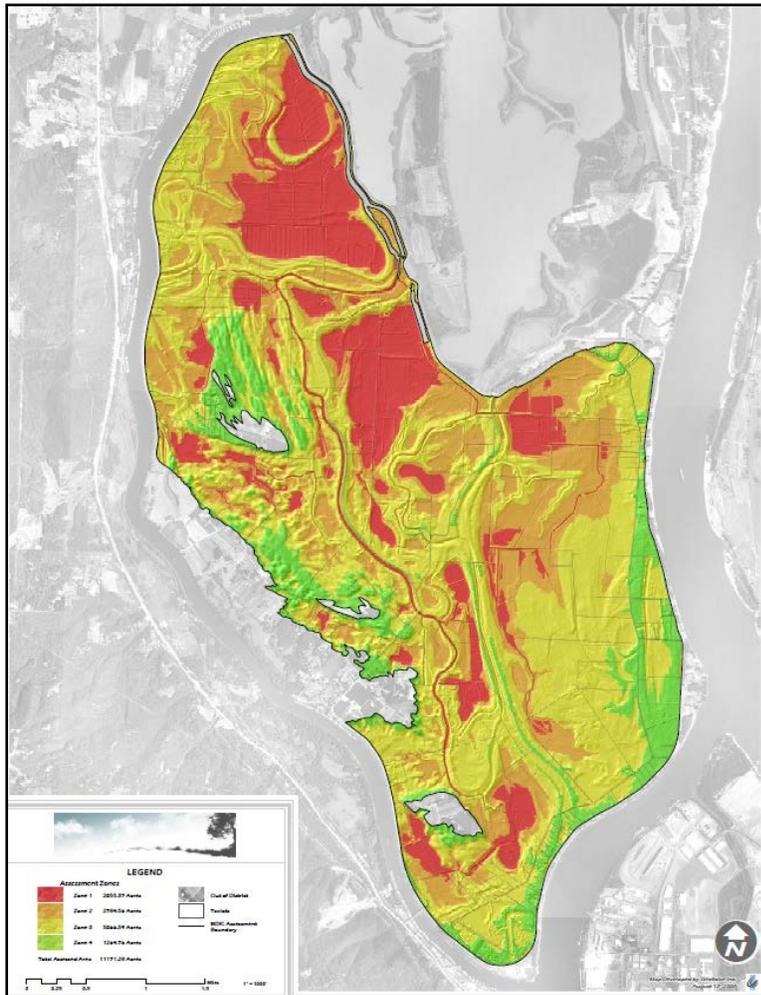
PEN 1, PEN 2 and SDIC delegate administrative management for the levees in their districts, through annual contracts, to the staff of MCDD. To protect against external flooding, MCDD maintains approximately 27 miles of levees and floodwalls, 18 of which run directly alongside the southern bank of the Columbia River. The remaining levees border the Columbia Slough or the Sandy River, or create compartments within the leveed area by aligning perpendicularly to the Columbia River or Slough levees. The levees were originally built by local landowners starting in 1917. The U.S. Army Corps of Engineers (USACE) subsequently updated the levee system. All district levees have previously been accredited by FEMA. More about the Columbia Corridor Drainage Districts can be obtained from its website:

www.mcdd.org.

Sauvie Island Drainage Improvement Company

The Sauvie Island levee is approximately 18 miles in length and is divided into four segments (Figure 3.2-5). It is managed by the Sauvie Island Drainage Improvement Company (SIDIC). The levee protects 11,200 acres from flooding. Levee construction began in the late 1930s, and it was constructed of material dredged from the Columbia River and pits and canals dug on the island. The main Pump House was constructed in 1941 and houses four pumps capable of evacuating 125,000 gallons-per-minute of water at varying river levels. The interior of the drainage system consists of over 30 miles of canals and ditches to convey rain, seepage and spring water from the interior of the levee to the Multnomah Channel. This levee has been accredited by FEMA. More information on the SIDIC can be obtained from its website: www.sidrainage.org.

Figure 3.2-5 Area Protected by the Sauvie Island Drainage Company



Source: SIDIC

Federal Levee Infrastructure Programs

The Columbia Corridor Drainage Districts' levee system currently has two certified levee systems (MCDD and SDIC) and two systems that are pursuing certification (PEN 1 and PEN 2). USACE certification of the PEN 1 and PEN 2 levee systems expired in August 2013 after USACE policy changes were adopted in 2012. This situation puts these levee systems at risk of losing their accredited status when FEMA issues

new FIRMs for the area. The MCDD and SDIC levee systems have certifications that will expire in 2017. The full system is currently accredited by FEMA. The Sauvie Island levee is also certified until 2017. All systems are active in the USACE Rehabilitation and Inspection Program, PL 84-99. MCDD estimates the potential cost of repairs to meet current standards at between \$100 million and \$200 million. Levee Ready Columbia, a group of stakeholders from government, business, environmental and community organizations convened by Portland Mayor Charlie Hales and Multnomah County Commissioner Jules Bailey, has been formed to identify collaborative solutions to ensure the levee system meets the requirements for participation in federal programs and continues to reduce the risk of flooding for important regional assets in the area.

Dam Failure

Columbia River Watershed

There are about 75 large dams and numerous smaller dams on the Columbia River and its tributaries that provide hydroelectric power, recreation, ecosystem-based functions and flood management. The dams within the Columbia River drainage area are operated by federal agencies; state, provincial or local governments; public utilities; and private owners. The four large dams on the Columbia River within Oregon are: Bonneville Dam, The Dalles Dam, John Day Dam and McNary Dam. These dams are maintained and operated by USACE. In the case of very unlikely, but not impossible, failure of one or more of these dams, severe flooding would occur along the Columbia River.

Multnomah County Watersheds and Willamette River Watershed

Failure of any of the dams within Multnomah County would result in localized flooding within watersheds downstream of the dam.

Failure of the Bull Run Dam would result in major flooding along Bull Run and the Sandy River downstream of the confluence with Bull Run.

Failure of the Mt. Tabor Reservoirs would result in localized flooding within the City of Portland between Mt. Tabor and the Willamette River.

Failure of any one or more of the major dams upstream on the Willamette River could result in substantial flooding along the lower Willamette River. However, the extent of flooding would depend strongly on river levels at the time of dam failure, the amount of available storage in dams downstream of a dam that failed, and whether or not progressive failure of downstream dams were to occur.

Urban Flooding

In most locations, stormwater drainage systems are designed to handle only small to moderate rainfall events. Stormwater systems are sometimes designed to handle only 2-year or 5-year flood events, and are rarely designed to handle rainfall events greater than 10-year or 15-year events.

For local rainfall events that exceed the collection and conveyance capacities of stormwater drainage systems, some level of flooding inevitably occurs. In many cases, local stormwater drainage systems are designed to allow minor street flooding to carry off stormwater that exceeds the capacity of the stormwater drainage system. In larger rainfall events, flooding may extend beyond streets to include yards. In major rainfall events, local stormwater drainage flooding also can flood buildings. In extreme cases, local stormwater drainage flooding can sometimes result in several feet of water in buildings, with correspondingly high damage levels.

3.2.2 History

A majority of flood events in and around the Planning Area have occurred in the winter due to rain accelerating snowmelt. **Table 3.2-2** lists significant flooding events that have impacted our communities.

Table 3.2-2 Significant Historic Floods

Date	Location	Type of Flood	Description
Multiple	Columbia River and Multnomah River	Flooding	Significant floods occurred in 1861, 1880, 1881, 1909, 1913, 1927, 1928, 1942, 1946, 1948, 1961, 1964/65, 1996, 2007. Details of some of these floods are provided below.
Dec. 1861	Willamette River	Rain on snow	Probably the most immense flood in the valley in recorded history, the “Great Flood” devastated the valley’s economy and resulted in the deaths of several people.
Dec. 1862	Willamette Basin	Rain on snow	Widespread flooding throughout western Oregon.
Feb. 1890	Willamette Basin	Rain on snow	Second largest flood of known magnitude; water levels in Portland: 22.3 ft.
June 1894	Columbia River	Snowmelt	Largest recorded flood on Columbia. Estimated to have covered everything below 36 feet along the Columbia River from the Sandy to the Willamette; only a few knolls were above water on Sauvie and Hayden islands.
Jan. 1923	Willamette & Columbia River	Rain on snow	Widespread damage to roads and railroads
Dec. 1937	Willamette Basin	Rain on snow	Considerable flooding; landslides
Dec. 1945	Willamette Basin/ NW Oregon	Rain on snow	Very warm temperatures; considerable flood damage
May–Jun. 1948	Columbia River	Rain, flooding, snowmelt	Memorial Day flood on the Columbia River. Levee breaches destroyed the City of Vanport (18,000 people); 15 fatalities recorded. Subsequent levee breaches followed, flooding Portland; flooding also occurred along Columbia River Highway and the Sandy River Delta. Snowmelt event in June and contributed impacts. Willamette River crested at 31.6 feet.
Dec. 1955	Statewide	Rain on snow	DR-49. Event occurred on December 29, 1955. Flooding and strong winds; five fatalities.
Jul. 1956	Statewide	Storms, flooding	DR-60. Event occurred on July 20, 1956. Storms and flooding.
Mar. 1957	Statewide	Flooding	DR-69. Event occurred on March 1, 1957.
Oct. 1962	Statewide	Storms	DR-136. Event occurred on October 16, 1962.
Feb. 1963	Statewide	Flooding	DR-144. Event occurred on February 25, 1963. Flooding.
Dec. 1964	Statewide	Heavy rains, flooding, rain on snow	DR-184. Event occurred on December 24, 1964. Record-breaking rainfall; damaged or destroyed about 750 homes along the Sandy River. In Multnomah County, the Columbia River Highway was washed out at the east end of the Beaver Creek Bridge. Statewide damage totaled \$157 million and 17 deaths.
Jan. 1972	Willamette & Sandy Rivers	Storms, flooding, rain on snow	DR-319. Event occurred on January 21, 1972. Widespread damage; five fatalities.
1974	Western Oregon	Rain on snow, flooding	Flooding resulted from rain-on-snow events. Willamette River at Portland crested at 25.7 feet. Nine counties declared disasters.
Jan. 1978	Willamette River	Rain on snow	Intense rain/snowmelt; widespread flooding
Feb. 1986	Statewide	Snowmelt, flooding	Intense rain, a melting snow, and flooding. Some homes evacuated.
1990	Western Oregon	Rain on snow, flooding	Ten rivers in eight counties were flooding in a rain-on-snow weather event. Many bridges were washed away.

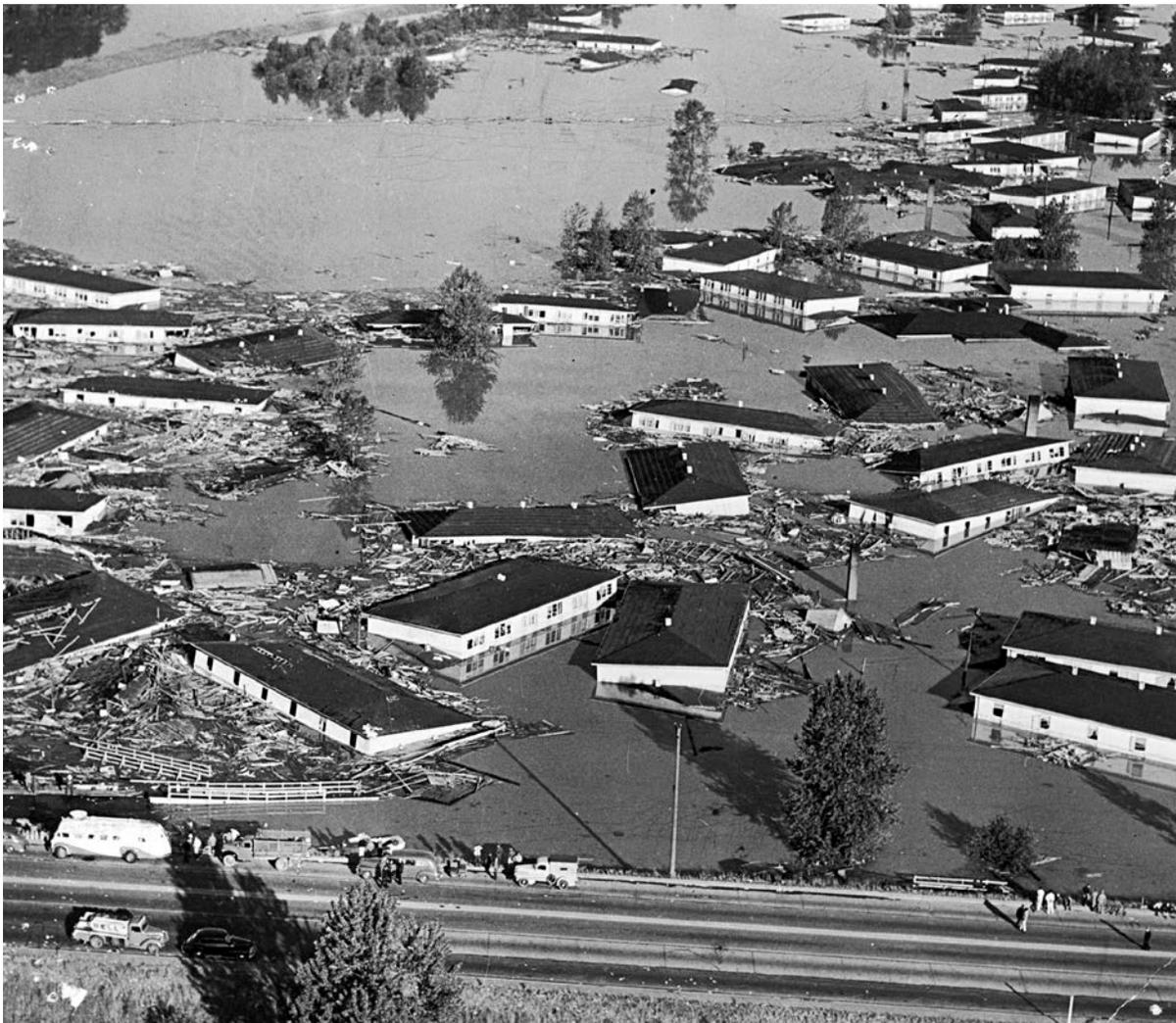
Date	Location	Type of Flood	Description
Feb. 1996	Statewide	Storms, flooding, rain on snow	DR-1099 Winter storms with rain, snow, ice, floods and landslides. Power outages, road closures and property damage. Warm temperatures, record breaking rains; extensive flooding in Multnomah County; widespread closures of major highways and secondary roads; eight fatalities. Multnomah County was one of 27 counties covered by the disaster declaration.
Dec. 1996-Jan. 1997	Statewide	Winter storm, flooding	DR-1160. Severe snow and ice. Up to four to five inches of ice in the Columbia Gorge. Interstate 84 closed for four days. Hundreds of downed trees and power lines. Widespread power outages in the greater Portland area, including Multnomah County.
Jan.-Feb. 1999	NW Oregon	Rain, flooding, landslides, mudslides	Widespread flooding on smaller rivers and streams; numerous landslides and mudslides. Historic Columbia River Highway east of the Sandy River Bridge covered with slides coming from the cliffs above. Mudslide pushed a house into Sandy River, resulting in a fatality.
Winter 2001	Wood Village	Flooding	Arata Creek overflowed its banks at the point where it crosses NW 244th Avenue in the winter of 2001. One building east of that point was damaged.
Jan. 2003	Portland area	Heavy rain	Johnson Creek crested at two feet above flood stage, the highest Johnson Creek had risen in years. No damages were reported, but the rising river prompted the evacuation of approximately 25 nearby houses. Heavy rain resulted in standing water on many streets in the Portland metro area, resulting in some road closures. A small slide resulted in the temporary closure of a ramp leading to the St Johns Bridge.
Dec. 2007-Jan. 2008	NW Oregon	Winter storms, heavy rain, flooding	DR-1824. Severe winter storm, flooding, winds, record and near-record snow, landslides and mudslides. Gresham received, 26 inches of snow . Many roads closed. Significant damages to public infrastructure, homes and businesses.
Jan. 2009	Portland area	Rain, flooding, rain on snow	Portland area received 3.04 inches of rain from a warm tropical storm ("Pineapple Express") which combined with extensive snowmelt from heavy snowfall in December. Flood elevations in Johnson Creek were the second highest recorded, and flooding also occurred on other streams in Multnomah County.
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides and debris flows.
Jan. 2012	Multnomah County	Rain, rain on snow	Heavy rain combined with snowmelt runoff caused the Johnson Creek at Sycamore to overflow its banks and flood low-lying areas. Johnson Creek crested at 13.2 feet on January 19 at 4 pm PST, 2.2 feet above flood stage.
Sep. 2013	Portland Metro Area	Heavy rain, flooding	KPTV-KPDX Broadcasting reported that heavy rain resulted in flooding and damage to the Legacy Good Samaritan Medical Center and several businesses in Northwest Portland. Besides damage to the hospital's emergency and operating rooms, some elective surgeries were cancelled.
Dec. 2015	Western Oregon	Winter storm, heavy rain	DR-4258. Severe winter storms, straight-line winds, flooding, landslides and mudslides.

Sources: National Climatic Data Center; Oregon Historical Society; Multnomah County Flood Insurance Study, Oregon Office of Emergency Management; Taylor and Hatton (1999); National Climatic Data Center; KPTV-KPDX (2013); FEMA (2016).

The construction of flood control infrastructure on the Columbia River and Willamette River has reduced, but not eliminated, the potential for major flood events on these rivers. A devastating example occurred on May 30, 1948. The Columbia and Willamette rivers were cresting at eight feet above flood stage when a breach occurred in a railroad embankment that served as a levee separating the City of Vanport from Smith Lake. Subsequent breaches occurred along the Columbia Slough.

The breach became a 500-foot gap that allowed flood waters to inundate the city within 10 minutes (**Figure 3.2-6**). Vanport was the nation's largest housing project and Oregon's second largest city at the time. There were 15 fatalities recorded, and 18,500 residents were displaced; roughly 6,300 were black (Geiling, 2015). The Oregon Historical Society and the Smithsonian have in-depth articles that discuss the racial discrimination that caused this natural disaster to have even greater impacts to society in the Portland area.

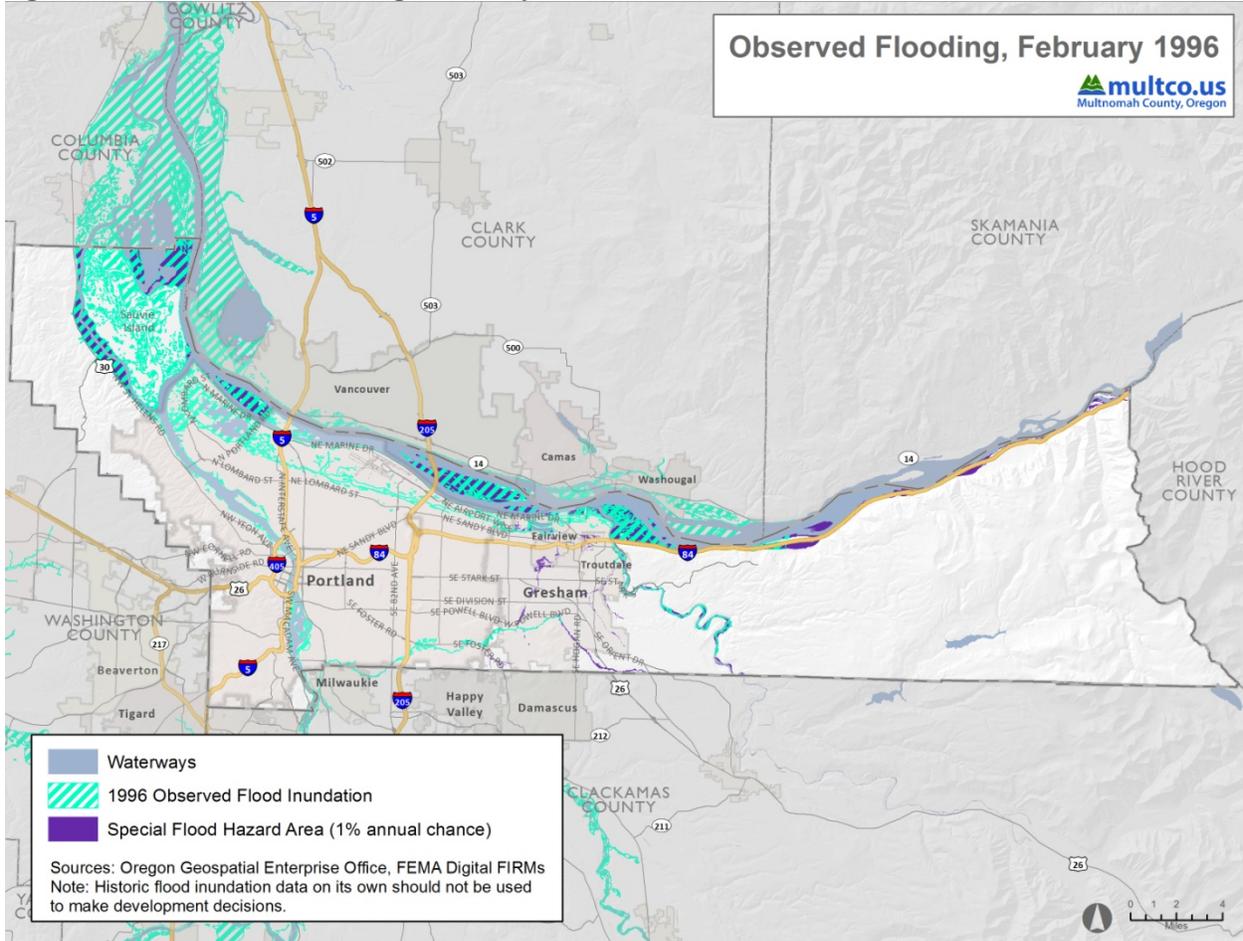
Figure 3.2-6 Vanport Flood, 1948



Source: Unknown

A more recent example of major flooding occurred in 1996 (**Figure 3.2-7**). The Willamette River crested at 28.6 feet in downtown Portland, nearly 11 feet above flood stage. Eight people died and damages were in the millions.

Figure 3.2-7: Observed Flooding, February 1996



Source: Oregon Geospatial Enterprise Office, FEMA Digital FIRMs

3.2.3 Probability

Riverine Flooding

Flooding can happen anywhere, but certain areas are especially prone to serious flooding. To help communities understand their risk, FEMA has created flood maps, also known as FIRMs, to show locations with high-risk (SFHA), moderate-to-low risk, and undetermined-risk. The National Flood Insurance Program (NFIP) defines levels of risk as (NFIP, 2016):

- **Special Flood Hazard Area (SFHA):** In high-risk areas, referred to as SFHA, there is at least a 1 in 4 chance of flooding during a 30-year mortgage. All home and business owners in these areas with mortgages from federally regulated or insured lenders are required to buy flood insurance. The SFHA is shown in dark purple on the flood maps in **Figures 3.2-8** and **-9**.

- **Moderate-to-Low Risk Areas:** In moderate-to-low risk areas, the risk of being flooded is reduced but not completely removed. Moderate to low risk represents either 0.2% annual chance of flooding or 1% annual chance of flooding behind an accredited levee. These areas submit over 20% of National Flood Insurance Program (NFIP) claims and receive one-third of disaster assistance for flooding. Flood insurance is not federally required in moderate-to-low risk areas, but it is recommended for all property owners and renters. In **Figures 3.2-8** and **-9**, areas with moderate-to-low risk are medium purple.
- **Undetermined Risk Areas:** No flood-hazard analysis has been conducted in these areas, but a flood risk still exists. Flood insurance rates reflect the uncertainty of the flood risk. In **Figures 3.2-8** and **-9**, undetermined areas are not specifically identified.

Except for Wood Village, all communities in the Planning Area have a SFHA. Portions of Fairview, Gresham, Sauvie Island and Troutdale have land along the Columbia River with a moderate-to-low risk.

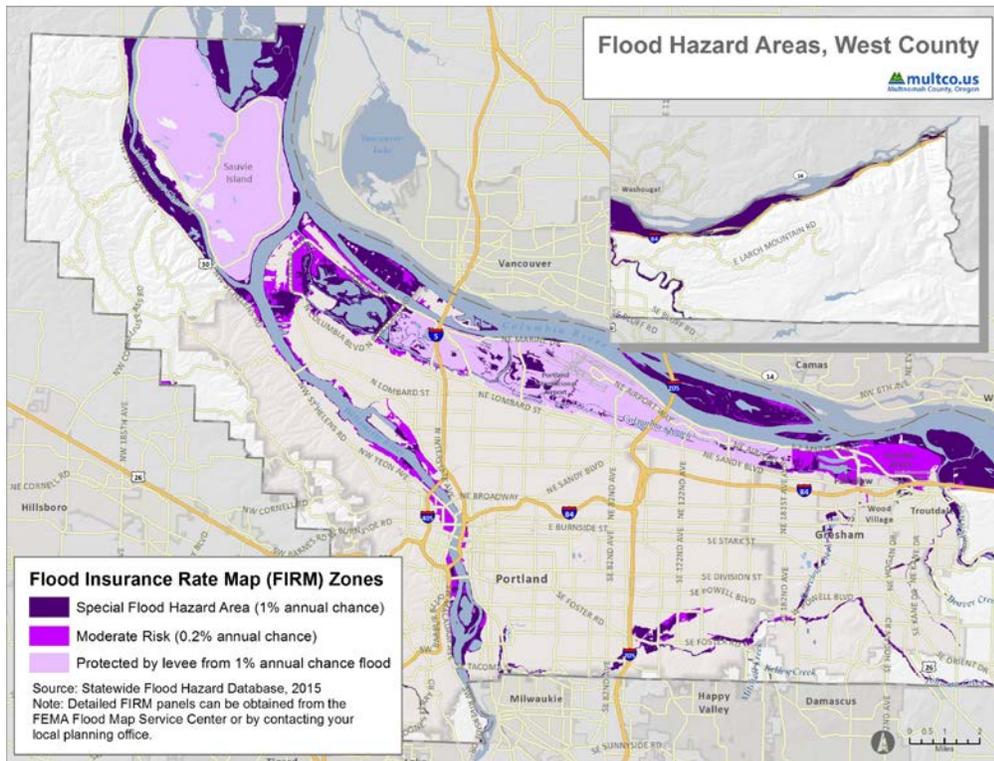
FIRMs were recently updated for all jurisdictions in Multnomah County (**Table 3.2-3**). Official FIRMs can be obtained online from the FEMA Flood Map Service Center (msc.fema.gov) or by contacting your jurisdiction's community development office.

Table 3.2-3 Effective FIRM Dates for the Planning Area

Jurisdiction	Initial FIRM	Current FIRM
Unincorporated Multnomah County	June 15, 1982	Dec. 18, 2009
Fairview	March 18, 1986	Dec. 18, 2009
Gresham	July 16, 1979	Dec. 18, 2009
Troutdale	Sept. 30, 1988	Dec. 18, 2009
Wood Village	Dec. 18, 2009	Dec. 18, 2009

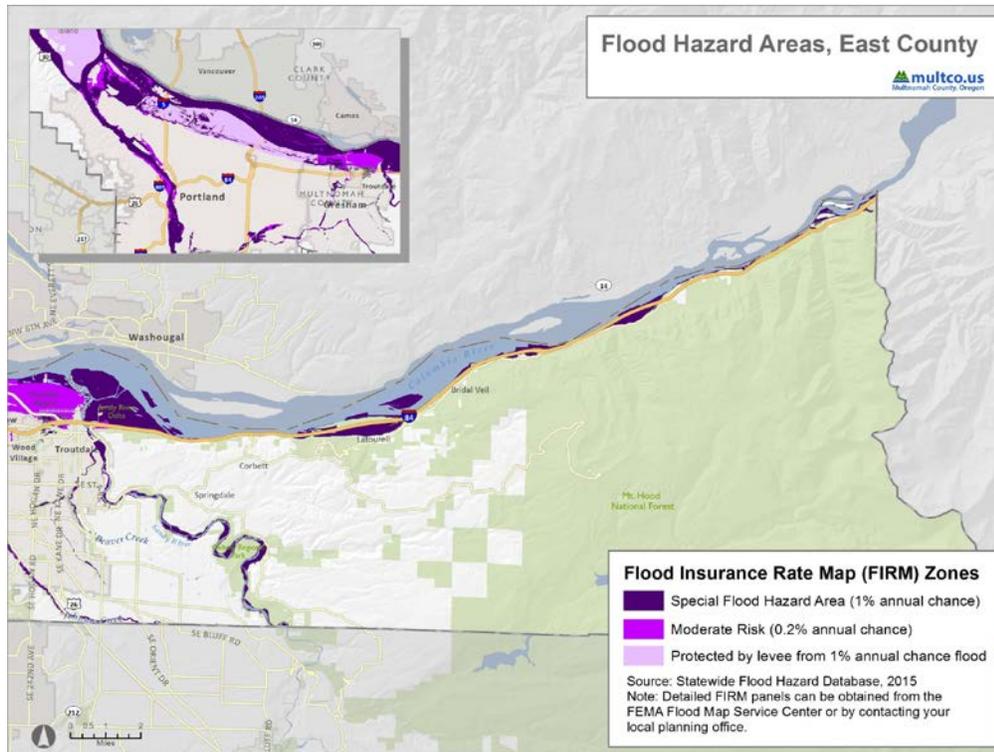
Source: DLCD, 2015

Figure 3.2-8 Flood Hazard Areas, West Multnomah County



Source: Statewide Flood Hazard Database, 2015

Figure 3.2-9 Flood Hazard Areas, East Multnomah County



Source: Statewide Flood Hazard Database, 2015

Conventional flood hazard maps examine only hazards posed by standing floodwaters on a given floodplain. However, damage from bank erosion as river channels naturally migrate may occur even in the absence of major flooding. Such channel migration can cause major damage.

Changing weather patterns, erosion and development can affect floodplain boundaries. FEMA has been working to update and modernize the nation's flood maps by identifying watersheds where additional study may be needed. Maps for the Lower Columbia–Sandy Watershed are in the process of being updated. Preliminary map reviews are currently taking place (in 2016). New maps are scheduled to become effective in 2017 (S. Lucker, personal communication, June 1, 2015). This risk assessment will be updated to reflect those changes during the next plan update.

Climate Change

According to the 2015 Oregon Natural Hazards Mitigation Plan, climate models project warmer drier summers for the Planning Area. Seasonal shifts in precipitation patterns means historical records may no longer provide a reliable guide to future flooding (Multnomah County, 2014).

An increase in extreme precipitation is projected for some areas, including an increased incidence of magnitude and return interval (DLCD, 2015). Increased urbanized flooding is likely with the potential for more intense rain events in mid-winter (Multnomah County, 2014).

Because landslides in Oregon are strongly correlated with rainfall, increased rainfall — particularly extreme events —likely will trigger increased landslides (DLCD, 2015). See **Section 3.3 Landslides** for more information on the relationship between rainfall and landslides.

In addition, the Willamette and Columbia rivers are tidally influenced, so sea level rise also could affect flooding. However, in the near-term, tectonic uplift of the coast may mitigate impacts of sea level rise (Multnomah County, 2014).

On the flip side, warmer, drier summers will have implications on water bodies and water supply systems. For more information on how climate change is projected to impact these systems, see **Climate Change** in section **3.4.3 Probability** under **3.4 Severe Weather**.

Warmer Winters and More Intense Rain Events

Climate models suggest that Multnomah County's total annual precipitation will not change dramatically and will continue to be dominated by natural variability and El Niño conditions. However, seasonal shifts in precipitation patterns are expected, leading to drier summers and the potential for more intense rain events in the other seasons. Some global and Pacific Northwest regional climate models suggest that extreme daily precipitation amounts could increase.

— Multnomah County Climate Change Preparation Strategy 2014

3.2.4 Vulnerability

Riverine Flooding

All jurisdictions in the Planning Area, with the exception the City of Wood Village, are subject to riverine flooding. To estimate the impact a major flood might have in the Planning Area, the HAZUS¹ flood model with national datasets was used. These datasets provide generalized outputs helpful in gaining awareness of the potential distribution of risk within the Planning Area (see www.fema.gov/HAZUS for details on datasets). More thorough analysis using local building data should be used before making policy decisions or designing specific flood mitigation projects.

Potential damages and expected losses were modeled for a 1% annual chance flood occurring on all rivers and streams within the county. It was estimated that 12 homes in the Planning Area would be substantially damaged during a 1% annual chance flood (**Table 3.2-4**). Substantial damage means that the cost of repairs is 50% or more of the structure’s market value before the disaster occurred (FEMA). Many more homes, 203, are estimated to sustain minor to moderate damages. No commercial buildings or industrial buildings in the Planning Area were estimated to sustain damage. The model did not estimate any damages to structures with agriculture, education, government or religion uses. The model also assumes levees will not fail.

Table 3.2-4 Residential Structures with Estimated Damage from a 1% Annual Chance Flood Scenario

Community*	# of Homes Substantially Damaged (>50% of Value)	# of Homes with <50% damage	# of Undamaged Homes	Total Homes in Inundation Areas
Total for Planning Area	12	203	109	324
Total for Unincorporated Multnomah County	10	62	18	90
• East of Sandy River	2	10	0	12
• Interlachen	0	0	1	1
• Pleasant Valley	0	1	3	4
• Riverdale Area	3	2	0	5
• Sauvie Island Area	5	47	14	66
• West of Sandy River	0	2	0	2
Fairview	0	36	13	49
Gresham	0	78	71	149
Troutdale	2	27	7	36
Wood Village	0	0	0	0

*Only communities with modeled flood impacts are included.

Source: HAZUS-MH Flood Model, 2016

¹ HAZUS is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic and social impacts of disasters.

The total losses for residential structures from a 1% annual chance flood affecting all rivers and streams in the county could be as much as \$44 million, according to the HAZUS model (**Table 3.2-5**).

Table 3.2-5 1% Annual Chance Flood Scenario Estimated Losses (\$) for Residential Structures

Community*	Building Loss	Contents Loss	Relocation Cost
Total for Planning Area	44,247,000	28,351,000	32,000
Total for Unincorporated Multnomah County	19,462,000	12,887,000	11,000
• East of Sandy River	4,809,000	3,970,000	1,000
• Interlachen	109,000	69,000	0
• Pleasant Valley	292,000	182,000	0
• Riverdale Area	1,282,000	722,000	1,000
• Sauvie Island Area	10,910,000	6,622,000	9,000
• West of Sandy River	2,060,000	1,322,000	0
Fairview	4,882,000	3,013,000	5,000
Gresham	13,371,000	8,471,000	11,000
Troutdale	6,532,000	3,980,000	5,000
Wood Village	0	0	0

*Only communities with modeled flood impacts are included.

Source: HAZUS-MH Flood Model, 2016

Channel Migration

According to a DOGAMI study, there are an estimated 479 people in the Planning Area at risk from channel migration along the Sandy River — 236 in Troutdale and 243 in unincorporated areas (DOGAMI, no date). The study found no critical facilities within this zone, such as hospitals, schools, police or fire buildings. There are, however, the following infrastructure within channel migration zones in Troutdale and the unincorporated areas, as shown in **Tables 3.2-6** and **3.2-7**:

- 186 structures, estimated at roughly \$38 million
- 8.4 miles of transportation infrastructure
- 6.9 miles of electric transmission lines
- 6 bridges
- 8 electric transmission towers

In addition, Troutdale and Multnomah County have currently undeveloped parcels designated for residential or commercial use within the channel migration zone, which means there may be a potential for future development in these high-hazard areas. During Multnomah County’s current Comprehensive Plan update process, planners are reviewing the need to restrict development in this zone and have proposed policies for inclusion in the plan.

Table 3.2-6 Structures Located within the Sandy River Channel Migration Zone

Community*	Residential		Commercial		Public		Total	
	#	Value (\$)	#	Value	#	Value	#	Value
Total for Planning Area	144	\$17,891,580	25	\$10,960,030	17	\$8,949,350	186	\$37,800,960
Troutdale	53	\$7,110,690	4	\$3,895,980	10	\$8,943,160	67	\$19,949,830
Unincorporated Multnomah County	91	\$10,780,890	21	\$7,064,050	7	\$6,190	119	\$17,851,130

* Only communities with modeled channel migration impacts are included.

Source: DOGAMI, no date

Table 3.2-7 Infrastructure within the Sandy River Channel Migration Zone

Community*	Arterial Roads (miles)	Highway/ Interstate (miles)	Road Bridge (#)	Electric Transmission Lines (miles)	Electric Transmission Towers (#)	Railroad (miles)
Total for Planning Area	7.9	0.4	6.0	6.9	8.0	0.1
Troutdale	2.1	0.2	2.0	3.3	5.0	0.1
Unincorporated Multnomah County	5.8	0.2	4.0	3.6	3.0	0.0

* Only communities with modeled channel migration impacts are included.

Note: There were no electric substations, wastewater treatment plants, dams, airports or railroad bridges within the hazard zone.

Source: DOGAMI, no date

National Flood Insurance Program (NFIP)

In response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods, Congress created the NFIP in 1968. The NFIP makes federally backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage (Insurance Information Institute, no date). All jurisdictions in the Planning Area participate in the NFIP, with the exception of Wood Village, which does not experience riverine flooding.

Table 3.2-10 provides statistics on the policies for each jurisdiction. A total of 54% of the policies currently in force are for structures built before floodplain maps were available for that community, also known as Pre-Flood Insurance Rate Maps, or Pre-FIRMs. Of those properties, six have the lowest floor one foot or more below the base flood elevation. These are considered Minus Rated Properties.

Table 3.2-10 NFIP Policy Statistics in the Planning Area

Community	Policies In Force	Pre-FIRM Policies	Minus Rated Policies	Insurance Coverage (\$)
Total for Planning Area	345	187	6	100,231,000
Unincorporated Multnomah County	177	112	2	49,917,000
Fairview	41	10	0	13,634,100
Gresham	83	45	1	23,214,600
Troutdale	44	20	3	13,465,300
Wood Village	NA	NA	NA	NA

Source: Oregon Department of Land Conservation and Development, 2016

Over the past 37 years, 105 NFIP claims have been made across the Planning Area. In that time period, \$1.2 million in payments have been received by property owners with flood insurance policies to cover flood losses (**Table 3.2-11**).

Table 3.2-11 NFIP Loss Statistics, Jan. 1978 – June 2015

Community	Total Losses Submitted	Losses Paid	Closed without Payment	Total Payments (\$)
Total for Planning Area	105	72	33	1,206,915.96
Unincorporated Multnomah County	86	61	25	1,148,575.44
Fairview	3	2	1	13,276.26
Gresham	6	2	4	7,862.87
Troutdale	10	7	3	37,201.39
Wood Village	0	0	0	0

Source: NFIP BureauNet, 2016

The NFIP defines a **repetitive loss structure** as an NFIP-insured structure that has had at least two paid flood losses of more than \$1,000 each in any 10-year period. There have been four repetitive flood loss claims in the Planning Area, including:

- Unincorporated Multnomah County:
 - 2 single-family homes
 - 1 non-residential property
- Troutdale:
 - 1 single-family home

A **severe repetitive loss structure** is an NFIP-insured structure that has incurred flood damage for which:

- Four (4) or more separate claim payments have been made under a Standard Flood Insurance Policy issued pursuant to this title, with the amount of each such claim exceeding \$5,000, and with the cumulative amount of such claims payments exceeding \$20,000; or
- At least two (2) separate claims payments have been made under a Standard Flood Insurance Policy, with the cumulative amount of such claim payments exceeding the fair market value of the insured building on the day before each loss (FEMA, 2016).

There are zero severe repetitive loss claims in the Planning Area.

Community Rating System

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance

premium rates are discounted to reflect the reduced flood risk resulting from the community actions (FEMA, 2016). Troutdale participates in the NFIP's Community Rating System (CRS), and has a rating of 7, providing a 15% discounted rate on flood insurance to properties within the SFHA and a 5% discount for properties outside the SFHA. Other jurisdictions in the Planning Area do not currently participate in the CRS program.

Strategies for Continued NFIP Compliance

Each community will continue to participate in the NFIP¹ and will look for opportunities to enhance their flood mitigation program. In addition, all communities in the Planning Area will revise flood ordinances as new flood risk information becomes available. Of particular interest to the Planning Area are new FIRMs and Risk MAP information scheduled to be published during the life of this plan. In 2016, new preliminary FIRMs for Gresham and the Sandy River Watershed were released. A Letter of Final Determination is anticipated in 2018. Concurrent Risk MAP "Resilience" efforts will take place within the Planning Area between 2017 and 2018. Resilience meetings include all jurisdictions in the Planning Area working alongside FEMA and the State Risk MAP Coordinator to identify mitigation and risk reduction strategies, and discuss possible action and implementation opportunities. The new FIRMs and recommendations from the Resilience meetings will help identify additional risk mitigation strategies for each jurisdiction to further its commitment to reducing flood risk to people and property.

The following flood risk mitigation actions are further described in **Table 4.2-3: Top Mitigation Actions of the Mitigation Strategy**.

- Action 22: Install high-water-mark signs to educate the public about flooding potential in targeted locations along or within the leveed areas. Communities impacted by this action: All jurisdictions in the Planning Area.
- Action 23: Continue participation in Levee Ready Columbia in order to ensure the Portland metro levee system does not lose accreditation by FEMA or become inactive in the U.S. Army Corps of Engineers' Rehabilitation and Inspection Program. Communities impacted by this action: All jurisdictions in the Planning Area.
- Action 24: Seek funding to support maintaining certification and accreditation of the Columbia River levee systems, determine appropriate level of flood protection, and educate the public on the benefits and residual risks associated with the levees. Communities impacted by this action: All jurisdictions in the Planning Area.
- Action 25: Identify target areas for flood mitigation projects, such as high-risk/repetitive risk problem areas. Identify specific mitigation projects and grants. Consider areas at risk to multiple hazards for increased cost benefit. Communities impacted by this action: City of Gresham
- Action 26: Assess whether local regulations should be updated to better protect citizens based on channel migration zone (CMZ) data. Communities impacted by this action: Unincorporated areas of Multnomah County and the City of Troutdale.
- Action 27: Identify stormwater stakeholders to participate on the steering committee during the next update. Communities impacted by this action: All jurisdictions in the Planning Area.

¹ The City of Wood Village is not exposed to a Special Flood Hazard Area (SFHA).

- Action 28: Flood-proof wastewater manholes and pipelines within the 100-year floodplain.
Communities impacted by this action: Unincorporated areas of Multnomah County, and Cities of Gresham, Fairview and Troutdale.
- Action 29: Coordinate with drainage districts when development is proposed in, on or near the levee systems managed by these entities to ensure minimal impact to the levee systems.
Communities impacted by this action: All jurisdictions in the Planning Area.

Levee Failure

Columbia Corridor Levees

The Columbia Corridor Drainage Districts operate and maintain levees that were first built between 1917 and 1920, when farmers wanted local flood protection to support year-round farming. At that time, there were only 500 homes behind the levees, and most of the land was either unimproved or used for farming. Now, the levees protect the Portland International Airport, a regional Exposition Center, thousands of homes and three major interstates. The area also is home to hundreds of businesses and 10% of Multnomah County's employment base. The levee system is essential to the protection of the daily life of 7,500 residents and the nearly 13,000 acres of land amounting to more than \$5 billion in assessed property (MCDD, 2014).

Despite the fact that the levees and pumping systems are aging infrastructure, current assessments show limited vulnerabilities. As part of Levee Ready Columbia, PEN 1 and PEN 2 have had recent engineering assessments to determine what work may be needed to be recertified, and identified vulnerabilities are presented in **Table 3.2-8**. Both systems continue to have targeted areas with deficiencies; however, the majority of the systems perform well even as water elevations near the 0.2% annual chance event (Oregon Solutions, 2015).

Table 3.2-8: Vulnerability Findings for PEN 1 and PEN 2 Levees

West Side of PEN 1: Railroad Embankment	
	The embankment was built by railroad companies for the purpose of rail transport and came to be included as part of the levee system after its construction.
	The railroad embankment is one of the locations where there was a breach in 1948, resulting in the Vanport flood and subsequent flooding of PEN 2.
	It was not possible to collect current soil samples or conduct analysis at this location due to access limitations associated with railroad ownership of the land.
	Information gathered since the Vanport flood indicates that the embankment does not meet modern soil stability or water seepage standards.
PEN 1 Cross-Levee: Interstate 5 and North Marine Drive	
	There are two sections within the vicinity of the interchange that are not high enough to prevent flood waters from entering PEN 1 or PEN 2, in the event that one of the two districts floods.
Northeast Corner of PEN 2: Columbia River Levee	
	The height of the existing levee adjacent to Marine Drive (just west of the intersection of NE 33rd Drive) is 6 to 12 inches lower than the required height.
PEN 2 Cross-Levee: Peninsula Drainage Canal	
	The cross-levee is narrow in width and has steep walls. The level of existing water in the Peninsula Drainage Canal is lower than the 1% annual chance flood elevation. This inequality in water level causes instability in the levee and can result in a large amount of erosion, which can cause failure. This risk would be an issue in the event that PEN 2 or MCDD floods.
	The Peninsula Drainage Canal is designated as a Special Habitat Area (SHA). It is home to sensitive species (including the Western painted turtle) and is also a migratory stopover habitat and a wildlife connectivity corridor. Any modification to the levee structure must evaluate the impacts to these species and existing habitat.

Source: Oregon Solutions, 2014

The minimum standard used by FEMA for accreditation (44 Code of Federal Regulation 65.10) is to reduce flood risk for a 1% annual chance flood elevation. Some cities in the United States have opted to protect to a higher 0.5% annual chance or 0.2% annual chance elevation. Because river systems vary widely, USACE selects a unique design standard for each levee’s inclusion and rating in its Rehabilitation and Inspection Program. For the Columbia Corridor levee system, The PEN 1 levee system is authorized for the 1876 flood, meaning it was designed to withstand the magnitude of the 1876 flood. The PEN 2 is also authorized for the 1876 flood, but some modifications make certain portions of the system authorized for the Levee Design Flood, or the 1894 flood, accounting for floodwater storage since dam construction (a modeled flood). MCDD and SDIC levees are both authorized for the Levee Design Flood. The Levee Design Flood is a higher standard than the 1% annual chance flood used by FEMA.

The engineering assessments did not include seismic assessment, climate change, or potential Columbia River Treaty scenarios (Oregon Solutions, 2014). The historical trends do not take into account future climate change projections (Multnomah County, 2014). As part of the current levee accreditation process, climate change modeling is being conducted in partnership with the U. S. Geological Survey (USGS) and USACE and should be completed in 2017 (Oregon Solutions, meeting notes, August 17, 2015).

Analysis of the MCDD and SDIC levees began in 2016 and is overseen by Levee Ready Columbia. Preliminary discussions of potential vulnerabilities for these districts have included the following (Levee Ready Columbia Meeting Notes, Oct. 2, 2015):

- MCDD: Extensive beaver dens are located at the waterward toe of the levee near Blue Lake Park. MCDD is working on an animal management plan to find options for minimizing damage from beaver habitat.
- SDIC: There is one pump station from the 1950s with two pumps, one of which requires immediate repair and another that needs to be repaired or updated soon. Few encroachments on the levee are anticipated due to slow development growth in this area.

Another consideration for flood vulnerability in the levee districts is the presence of many industrial sites that contain hazardous materials. While proper management of these materials should minimize spills or leaks that could contaminate flood waters, the potential impact of contaminated flood waters is high due to the location of the Columbia South Shore Well Field Protection Area that covers a large portion of the Columbia Corridor Drainage Districts (**Figure 3.2-10**). The Portland Water Bureau's Groundwater Protection Program and the City of Gresham's Well Field Protection Program offer more information about reducing risk of groundwater contamination.

Why should the levees meet federal standards?

Levees are maintained to modern standards for public safety and flood risk reduction.

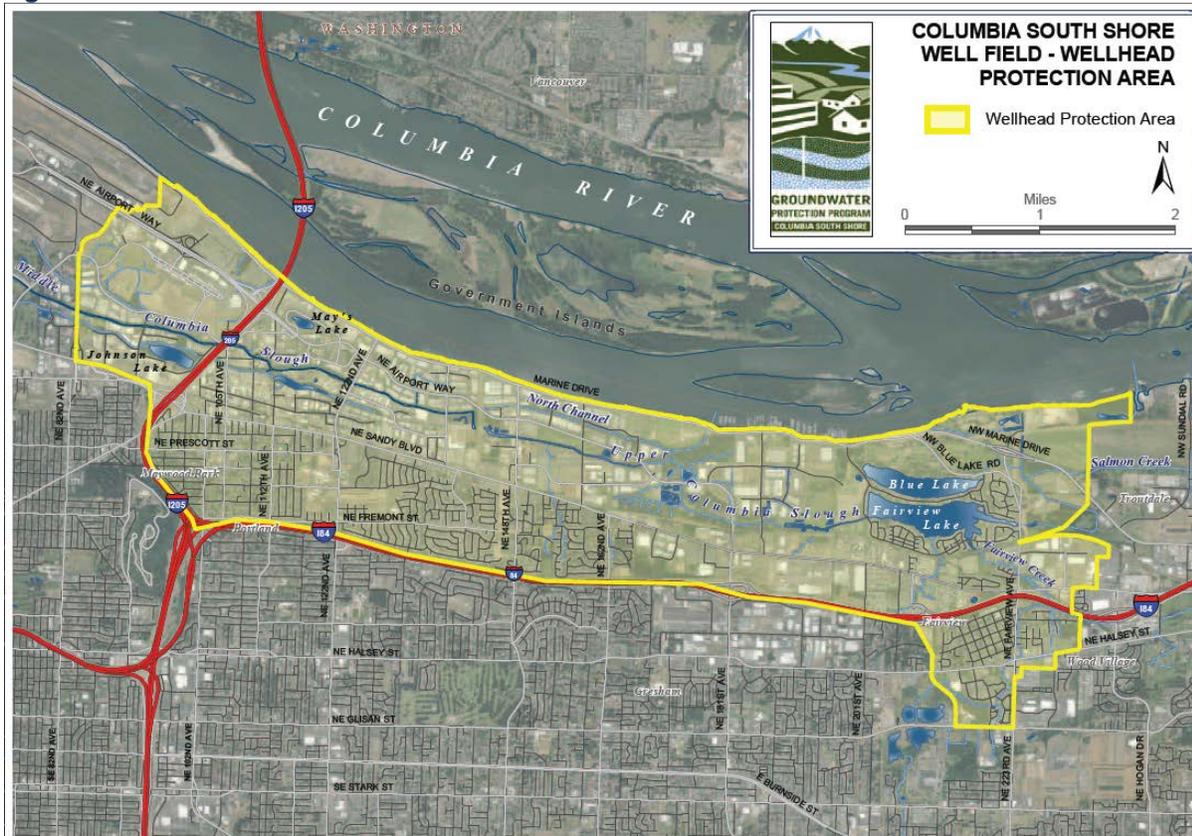
Property owners are not required to buy flood insurance if levees are accredited.

Property owners can acquire low cost flood insurance through the National Flood Insurance Program.

Floodplain development code standards do not apply to developments protected by levees.

— Oregon Solutions, 2014

Figure 3.2-10 Location of Columbia South Shore Well Field



Source: Columbia South Shore Groundwater Protection Program

MCDD has been working on mapping potential inundation depths within the levee districts should a breach occur. Those maps are currently in progress and will be used at a later date to do a more thorough estimate of potential losses from different levee breach scenarios. MCDD also has been working on emergency response and evacuation planning with each jurisdiction, with land within the districts. Currently, the City of Portland has completed a draft evacuation plan for the area from Smith and Bybee Lakes on the west to the city limits at NE 185th Avenue on the east (City of Portland, 2014).

Levees on Sauvie Island

The land uses protected by the levee system in Sauvie Island are rural, low-density residential and agriculture. Community input during the recent update of the Sauvie Island/Multnomah Channel Plan (2015) emphasized the importance of preserving the rural character of the community. The population and property at risk therefore will not increase substantially due to the community's planning policies and implementing codes.

Recent discussions about the vulnerabilities of the system managed by the SIDIC included the following issues (Levee Ready Columbia Meeting Notes, Oct. 2, 2015):

- There is one main pumping station with four smaller interior pumps. The newest pump was installed in 1964.

- There are encroachments in the levees along the Willamette River and Columbia River that are primarily residences built within the levee. Some of the houses were built before the levee system.
- Most water on the island comes in through seepage from the river — the island was naturally a system of lakes.

The seasonal farm worker population on the island presents a special consideration for Sauvie Island levee failure risk is. Many of the farm workers are Hispanic and may have language barriers. The farm workers also may lack their own transportation if evacuation were necessary.

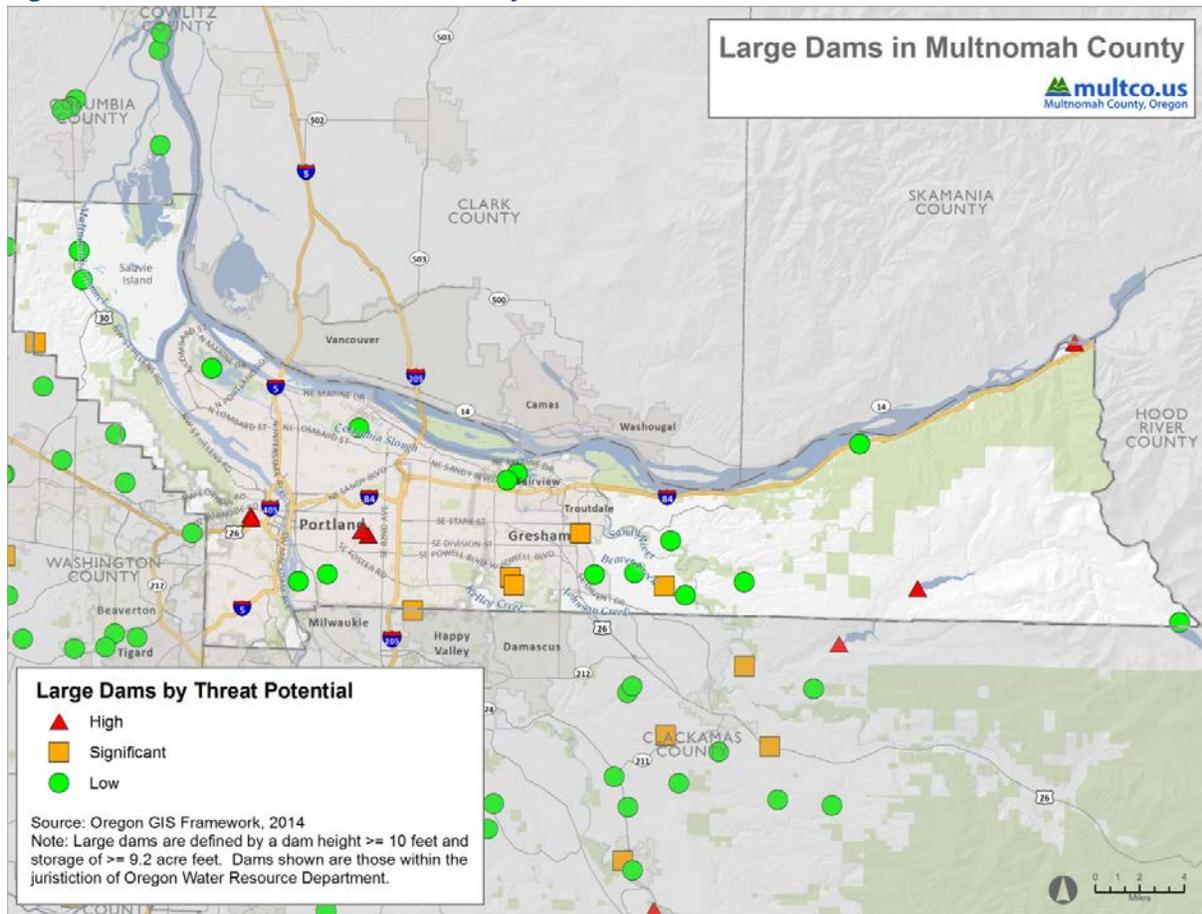
Dam Failure

If not maintained and operated correctly, dams can pose risks to people living downstream, who are often unaware they are in a potential inundation zone. When dams age, deteriorate or malfunction, they can release sudden, dangerous flood flows. Downstream development increases the potential consequences of a dam's failure. Many dams, should they fail, also can affect the delivery of essential utilities or flood control (FEMA, 2013).

The Oregon Water Resources Department uses the National Inventory of Dams (NID) threat potential methodology, and maintains an inventory of all large dams in Oregon. The inventory lists 26 dams in Multnomah County (**Figure 3.2-11** and **Table 3.2-9**) with the following threat potentials: 7 high, 5 significant, and 14 low. The downstream threat potential is defined by the Interagency Committee on Dam Safety as follows (USACE, 2008):

- **Low Potential:** Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
- **Significant Potential:** Dams assigned the significant hazard potential classification are those where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impacts other concerns. Significant hazard potential classification dams often are located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure.
- **High Potential:** Dams assigned the high hazard potential classification are those where failure or mis-operation probably will cause loss of human life.

Figure 3.2-11 Dams in Multnomah County



Source: Oregon GIS Framework, 2014

Table 3.2-9 Multnomah County Dam Inventory

Dam	Height (ft.)	Storage (acre ft.)	River	Jurisdiction	Owner	Last Inspection	Threat Potential
BONNEVILLE DAM	110	277000	COLUMBIA RIVER	Multnomah	Corps of Engineers, Portland District	4/1/2008	HIGH
BULL RUN DAM 1 (UPPER)	194	33760	BULL RUN RIVER	Multnomah	City of Portland	7/6/2011	HIGH
PORTLAND #1 (MT.TABOR)	30	37	BULL RUN RIVER (OFFSTREAM)	Portland	City of Portland	6/28/2011	HIGH
PORTLAND #3 (WASHINGTON PARK)	53	50	BULL RUN RIVER (OFFSTREAM)	Portland	City of Portland	9/15/2014	HIGH
PORTLAND #4 (WASHINGTON PARK)	60	54	BULL RUN RIVER (OFFSTREAM)	Portland	City of Portland	9/15/2014	HIGH
PORTLAND #5 (MT.TABOR)	55	153	BULL RUN RIVER (OFFSTREAM)	Portland	City of Portland	6/28/2011	HIGH
PORTLAND #6 (MT.TABOR)	28	230	BULL RUN RIVER (OFFSTREAM)	Portland	City of Portland	6/28/2011	HIGH
BINFORD DAM	25	30	HIENY CREEK	Gresham	City of Gresham	7/25/2014	SIGNIFICANT
MT. HOOD COMMUNITY COLLEGE DAM	58	25	KELLY CREEK	Gresham	Mt. Hood Community College	1/13/2014	SIGNIFICANT
PEYRALANS RES.	23	12	BUTLER CREEK	Gresham	Marpol Ridge HOA	3/14/2013	SIGNIFICANT
SESTER, WILLIAM H. RES. 1	32	55	BEAVER CREEK, TRIB TO	Multnomah	William H. Sester	4/18/2013	SIGNIFICANT
VAN RADEN	27	115	ROCK CREEK	Multnomah	Fred & Kenneth Raden	5/28/2014	SIGNIFICANT
BELCHERS DAM	28	30	MIDDLE FORK BEAVER CREEK	Multnomah	Darold Belcher/Dan Belcher	9/14/2010	LOW
BULL RUN LAKE DAM	55	14500	BULL RUN RIVER	Multnomah	City of Portland	4/28/1995	LOW
CRAMPTON, RAYMOND	18	16		Multnomah	Raymond Crampton	4/7/2009	LOW
DIACK RESERVOIR	26	20	SANDY RIVER, TRIB OF	Multnomah	Samuel L. Diack	4/8/2009	LOW
FAIRVIEW LAKE	18	411	COLUMBIA SLOUGH	Fairview	City of Fairview	3/12/2014	LOW
KELLY CREEK REGIONAL DETENTION POND	20	67		Gresham		3/15/2011	LOW
MULTNOMAH CHANNEL DAM #1	8.6	203	TRIB/COLUMBIA RIVER	Multnomah	Metro Parks & Greenspaces		LOW
MULTNOMAH CHANNEL DAM #2	11.5	240	TRIB/COLUMBIA RIVER	Multnomah	Metro Parks & Greenspaces	8/25/2010	LOW
OAKS BOTTOM (PTD PARKS)	9	451		Portland			LOW
OSBURN RESERVOIR	34	52	TROUT CREEK, TRIB TO	Multnomah	Tom Lehman	11/17/2011	LOW
PDX DE-ICING LAGOON	12	41		Portland	Portland International Airport	12/3/2010	LOW
REED LAKE	8	16.8	CRYSTAL SPRINGS CREEK	Portland	The Reed Institute		LOW
SMITH-BYBEE LAKES	14	4100	COLUMBIA SLOUGH	Portland	City of Portland	8/25/2010	LOW
WAHKEENA REARING RESERVOIR	19	180	WAHKEENA CREEK	Multnomah	ODFW	11/15/2011	LOW

Source: Oregon Water Resources Department, "Dam Inventory Query"

Currently, dam breach inundation zones are not shown on FIRMs as areas requiring flood insurance. Even though it is not required, buying flood insurance to protect a financial investment in homes and businesses located below dams may be wise. Dam breach inundation zones may far exceed the 1% annual chance flood zones mapped by FEMA. Dam failure floods are almost always more violent than normal stream or river floods (FEMA, 2013).

However, dam failures or partial failures are not usually caused by storm events. Most failures fall into one or more of the following categories (FEMA, 2013):

- **Structural Failures:** Foundation defects, including settlement and slope instability, or damage caused by earthquakes, have caused about 30% of all dam failures in the United States.
- **Mechanical Failures:** Malfunctioning gates, conduits or valves can cause dam failure or flooding both upstream and downstream, and account for about 36% of all dam failures in the United States.
- **Hydraulic Failures:** Overtopping of a dam often is a precursor to dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways or settlement of the dam crest accounts for approximately 34% of all dam failures in the United States.

In addition to the dams within Multnomah County, there are four dams on the Lewis River in Washington that could impact low-lying areas along the Columbia and Willamette rivers in Multnomah County. These dams are classified as having high downstream threat potential with more than 300 lives at risk (Department of Ecology, 2015).

The North Fork of the Lewis River flows from the slopes of Mt. Adams into the Columbia River about 19 miles east of Vancouver, Washington. PacifiCorp Energy operates four dams on this river. Computer modeling of hypothetical domino failures of the dams was conducted for the purposes of developing an Emergency Action Plan to notify the public and plan for evacuation. The worst case scenario dam failure included flood conditions that could impact low-lying areas along the Columbia and Willamette rivers in Multnomah County. This scenario included large portions of Sauvie Island. Because of the need to protect critical energy infrastructure information, these inundation scenario maps cannot be released. However, they did inform the development of procedures to provide early warning to people within the inundation zone who could be affected by the sudden release of water caused by natural disaster, accident, or failure of any component of the system of dams.

Urban Flooding

The risk of urban floods increases as development increases. During heavy rainstorms, runoff from buildings, streets and other impervious surfaces can exceed the capabilities of the existing stormwater drainage infrastructure and result in flooded streets, parking lots, yards and basements. Storm drains may back up with yard waste or other flood debris, leading to further localized flooding. The grading of developed property also can alter drainage direction of water from one property to another. Following is a list of the most problematic sites for urban flooding in the Planning Area.

Unincorporated Multnomah County

- Stormwater drainage problems have been minor, with no locations known to have significant flooding problems. The county's current regulations for new stormwater drainage systems require

control of the 10-year, 24-hour storm. However, many older drainage systems are built to lower standards.

Fairview

- NE Glisan Street at Fairview Creek
- NE Halsey Street between 201st and 205th Streets
- 223rd North of Halsey Street and south of Bridge Street
- Sandy Boulevard at Fairview Creek

Gresham

- Areas along Burlingame Creek, particularly those near Hogan Road where Burlingame enters the Gresham Golf Course
- Properties along Johnson Creek off Park Avenue

Troutdale

- Areas along the Sandy River
- Areas along the lower reaches of Beaver Creek

Wood Village

- Sandy Drainage Improvement Company
- Increased influent stormwater may overload the system's current capacity.
- Culvert at Troutdale Airport
- Troutdale Reynolds Industrial Project Mitigation Site

Other Hazards That Can Impact Flooding

Wildfires change the water conditions of a watershed, such as how fast water can move, and how vulnerable the land surface is to erosion. This can result in more severe flooding and mud or debris flows. These secondary impacts from a wildfire can damage property and infrastructure. For instance, if a dam is in an area impacted by a wildfire, this could increase the risk of dam failure by increased water flow or sedimentation and debris obstructing spillways (Department of Ecology, no date).

Both dams and levee systems are vulnerable to seismic activity. However, based on the 2001 USACE study of the seismic performance of the Columbia River Levee, a seismic event by itself would not result in interior flooding, unless a major flood event was in progress. The study also highlights that there is no known correlation between high-water periods and earthquakes. Though the study considered only a small section of the levee in front of the airport, and not all levees perform the same, the fact remains that there is no known correlation between high-water periods and earthquakes. Therefore, the likelihood of a major flooding event on the Columbia River and an earthquake occurring at the same time is very low.

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3.3 Landslide

Much of the northwest portion of Multnomah County is prone to very large and deep landslides. These types of slides tend to move slowly and rip apart infrastructure.

The cities of Gresham and Wood Village consider themselves to have moderate risk to landslides because of slide hazard zones in developed areas.

As more areas susceptible to landslides are developed, greater losses and damages to people and property are likely to result from landslides.

The area's landslide risk is strongly correlated with rainfall, particularly in extreme rain events. Projected increases in extreme precipitation caused by climate change likely will trigger increased landslides in the future.

3.3.1 Overview

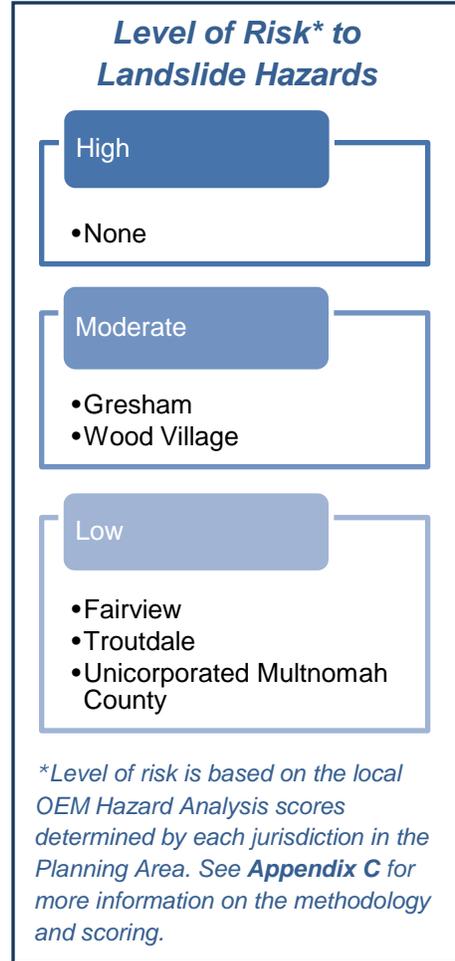
The term "landslide" refers to a variety of slope instabilities that result in the downward and outward movement of slope-forming materials, including rocks, soils and artificial fill. There are three main factors that trigger potential for landslides: slope, soil and rock characteristics, and water content.

In general, landslide-prone locations are:

- on or close to steep slopes
- steepened roadcuts or excavations into steep slopes
- on fill slopes
- existing landslides or places of known historic landslides
- steep areas where surface runoff is concentrated
- steep canyon bottoms, and outlets stream channels

Areas with steeper slopes, weaker geology and higher annual precipitation tend to have more landslides. Most landslides in Multnomah County happen during rainy months when soils are saturated with water. However, landslides may happen at any time of year. Other contributing causes of landslides include: placing fill (weight) on steep slopes, vegetation removal, undercutting of a slope by erosion or excavation, and intense prolonged rainfall or rapid snow melt that cause sharp changes in groundwater levels.

Earthquakes will trigger landslides. Areas prone to seismically triggered landslides are the same as those prone to ordinary (i.e., non-seismic) landslides. As with ordinary landslides, seismically triggered landslides are more likely with earthquakes that occur when soils are saturated with water.



Types

Four types of landslides — slides, flows, spreads and topples/falls — are distinguished based on the types of materials involved, the mode of movement, and how they are triggered. All communities in the Planning Area are impacted by these types of landslides (**Table 3.3-1**). These four types of landslides are characterized in **Figure 3.3-1**.

Table 3.3-1 Types of Landslide Hazards that Impact Each Jurisdiction

Jurisdiction	Slides	Flows	Spreads	Topples/Falls
Unincorporated Multnomah County	✓	✓	✓	✓
Fairview	✓	✓	✓	✓
Gresham	✓	✓	✓	✓
Troutdale	✓	✓	✓	✓
Wood Village	✓	✓	✓	✓

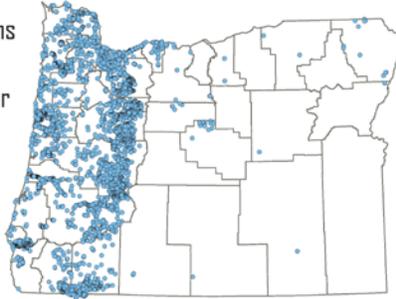
Source: DOGAMI, 2016; NHMP Steering Committee, 2016

Figure 3.3-1 Types of Landslide Hazards

Oregon Geology Fact Sheet | **Landslide Hazards in Oregon**

Landslides affect thousands of Oregonians every year. Protect yourself and your property by knowing landslide types, their triggers and warning signs, how you can help prevent landslides, and how to react when one happens.

9,500 landslides were reported in Oregon in winter 1996-97 ▶



Common landslide triggers in Oregon

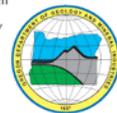
- intense rainfall
- rapid snow melt
- freeze/thaw cycles
- earthquakes
- volcanic eruptions
- human
 - changing the natural slope
 - concentrating water
- combinations of the above

COMMON LANDSLIDE TYPES	TRIGGERS AND CONDITIONS	EXAMPLES
<p>SLIDES — downslope movement of soil or rock on a surface of rupture (failure plane or shear-zone). Commonly occurs along an existing plane of weakness or between upper, relatively weak and lower, stronger soil and/or rock. The main modes of slides are translational and rotational.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><i>translational</i></p> </div> <div style="text-align: center;"> <p><i>rotational</i></p> </div> </div>	<p>Slides are commonly triggered by heavy rain, rapid snow melt, earthquakes, grading/removing material from bottom of slope or adding loads to the top of the slope, or concentrating water onto a slope (for example, from agriculture/landscape irrigation, roof downspouts, or broken water/sewer lines).</p> <p>Slides generally occur on moderate to steep slopes, especially in weak soil and rock.</p>	<p style="text-align: center;"><i>translational slide</i> <i>rotational slide</i> <i>(most slides are combinations of translational and rotational movement)</i></p>
<p>FLOWS — mixtures of water, soil, rock, and/or debris that have become a slurry and commonly move rapidly downslope. The main modes of flows are unchanneled and channeled. Avalanches and lahars are flows.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><i>unchanneled flows— left: earth flow; right: debris avalanche</i></p> </div> <div style="text-align: center;"> <p><i>channeled flow</i></p> </div> </div>	<p>Flows are commonly triggered by intense rainfall, rapid snow melt, or concentrated water on steep slopes. Earth flows are the most common type of unchanneled flow. Avalanches are rapid flows of debris down very steep slopes.</p> <p>A channeled flow commonly starts on a steep slope as a small landslide, which then enters a channel, picks up more debris and speed, and finally deposits in a fan at the outlet of the channel.</p> <p>Debris flows, sometimes referred to as rapidly moving landslides, are the most common type of channeled flow. Lahars are channeled debris flows caused by volcanic eruptions.</p>	<p style="text-align: center;"><i>debris avalanche (unchanneled flow)</i> <i>earth flow (unchanneled flow)</i> <i>channeled debris flow</i> <i>lahar aftermath (note the flow height indicated by stained trees)</i></p>
<p>SPREADS — extension and subsidence of commonly cohesive materials overlying liquefied layers.</p>	<p>Spreads are commonly triggered by earthquakes, which can cause liquefaction of an underlying layer. Spreads usually occur on very gentle slopes near open bodies of water.</p>	<p style="text-align: center;"><i>spread</i></p>
<p>TOPPLES / FALLS — rapid, nearly vertical, movements of masses of materials such as rocks or boulders. Toppling failures are distinguished by forward rotation about some pivotal point below or low in the mass.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><i>topple</i></p> </div> <div style="text-align: center;"> <p><i>fall</i></p> </div> </div>	<p>Topples and falls are commonly triggered by freeze-thaw cycles, earthquakes, tree root growth, intense storms, or excavation of material along the toe of a slope or cliff. Topples and falls usually occur in areas with near vertical exposures of soil or rock.</p>	<p style="text-align: center;"><i>topple</i> <i>fall</i></p>

Landslide diagrams modified from USGS Landslide Fact Sheet FS2004-3072. Photos — Translational slide: Johnson Creek, OR (Landslide Technology). Rotational slide: Oregon City, OR, January 2006. Debris avalanche flow: Cape Lookout, OR, June 2005 (Ancil Nance). Earth flow: Portland, OR, January 2006 (Gerrit Huizenga). Channeled debris flow: Dodson, OR, 1996 (Ken Cruikshank, Portland State University). Lahar: Mount St. Helens, WA, 1980 (Lyn Topinka, USGS/Cascades Volcano Observatory). Spread: induced by the Nisqually earthquake, Sunset Lake, Olympia, WA, 2001 (Steve Kramer, University of Washington). Fall: Portland, OR (DOGAMI). Topple: I-80 near Portland, OR, January 2006 (DOGAMI).

Oregon Department of Geology and Mineral Industries 800 NE Oregon St., Suite 965 Portland, OR 97232 971-673-1555 www.OregonGeology.com

LAST REVISED 11-12-2008



Source: DOGAMI, 2008

Location and Extent

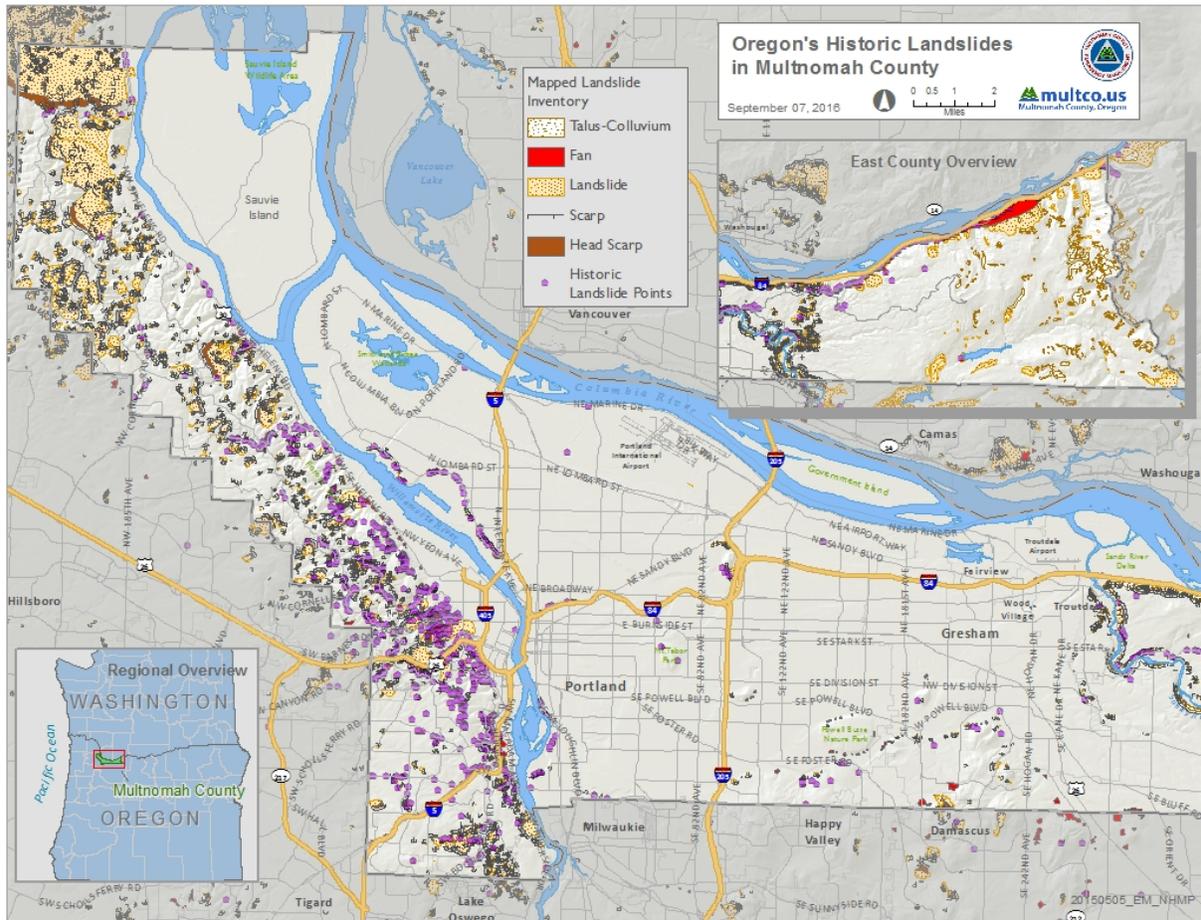
The Oregon Department of Geology and Mineral Industries (DOGAMI) found that to more fully understand the landslide hazard in Oregon, lidar (light detection and ranging) topographic data must be collected and used during the mapping of existing landslides and modeling of future susceptibility (Oregon Department of Land Conservation and Development [DLCD], 2015). Collaborative landslide research in 2005 conducted by DOGAMI and the U.S. Geological Survey Landslide Hazards Program resulted in two key findings. First, the use of the lidar data resulted in the identification of 3 to 200 times the number of landslides than the number identified using other data. Second, the ease and accuracy of mapping the spatial extent of landslides...[was] greatly improved [by lidar]... (DLCD, 2015).

DOGAMI has since updated its State Landslide Information Database for Oregon (SLIDO) through December 29, 2014 (version 3.2). SLIDO data and an interactive web-based map can be found at the website: <http://www.oregongeology.org/sub/slido/index.htm>.

This version of SLIDO includes past landslides for most of Multnomah County, as shown in **Figure 3.3-2**. There are 2,574 lidar-based landslide deposits and 977 historic point locations of landslides in the county¹. Data for the northeastern portion of the county was completed recently and will be available in 2017.

¹ DOGAMI's lidar-based data of past landslides in Multnomah County includes landslides within the City of Portland.

Figure 3.3-2 Landslide Inventory Map



Source: DOGAMI, SLIDO 3.2, 2014

3.3.2 History

In 1996, one of the most notable winter storms in the Planning Area triggered more than 700 landslides in the Portland metropolitan area. More than 100 homes were moderately to completely damaged (Burns et al., 1998). Significant landslides occurred in areas west of the Sandy River, including Wilson Road south of Kerslake Road and SE Stark Road about ½ mile west of the Sandy River. Rockfalls from steep slopes fell along the Historic Columbia River Highway. An approximately three-mile long debris flow closed Interstate 84 and the Union Pacific Railroad for several days. Mandatory evacuations took place in the Dodson-Warrendale area near Gresham in east Multnomah County. In some situations, houses and other buildings were partially and fully destroyed, such as the house in **Figure 3.3-3** (which remained in place after 1996 and was subsequently adjacent to a 2001 landslide). A few properties were acquired by agencies through post-disaster funds and no new structures can be constructed on them. In addition, many landslides in forest areas that had been clear-cut had damaged logging roads. **Table 3.3-2** lists this and other significant historic landslides that have occurred in the Planning Area.

Figure 3.3-3 Landslide along Interstate 84 in the Dodson-Warrendale Area, December 2, 2001



Sources: Aerial photo from Oregon Department of Transportation (ODOT), December 2, 2001; house photo from Tricia Sears, 2003.

Table 3.3-2 Significant Historic Landslides

Date	Location	Description
Feb. 1918	Dodson-Warrendale, Oregon	Massive debris flow that initiated in canyon east of St. Peters Dome and flowed northward; covered the highway in 10–12 feet of debris. Estimated 500,000 to 1 million cubic yards of material deposited.
Dec. 1964	Statewide	DR-184. Heavy rains and flooding, with landslides, on December 24, 1964.
Mar. 1972	Near Portland, Oregon	Mud and rockslide on I-5; three motorists injured.
1964, 1972, and 1975	Columbia Gorge, Oregon	Flooding and debris flow events described in a report as coming from a verbal source for the noted years, but no supporting documents.
Oct. 1984	I-84 near Cascade Locks, Oregon	Rockslide; fatalities: two children; cost of stabilizing the slide area: \$4 million.
Dec. 1987	John B. Yeon State Park	A debris flow event removed a footbridge over McCord Creek.
Sep. 1990	Near Troutdale, Oregon	Landslide injured four highway workers.
Feb. 1996	Dodson-Warrendale, Portland Metro area, Oregon	DR-1099. Heavy rains and rapidly melting snow contributed to thousands of landslides and debris flows across the state; many occurred on clear-cuts that damaged logging roads; I-84 closed at Dodson-Warrendale; 700 landslides in the Portland metro area.
Apr. 1997	I-84 at Milepost 35	A debris flow event on April 20, 1997, covered both lanes of eastbound I-84 for approximately nine hours.
Jan.- Feb. 1999	Northwest Oregon	Widespread flooding on smaller rivers and streams; numerous landslides and mudslides. Historic Columbia River Highway east of the Sandy River Bridge covered with slides coming from the cliffs above.
Nov. 2001	I-84 near Milepost 35	Multiple debris flows on November 28, 2001; they occurred in the drainage basin after five days of heavy rainfall. These flows originated in the steep cliffs south of the drainage basin. Approximately 200,000 cubic yards of debris was deposited.
Dec. 2003-Jan. 2004	Statewide	DR-1510. Winter storms with landslides. Much of the Portland area shut down.
May 2006	Statewide	DR-1632. Statewide impacts from storms, floods, landslides and mudslides.
Dec. 2007-Jan. 2008	Western Oregon	DR-1824. Severe winter storms, record and near-record snow, landslides and mudslides.
Jan. 2011	Statewide	DR-1956. Severe winter storm, flooding, mudslides, landslides and debris flows.
Jun. 2014	Historic Columbia River Highway	A landslide closed the Historic Columbia River Highway just west of the Stark Street bridge. ODOT estimated the slide to be about 1,000 cubic yards of rock.
Dec. 2015	Western Oregon	DR-4258. Severe winter storms, straight-line winds, flooding, landslides and mudslides.

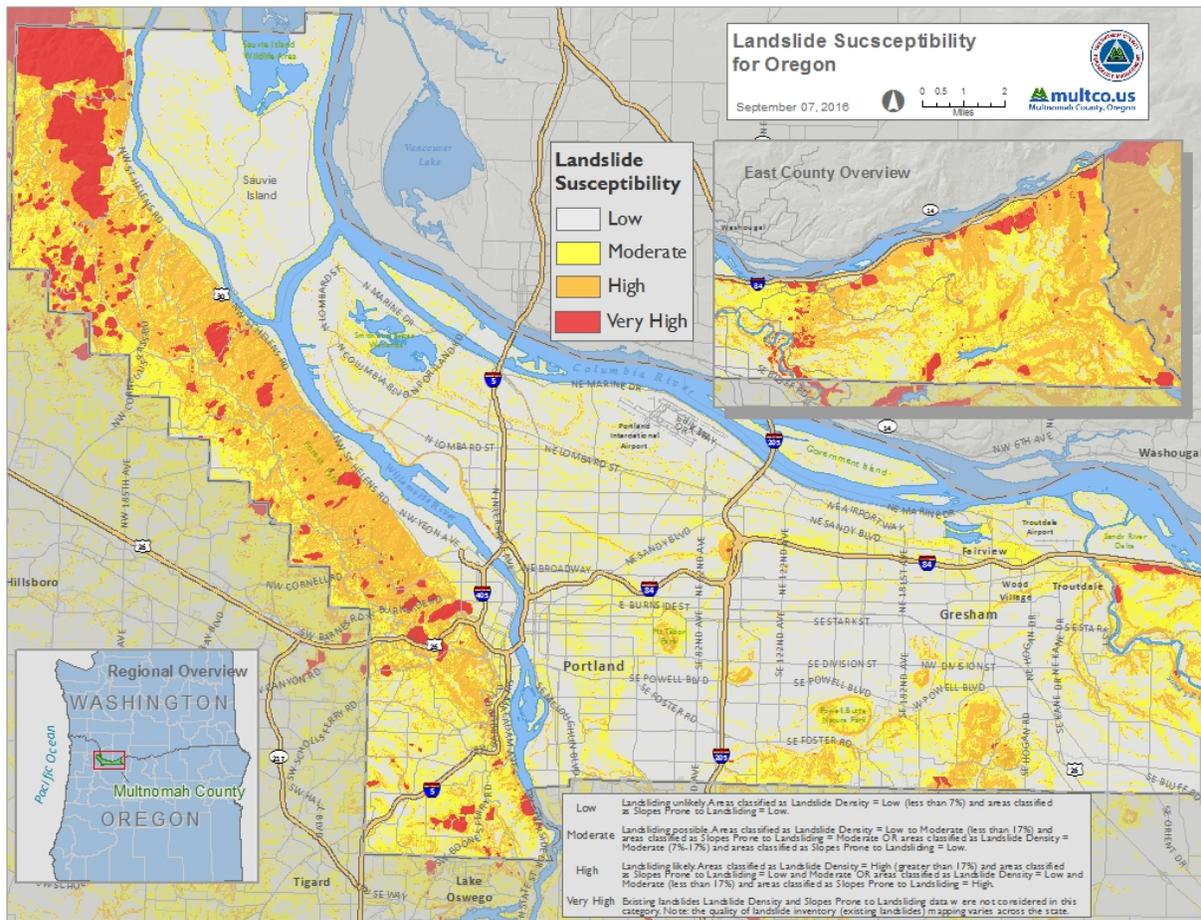
Sources: ODOT Emergency Operations Plan, May, 2002; Interagency Hazard Mitigation Team Report, Federal Emergency Management Agency (FEMA)-1099-DR-OR, June, 1997; Interagency Hazard Mitigation Team Report, FEMA-1149-DR-OR, March, 1997; Taylor and Hatton, 1999; Hazards and Vulnerability Research Institute, 2007; The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]; Columbia, SC: University of South Carolina; FEMA, 2016; Powell et al, 1996; Denning, 1987; Watanbe, 1997; BikePortland.org, 2014.

3.3.3 Probability

Landslides tend to move repeatedly over time. As such, the location of existing landslides is critical for predicting the locations of future landslides. However, the location of existing landslides alone is not enough to predict the future. The geology, slope and triggering factors such as water, earthquakes, volcanic eruptions and man also must be considered. All of these factors combined result in landslide susceptibility, or the more- or less-likely locations of future landslides. Inventory and susceptibility maps can be used to guide assessments for future developments, and can be used to assist in planning and mitigation of existing landslides (DLCD, 2015).

As of today, the best data to predict locations of future landslide events is Multnomah County’s current inventory of past landslides and the statewide landslide susceptibility overview map (Figure 3.3-4). Landslide inventory maps reveal areas that may require additional site evaluation prior to development.

Figure 3.3-4 Landslide Susceptibility in Multnomah County



Source: DOGAMI, 2016

In February 2016, DOGAMI published a Landslide Susceptibility Overview Map of Oregon and a related report called Open File Report 0-16-02 Landslide Susceptibility Overview Map of Oregon. The maps and report provide a general level of data for the entire state, with some specific data for the county and city level. The map is designed to provide landslide hazard information for regional planning, and specifically to identify areas where more detailed landslide mapping is needed (DOGAMI, 2016). **Table 3.3-3** uses

data from the report to show the percentage of low to very high landslide susceptibility in the Planning Area. Portions of the Planning Area not identified as susceptible to landslides are not included in the calculations.

Table 3.3-3 Landslide Susceptibility Exposure for Fairview, Gresham, Troutdale and Wood Village

Jurisdiction	Landslide Susceptibility Exposure %			
	Low	Moderate	High	Very High
Fairview	63.2	31.5	5.2	0.0
Gresham	66.6	23.4	9.8	0.3
Troutdale	65.7	25.6	7.4	1.3
Wood Village	53.3	40.8	5.9	0.0

Source: DOGAMI, 2016

Future Data

DOGAMI is in the process of developing new lidar-based landslide inventory data for eastern Multnomah County and detailed landslide susceptibility maps for central and western Multnomah County. This study is scheduled to be completed in early 2017. When complete, this study will result in more robust countywide inventory (history) maps and the first landslide susceptibility (probability) maps for the Natural Hazards Mitigation Plan (NHMP) Planning Area. These maps will include data and related analysis that will inform future land use and hazard mitigation planning efforts.

- Landslide Inventory Maps:** A countywide inventory map of past landslides. Portions of Multnomah County have been inventoried in the past several years, but as of July 2016, the entirety of Multnomah County has been inventoried. A map of the entire county will be produced showing this information. This will be the first lidar-based countywide inventory map of its kind in the United States.
- Landslide Susceptibility Map:** This map will identify locations that are identified as susceptible to future landslides, based on the inventory of past landslides and related information. This map will be produced by the end of 2016. The detailed information in this map for Multnomah County is at a level of specificity that is greater than the previously mentioned Landslide Susceptibility Overview Map of Oregon. The level of detail is ideal for use in local risk reduction actions such as planning, regulation and zoning.

Climate Change

According to the Multnomah County and City of Portland Climate Change Preparation Strategy (2014) and the Oregon NHMP (2015), climate models project an increased incidence of flooding and an increased magnitude of extreme flooding events to occur in western Oregon, including Multnomah County. Increased rainfall, particularly extreme events, likely will trigger an increase in the number of landslides (DLCD, 2015). With warmer winters, there will be an increased incidence of landslides (Multnomah County and City of Portland, 2014).

3.3.4 Vulnerability

Landslides can move very fast, impacting people and property in many ways and posing risk to life safety. Landslides can block and damage roadways as they dump debris on roadways or as roadways themselves slide downhill. Even ground displacements of a few inches can result in pipe failures and building or road damages. The less common larger landslides can affect several buildings and homes, or entire neighborhoods; major roads or highways, including bridges, overpasses and viaducts; or major

utility lines. Large landslides can have significant economic impact, in the range of tens of millions of dollars. Occupants of buildings or vehicles may be injured or killed by landslides of any size. **Table 3.3-4** summarizes the potential impacts of landslides to the jurisdictions in this NHMP.

Table 3.3-4 Potential Impacts of Landslides on Communities in Multnomah County

Inventory	Probable Impacts
Portion of Multnomah County Affected	Landslides are possible in any of the landslide hazard areas shown in the landslide inventory map in Figure 3.3-1.
Buildings	Landslides may affect a small number of buildings. In unincorporated parts of the county, most buildings at risk are residential buildings.
Streets within Communities	Street closures possible, but impacts generally limited because of short detour routes.
Roads within and to/from Multnomah County	Potential closures of major highways due to landslides, including Highway 30, Interstate 84, and many secondary roads. Road closures can pose economic hardship to businesses and residents.
Rail Transportation	Disruption of rail service possible along the Highway 30 and Interstate 84 corridors.
Electric Power	Potential for localized loss of electric power due to landslides affecting power lines in or near Multnomah County.
Other Utilities	Potential outages of water, wastewater and natural gas from pipe breaks from landslides. Probable impacts are localized.
Casualties	Landslides that impact buildings or roads could result in casualties (death or injuries)

Source: Unknown

There are 839 buildings within the mapped landslide hazard zones in the Planning Area, most of which are in unincorporated areas of the county (**Table 3.3-5**). It is important that the current data does not indicate the use of these buildings.

Table 3.3-5 Total Buildings in Landslide Zones by Jurisdiction

Jurisdiction	Count
Unincorporated Area of Multnomah County	778
Gresham	33
Troutdale	28

Source: DOGAMI, SLIDO 3.2, 2014

Following is a list of areas in the Planning Area that are particularly vulnerable to landslides.

Multnomah County

- Developed areas in the West Hills, including U.S. Highway 30 and the adjacent rail line
- Interstate 84 and the Historic Columbia River Highway from Troutdale east to the Multnomah County border
- East-west Union Pacific Railroad tracks in the Columbia River Gorge
- Dodson-Warrendale area (including the area of the 1996 three-mile long debris flow)
- Hilly eastern portion of Multnomah County
- Steep slopes along portion of Stark Street outside Troutdale city limits

Gresham

- Springwater and Pleasant Valley communities
- Areas in the south-central part of the city
- Along the city's buttes at
- Gresham Butte, north and east face and Walter's Road
- Hogan Butte, east face
- Along Miller Avenue, Lovar Street and 14th Street

Fairview

- Small areas near Sandy Boulevard and Interstate 84 with slopes between 15 and 30 degrees
- Areas in Interlachen with slopes between 15 and 30 degrees

Troutdale

- Canyons along Beaver Creek
- Canyons along the Sandy River
- Steep slopes along Historic Columbia River Highway east of the Sandy River area north of Tad's restaurant

Wood Village

- Hilly area in the southern part of the city
- Slide upslope possibility south and west from NE 238th Drive that could cause damage to NE 238th Drive and to the condominiums on the east side of the street

3.3.5 References

- BikePortland. (2014). Landslide Closes Historic Columbia River Highway near Stark St. Bridge. Retrieved from <http://bikeportland.org/2014/06/05/landslide-closes-historic-columbia-river-hwy-near-stark-st-bridge-106902>
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- Oregon Department of Land Conservation and Development (DLCD). (2015). 2015 Oregon Natural Hazard Mitigation Plan. Retrieved from <http://www.oregon.gov/LCD/HAZ/pages/nhmp.aspx>.
- Powell, W. O, Robertson, C. A, & Watanbe, R. (1996, May 31). Geotechnical Report: Dodson/Warrendale debris flows, a multi-agency report from Multnomah County, the Dodson Water Cooperative, the Bonneville School, the Oregon Department of Transportation, the Oregon Department of Parks and Recreation, the U.S, Forest Service, the Federal Highway Administration, the U.S. Army Corps of Engineers, the Union Pacific Railroad, and Shannon & Wilson, Inc., Geotechnical Consultants.
- Watanbe, R., Oregon Department of Transportation. (1997, May 28). Interoffice memo to Charlie Sciscione, written communication.

3.4 Severe Weather

Winter weather events occur annually in Multnomah County, sometimes becoming severe (Oregon Department of Land Conservation and Development [DLCD], 2015). All of the infrastructure and population in the Planning Area are subject to severe weather. It is common in winter months for heavy rains to cause flooding and landslides throughout the county.

Communities near the Columbia River Gorge are especially vulnerable to ice storms that impact roadways and damage trees and utilities. This includes all four cities and some unincorporated areas.

3.4.1 Overview

All communities within Multnomah County are subject to severe weather events. Severe weather events that commonly take place in winter months occur more frequently and have a greater impact on our communities than do those that take place during summer months. Much of the time, severe weather storms result from large-scale weather systems moving inland from the Pacific Ocean and can affect a large portion of the Pacific Northwest.

Types

Severe weather affecting the Planning Area is generally characterized by winter rather than summer storm events. Typically, winter events include a combination of heavy rains and high winds, sometimes with snow and ice, especially at higher elevations. Multiple hazards can result from severe winter weather. For example, heavy rains can result in localized or widespread flooding and landslides. See sections **3.2 Flooding** and **3.3 Landslides** for more information about how these hazards are impacted by severe weather.

Less frequent severe weather events that typically occur in summer include thunderstorms, hail, lightning strikes, tornadoes and drought/heatwave. Because summer severe weather events are infrequent and tend to have little impact on the Planning Area, little data is available for these hazards. As such, this section assesses the risk to these hazards to a lesser degree. A more robust analysis has been conducted for severe winter weather events.

Table 3.4-1 shows which types of severe weather impact each of the communities in the Planning Area throughout the year.

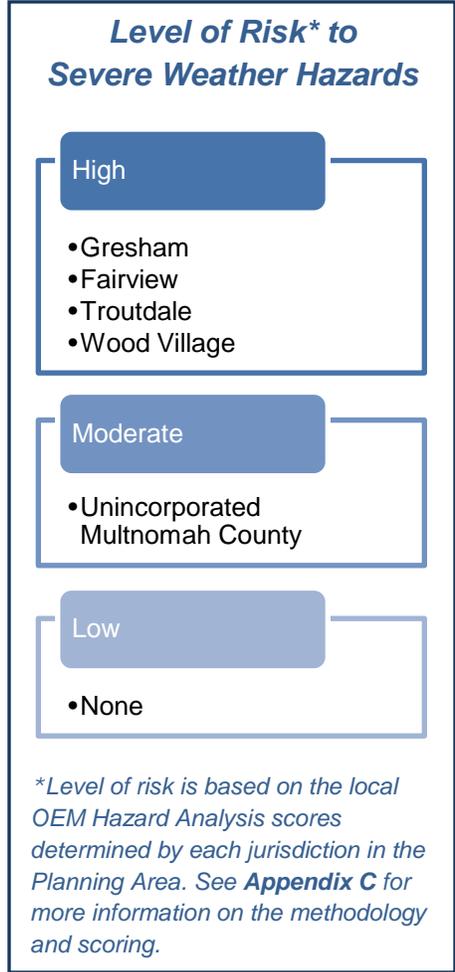


Table 3.4-1 Types of Severe Weather Hazards that Impact Each Jurisdiction

Jurisdiction	Heavy Rain	Windstorm	Snow & Ice	Thunderstorm	Hail	Lightning	Tornado	Drought / Heatwave
Unincorporated Multnomah County	✓	✓	✓	✓	✓	✓		✓
Fairview	✓	✓	✓	✓	✓	✓		✓
Gresham	✓	✓	✓	✓	✓	✓	✓	✓
Troutdale	✓	✓	✓	✓	✓	✓	✓	✓
Wood Village	✓	✓	✓	✓	✓	✓		✓

Source: DLCD, 2015; and Natural Hazard Mitigation Plan (NHMP) Steering Committee, 2016

Location and Extent

Typically, winter storms that affect the Planning Area are large cyclonic low-pressure systems moving inland from the Pacific Ocean. These storms usually affect large areas of Oregon, or even the whole Pacific Northwest. Summer storms tend to be more localized. All of the infrastructure and population within the Planning Area are exposed to severe weather. However, history shows that transportation systems are more frequently impacted and thus are at higher risk of damage from severe weather events than buildings. The location and severity of these events varies widely based on specific local conditions.

The data for rainfall, snowfall and temperature discussed below is from the National Weather Service (NWS) and the Western Regional Climate Center (WRCC). Data for the City of Portland and unincorporated areas of Multnomah County west of I-205 come from the weather data collection site at the Portland International Airport. Data for the cities of Troutdale, Fairview, Wood Village and Gresham and the unincorporated areas east of I-205 comes from the weather data collection site at the Troutdale Airport.

Severe Winter Storms

Heavy Rainfall

Whether flooding occurs at specific sites depends heavily on specific local rainfall totals during individual storms and local drainage conditions. For example, two inches of rain in one area may cause no damage at all, while two inches of rain in a nearby area may cause road washouts and flooding of buildings. Typically, small local drainage basins have very short response times, and may reach flood levels within a few hours or less. Large drainage basins, such as the Columbia River Basin, usually have response times of a week or more.

Precipitation varies significantly across the Planning Area, with higher precipitation at higher elevations, especially on the slopes of Mount Hood. The impact of heavy rainfall depends on the total inches of rain, rain-induced snowmelt and the intensity of rainfall (inches per hour or inches per day). Topographic and hydrological conditions — such as steep or flat terrain, or poorly or well-drained soil — also affect the magnitude, duration and extent of heavy rainfall. Identification of specific sites subject to localized flooding is based on historical occurrences of repetitive flooding. Flood data are addressed in section **3.2 Flood**.

Flash floods, which are produced by episodes of intense heavy rains (usually within six hours or less) or dam failures, are rare in western Oregon but do present a potential hazard. See section **3.2 Flood** for more information about dam failure.

Heavy rainfall also can trigger landslides in areas with saturated soil. See section **3.3 Landslides**.

Windstorm

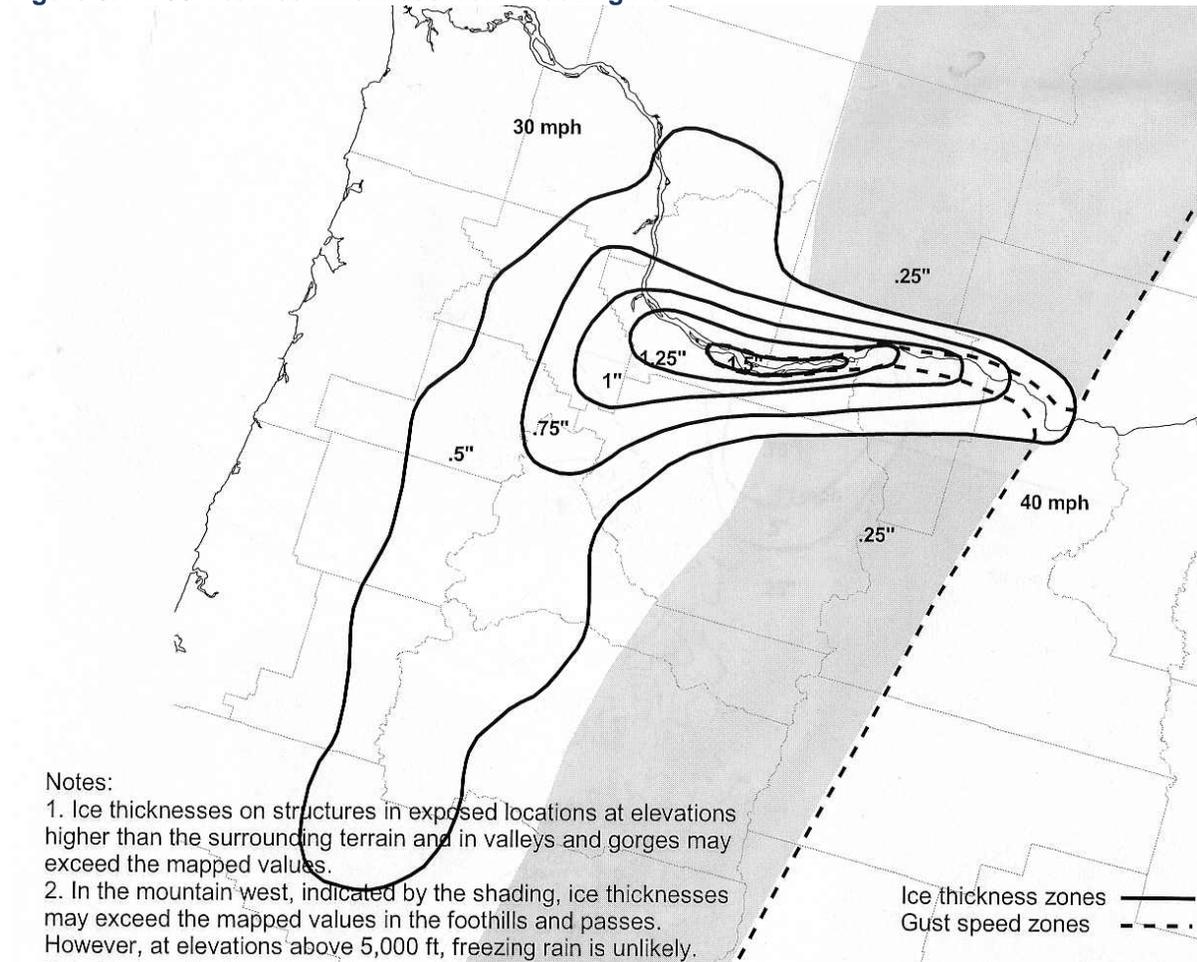
Wind speeds associated with winter storms vary depending on meteorological conditions and local topography. Wind speeds in much of the Planning Area are higher than many locations in western Oregon, other than the coast, because of the unusually high winds common in the Columbia River Gorge. High elevations, such as on Mount Hood, experience even higher wind speeds.

The highest sustained wind speed recorded at the Portland International Airport was 88 mph during the 1962 Columbus Day windstorm. The peak gust recorded during this storm was 104 mph before the wind equipment was damaged; thus, the actual peak gust likely was higher than 104 mph.

Snow and Ice

The level of risk to snow and ice storms is relatively high for the Planning Area, especially ice storms. Higher elevations receive much higher snowfall than areas at lower elevations. Risk of ice storms in western Oregon is highest along the Columbia River (**Figure 3.4-1**). In fact, this area has the highest level of ice storm in the entire United States, according to a report from the American Lifelines Alliance (2004).

Figure 3.4-1 50-Year Ice Thickness from Freezing Rain



Source: American Lifelines Alliance, 2004

Other Severe Weather

Other severe weather events including severe thunderstorms, hail, lightning, tornadoes and drought/heatwave tend to impact the Planning Area during summer months. These events are less frequent and have a lesser impact on our communities than do severe winter storms. Typically, these events are too minor to be recorded and damage is localized. As such, little data is available for these hazards. Nonetheless, these types of severe weather events impact communities in the Planning Area to some extent and should be mentioned.

3.4.2 History

Recent winter storms affecting Multnomah County in 2008, 2009, 2010, 2012 and 2015 brought multiple countywide rain, ice and snow storms. Rains caused flooding and landslides. Freezing rain turned to ice.

The most recent major snow storm affecting the Planning Area occurred in December 2008. This storm dumped more than a foot of snow and ice on the area. The major effects were road closures, including closures on hilly streets, and along Interstate 84 through the Columbia River Gorge for two days. The storm also caused many local power outages.

Ice storms have affected communities in the Planning Area throughout history. **Figure 3.4-2** shows downtown Troutdale after the ice storm of November 18, 1921.

Figure: 3.4-2 Ice Storm in Downtown Troutdale, November 18, 1921



Source: Unknown.

In February 1996, rain, snow, flooding and landslides resulted in power outages, road closures and property damage. Also in 1996, there was a significant ice storm in December that covered parts of the Columbia River Gorge in up to four to five inches of ice. Interstate 84 was closed for four days. There were hundreds of downed trees and power lines, with widespread power outages in the greater Portland metro area. Both 1996 events were recognized with disaster declarations, DR-1099 and DR-1160 respectively.

The National Climatic Data Center (NCDC) database lists seven hail events in Multnomah County between 1991 and 2010. Six of the events had hail diameters of 0.5 inches to 1.5 inches. Two of these events resulted in minor damages, with a total of roughly \$10,000 per event. There is little data before 1991, indicating the database likely is incomplete for earlier years.

The NCDC database lists an additional seven severe lightning events for Multnomah County. Only three events reported damages, in 1995, 2005 and 2008. Two of these events occurred in Gresham during the month of June: in 1995, with \$115,000 in damages; and in 2005, with \$50,000 in damages.

The NWS identifies four historic tornadoes (1972, 1978, and two in 1991) and one cyclonic storm (1904) within Multnomah County. The 1972 tornado caused relatively minor damage in the county and approximately \$6 million in damage in Vancouver, Washington. This event demonstrates the low probability but significant damage that can result from tornadoes.

These and other significant severe weather events that have impacted the Planning Area are listed in **Table 3.4-2**.

Table 3.4-2 Significant Historic Severe Weather

Date	Location	Type of Severe Weather	Description
Dec. 1861	Statewide	Snow	Snowfall 1-3 inches. Snow in Willamette Valley until late February 1862.
Winter 1862, 1866, 1884, 1885, 1890, 1892, 1895	Portland area / Northern Willamette Valley	Snow	Severe winter conditions, especially in Portland area. Record-breaking snowfalls (especially in 1892).
Mar. 1904	E. Portland	Tornado	“Cyclonic storm” damaged the Lewis and Clark Fairgrounds, several shacks and a large warehouse.
Jan. 1916	Statewide	Snow	Two snow storms, each dropped five inches or more.
Dec. 1919	Portland area	Snow	Third heaviest snowfall on record. Columbia River froze, closing navigation.
Jan. 1921	Multnomah County	Ice storm	
Nov. 1921	Troutdale	Ice storm	Closed downtown Troutdale.
Winter 1927, 1936, 1937, 1943, 1949	Portland area, W. Oregon	Snow	Heavy snowfall.
Apr. 1931	W. Oregon	Winter storm	Unofficial wind speeds reported at 78 mph. Damaged fruit orchards and timber.
Jan. 1950	Statewide	Snow	Friday the 13th Storm. Heaviest snowfall since 1890. Freezing rain. Deep snowdrifts closed all highways west of the Cascades and through the Columbia River Gorge. Roads and schools closed. Downed power lines. Severed communication. Hundreds of thousands of dollars in property damage.

Date	Location	Type of Severe Weather	Description
Nov. 1951	W. Oregon	Winter storm	
Dec. 1951	W. Oregon	Winter storm	Statewide storm with wind speeds 60 mph in Willamette Valley. Widespread damage to transmission and utility lines. Damaged buildings.
Dec. 1955	W. Oregon	Winter storm	
Winter 1956 1960, 1962	W. Oregon	Snow, ice	Packed snow became ice. Many auto accidents.
Nov. 1958	Statewide	Winter storm	Every major highway blocked by fallen trees during windstorm. Gusts up to 71 mph.
Mar. 1960	Statewide	Snow	Snowfall amounts were 3-12 inches, depending on location.
Oct. 1962	W. Oregon	Winter storm	1962 Columbus Day Storm. Most severe windstorm for western Oregon due to sustained wind speeds and damage levels. Highest sustained winds, 88 mph, at Portland International Airport. Winds in the Willamette Valley up to 116 mph. Estimated damages \$170 million. 84 homes destroyed, 5,000 severely damaged.
Dec. 1964	Statewide	Heavy rains and flooding	DR-184. Occurred on Dec. 24, 1964.
Mar. 1963	W. Oregon	Winter storm	
Oct. 1967	W. Oregon	Winter storm	
Jan. 1969	Statewide	Snow	Record-breaking snowfalls. \$3 to \$4 million in property damage.
Mar. 1971	W. Oregon	Winter storm	Great damage in the Willamette Valley; homes and power lines destroyed by falling trees.
Jan. 1972	W. Oregon	Storms and flooding	DR-319. Storm and flooding events on Jan. 21, 1972.
Apr. 1972	Portland area	Tornado	F3 tornado, the most violent tornado in Oregon's recorded history. About \$250,000 damages across the state. About \$5 million damages, six deaths, 300 injuries in Vancouver, WA.
Aug. 1978	Near Gresham	Tornado	Small tornado touched ground briefly with some damage to buildings and crops.
Jan. 1980	Statewide	Winter storm	Series of storms bringing snow, ice, wind and freezing rain. Six fatalities.
Nov. 1981	W. Oregon	Winter storm	
Feb. 1985	Statewide	Snow	Western valleys received 2-4 inches of snow. Massive power failures (tree limbs broke power lines).
Dec. 1985	Willamette Valley	Snow	Heavy snowfall throughout valley.
Mar. 1988	Statewide	Winter storm	Strong winds. Heavy snow.
Feb. 1989	Statewide	Winter storm	Heavy snowfall. Record low temperatures.
Jan. 1990	Statewide	Winter storm	Heavy rain with winds greater than 75 mph; significant damage; one death.
Feb. 1990	Statewide	Snow	Average snowfall from one storm was about four inches in the Willamette Valley.
Apr. 1991	Near Gresham	Tornado	Small weak tornado touched down. Slight damage.
Nov. 1991	Near Troutdale	Tornado	Small tornado damaged fencing, with minor damage to one building.
Dec. 1992	W. Oregon	Snow	Heavy snow. Interstate 5 closed.
Feb. 1993	W. Oregon	Snow	Record snowfalls.
Jun. 1995	Gresham	Lightning	\$115,000 in damages.
Dec. 1995	Statewide	Winter storm	Winds reached 62 mph in the Willamette Valley.

Date	Location	Type of Severe Weather	Description
Feb. 1996	Columbia Gorge	Winter storms, flooding, landslides	DR-1099. Winter storms with rain, snow, ice, floods and landslides. Power outages, road closures and property damage.
Dec. 1996	Statewide	Winter storm	DR-1160. Severe snow and ice. Up to four to five inches of ice in the Columbia River Gorge. Interstate 84 closed for four days. Hundreds of downed trees and power lines. Widespread power outages in the greater Portland area, including Multnomah County.
Nov. 1997	W. Oregon	Wind storm	Uprooted trees. Considerable damage to small airports. Winds up to 52 mph.
Winter 1998-1999	Statewide	Snow	Series of storms. One of the snowiest winters in Oregon history.
Jan.- Feb 1999	NW Oregon	Rain, Rain on snow, flooding, landslides, mudslides	Widespread flooding on smaller rivers and streams; numerous landslides and mudslides. Historic Columbia River Highway east of the Sandy River Bridge covered with slides coming from the cliffs above.
Feb. 2002	W. Oregon	Winter storm	Damages \$6.14 million. Downed power lines and trees. Buildings damaged. Power outages caused some water supply problems.
Dec. 2003-Jan. 2004	Statewide	Snow and ice	DR-1510. Much of Portland area shut down. Twenty-six counties received assistance from the Federal Emergency Management Agency (FEMA).
Jun. 2005	Gresham	Lightning	\$50,000 in damages.
Dec. 2005	Multnomah, Clackamas & Washington counties.	Wind storm	\$9,000 in property damage in Multnomah, Clackamas and Washington counties.
Jan. 2006	Willamette Valley	Windstorm	Winds up to 58 mph caused total of \$500,000 in damages over Clackamas, Columbia, Washington, Multnomah, Yamhill, Marion and Polk counties.
Feb. 2006	Multnomah, Clackamas, Washington, and Columbia Counties	Windstorm	Winds caused \$167,000 in damages for Multnomah, Clackamas, Washington and Columbia counties; impacts also in Region 1 & 3 for a total of \$575,000 in damages.
May 2006	Statewide	Storms, flooding, landslides, mudslides	DR-1632. Statewide impacts from storms, floods, landslides and mudslides.
Jul. 2006	Statewide	Heatwave	Multiple days of temperatures over 100 degrees Fahrenheit.
Dec. 2006	W. Oregon	Winter storm	
Jul. 2007	Multnomah & Washington Counties	Windstorms	Wind gusts up to 58 mph, several downed trees; \$5,000 in damage (\$1,000 in Beaverton).
Sep. 2007	Multnomah County	Wind storm	Severe storm with hail and tornado; \$5,000 in damages.
Dec. 2007-Jan. 2008	W. Oregon	Winter storm	DR-1824. Severe winter storm, record and near-record snow, landslides and mudslides. Gresham received 26 inches of snow .
Jul. 2008	Fairview	Lightning	\$2,000 in damages.
Dec. 2008-Jan. 2009	W. Oregon	Winter storm	
Dec. 2009	Statewide	Winter storm	Snow and freezing rain in Salem, and from Portland to Hood River. I-84 closed for 22 hours.
Nov. 2010	Statewide	Winter storm	Snow, freezing rain and ice from Portland to Hood River.

Date	Location	Type of Severe Weather	Description
Jan. 2011	Statewide	Winter storm	DR-1956. Severe winter storm, flooding, mudslides, landslides and debris flows.
Jan. 2012	Multnomah County	Winter storm	Snow and ice east of Troutdale. I-84 closed for nine hours.
Dec. 2015	W. Oregon	Winter storm	DR-4258. Severe winter storms, straight-line winds, flooding, landslides and mudslides.

Sources: Taylor and Hatton, 1999; FEMA-1405-DR-OR: February 7, 2002, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon; Hazards and 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>; National Climatic Data Center, Storm Events, Database <http://www.ncdc.noaa.gov/stormevents/>

3.4.3 Probability

Severe Winter Weather

Heavy Rainfall

Extreme precipitation is perhaps the most common and widespread natural hazard in Oregon (DLCD, 2015). Severe or prolonged storms can raise rivers and streams to their flood stages and keep them there for several days. Typically, the area experiences flooding after more than three days of rain or when heavy rain falls on already saturated soil in a short period of time.

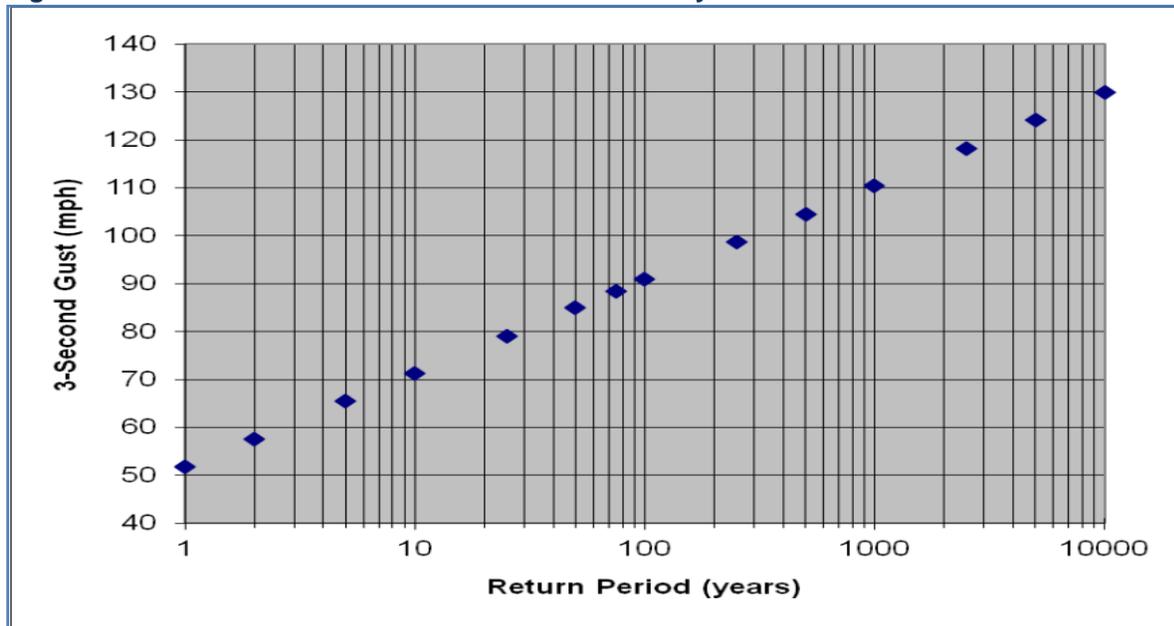
Areas with high risk to flooding are identified in Flood Insurance Rate Maps (FIRMs) created by FEMA. Data from FIRMs have been used to create flood risk maps found in **Chapter 3.2 Flood**. These maps illustrate the 0.1% and 0.2% annual chance of flooding across the county.

Windstorm

The wind hazard curves for Multnomah County, based on the American Society of Civil Engineers (ASCE) 7-10 probability relationships for standard wind design locations, is shown in **Figure 3.4-3**. The 10-year and 100-year return period for high wind events are approximately 71 mph and 91 mph respectively. These wind speeds are three-second gusts which typically are about 30% higher than sustained wind speeds.

Temperature and precipitation extremes are projected to increase in the Northwest.

— Oregon Climate Change Research Institute
(Dalton, et al, 2013)

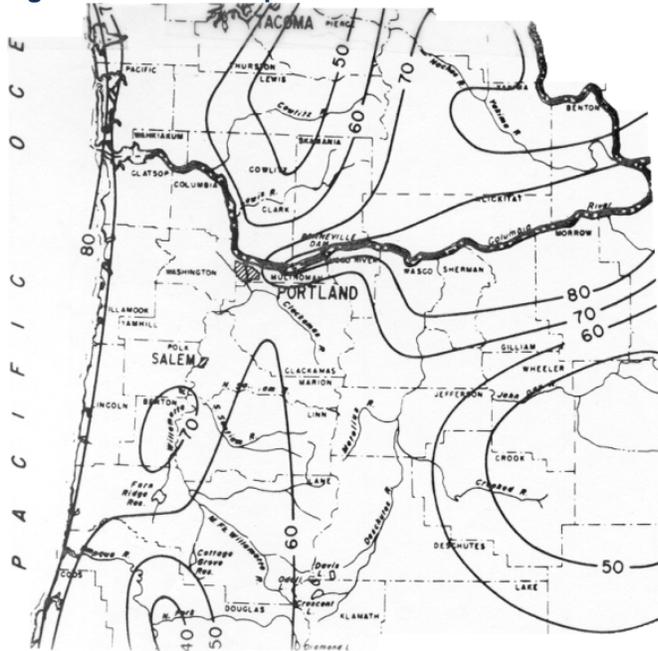
Figure 3.4-3 Wind Hazard Curves for Multnomah County

Source: Unknown.

Figures 3.4-4 and **3.4-5** show wind speed contours for recurrence intervals of two years and 50 years. These data are for sustained wind speeds. Peak gusts are commonly 30% or so higher than sustained winds. Though this data is fairly old, published in *The Journal of Applied Meteorology* in 1981, according to the NWS the information is still representative of overall wind conditions in Oregon and communities within Multnomah County (Tyree Wilde, NWS, personal communication, 2016).

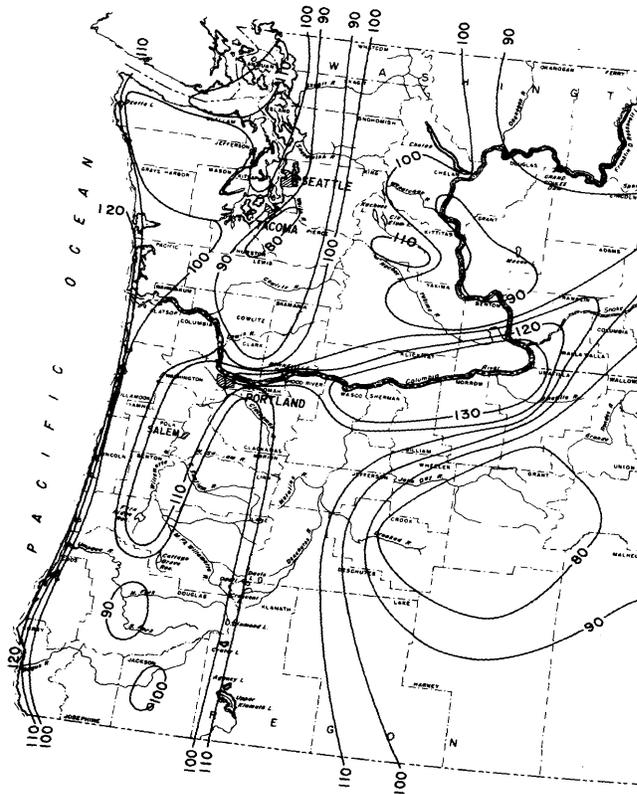
These wind speeds are high enough to cause widespread damage, and exposed sites may experience severe damage. Winter storms that create significant wind damage occur about once every decade. Storms producing major wind damage occur about once every few decades.

Figures 3.4-4 Wind Speed Contours for 2-Year Recurrence Interval (km/hour)



Source: Source: Wantz and Sinclair, 1981

Figures 3.4-5 Wind Speed Contours for 50-Year Recurrence Interval (km/hour)



Source: Wantz and Sinclair, 1981

Snow and Ice

Average annual snowfall in the Planning Area is only about 5 to 6 inches. As described earlier, there are years of no snow on record, and many years with 10 or more inches. Snowfall amounts and locations vary. However, as history shows, the Planning Area is susceptible to notable snow and ice storms that can impact the larger Pacific Northwest region.

Ice thickness can reach about 1.5 inches in a 50-year return period in the Planning Area. Ice thicknesses for 25-year and 10-year ice storms would be about 1.2 and about 0.75 inches respectively. That is enough ice to cause significant (0.75 to 1.2 inches) to substantial (1.5 inches) widespread damage, especially to trees and utility lines (American Lifelines Alliance, 2004).

Climate Change

According to the 2015 Oregon Natural Hazards Mitigation Plan (NHMP), there is little research on how climate change influences winter storms in the Pacific Northwest. However, climate models do project hotter, drier summers with more high-heat days, and warmer winters with the potential for more intense rain events. For more information on how climate change is projected to influence flooding, landslides and wildfire, see sections **3.2 Flood**, **3.3 Landslide** and **3.6 Wildfire**.

As temperature and precipitation patterns change, there is likely to be more data about severe summer weather events, including drought. Future iterations of this plan will assess the Planning Area's risk to more severe weather events as new data become available.

A declining snowpack is an important indicator of a changing climate. The Pacific Northwest has experienced the largest decline in average snowpack in the western United States (Multnomah County and City of Portland, 2014). A 2013 study by the Oregon Climate Change Research Institute states two key findings related to impacts of reduced snowpack on our water systems (Dalton, et al, 2013):

- “Reduced snowpack and shifts in streamflow seasonality due to climate change pose an additional challenge to reservoir system managers as they strive both to minimize flood risk and to satisfy warm season water demands.
- Reduced snowpack and shifts in timing and magnitude of precipitation and runoff could significantly affect culturally and economically important aquatic species, such as salmon.”

3.4.4 Vulnerability

As cold arctic winds blow down the Columbia River Gorge over east Multnomah County, it is not uncommon to have severe ice and sleet storms in the Planning Area. According to the 2015 Oregon NHMP, the Portland metro area is the most vulnerable [to severe winter weather], and these storms can have negative impacts on the economy statewide. Winter storms have delayed air traffic and closed the Portland International Airport. Ice and sleet storms on roads create extremely dangerous driving conditions and can cripple the movement of goods and services across the state (DLCD, 2015). Road closures during winter storms are common due to washouts, deep water on roads, high winds, heavy wet snow, or ice storms. Closures on Interstate 84 outside of Multnomah County may affect transportation to/from the county. Due to the large population and large truck commodity transport through the Portland metro region, it is extremely costly when severe winter storms close roads (DLCD, 2015).

Severe weather events can affect buildings and infrastructure directly and indirectly. Direct effects include damages within the county. Indirect effects involve damages outside the area that affect the county, such as damages that interrupt or stop transportation routes or utility services.

Ice and high winds can cause branches, trees and power lines to break or fall, ultimately creating power disruptions or outages. Tree-fall-induced power outages primarily affect local electric distribution systems. Fortunately, transmission system cables generally are less prone to tree-fall damage because of design and better tree trimming maintenance.

In severe wind storms, direct wind damage or wind-driven debris can damage buildings, especially more vulnerable types of construction such as mobile homes. A significant portion of the housing stock in Wood Village and east of the Sandy River consists of manufactured homes, roughly 30% and 20% respectively, making these communities particularly vulnerable to wind storms. See **2.4 Housing** in section **2 Community Profile** for more information.

Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment identifies earthquakes and severe weather events as posing the greatest threat to long-term utility interruption or failure. The impacts from utility failures often are widespread and can affect thousands of people, even when small areas of infrastructure are affected.

Probable impacts of winter storms to the Planning Area are summarized in **Table 3.4-3**

Table 3.4-3 Probable Impacts of Winter Storms

Inventory	Probably Impacts
Portion of Multnomah County affected	Severe winter storms may affect all of Multnomah County, although the severity of impacts typically varies significantly with location within the county.
Buildings	Isolated damage from tree falls, wind, heavy snow loads, landslides and localized flooding. Mobile homes are more vulnerable to high winds.
Streets and Roads within Multnomah County	Road closures due to snow or ice, tree falls, landslides or flooding.
Highways to/from Multnomah County	Road closures also may affect major highways to/from Multnomah County, especially Interstate 84 through the Columbia River Gorge
Airports	Severe weather may result in temporary closures of Portland International Airport and smaller airports in Multnomah County
Electric Power*	Loss of electric power may be localized or widespread due to effects of wind, snow, ice, and tree falls on local distribution lines or very widespread transmission line fail
Other Utilities*	Generally minor impacts on other utilities from winter storms, except for possible effects of loss of electric power; however, telephone and other telecommunications systems with above-ground lines also may experience outages.
Casualties	Potential for casualties (deaths and injuries) from tree falls or contact with downed power lines, or from traffic accidents.

*See **Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment** for information on the vulnerability of utility systems in the Planning Area.

Source: Unknown.

3.4.5 References

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3.5 Volcano

The proximity of the Cascade Mountain Range (Cascades) to the cities of Troutdale, Wood Village and Fairview creates a moderate level of risk to volcanic hazards for these communities. Because the return rate for volcanic events ranges from hundreds to thousands of years, the probability of such events is low. However, when an eruption does occur, dangerous mudflows called lahars could bury all or part of these communities, and damages likely would range from severe to total. A major lahar is probably the worst-case natural disaster for the City of Troutdale.

The entire Planning Area could be impacted by ashfall from eruptions along the Cascades. Even minor amounts of ashfall could impact public health, critical facilities, lifelines, public infrastructure, and the private economy and business sector.

3.5.1. Overview

There are five major volcanoes in the Cascades that are in relative proximity and pose a potential threat to the Planning Area: Mount St. Helens, Mount Hood, Mount Rainier, Mount Adams and Mount Jefferson. All are known or suspected to be active, and most have geological records that indicate past histories of explosive eruptions with large ash releases. Mount Hood and Mount St. Helens pose the greatest threat to the communities in the Planning Area.

Types

The volcanoes in the Cascade Mountain Range differ markedly in their geological characteristics. The largest volcanoes, such as Mount Hood and Mount St. Helens, are stratovolcanoes. Stratovolcanoes tend to have explosive eruptions. These volcanoes may be active for tens of thousands to hundreds of thousands of years. In some cases, these large volcanoes may have explosive eruptions, such as Mount St. Helens in 1980, or Crater Lake about 7,700 years ago. More numerous among the Cascades are mafic volcanoes. Mafic volcanoes are typically active for much shorter time periods, up to a few hundred years. They generally form small craters or cones and erupt effusively as lava flows (U. S. Geological Survey [USGS], 2013), rather than large explosive events.

It should be noted that the Cascades can be the source of and location of multiple hazards, such as volcanoes, landslides, floods, severe weather, wildfires and earthquakes.

Figure 3.5-1 illustrates the types volcanic hazards commonly found in the western United States and Alaska. Some hazards, such as lahars and landslides, can occur even when a volcano is not erupting (Mount Hood Facilitating Committee, 2013). The types of volcanic hazards that can impact each jurisdiction in the Planning Area are shown in **Table 3.5-1** and described below.

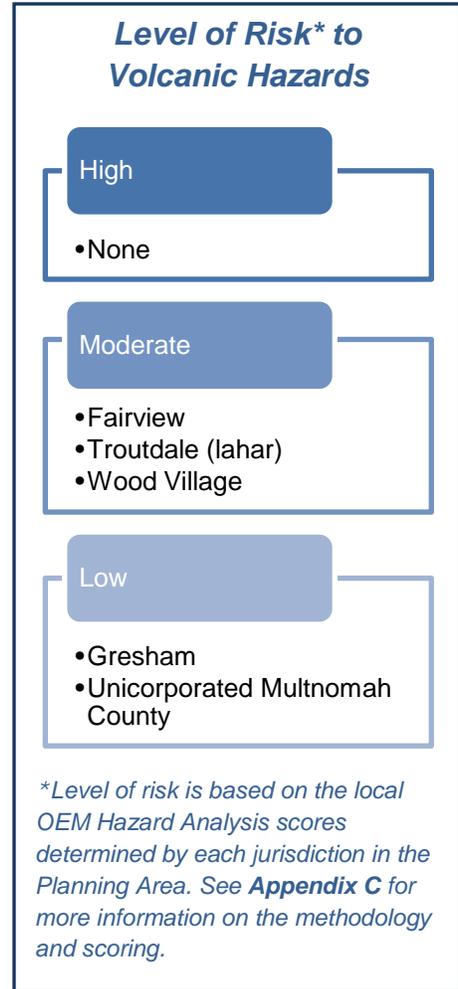
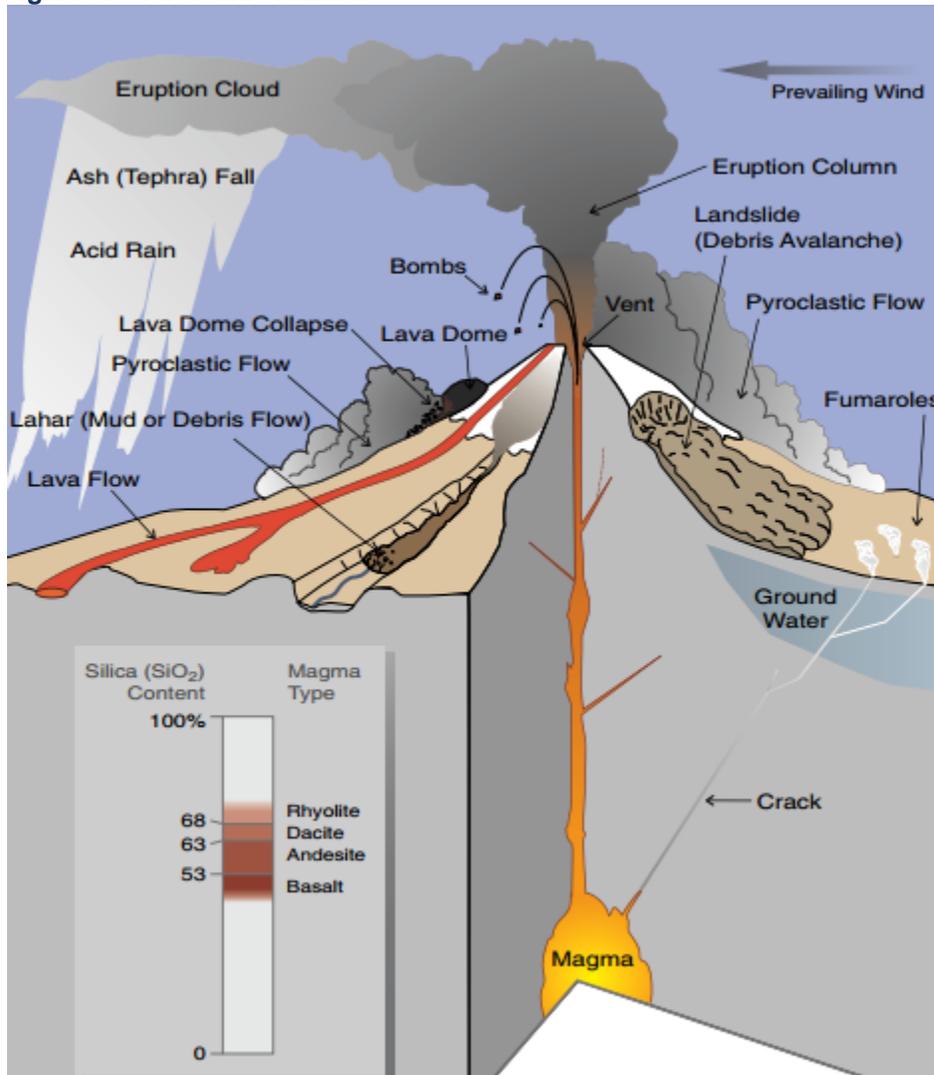


Figure 3.5-1 Volcanic Hazards



Source: Mount Hood Facilitating Committee, 2013

Table 3.5-1 Types of Volcanic Hazards that Impact Each Jurisdiction

Jurisdiction	Ashfall	Blast Effects	Lahars	Landslides
Unincorporated Multnomah County	✓	✓	✓	✓
Fairview	✓	✓	✓	✓
Gresham	✓	✓	✓	✓
Troutdale	✓	✓	✓	✓
Wood Village	✓	✓	✓	✓

Source: Oregon Department of Land Conservation and Development (DLCD), 2015; and Natural Hazards Mitigation Plan (NHMP) Steering Committee, 2016

Ashfall

Ashfall occurs when explosive eruptions blast rock fragments into the air. Such blasts may include solid and molten rock fragments called tephra. The largest rock fragments — sometimes called “bombs” — generally fall within two miles of the eruption vent. Smaller ash fragments less than about 0.1 inch typically rise into the area forming a huge eruption column. In very large eruptions, ash falls may total many feet in depth near the vent and extend for hundreds or even thousands of miles downwind. Modest production of ashfall would pose chiefly non-life-threatening hazards to nearby communities (USGS, 2016).

Blast Effects

Blast effects may occur with violent eruptions, such as Mount St. Helens in 1980. Most volcanic blasts are largely upwards. However, the Mount St. Helens blast was lateral, with impacts 17 miles from the volcano. Similar or larger blast zones are possible for any of the major Cascades volcanoes.

Lahars

Lahars, also known as mudflows, are common when volcanoes erupt with heavy loads of ice and snow. These flows of mud, rock and water can rush down channels at 20 to 40 miles per hour, and can extend for more than 50 miles. For some volcanoes, lahars are a major hazard because highly populated areas are built on lahar flows from previous eruptions.

Landslides

Landslides are the rapid downslope movement of rocky or earthen material (e.g., soil, trees, etc.), snow or ice. Volcano landslides can range from small movements of loose debris to massive collapses of the entire summit or sides of a volcano. Debris avalanches are a type of landslide. See **Section 3.3 Landslides** for additional details.

Lava Flows

Lava flows are eruptions of molten rock. Lava flows for the major Cascades volcanoes tend to be thick and viscous, forming cones, and thus typically affecting areas only very near the eruption vent. However, flows from the smaller mafic volcanoes may be less viscous and may spread out over wider areas. Lava flows destroy everything in their path.

Pyroclastic Flows

Pyroclastic flows are high-speed avalanches of hot ash, rock fragments and gases. Pyroclastic flows can be as hot as 1500 degrees Fahrenheit and move downslope at 100 to 150 miles per hour. Pyroclastic flows are extremely deadly for anyone caught in their path.

Location and Extent

The Smithsonian Institution's Global Volcanisms Project lists 20 active volcanoes in Oregon and seven in Washington (**Table 3.5-2**).

Table 3.5-2 Active Volcanoes in Oregon and Washington

Volcano	Type	Last Eruption
Oregon		
Mount Hood	Stratovolcano	1866
Mount Jefferson	Stratovolcano	950; main volcano inactive for >10,000 years
Blue Lake Crater	Crater	1490 BC
Sand Mountain Field	Cinder cones	1040 BC?
Mount Washington	Shield volcano	620; main volcano inactive
Belknap Field	Shield volcano	460?
North Sister Field	Complex volcano	350
South Sister	Complex volcano	50 BC?
Mount Bachelor	Stratovolcano	5800 BC
Davis Lake	Volcanic field	2790 BC?
Newberry Volcano	Shield volcano	620; crater formation 300,000 to 500,000 years ago
Devil's Garden	Volcanic field	Unknown
Squaw Ridge Lava Field	Volcanic field	Unknown
Four Crater's Lava Field	Volcanic field	Unknown
Cinnamon Butte	Cinder cones	Unknown
Crater Lake	Caldera	2290 BC; crater formation about 7,700 years ago
Diamond Craters	Volcanic field	Unknown
Saddle Butte	Volcanic field	Unknown
Jordan Craters	Volcanic field	1250 BC
Jackies Butte	Volcanic field	Unknown
Washington		
Mount Baker	Stratovolcano	1880
Glacier Peak	Stratovolcano	1700 ± 100
Mount Rainier	Stratovolcano	1825 (?)
Mount Adams	Stratovolcano	950 AD (?)
Mount St. Helens	Stratovolcano	1980 - 2008
West Crater	Volcanic Field	5760 BC (?)
Indian Heaven	Shield Volcanoes	6250 ± 100 BC

Source: Smithsonian Institution, 2016

Volcanic hazards typically have impacted the Planning Area locally. However, lahars can travel considerable distances through stream valleys, and ashfall can blanket areas many miles from the source. (Oregon Department of Land Conservation and Development [DLCD], 2015)

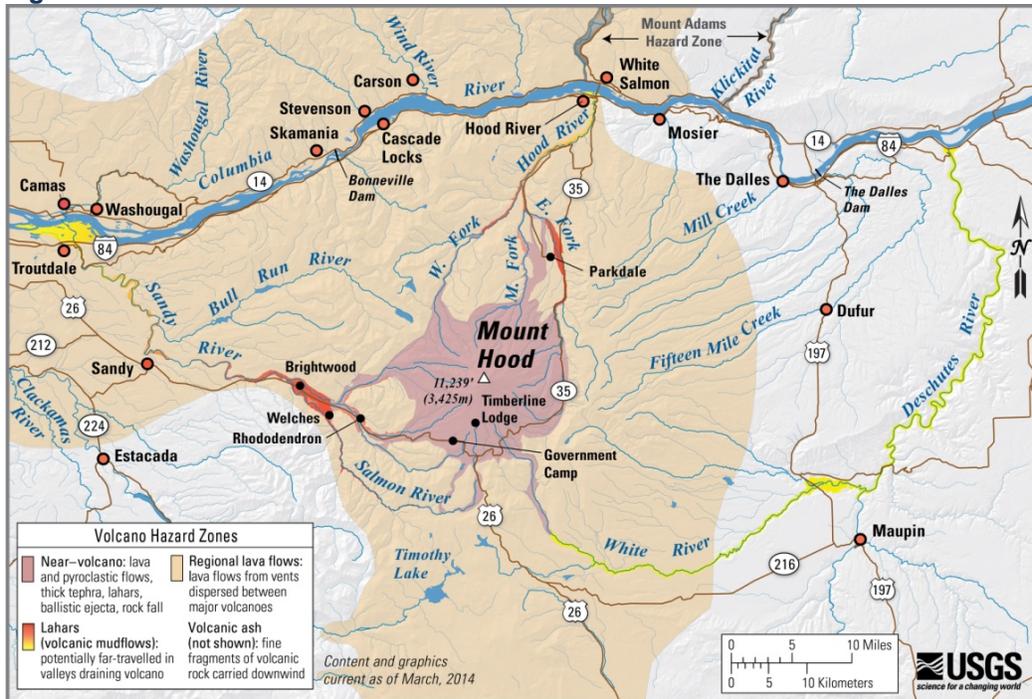
Ashfall and lahars from Mount Hood and Mount St. Helens pose the most significant volcanic threats to the Planning Area — Mount Hood because of its proximity, and Mount St. Helens because of its proximity and high level of volcanic activity. Mount Hood is located near the boundary of Clackamas County and Hood River County, about 10 miles from the southeast corner of Multnomah County. Mount St. Helens is located approximately 50 miles northeast from downtown Portland.

Mount Hood

Mount Hood continues to show signs that it is a functioning active volcano. Even when not erupting, Mount Hood produces frequent earthquakes and earthquake swarms, and steam and volcanic gases are emitted in the area around Crater Rock near the summit (Mount Hood National Forest and USGS, 2015). The Cascade Mountain Range volcanoes are located in proximity to the active Cascadia Subduction Zone and nearby potentially active crustal faults, which contribute to moderate seismic hazard in the area (DLCD, 2015).

Mount Hood's primary eruptive style has alternated between lava dome building and lava flows. The most likely widespread and hazardous consequence of a future eruption of Mount Hood would be for lahars to sweep down the entire length of the Sandy and White river valleys. Modest production of ashfall would also pose chiefly non-life-threatening hazards to nearby communities (USGS, 2016). **Figure 3.5-2** shows volcanic hazard zones around Mount Hood, mapped by the USGS (USGS, 2014).

Figure 3.5-2 Mount Hood Volcano Hazard Zones



Source: USGS, 2014

As shown in **Figure 3.5-3**, volcanic hazard zones are classified as proximal and distal, based on distance from the volcano, vent location and type of hazardous events. Proximal volcanic hazard zones (P) are areas subject to the volcanic hazards within 30 minutes, including but not limited to slow-moving lava flows, pyroclastic flows and lahars. Areas within a proximal volcanic hazard zone should be evacuated before an eruption begins, because there is little time to get people out of harm's way once an eruption starts. Most pyroclastic flows and lava flows should stop within the proximal hazard zone, but lahars can travel much farther (Mount Hood Facilitating Committee, 2013). There are no proximal volcanic hazard zones in Multnomah County.

Distal volcanic hazard zones (D) are areas adjacent to rivers that are pathways for lahars. Estimated travel time for lahars to reach these zones is more than 30 minutes, which may allow individuals time to move to higher ground and greater safety if given warning. **Figure 3.5-3** shows inundation areas for lahars of a size similar to lahars that swept through the Sandy River 1,500 year ago. Lahars could affect transportation corridors by damaging or destroying bridges and roads. Some water from the Bull Run Watershed, the primary drinking water supply for the Portland metropolitan region, is transported in a conduit that crosses distal hazard zones along the Sandy River (Mount Hood Facilitating Committee, 2013).

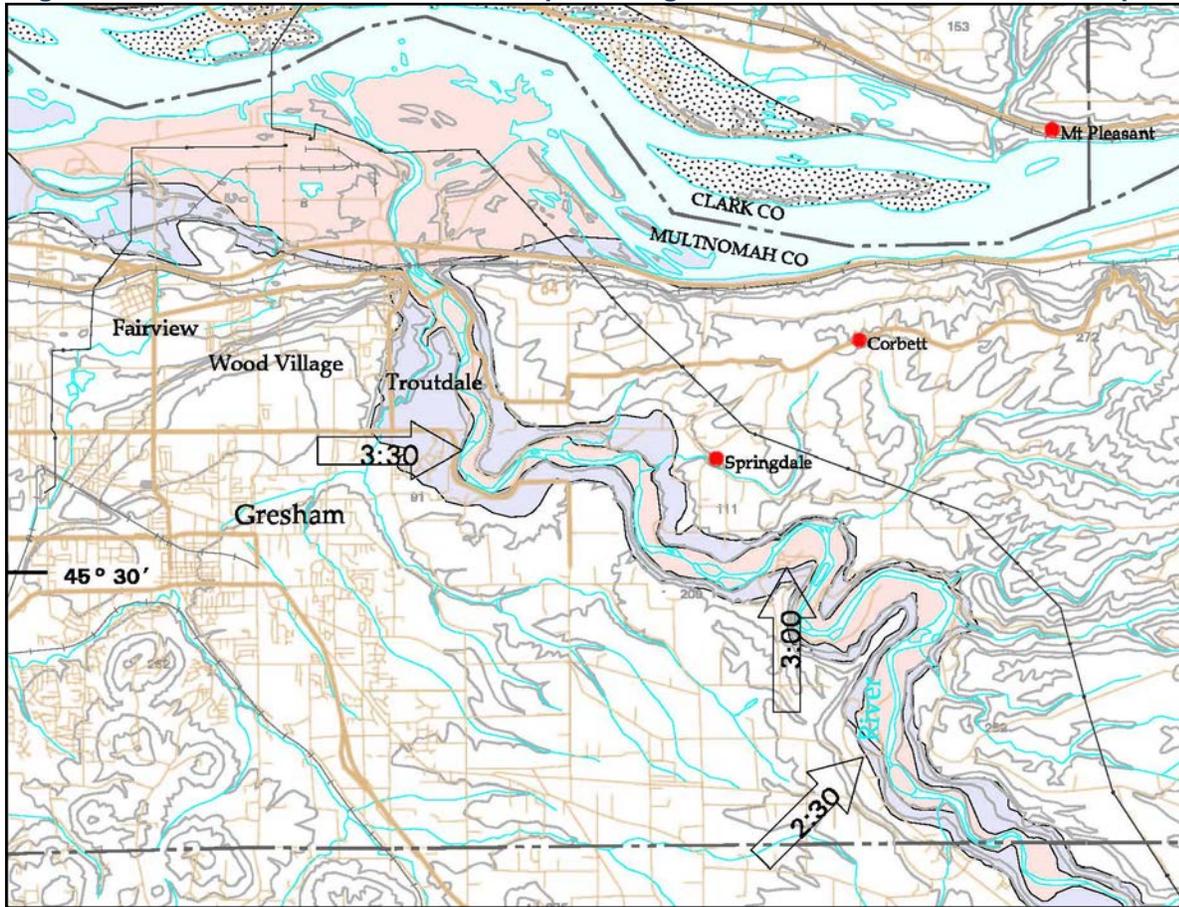
The vent location on Mount Hood during the past two eruptions was near Crater Rock. Scientists anticipate that the vent for the next eruption most likely will be in the same area. Thus, areas within the hazard zones identified in **Figure 3.5-3** have a high probability of being affected during the next eruption (Mount Hood Facilitating Committee, 2013).

Figure 3.5-3 Hazards Zonation Map for Mount Hood



Source: Scott, W.E., et al, 1997

Figure 3.5-5 Mount Hood Lahar Hazard Map Showing Arrival Times from the Time of Eruption



Source: USGS, 1997

Map Legend



Hazard zone DA – Areas along Sandy River and its tributaries and White River that are subject to lahars generated by eruptions at vent located at or near Crater Rock, and to debris avalanches and related lahars generated from steep upper flanks on west and south sides of Mount Hood. The 30-year probability of inundation of a substantial portion of the zone is about 1 in 15 to 1 in 30.



Areas along Sandy and Hood rivers subject to inundation by a debris avalanche and lahar of about 500 million cubic meters, which is considered to be among the largest magnitude events possible at Mount Hood. Estimated 30-year probability of such an event is very low – less than 1 in 3,000.

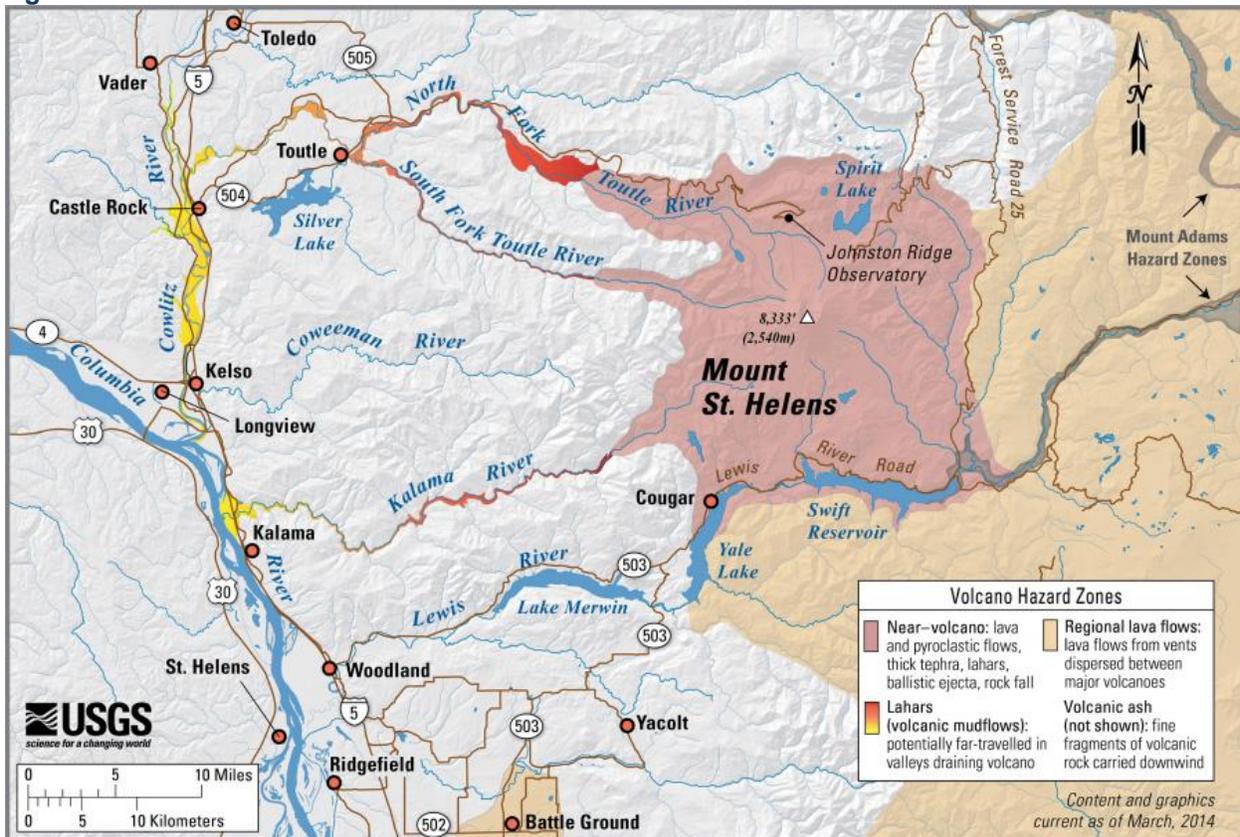
Mount St. Helens

In 1980, Mount St. Helens in Washington erupted and killed 57 people. Lateral blast effects covered 230 square miles and reached 17 miles northwest of the crater. Pyroclastic flows covered six square miles and reached five miles north of the crater. Landslides covered 23 square miles. Ash accumulations were about 10 inches at 10 miles downwind, 1 inch at 60 miles downwind, and ½ inch at 300 miles downwind. Lahars affected the north and south forks of the Toutle River, the Green River and, ultimately, the Columbia River, as far as 70 miles from the volcano.

Mount St. Helens's high frequency of eruptions during the recent geologic past and its two eruptive episodes of the past three decades indicate a high probability of renewed eruptive activity. In addition, the volcano has produced four large explosive eruptions during the past five centuries that affected the Pacific Northwest region and sent large amounts of volcanic ash downwind (USGS, 2014).

Among the possibilities for renewed activity at Mount St. Helens are resumption of lava-dome growth, eruption of basaltic or andesitic ashfall and lava flows, explosive eruptions of dacitic ashfall and pyroclastic flows, and large lahars that sweep down valleys heading on the volcano. **Figure 3.5-6** shows volcano hazard zones for Mount St. Helens (USGS, 2014). The Planning Area's primary risk from Mount St. Helens is ashfall.

Figure 3.5-6 Mount St. Helens Volcano Hazards



Source: USGS, 2014

3.5.2 History

In Oregon, awareness of the potential for volcanic eruptions was greatly increased by the 1980 eruption of nearby Mount St. Helens in Washington, which killed 57 people. In this eruption, lateral blast effects covered 230 square miles and reached 17 miles northwest of the crater, pyroclastic flows covered six square miles and reached five miles north of the crater, and landslides covered 23 square miles. Ash accumulations were about 10 inches at 10 miles downwind, 1 inch at 60 miles downwind, and ½ inch at 300 miles downwind. Lahars (mudflows) affected the north and south Forks of the Toutle River, the Green River and, ultimately, the Columbia River, as far as 70 miles from the volcano.

Over the past 4,000 years in Oregon — a geologically short time period — there have been three eruptions of Mount Hood, four eruptions in the Three Sisters area, two eruptions in the Newberry Volcano area, and minor eruptions near Mount Jefferson, at Blue Lake Crater, in the Sand Mountain Field, near Mount Washington and near Belknap Crater. During this time period, the most active volcano in the Cascades has been Mount St. Helens in Washington State with about 14 eruptions.

In the past 200 years, seven of the Cascade volcanoes in have erupted, including Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, Mount Hood, Mount Shasta and Mount Lassen. The most recent series of events (1760–1907) consisted of small lahars, debris avalanches, steam explosions and minor ashfalls (DLCD, 2015).

Table 3.5-4 includes documented historic events that have impacted the Planning Area specifically.

Table 3.5-4 Significant Historic Volcanic Events

Date	Location	Description
About 20,000 to 13,000 years before present (YBP)	Polallie eruptive episode, Mount Hood	lava dome, pyroclastic flows, lahars, tephra
About 1,500 YBP	Timberline eruptive period, Mount Hood	lava dome, pyroclastic flows, lahars, tephra
1760–1810	Crater Rock/Old Maid Flat on Mount Hood	pyroclastic flows in upper White River; lahars in Old Maid Flat; dome building at Crater Rock
1859/1865	Crater Rock on Mount Hood	steam explosions/tephra falls
1907	Crater Rock on Mount Hood	steam explosions
1980	Mount St. Helens (Washington)	debris avalanche, ashfall, flooding on Columbia River

Sources: USGS, Cascades Volcano Observatory: <http://volcanoes.usgs.gov/observatories/cvo>, no date; Wolfe and Pierson, 1995; and Scott et al., 1997

3.5.3 Probability

Multnomah County is closest to Mount Hood (in Clackamas County), a stratovolcano. According to the 2015 Oregon Natural Hazards Mitigation Plan (NHMP):

Stratovolcanoes have wide ranging modes of eruption, making future volcanic activity difficult to predict definitively. Mount Hood's eruptive history can be traced to late Pleistocene times (15,000–30,000 years ago) and will no doubt continue. However, the central question remains: When?

Geoscientists have provided estimates of future activity in the vicinity of Crater Rock, a well-known feature on Mount 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 (Scott et al., 1997).

Ashfall

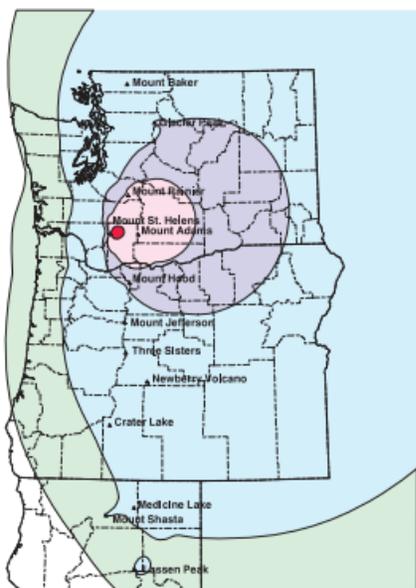
Return periods for ashfall from the Cascades are estimated by the USGS and shown in **Figure 3.5-7**. These maps predominantly reflect volcanic eruptions at Mount St. Helens, because this volcano is much more active than the other volcanoes in the Cascades. These maps indicate the following return periods and probabilities:

- 1,000 year return period; 1 centimeter (about 0.4 inch) or more of volcanic ash; 0.1% probability; and
- 4,000 year return period; 10 centimeters (about 4 inches) or more of volcanic ash; 0.025% probability.

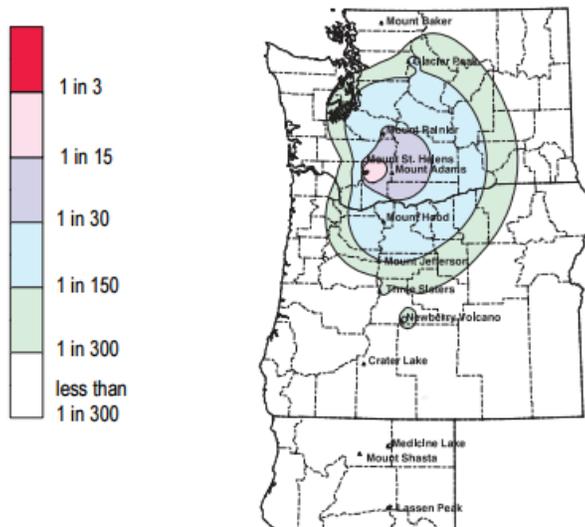
Depending on the volume of ash ejected by an eruption and on prevailing wind directions at the time of an eruption, various thicknesses of ash may impact the Planning Area. Non-prevailing winds would be needed to transport volcanic ash from the nearest Cascades volcano to our communities. These winds do occur, but are much less common than the prevailing westerly winds.

Figure 3.5-7 Probable Ashfall from Volcanoes in Oregon and Washington

Map showing 30-year probability of accumulation of 1 centimeter (0.4 inch) or more of tephra from eruptions of volcanoes in the Cascade Range.



Map showing 30-year probability of accumulation of 10 centimeters (4 inches) or more of tephra from eruptions of volcanoes in the Cascade Range.



Source: Scott et al., 1997

Lahar

The 30-year probability for a moderate lahar event is estimated at about 1 in 15 to 1 in 30. A major lahar has a return period of about 450 to 900 years. The worst case lahar is from Mount Hood and has a 30-year probability of less than 1 in 3,000, about 10,000 years.

The length of time for a lahar to arrive in the Planning Area ranges from about 2 hours and 30 minutes near the southern border of Multnomah County to 3 hours and 30 minutes in Troutdale (**Figure 3.5-5**).

3.5.4 Vulnerability

According to the 2015 Oregon NHMP, communities within Multnomah County are at risk and should consider the impact of volcano-related activity on small mountain communities, dams, reservoirs, energy-generating facilities, highways and the local economy (e.g., wood products and recreation). In addition, debris entering the Columbia River from eruptions at Mount St. Helens or Mount Hood may disrupt shipping operations based in Multnomah County (DLCD, 2015).

Ashfall

Even minor amounts of ashfall can result in significant impacts, and 100% of the population, critical facilities, lifelines, public infrastructure, and the private economy and business sector are exposed. Possible impacts of ashfall on the Planning Area include (USGS, 2003):

- Reduced sunlight and visibility
- Respiratory problems for at-risk population such as elderly, young children or people with respiratory problems, and irritation to eyes

- Impacts on public water supplies drawn from surface waters, including degradation of water quality (high turbidity) and increased maintenance requirements at water treatment plants
- Electric power outages from ash-induced short circuits in distribution lines, transmission lines and substations
- Disruptions of air traffic from the Portland International Airport, Troutdale Airport and other airports in the Pacific Northwest
- Clogging of filters, abrasion and corrosion, and other possible severe damage to vehicle engines, furnaces, heat pumps, air conditioners, commercial and public building combined HVAC systems (heating, ventilation and air conditioning), and other engines and mechanical equipment
- Clean-up and ash removal from roofs, gutters, sidewalks, roads, vehicles, HVAC systems and ductwork, engines and mechanical equipment
- Collapse of roofs and structures due to weight, and slippery conditions when wet (a one-inch layer of ash weighs five to 10 pounds per square foot when dry, but 10 to 15 pounds per square foot when wet)

Lahar

Lahar events could profoundly disrupt transportation to and from Multnomah County if the Interstate 84 bridge and other bridges across the Sandy River were to fail. Critical infrastructure would be damaged. Interstate 84 and other east-west routes probably would be closed for long periods of time. A major lahar event could completely destroy buildings in the Planning Area.

In a moderate lahar event, large portions of Troutdale, Fairview and Wood Village could be inundated. Depending on the volume of the lahar, all or part of this area could be buried. Large lahars could result in extreme levels of damage and a high potential for casualties unless complete evacuations were carried out before the lahar reached populated areas. Depending on the depth of the lahar deposits, damage likely would range from severe to total. Possible impacts include:

- **Troutdale:** Troutdale is especially exposed to lahars along the Sandy River and its tributaries, the White River and Hood River. Most of the city is within the inundation zone. A moderate lahar could impact areas along the Sandy River, the lower reach of Beaver Creek and most of Troutdale north of Interstate 84. In the worst-case event, a lahar could affect the area extending westward from the Sandy River as far as the vicinity of South Troutdale Road and South Buxton Road. Such events also would profoundly disrupt transportation to and from Troutdale, especially across the Sandy River Valley. Interstate 84 and other east-west routes probably would be closed for long periods of time. The worst-case lahar is probably the worst-case natural disaster for Troutdale.
- **Fairview:** A moderate lahar could impact portions of the Interlachen area and the parts of Fairview north and northeast of Interlachen. In the worst-case event, severe to total damage would extend further south, including most of the city north of Sandy Boulevard.
- **Wood Village:** A moderate lahar probably would not reach Wood Village, but would disrupt transportation routes and utilities to the east of Wood Village. In the worst-case lahar event, the flows could cover portions of Wood Village, especially in the northeastern most parts of the city north of Interstate 84, near the Union Pacific Railroad tracks. In Wood Village, the area at most risk from lahars is the Wood Village Mobile Home Park on NE Sandy Boulevard. This park includes 91 manufactured homes and two site-built residential structures.

3.5.5 References

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3.6 Wildfire

Multnomah County has escaped the recent large fire occurrences of other western Oregon counties. However, weather, fuels buildup and climatic changes have created conditions conducive for a large fire event (Multnomah County, 2011).

This is especially true in unincorporated areas where residential development is heavily interwoven with forest land, vegetation is essentially continuous, and fire suppression resources are scarce. A relatively small fire in these areas would pose a significant risk to many residents and their homes.

Strong east winds generated in the Columbia River Gorge are a driver of wildfire risk, particularly in October and November, when northwest Oregon is historically at its peak for fire danger (Multnomah County, 2011). High winds during the peak of wildfire season place Troutdale at moderate risk to wildfires.

Landscaping and other vegetation in most parts of urban and suburban communities in the Planning Area are not continuous. Low fuel loads and a break in potential fuel sources reduce the risk to wildfire hazards in these areas. For this reason, communities in Gresham, Fairview and Wood Village have relatively low risk to wildfire.

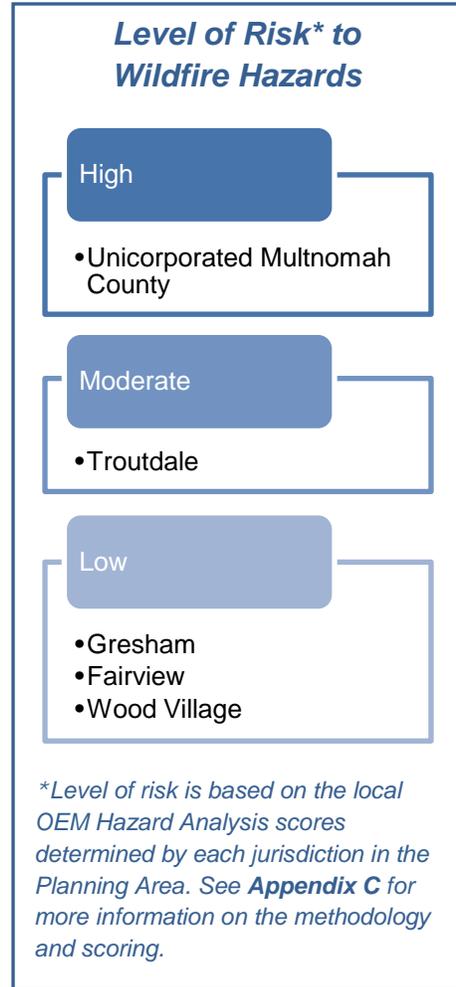
Climate models predict hotter, drier summers and a decrease in summer precipitation for the Planning Area, which will result in more wildfire events and increased exposure to wildfire smoke.

3.6.1 Overview

The 2011 Multnomah County Community Wildfire Protection Plan (CWPP) is the best available characterization and analysis of wildfire risk for the Planning Area. As such, this wildfire chapter is based on the data and analysis in the CWPP.

There is extensive forestland in the Planning Area, both on undeveloped land within the National Forest and on land adjacent to developing areas. All are subject to wildfire. The level of wildfire risk depends on the following factors.

- **Vegetative Fuel Load:** The age of timber stands can be a factor in whether a non-threatening ground fire will spread to the canopy and become a dangerous crown fire. Clearings and fuel breaks will disrupt a slow moving wildfire, enabling successful suppression. Large expanses of fallow fields or non-annual cash crops provide areas of continuous vegetation.
- **Weather:** High temperatures, low humidity and high winds greatly accelerate the spread of a wildland fire and make containment difficult or impossible.
- **Topography:** Steeper slopes exacerbate fire spreading and impede fire suppression efforts.



- **Fire Suppression Resources:** Water resources for fire suppression typically are lower in these areas, which are served by pumped pressure zones. Fire department response times may be longer in these areas because of distance or narrow streets and driveways.
- **Construction and Defensible Space:** Fire-safe construction practices and defensible space practices such as weed abatement can reduce an area's risk to wildfire.

Forestland management practices such as fire exclusion, livestock grazing and timber harvesting have altered natural fire frequency, duration, extent and severity in the Planning Area. As a result, risk to wildfire hazards is increasing in forested lands and in developed areas adjacent to forests.

Agricultural and ranching activities increase the risk of a human-caused wildfire spreading. Large expanses of fallow fields or non-annual cash crops provide areas of continuous vegetation (fuels) that have potential to threaten several homes and farmsteads. Under extreme weather conditions, escaped agricultural fires could threaten individual homes or a town.

Urban and suburban areas tend to have lower risk to wildfire hazards. Paved areas, open spaces and mowed grassy areas typically have low fuel loads. In these environments, most fires are structural. Furthermore, urban and suburban communities tend to have the capacity to provide water for fire suppression and to support fire departments that respond quickly. Thus, the risk of a single structure fire spreading to involve multiple structures is generally quite low.

Types

For the purposes of mitigation planning, we define three types of fires: structure fires, wildland fires, and wildland urban interface (WUI) fires. This chapter focuses on WUI fires, which pose a threat to all jurisdictions in the Planning Area, especially the unincorporated areas.

Structure Fires

Structure fires are fires where structures and contents are the primary fire fuel. Structure fires are most often confined to a single structure or location, although in some cases they may spread to adjacent structures.

Wildland Fires

Wildland fires are fires where vegetation (grass, brush, trees) is the primary fire fuel — few or no structures are involved. The most common suppression strategy is to contain the fire at its boundaries, to stop the spread of the fire, and then to let the fire burn itself out. Fire suppression responsibility is shared by local and state fire agencies.

Wildland Urban Interface (WUI) Fires

The defining characteristics of a WUI fire are structures built in or immediately adjacent to areas with essentially continuous vegetative fuel loads. WUI fires often spread quickly, and structures can become fuel sources. Fire suppression efforts for WUI fires focus on saving lives and on protecting structures to the extent possible.

Table 3.6-1 Wildland Urban Interface in Each Jurisdiction

Jurisdiction	Wildland Urban Interface
Unincorporated Multnomah County	✓
Fairview	✓
Gresham	✓
Troutdale	✓
Wood Village	✓

Sources: Multnomah County, 2011; Oregon Department of Land Conservation and Development (DLCD), 2015; and Natural Hazards Mitigation Plan (NHMP) Steering Committee, 2016.

According to the CWPP, wildfires in Multnomah County are most commonly caused by lightning or human activity, as shown in **Table 3.6-2**.

Lightning-Caused Fires

Lightning-caused fires in Multnomah County occur less frequently than compared to southern and eastern Oregon. Recent 10-year averages from the Oregon Department of Forestry (ODF) show lightning as the cause of one to two fires yearly on private land. However, in some years, lightning has ignited a few fires from one storm event in Multnomah County. These multiple fire events sometimes cause a shortage of resources, and contingency move-ups from other parts of the state become necessary (Multnomah County, 2011).

Human-Caused Fires

Human-caused fires are responsible for the majority of fires in Multnomah County. The North Cascade District of ODF lists discarded cigarettes as the number one cause of fires on forest lands in Multnomah County. The second leading cause of fires in the North Cascade District is debris burning in residential areas. Equipment use is identified as the third leading cause of fires, and refers to sparks generated from lawnmowers, chainsaws and other equipment (Multnomah County, 2011).

Table 3.6-2 Wildfire Ignitions on Oregon Department of Forestry* Protected Lands in Multnomah County, 1960-2011

Cause	Percentage
Lightning	5%
Human-Caused: Total	95%
Debris Burning - Logging	5%
Juveniles	7%
Railroad	7%
Recreation	7%
Arson	11%
Equipment Use – Non-Logging	14%
Debris Burning – Non Logging	18%
Human-Caused Miscellaneous	26%

* Fire data is only for ODF protected lands in Multnomah County. During the CWFP process, the need to address inconsistent reporting was identified.

Source: Multnomah County, 2011

Location and Extent

Communities at Risk

The CWPP planning process is designed to identify and prioritize areas for wildfire prevention and response efforts, referred to as Communities at Risk. The CWPP recognizes the Communities at Risk identified by the ODF. These Communities at Risk have a combination of five risk variables:

1. **Hazard:** vegetation, topography and climate
2. **Risk:** historical fire occurrence and ignition sources
3. **Values:** community values, watersheds, critical facilities and infrastructure
4. **Protection Capabilities:** Fire district response time
5. **Structural Vulnerability:** wildland urban interface

ODF Communities At Risk within Multnomah County include:

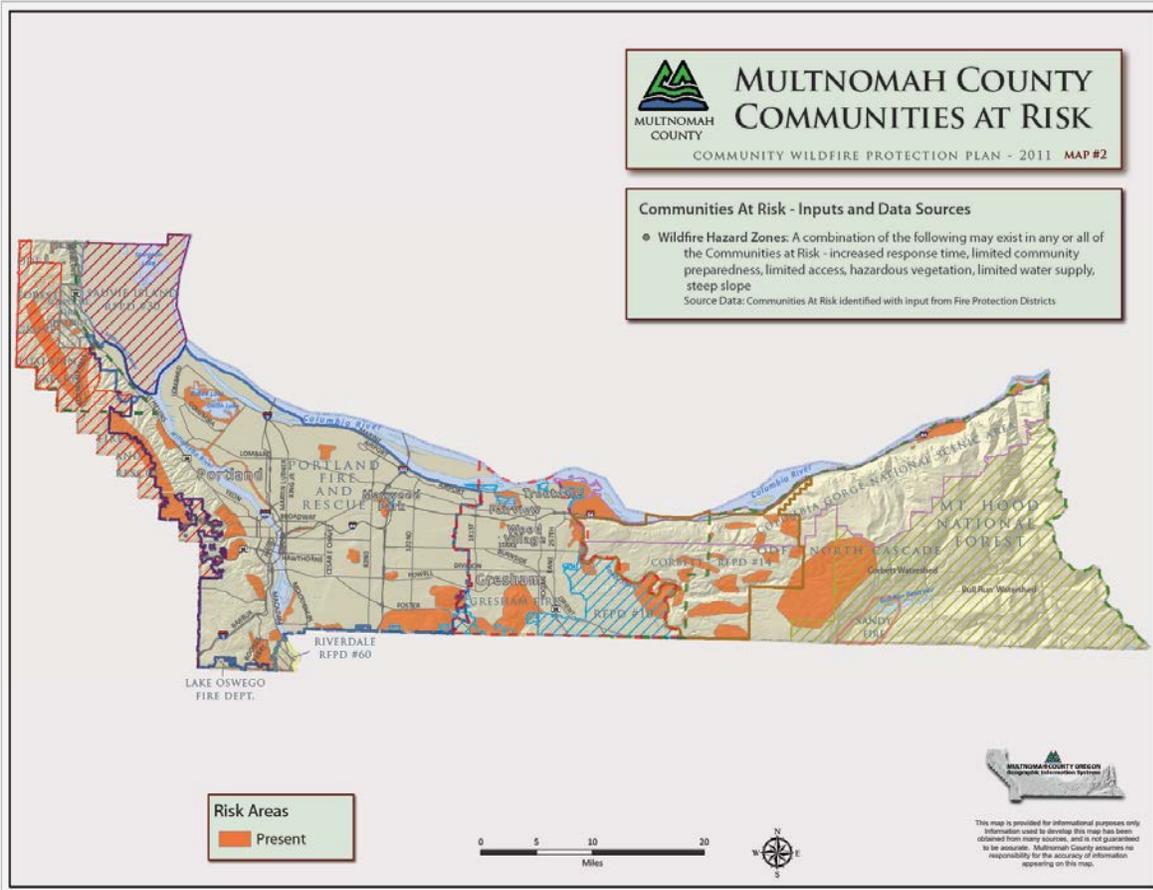
- Fairview
- Gresham
- Lake Oswego
- Maywood Park
- Multnomah County Fire District #10
- Portland
- Riverdale Rural Fire Protection District
- Sauvie Island Rural Fire Protection District
- Scappoose Rural Fire Protection District
- Troutdale
- Tualatin Valley Fire and Rescue
- Unincorporated Multnomah County
- Wood Village

The CWPP also recognizes local service boundaries for fire protection. This reduces redundancy and organizes communities into more functional units (Multnomah County, 2011). These include three Incorporated Fire Districts and six Rural Protection Districts:

- Portland Fire & Rescue
- Gresham Fire (*provides services to City of Gresham residents and contracts with Fairview, Troutdale, Wood Village and parts of unincorporated Multnomah County*)
- Scappoose RFPD
- Corbett RFPD #14
- Tualatin Valley Fire & Rescue
- Sauvie Island RFPD # 30
- RFPD #10 (Gresham Fire)
- RFPD # 1 (Portland Fire & Rescue)
- RFPD # 60 (Lake Oswego Fire)
- Unprotected Areas

Communities At Risk are mapped in **Figure 3.6-1**, including those identified by ODF and the additional nine fire protection service areas mentioned above.

Figure 3.6-1 Communities at Risk



Source: Multnomah County, 2011

3.6.2 History

From 1960 to June 2016, there have been 164 fires in Multnomah County burning a total of 1,609 acres. Of the major fires to impact Oregon, zero occurred within Multnomah County. Significant wildfires that have impacted the Planning Area are listed in **Table 3.6-3**.

Table 3.6-3 Significant Historic Wildfires

Date	Location	Description
1889	Multnomah County	Balch Creek Canyon Fire. Started in northwest Portland and burned west, over Portland's West Hills toward the Cascade Mountains. Covered 9,000 acres.
1902	Multnomah and Clackamas Counties	170,000 acres burned.
Aug. 1933	Tillamook, Washington, and Yamhill Counties	Burned for 14 days. Covered 240,000 acres.
Aug. 1939	Multnomah and Washington Counties	In Dutch Creek Canyon near Scappoose, just west of Forest Park. Fire spread rapidly. 20-mph winds. 200 firefighters deployed. 1,500 people deployed by NW Forest Protective Association. 14,000 acres of timberland lost.

Date	Location	Description
1940	Multnomah County	The Bonny Slope Fire. Began in southern portion of Forest Park and burned through the West Hills, more than 1,000 acres.
Aug. 1951	Portland	Burma Road Fire. Started in Forest Park. Fire consumed more than 100 acres in one evening. Flames reached 50-ft. high. 3,000 acres burned. 500 firefighters fought the blaze.
1960	Gresham	Wildfire on Grant Butte.
Sep. 1971	Columbia River Gorge	Sky Hook Fire. 1,831 acres burned.
Oct. 1991	Columbia River Gorge	Falls Fire. Threatened Multnomah Falls Lodge. Closed Hwy 30 and the Columbia Gorge Scenic Hwy. Residents evacuated. No injuries or deaths. 975 acres burned.
Aug. 2001 and 2002	Portland	2001 fire on Willamette Bluff near the University of Portland. Five-alarm fire fought by firefighters and citizens. Burned 38 acres. Burned again in 2002, covering 10 acres.
Aug. 2002 Sept. 2003	Portland	Powell Butte. Three relatively small fires. Burned 54.75 acres.
Sep. 2003	Columbia River Gorge	Cascade Locks Fire. Started in Cascade Locks. Strong east winds drove the fire more than a mile. Burned more than 300 acres on each side of I-84. Residents evacuated; two residential buildings burned and other buildings threatened.
2003	Columbia River Gorge	Herman Creek Fire. Burned more than 500 acres. Jumped I-84 five times. Destroyed three homes.
Sep. 2005	Vista House in Columbia River Gorge	Vista House Fire. Started 0.5 miles from Vista House. Burned 10 acres.

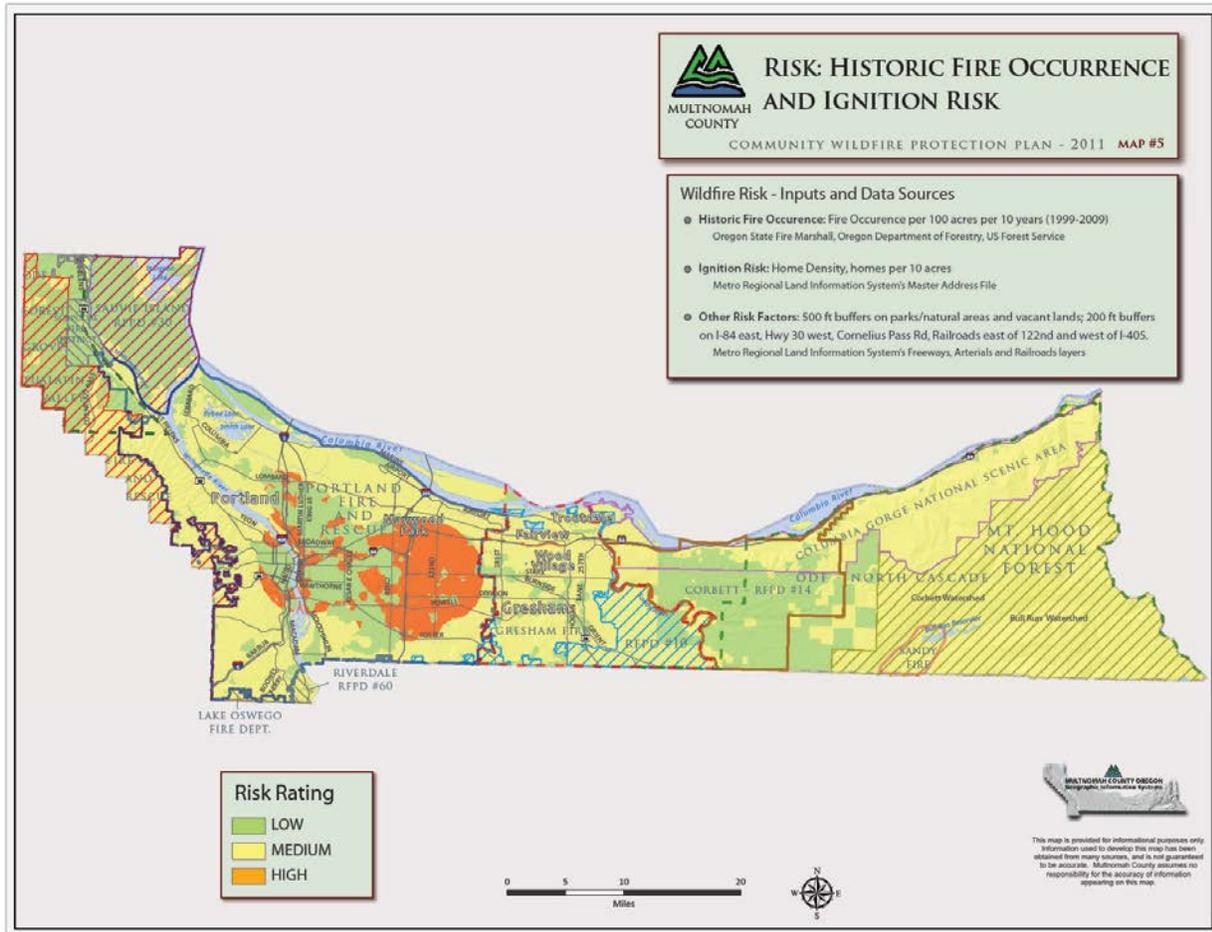
Source: Brian Ballou, 2002; Oregon State, no date; Multnomah County, 2011; and unknown sources.

3.6.3 Probability

To indicate future fire occurrence, a composite map using historic fire events and potential ignition sources was developed for the CWPP. Notable data limitations were identified, such as inconsistency in data reporting, areas with high density and low fuel loads that scored high because of density, and the inability to include large historic fires data (Multnomah County, 2011). There was an effort to eliminate inconsistencies through weighting techniques, but “glaring inconsistencies” remain including the following (Multnomah County, 2011):

- Some urban areas scored higher because parks were in close proximity to developed areas and fire departments had a higher capacity for reporting fires.
- “Wildland fire” may be defined differently by urban and rural fire departments.
- Corbett shows low risk due to low urban density and limited ability to report fires, leading to an undercount of fires reported.

Figure 3.6-2 Risk: Historic Fire Occurrence and Ignition Risk



Source: Multnomah County, 2011

Climate Change

In 2011, the National Research Council (NRC) estimated that for each 1.8 degree Fahrenheit rise in global temperature, the number of acres burned in the western United States could increase by 200% to 400% (National Geographic, 2015). One-fourth of the Earth's vegetated surface is seeing longer fire seasons, according to the U.S. Forest Service. These fire weather changes coupled with ignition sources and available fuel could markedly impact global ecosystems, societies, economies and climate (National Geographic, 2015).

According to the Multnomah County and City of Portland Climate Change Preparation Strategy and the Oregon Natural Hazards Mitigation Plan (NHMP), climate models project hotter, drier summers and a decline in mean summer precipitation for Oregon. Coupled with projected decreases in mountain snowpack due to warmer winter temperatures, Multnomah County is expected to be affected by an increased incidence of drought and wildfire. One example is based on a study conducted by the NRC that linked climate change to an increased exposure to wildfire smoke. See section **3.6.4 Vulnerability** for more information about public health risks to wildfire smoke.

3.6.4 Vulnerability

Wildland Urban Interface (WUI)

Because wildfire prevention and fuels treatments will be managed differently in urban communities than in communities adjacent to heavily forested landscapes, the CWPP Risk Assessment Subcommittee developed a WUI relevant to surrounding land use (Multnomah County, 2011).

- In urban areas, the WUI extends approximately two blocks from the 500-foot vegetation buffer. Structures inside this buffer are either (1) most vulnerable to being damaged by wildfire, or (2) positioned to spread fire from their property to adjacent forests.
- In more heavily forested timber or agricultural areas with adjacent communities or infrastructure, the WUI extends to 1.5 miles beyond structures, or to ridge tops, when appropriate.

These WUI areas are shown in **Figure 3.6-3**.

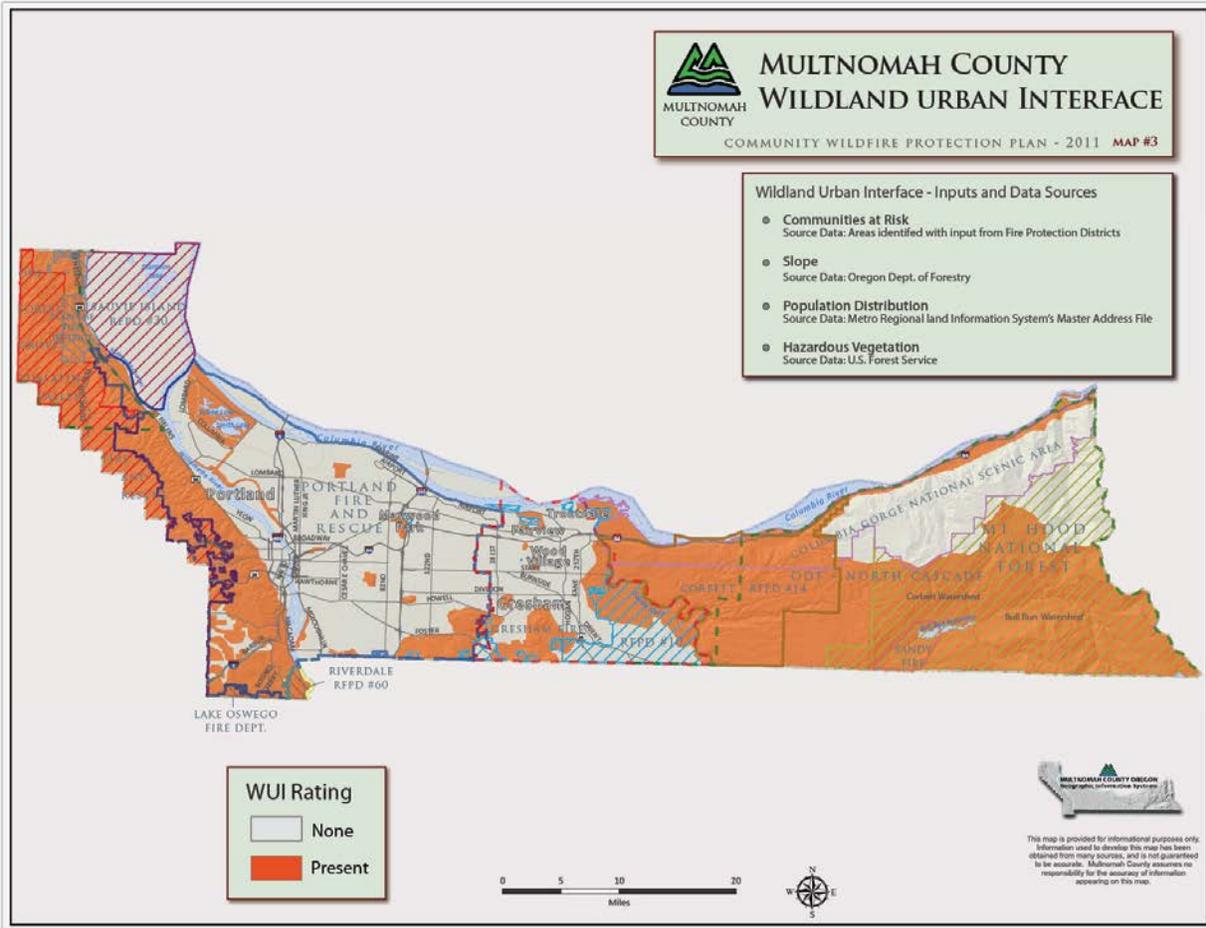
Decades of forest management, fire suppression and climate change have significantly altered forest composition and structure.

The result is an increase in the wildfire hazard as forest vegetation has accumulated to create a more closed, tighter forest environment that tends to burn more intensely than in the past.

Rising temperatures and changes to precipitation patterns result in drought conditions, making forests more susceptible to ignitions.

— Multnomah County CWPP, 2011

Figure 3.6-3 Multnomah County Wildland Urban Interface



Source: Multnomah County, 2011

According to the CWPP, although each fire agency in Multnomah County is considered a Community at Risk, wildfire hazards vary within fire district boundaries, as most districts/departments encompass a variety of communities that have very different development patterns, vegetation types and protection capability. Local fire agency personnel identified 57 areas that were at particular high risk to wildfire and are considered Local Communities at Risk (**Table 3.6-5**). It is recommended that fire agencies target these areas for site-specific wildfire planning and project implementation. Although each Local Community at Risk has unique wildfire hazards and potential impediments to emergency response, the following issues are common to the majority of high-risk strategic planning areas.

- Structural Ignitability
- Access Limitations
- Protection Capability
- Water Supply

Table 3.6-5 Local Communities at Risk to Wildfire in Multnomah County

Portland Fire & Rescue Bureau	<ul style="list-style-type: none"> • Skyline Ridge • Mount Tabor • Kelly Butte • Powell Butte • Johnson Creek Watershed • Oaks Bottom • Springwater & Flavel • Sullivan’s Gulch • Willamette Bluffs Escarpment • Forest Heights 	<ul style="list-style-type: none"> • Smith/Bybee Lake • Forest Park • Linnton • NW Portland (Pittock Mansion area) • Tryon Creek • Terwilliger Curves • Oregon Zoo & Hoyt Arboretum • Riverdale • Bull Run Watershed
Port of Portland Fire	<ul style="list-style-type: none"> • Elrod Road 	<ul style="list-style-type: none"> • Government Island (Unprotected)
Gresham Fire Department	<ul style="list-style-type: none"> • Walters Hill/Gresham Butte • Ritchie Road • Oxbow Park • Lower Sandy River Bend 	<ul style="list-style-type: none"> • 1000 Acres (a.k.a. Sandy River Delta) • Blue Lake • Wisteria Lane • Wistful Vista
Scappoose Fire District	<ul style="list-style-type: none"> • Holbrook Road • Logie Trail Road 	<ul style="list-style-type: none"> • Gilkenson Road
Rural Fire Protection District # 14 (Corbett Fire)	<ul style="list-style-type: none"> • Trout Creek Road • Tout Creek Camp • Aims Road • Mannthay Road • Deverell Road • Gordon Creek • North Oxbow • Camp Angeles • Corbett Watershed • Brower/Palmer Mill 	<ul style="list-style-type: none"> • Ricker/O Regan Roads • Howard Road • Alder Meadows • Maffet Road • Red Elder • Haines/Thompson Mill • Columbia Historic Hwy • Latourell/Alex Barr • Bridal Veil Lakes
Tualatin Valley Fire & Rescue	<ul style="list-style-type: none"> • Skyline Ridge • Cornelius Pass 	
Unprotected Areas	<ul style="list-style-type: none"> • Warrendale-Dodson • Bonneville • Small portion of Forest Park 	<ul style="list-style-type: none"> • Ainsworth • Eagle Creek • Government Island
Sauvie Island	<ul style="list-style-type: none"> • Entire Island 	

Source: Multnomah County, 2011

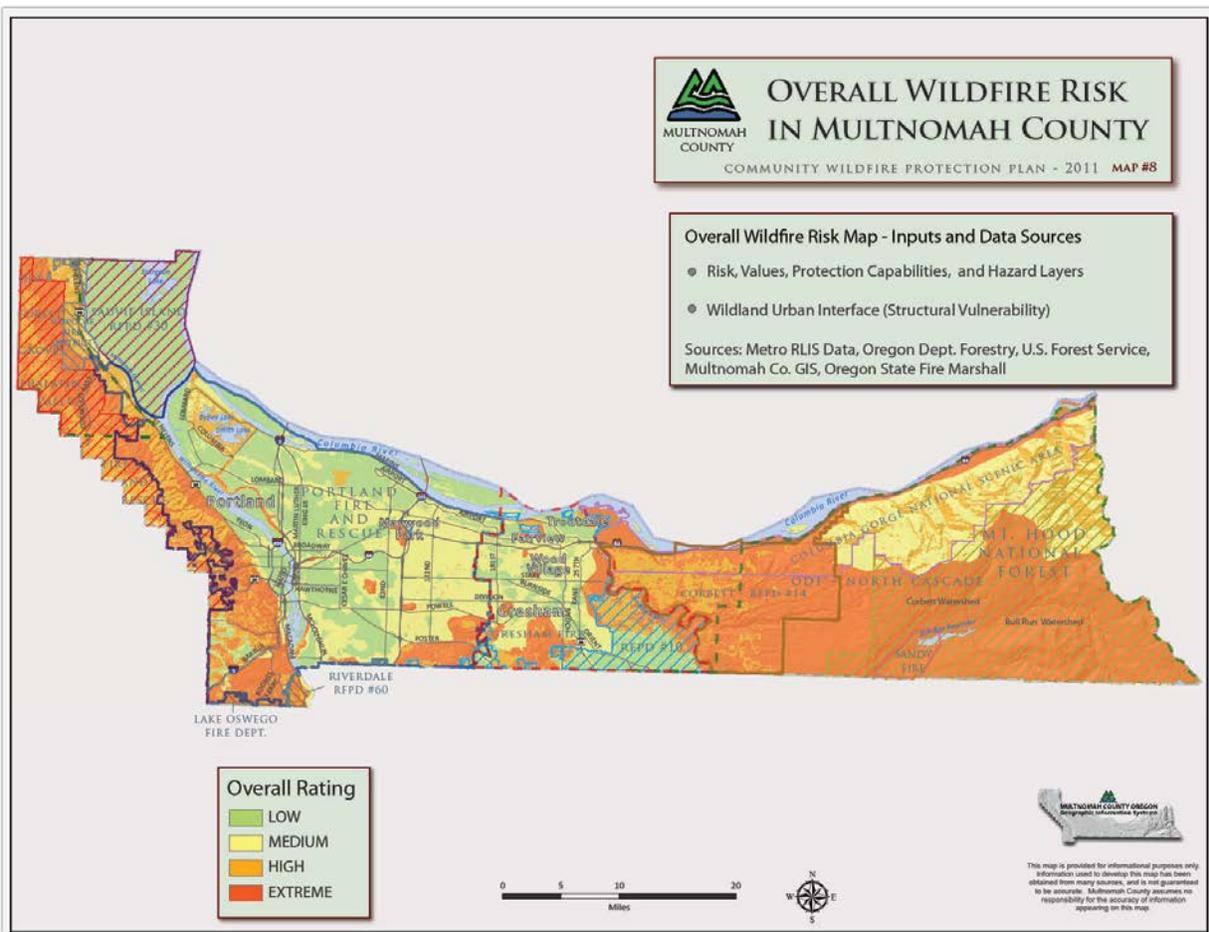
A Wildfire Hazard and Risk Assessment developed for the CWPP considered four categories to determine *relative* severity of fire risk (**Table 3.6-6**). The map in **Figure 3.6-4** represents the county's perception of low, moderate, high, and extreme hazard areas, based on these categories. Roughly 200,000 acres are in high and extreme wildfire risk areas (**Table 3.6-7**).

Table 3.6-6 Wildfire Hazard and Risk Assessment Elements

Assessment Categories	Elements
Wildfire Hazard	Fuels (developed from vegetation information), Slope, Aspect, Elevation, Weather
Wildfire Risk	Historic Fire Occurrence (derived from state and federal fire agency databases), and an estimation of Ignition Risk based on expert opinion and home density
Community Values	Life/Property as determined by home density (homes per 10 acres) and community infrastructure
Protection Capability	Fire Response Time (determined from fire district boundaries and district-reported response times) and Community Preparedness
Structural Vulnerability	The Wildland Urban Interface was determined as the area having the highest degree of structural ignitability.

Source: Multnomah County, 2011

Figure 3.6-4 Overall Wildfire Risk in Multnomah County



Source: Multnomah County Community Wildfire Protection Plan, 2011

Table 3.6-7 Number Acres in Each Hazard Level in Multnomah County

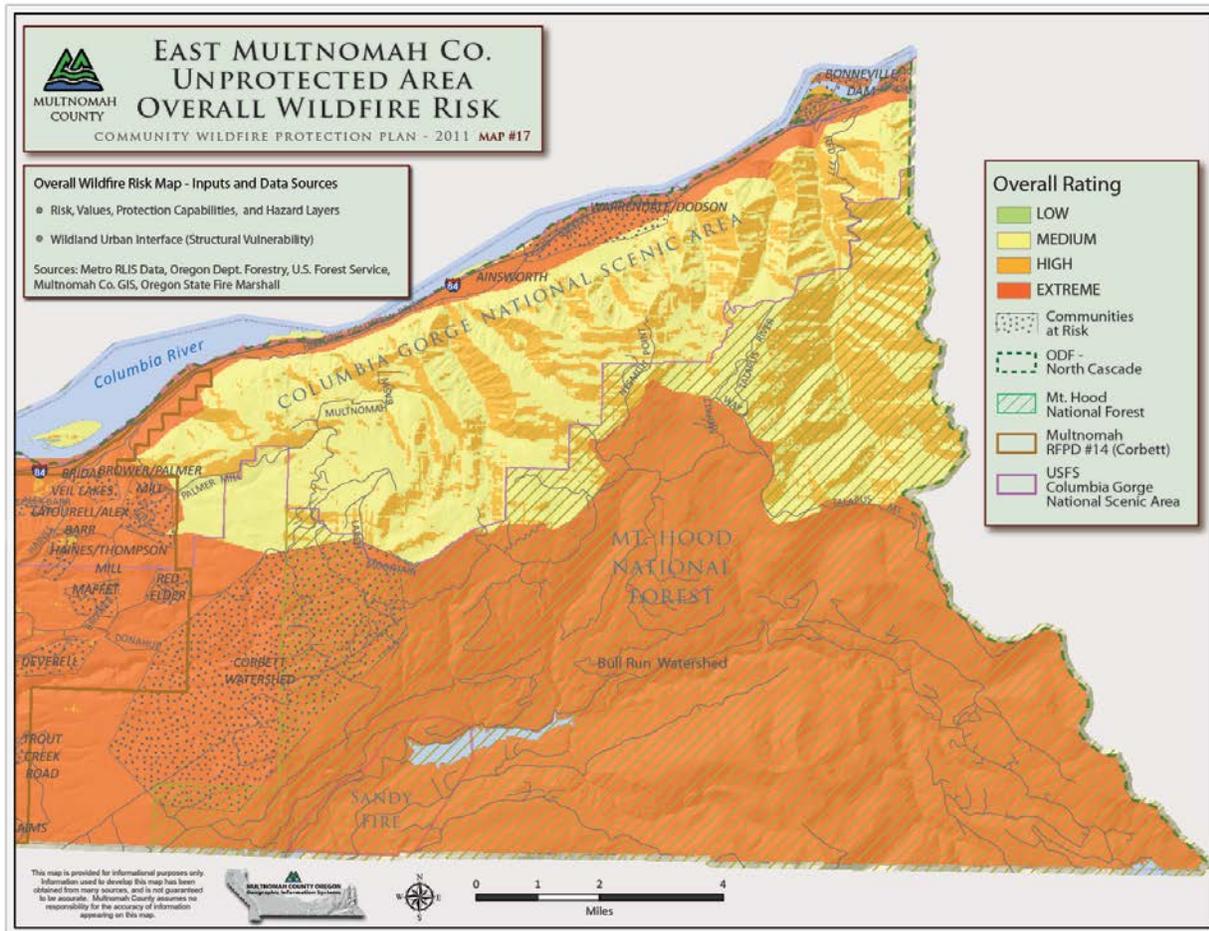
Hazard Level	Acres
Low	18,285
Moderate	59,169
High	84,344
Extreme	115,177

Source: Multnomah County, 2011

There are approximately 92,864 acres of structurally unprotected lands in Multnomah County. The majority of those unprotected lands, 88,379 acres, are in the eastern part of the county, which includes the Columbia River Gorge National Scenic Area and Mount Hood National Forest. Government Island, located in central Multnomah County, accounts for 1,939 acres (**Figure 3.6-5**); 2,546 acres are in the western part of the county in Forest Park (Multnomah County, 2011).

The Oregon Department of Forestry and the U. S. Forest Service provide wildland fire protection to these areas, but their scope is limited to forest protection, not rescue or structural fire protection. It would take these wildland fire agencies more than 20 minutes to respond to a wildland fire in these areas (Multnomah County, 2011). Local fire agencies providing structural fire protection adjacent to these unprotected areas have developed a list of actions to build capacity and assist in making Communities at Risk more resilient to potential wildfires (Multnomah County, 2011).

Figure 3.6-5 Structurally Unprotected Communities at Risk



Source: Multnomah County, 2011

Structures in the unincorporated areas of the Communities at Risk are predominantly single-family residential or rural buildings, along with four industrial buildings. In the incorporated areas, there are mostly residential buildings and a few buildings with other uses, including industrial buildings.

Wildfire risk in the WUI often is exacerbated by homeowners' reluctance to evacuate quickly. Instead, homeowners often try to protect their homes with whatever fire suppression resources are available. Such efforts generally have very little effectiveness. For example, the water flow from a garden hose is too small to meaningfully impact a single-structure fire once the structure is significantly engulfed by flames, and is too small to have any impact on a WUI fire. Homeowners who delay evacuation in attempts to save their homes may place their lives in jeopardy by delaying evacuation until it may be impossible.

Public Health

High levels of smoke from major fires pose health risks. Breathing in wildfire smoke can cause coughing, stinging eyes, trouble breathing normally, scratchy throat, runny nose, irritated sinuses, wheezing and shortness of breath, chest pain, headaches, tiredness, an asthma attack, and fast heartbeat (Centers for Disease Control and Prevention, 2013). Some individuals — including children, elderly, and individuals with asthma and other respiratory diseases or cardiovascular disease — may be especially vulnerable to

wildfire smoke. A study by the Environmental Protection Agency found medical needs rose during the smokiest days of a peat fire in North Carolina in 2008. Emergency room visits for breathing problems rose by 66 percent. Emergency room visits for heart failure increased 37 percent. People living in poverty were impacted most significantly (National Geographic, 2015).

3.6.5 References

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4 Mitigation Strategy

*The **Mitigation Strategy** is a long-term blueprint for creating a more disaster-resilient community by reducing the potential losses identified in the risk assessment. Disaster resilience is the ability of communities to “mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future disasters” (Multidisciplinary Center for Earthquake Engineering Research, 2004).*

4.1 Vision, Goals and Objectives

The vision for Multnomah County and its partners is to foster a disaster-resilient community in which:

- Risk-consciousness at all levels — from individuals and businesses to government agencies — is forefront in decision-making.
- Efforts to reduce risk are conducted in an inclusive and collaborative environment.
- Equity is a key consideration in identifying and implementing mitigation and disaster recovery actions.
- The risk to health and safety of all citizens from disaster events is minimized.
- All communities within the county are able to effectively and efficiently recover from disasters because impacts to the economy, built environment, and natural and cultural resources have been greatly reduced.

To reach this vision of resilience, the mitigation strategy is built upon the following goals and objectives:

Goal 1. Strengthen the capacity of the whole community¹ to reduce risk by increasing hazard awareness, creating partnerships, and leveraging multiple implementation mechanisms and funding opportunities.

Obj. 1.1. Ensure the risk assessment and related risk information materials are current with the best available science and appropriate for diverse audiences.

Obj. 1.2. Support community outreach activities that increase stakeholder awareness and understanding of hazard risk and mitigation options.

Obj. 1.3. Continue efforts to build effective partnerships with community-based organizations, businesses and government agencies to identify and implement mitigation actions.

Obj. 1.4. Integrate risk reduction concepts, policies and projects into existing planning and implementation mechanisms, such as comprehensive plans, development codes and capital improvement plans.

Obj. 1.5. Seek various funding opportunities, including mitigation-specific grant sources and local financing solutions.

Obj. 1.6. Enhance efforts to monitor vulnerability reduction and document progress toward resiliency.

¹ The whole community includes individuals, families and households; communities; nongovernmental organizations; private-sector entities; and government agencies (National Mitigation Framework, 2013).

Goal 2. Develop mitigation actions that consider all community systems: economic, health and social services, housing, infrastructure, and natural and cultural resources.

- Obj. 2.1. Consider strategies that support a prosperous and resilient economy and that would expedite economic restoration following an incident.
- Obj. 2.2. Consider strategies that promote the health, independence and well-being of the whole community.
- Obj. 2.3. Consider strategies that mitigate existing housing risks and increase resilience in new construction, repair and rebuilding.
- Obj. 2.4. Consider strategies that strengthen essential infrastructure and services, decrease disruptions, and increase resilience in new construction, repair and rebuilding.
- Obj. 2.5. Consider strategies that conserve, protect and restore the natural and cultural assets of the community.

Goal 3. Prioritize mitigation actions that have a high benefit-to-cost ratio and increase social equity.

- Obj. 3.1. Prioritize actions that have a positive benefit-to-cost ratio by estimating whether the expected long-term benefits of losses avoided will exceed the cost of the mitigation action.
- Obj. 3.2. Prioritize the allocation of resources for mitigation actions that benefit underserved¹ and underrepresented² communities, especially those in high-hazard-risk areas.
- Obj. 3.3. Seek opportunities in which hazard mitigation also benefits other community goals, such as economic development, energy efficiency, public health, universal design or environmental conservation.
- Obj. 3.4. Consider the increased benefit an action may have that reduces risk from multiple hazards.

Goal 4. Plan for including mitigation activities during post-disaster recovery and reconstruction.

- Obj. 4.1. Integrate policies that reduce disaster risk into recovery plans and reconstruction standards by planning for recovery prior to a disaster.
- Obj. 4.2. Educate stakeholders on post-disaster mitigation funding sources and opportunities to build back resiliently.
- Obj. 4.3. Ensure policies and public outreach strategies are in place to provide equitable access to post-disaster mitigation opportunities.

¹ *Underserved* means people and places that historically and currently do not have equitable resources, access to infrastructure, healthy environments, housing choice, etc. Due to historical inequitable policies and practices, disparities may be recognized in both access to services and outcomes.

² *Underrepresented* recognizes that some communities historically and currently have not had equal voice in institutions and policy-making, and have not been served equitably by programs and services.

4.2 Actions

4.2.1 Action Identification

A mitigation action is a specific action, project, activity or process taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Mitigation actions are different from actions taken to prepare for or respond to hazard events. By reducing risk, mitigation lessens the need for response resources and speeds recovery. Actions that are focused on response and operational planning are tracked through separate planning processes by emergency management entities in the Planning Area.

Table 4.2-1 details the primary types of mitigation actions, including: (1) plans and regulations, (2) structural and infrastructure projects, (3) natural systems protection or restoration, (4) education and awareness programs, and (5) actions that improve the Natural Hazards Mitigation Plan (NHMP) planning process and plan during implementation and future updates.

Table 4.2-1 Types of Mitigation Actions

Mitigation Type	Description	Examples
Local Plans and Regulations	These actions include government authorities, policies or codes that influence the way land and buildings are developed and built.	<ul style="list-style-type: none"> • Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • National Flood Insurance Program (NFIP) Community Rating System • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
Structural and Infrastructure Projects	<p>These actions involve modifying existing structures and infrastructure to protect them from hazards or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure.</p> <p>This type of action also involves projects to construct man-made structures to reduce the impact of hazards.</p> <p>Many of these types of actions are projects eligible for funding through the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance program.</p>	<ul style="list-style-type: none"> • Acquisitions and elevations of structures in flood-prone areas • Utility undergrounding • Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts
Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	<ul style="list-style-type: none"> • Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation

Education and Awareness Programs	These are actions to inform and educate citizens, elected officials and property owners about hazards and potential ways to mitigate them. A greater understanding and awareness of hazards and risk among local officials, stakeholders and the public is more likely to result in risk-conscious decision-making.	<ul style="list-style-type: none"> • Radio or television spots • Websites with maps and information • Real estate disclosure • Presentations to school groups or neighborhood organizations • Mailings to residents in hazard-prone areas. • StormReady • Firewise Communities
Planning Process and Analysis	These are improvements to the hazard mitigation planning process and to the resulting plan document.	<ul style="list-style-type: none"> • More detailed or advanced risk assessments • Including additional stakeholders in planning and implementation processes • Enhanced sections or improved format to plan or accessory documents

Source: FEMA's Local Mitigation Plan Review Guide, 2011

To identify actions for this plan update, the steering committee first reviewed actions from the previous mitigation plans, related local plans and regulations, guides on mitigation best practices, and activities that are eligible for federal Hazard Mitigation Assistance funding. At a Hazard Mitigation Strategy Workshop on October 1, 2015, preliminary “action ideas” were shared with the steering committee and key stakeholders and additional action ideas were brainstormed. Public outreach activities provided additional opportunities for identifying actions. Action ideas were then reviewed in relation to the updated risk assessment to determine which actions would reduce identified risks to life safety or property.

4.2.2 Action Prioritization

Mitigation action screening criteria and prioritization criteria were reviewed and edited at the Hazard Mitigation Strategy Workshop. For more information about the workshop, see section 5.1.2 Stakeholder Participation and meeting minutes in **Appendix G: Planning Process Documents**.

Screening criteria:

- Minimal equity impacts
- Technically feasible
- Legal authority exists
- Administrative capacity exists
- Political/public support exists
- Minimal adverse environmental impacts
- Addresses an identified risk
- Meets goals and is consistent with goals from other communities’ plans

The committee then further refined the prioritization criteria, as shown in **Table 4.2-2 Mitigation Action Prioritization Criteria**.

The committee unanimously preferred that each jurisdiction prioritize actions for its own community, rather than having one set of priority actions for the entire Planning Area. Each jurisdiction then identified its top mitigation actions by answering the question, “*To which actions will your community dedicate resources within the next five years?*” Finally, each jurisdiction applied the prioritization criteria in **Table 4.2-2** to its top actions.

Points were assigned to top actions based on the scoring system shown in **Table 4.2-2**: Low (1 point), Medium (2 points) and High (3 points). The overall score provides a priority ranking for the action in the Action Plan, with the highest scores equaling the highest ranked projects. Projects with the same score

will be considered equally by the steering committee when opportunities for funding or implementation emerge. The responsible organization to which an action is assigned also will be asked to weigh in on any decision regarding the action moving forward.

Table 4.2-2 Mitigation Action Prioritization Criteria

Criteria	High (3 points)	Medium (2 point)	Low (1 point)
Equity¹	Social benefits are highly likely, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral to positive, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.
Benefits	Supports compliance with a legal mandate or will have an immediate impact on the reduction of risk exposure to life and property.	Will have a long-term impact on the reduction of risk exposure to life and property.	Long-term benefits of the action are difficult to quantify in the short term.
Costs	Possible to fund under existing budget. Project is or can be part of an existing ongoing program or would not require substantial effort to initiate or appropriate funds.	Possible to budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment.	Existing work plan and funding levels are not adequate to cover the costs of the proposed project.
Risk²	Addresses a high-risk issue as described in the risk assessment.	Addresses a moderate-risk issue as described in the risk assessment.	Addresses a low-risk issue or has not been assessed for the level of risk.
Capacity	Capacity is highly feasible within 1 to 3 years.	Capacity is feasible within 5 years, but may need to be further explored.	Capacity is uncertain to unlikely within 5 years.

Source: Mitigation action prioritization criteria was developed by the NHMP Steering Committee

4.2.3 Action Plan

Table 4.2-3 Top Mitigation Actions contains 51 prioritized actions that form the mitigation strategy. These actions address vulnerabilities identified in section **3 Hazard Identification and Risk Assessment** and focus on the hazards to which each jurisdiction has a high and moderate level of risk as identified by the local Office of Emergency Management (OEM) Hazard Analysis scores. For more information on the OEM Hazard Analysis methodology and scores, see **Appendix C Local OEM Hazard Analysis Scores**. Considerable updates were made from the previous Action Plans, and are tracked in **Appendix E: Progress Report on Mitigation Efforts**.

¹ Actions that would adversely impact people or places were not considered.

² Environmental impacts are part of the risk analysis in section **3 Hazard Identification and Risk Assessment**, and are therefore considered in the prioritization criteria “Risk.”

Not all actions relate to every jurisdiction in the Planning Area. As such, the steering committee agreed that each jurisdiction would prioritize the actions most relevant to their community. See **4.2.2 Action Prioritization** for the prioritization process used by each jurisdiction.

Table 4.2-3 only lists communities for which the action is a top priority. There are a total of 42 top actions for the Planning Area. Actions are grouped by hazard and in no order of priority. For each top action, **Table 4.2-3** lists:

- **Community systems** addressed by the action, as described in **Goal 2**. Community systems include: economic, health and social services, housing, infrastructure, and natural and cultural resources.
- Relevant **action type(s)** as described in **Table 4.2-1**. Action types include: local plans and regulations, structural and infrastructure projects, natural systems protection, education and awareness programs, and planning process and analysis.
- **NHMP goal(s)** addressed by that action. See **Section 4.1** for a description of the goals.
- **Carry-over and consistency notes** listing which actions in current local NHMPs in the Planning Area have been revised or carried over as is; as well as other plans with which that action aligns.
- The **jurisdiction(s)** for which this is a top action.
- The **lead** entity to champion the action.
- **Prioritization criteria** scores. See **Table 4.2-2** for a description of the prioritization criteria — equity, benefits, costs, risks, capacity — and scoring method.
- Known or potential **funding** sources.
- Known or potential planning **mechanisms** that could implement the action.
- **Notes** when applicable.

Nine actions not identified as “top actions” (**Table 4.2-4 Other Mitigation Actions**) will be evaluated and reviewed during the required semi-annual NHMP monitoring meetings. If the equity, benefits, costs, risk, or capacity and support change during this plan’s five-year cycle, the steering committee will reassess the prioritization and ranking for these other actions.

Table 4.2-3: Top Mitigation Actions

ALL HAZARDS	Hazard	Top Mitigation Actions																															
	Action ID																																
	1	<p>Leverage existing hazard mitigation public outreach methods to develop a Hazard Mitigation Outreach Strategy for the Planning Area. The strategy will be culturally appropriate, and inclusive of traditionally underserved and underrepresented populations, and access and functional needs.</p> <p>Community System: All Action Type: Education and Awareness Programs NHMP Goals: 1, 2, 3 Carry-over and Consistency Notes: Revises local NHMP actions # 3, 14, 68, 79, 98, 109, 116, 129, 139; consistent with Climate Action Plan actions 15F, 16B, 17C, and the Multnomah County Vulnerable Populations Assessment Report</p>																															
		<table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="6">Prioritization Criteria</th> <th></th> <th></th> <th></th> </tr> <tr> <th>Jurisdiction</th> <th>Lead</th> <th>Equity</th> <th>Benefit</th> <th>Cost</th> <th>Risk</th> <th>Capacity</th> <th>Priority Score</th> <th>Potential Funding</th> <th>Potential Implementation Mechanism</th> <th>Notes</th> </tr> </thead> </table>												Prioritization Criteria									Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
				Prioritization Criteria																													
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes																					
		Fairview	Police chief with assistance of Public Safety Advisory Committee (PSAC)	3	3	3	3	3	13	General Fund: Police/Emergency Management	City Council Public Safety Advisory Committee; Emergency Operations Plan Addenda																						
	Wood Village	Public Works	2	2	3	3	3	13	General Fund	Public Outreach Program	Newsletter articles regarding all hazards, with a special focus on severe weather (i.e., urban flooding) and volcanic hazards																						
	Gresham	Emergency Management	1	2	3	3	3	12	General Funds/UASI	Public outreach program	Work with Multnomah County Emergency Management and Boise State University to create a Hazard Mitigation Outreach Toolkit to include a hazard mapping program.																						
	2	<p>Share hazard mitigation information to encourage integration into other planning mechanisms, such as comprehensive plans (i.e., Statewide Land Use Goal 7: Areas Subject to Natural Hazards) and development code updates.</p> <p>Community System: All Action Type: Local Plans and Regulations NHMP Goals: 1, 2 Carry-over and Consistency Notes: Revises local NHMP actions # 13, 20, 64, 84, 107; consistent with Climate Action Plan action 15F</p>																															
		<table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="6">Prioritization Criteria</th> <th></th> <th></th> <th></th> </tr> <tr> <th>Jurisdiction</th> <th>Lead</th> <th>Equity</th> <th>Benefit</th> <th>Cost</th> <th>Risk</th> <th>Capacity</th> <th>Priority Score</th> <th>Potential Funding</th> <th>Potential Implementation Mechanism</th> <th>Notes</th> </tr> </thead> </table>												Prioritization Criteria									Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
				Prioritization Criteria																													
Jurisdiction		Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes																						
Multnomah County		Dept. of Community Services, Land Use Planning Division	2	1	3	3	3	12	General Fund	Coordination Meetings, Land Use Ordinance Amendments																							
Fairview	City's Senior Management Team	2	2	3	3	2	12	General Fund; Utility Funds	Comprehensive Land Use Plan, Land Use Development Ordinance, Utility Master Plans																								
Troutdale	Planning Dept.	3	3	3	3	3	15	General Fund, grants	Comprehensive Land Use Plan, Zoning Ordinance																								

ALL HAZARDS

Enhance the list of plans, policies and codes for each jurisdiction that address hazards in the Hazard Mitigation Plan. Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2 Carry-over and Consistency Notes: New action											
3	Jurisdiction	Lead	Prioritization Criteria					Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
			Equity	Benefit	Cost	Risk	Capacity				
	Multnomah County	Emergency Management	1	2	3	1	3	10	General Fund; Emergency Management Program Grants funds	Comprehensive Land Use Plan, Zoning Ordinance	
	Fairview	City's Senior Management Team	2	2	3	3	3	13	General Fund	Senior Management Team	
	Gresham	Planning Department	2	3	3	3	3	14	General Funds	Floodplain Code	Complete Environmental Overlay Project and update floodplain code to reflect newer federal guidelines intended to ensure Endangered Species Act considerations are included in floodplain management decisions.

Work cross-jurisdiction with the Portland Metro Region's Urban Area Security Initiative's (UASI) Regional Disaster Preparedness Organization (RDPO) to develop a Post-Disaster Recovery Plan for the region. This project has been approved by the RDPO to receive UASI 2016 grant funding. Community System: All Action Type: Local Plans and Regulations NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: New action											
4	Jurisdiction	Lead	Prioritization Criteria					Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
			Equity	Benefit	Cost	Risk	Capacity				
	Multnomah County	Emergency Management	1	2	3	1	2	9	Emergency Management Program Grant Funds	RDPO Post Disaster Recovery Plan	
	Fairview	City's representative to RDPO	3	3	1	2	2	11	General Fund, UASI 2016 Grant	RDPO Post Disaster Recovery Plan	
	Troutdale	City Manager	3	3	3	3	3	15	General Fund	RDPO Post Disaster Recovery Plan	

ALL HAZARDS

5	<p>Integrate hazard risk assessments with jurisdiction/agency continuity of operations requirements to identify mitigation priorities; e.g., facilities that house critical functions and are at risk should be prioritized for mitigation/retrofit/alternative projects within each agency’s Capital Improvements Program. Consideration should be given to life safety vs. habitable vs. operational. Document what has already been mitigated and make info easily accessible. The list of mitigation needs can also be used after a disaster to include mitigation during recovery/repair activities.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2, 4</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions # 15, 19, 42, 48, 59, 70, 78, 83, 91, 108 , 137</p>											
	Prioritization Criteria											
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	Department of County Assets	1	2	2	3	2	10	Building Base, Project Specific (Capital Improvement Plans), or Grants, if available.	Facilities and Property Management development and adoption of policy or procedure		
	Fairview	City's Senior Management Team	2	3	1	2	1	9	General Fund, Utility Funds	Continuity of Operations Plan		
Troutdale	Public Works	3	3	3	3	3	15	Utility Funds	Continuity of Operations Plan			
6	<p>Explore and document in the plan how hazard mitigation is integrated into the early design process for public facility and infrastructure projects. Explore opportunities to show co-benefits of sustainable and resilient building practices.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 2</p> <p>Carry-over and Consistency Notes: Consistent with Climate Action Plan actions 14A, 16</p>											
	Prioritization Criteria											
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	Department of County Assets	1	3	2	3	2	11	Integrate into Project Fund	Facilities and Property Management design process		
	Fairview	City's Senior Management Team	3	3	3	2	3	14	Project-specific Funding, (i.e., new public workshop, new well head)	Request For Proposal process for improvement of new structures		
Wood Village	City Manager	1	1	2	3	3	10	General Fund	Development Request For Proposal process			
Troutdale	Public Works	3	3	3	3	3	15	Utility Funds	Include in preplanning for city structures			

ALL HAZARDS

7	<p>Develop Community Executive Summaries that explain the relevant portions of the Hazard Mitigation Plan to elected officials and members of specific communities. Provide annual progress report updates to the Community Summaries.</p> <p>Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Revises local NHMP action # 128</p>																										
	<table border="1"> <thead> <tr> <th colspan="8">Prioritization Criteria</th> </tr> <tr> <th>Equity</th> <th>Benefit</th> <th>Cost</th> <th>Risk</th> <th>Capacity</th> <th>Priority Score</th> <th colspan="2"></th> </tr> </thead> </table>								Prioritization Criteria								Equity	Benefit	Cost	Risk	Capacity	Priority Score			Potential Funding	Potential Implementation Mechanism	Notes
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Equity	Benefit	Cost	Risk	Capacity	Priority Score																						
Fairview	City Administrator	2	2	3	2	1	10	Administration Budget	Emergency Operation Plan Addenda																		
8	<p>Collaborate and coordinate across the Planning Area to support applications to FEMA Hazard Mitigation Assistance grants and Oregon Seismic Rehabilitation Grant Program annually.</p> <p>Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 4</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions # 4, 18, 36, 69, 82, 112</p>																										
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Equity	Benefit	Cost	Risk	Capacity	Priority Score																						
Multnomah County	Emergency Management	1	2	3	3	3	12	Emergency Management Program Grant Funds	Capital Improvements Plans																		
9	<p>Assess resources needed for plan implementation and develop capacity options for consideration by participating jurisdictions to pool resources. Develop a cross-jurisdictional team to work on analysis, stakeholder coordination, and grant writing. Partner with state, regional, and academic organizations to coordinate projects related to risk analysis and reduction. Seek opportunities to coordinate planning processes of related plans with similar update cycles, e.g. NHMPs, Community Wildfire Protection Plan, Climate Action Plan.</p> <p>Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 4</p> <p>Carry-over and Consistency Notes: Revises local NHMP action # 130; consistent with Climate Action Plan actions 20C, 20J, 20N</p>																										
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Equity	Benefit	Cost	Risk	Capacity	Priority Score																						
Gresham	Emergency Management	1	2	3	1	2	9	City Budget	Capital Improvements Plans																		

ALL HAZARDS

10	Seek business alliances and other private sector representation in the mitigation planning process.										
	Community System: Economic Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: Revises local NHMP actions # 16, 80, 127										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Gresham	Emergency Management	2	3	2	1	3	11	City Budget	Emergency Management Work Program	
11	Either invite existing Equity Council/Work Group or establish an Equity Working Group to provide guidance to the Hazard Mitigation Plan Steering Committee and other emergency management plans (e.g., Emergency Operations Plans) and programs.										
	Community System: Health and Social Services Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 3 Carry-over and Consistency Notes: Consistent with Climate Action Plan actions 16C, 20A and the Multnomah County Vulnerable Populations Assessment Report (2012)										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Multnomah County	Emergency Management	3	1	3	1	3	11	General Fund	Multnomah County Office of Diversity and Equity work program	
12	Further integrate social vulnerability data into the hazard risk assessment and use this to inform decisions on mitigation priorities.										
	Community System: Health and Social Services Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 3 Carry-over and Consistency Notes: Consistent with Climate Action Plan action 14B										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Multnomah County	Emergency Management	3	2	3	1	3	12	Emergency Management Program Grant Funds	Comprehensive Land Use Plan, Zoning Ordinance	

ALL HAZARDS	13	<p>Coordinate with the Joint Office for Homeless Services (JO) to reduce risk to natural hazards for people experiencing homelessness. Work with the JO to educate its staff and partner organizations about hazard exposure maps. Encourage JO to reference hazard exposure maps when siting indoor and outdoor locations for people experiencing homelessness. Coordinate with JO on outreach standard operating procedures for people experiencing homelessness during severe weather, flooding events and other emergency situations.</p> <p>Community System: Health and Social Services, Housing Action Type: Education and Awareness Programs, Local Plans and Regulations NHMP Goals: 2, 3</p> <p>Carry-over and Consistency Notes: New action</p>										
		Prioritization Criteria								Potential Funding	Potential Implementation Mechanism	Notes
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score			
Multnomah County	Emergency Management	3	3	3	3	3	15	Emergency Management Program Grant Funds	Johnson Creek Severe Weather Standard Operating Procedure, Severe Weather Standard Operating Procedure			
ALL HAZARDS	14	<p>Assist the Coalition of Community Health Clinics (CCHC) in identifying a structural engineer certified in multi-hazard building assessments to assess CCHC clinics. Provide technical assistance to CCHC as it seeks funding source(s) for structural assessments. Provide technical assistance to CCHC to prioritize improvements to CCHC clinics based on assessment findings.</p> <p>Community System: Health and Social Services Action Type: Structural and Infrastructure NHMP Goals: 1,2,3</p> <p>Carry-over and Consistency Notes: New action</p>										
		Prioritization Criteria								Potential Funding	Potential Implementation Mechanism	Notes
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score			
Multnomah County	Health Department, Emergency Preparedness and Response	3	2	1	2	2	10	Public Health Emergency Preparedness grant; Urban Area Security Initiative (UASI) grants; Hospital Preparedness Program	Public Health Emergency Preparedness Work Plan			
EARTHQUAKE	15	<p>Advocate for the creation of a Critical Energy Infrastructure (CEI) Hub Disaster Resiliency Workgroup.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: New action, consistent with Portland Mitigation Action Plan</p>										
		Prioritization Criteria								Potential Funding	Potential Implementation Mechanism	Notes
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score			
Multnomah County	Emergency Management	1	1	3	3	2	10	Emergency Management Program Grant Funds				

EARTHQUAKE	16	Participate in Regional Disaster Preparedness Organization (RDPO)/Oregon Department of Geology and Mineral Industries (DOGAMI) regional HAZUS risk assessment for earthquakes. Provide local data where available. Incorporate new data into next NHMP update. Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2 Carry-over and Consistency Notes: Revises local NHMP action # 40										
		Prioritization Criteria										
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
		Multnomah County	Emergency Management	1	2	3	3	3	12	Emergency Management Program Grant Funds		New data will inform multiple local plans, including the next NHMP
		Fairview	City Administrator	3	3	3	3	3	15	General Fund	City Council goal; Appoint a council representative and staff assistance	New data will inform multiple local plans
		Wood Village	City Manager	2	1	3	3	3	12	General Fund		New data will inform multiple local plans
		Troutdale	Planning Department	3	3	2	3	2	13	General Fund		New data will inform multiple local plans
	Gresham	Geographic Information Systems	1	2	3	3	3	12	Administration budget		Update city risk maps utilizing new HAZUS data.	
	17	Between 2016 and 2018, conduct a Seismic Feasibility Study on the Burnside Bridge, a regional lifeline route, to evaluate various rehabilitation and replacement alternatives for a seismically resilient crossing. Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2 Carry-over and Consistency Notes: Revises local NHMP action # 41										
		Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	Department of Community Services (DCS), Division of Transportation, Bridges	1	2	3	3	3	12	General Fund	Willamette Bridge Capital Improvement Plan		
	18	Seek funding, between 2017 and 2019, for a National Environmental Policy Act (NEPA) study to help the county make an informed decision on which alternatives from the Seismic Feasibility Study should be further evaluated in the design phase. Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2 Carry-over and Consistency Notes: Revises local NHMP action # 41										
		Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	DCS, Division of Transportation, Bridges	1	2	1	3	2	9	To Be Determined	Willamette Bridge Capital Improvement Plan		

EARTHQUAKE

19	<p>Many agencies within the county have begun to analyze facility-specific seismic risk, e.g., Multnomah County and the Port of Portland. County stakeholders should prioritize critical facilities/infrastructure, gather seismic risk data when available (structural and non-structural), prioritize risk assessments where there are gaps, and begin to develop a funding strategy for mitigation of the most critical facilities. Document what has already been mitigated and make information easily accessible. The list of mitigation needs can also be used after a disaster to include mitigation during recovery/repair activities.</p> <p>Community System: Infrastructure Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: Revises local NHMP actions # 1, 5, 34, 37, 6, 69, 96, 137</p>										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Fairview	City Administrator	2	3	1	3	2	11	General Fund, Utility Funds	City Council goal	Set as a City Council goal in year 2 of NHMP
Gresham	Fire and Emergency Services	2	3	1	3	3	12	Oregon Seismic Rehabilitation Grant Fund	Fire and Emergency Services Work Program	Seismically retrofit Fire Station 75, final station in city to be retrofitted	
20	<p>Expand seismic retrofit incentive programs for home owners.</p> <p>Community System: Housing Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2 Carry-over and Consistency Notes: New action</p>										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
Multnomah County	Emergency Management	1	2	2	3	2	10	Unknown	Commercial Property Assessed Clean Energy (CPACE) Project	CPACE includes multi-family properties	
21	<p>Inventory and perform seismic upgrades to suspended wastewater conveyance pipelines (i.e., roadway crossings, pipe bridges, etc.).</p> <p>Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2, 3 Carry-over and Consistency Notes: Action # 138</p>										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Fairview	Public Works Director	3	3	1	3	1	11	Sewer User Fees	Wastewater Capital Improvement Plan	
Troutdale	Public Works	3	3	2	3	3	14	Utility Funds	Wastewater Capital Improvement Plan		
Gresham	Wastewater Services	3	3	2	2	3	13	Utility Funds	Capital Improvement Plan	Analyze existing elevated wastewater conveyance pipeline vulnerabilities.	

FLOOD	22	<p>Over the next five years, install high-water-mark signs to educate the public about flooding potential in targeted locations along or within the leveed areas.</p> <p>Community System: All Action Type: Education and Awareness Programs NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Action # 44</p>										
		Prioritization Criteria										
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Multnomah County Drainage District (MCDD)	Community Affairs	2	2	3	3	3	13	Local Resources	MCDD Community Outreach Plan		
	23	<p>Partners who signed the Declaration of Cooperation will continue participation in Levee Ready Columbia in order to ensure the Portland metro levee system does not lose accreditation by FEMA or become inactive in the U.S. Army Corps of Engineers' Rehabilitation and Inspection Program. The NHMP Steering Committee will continue to integrate flood mitigation relevant to the levee system by staying actively informed and engaged with Levee Ready Columbia, particularly in review of risk assessments and discussions of the appropriate level of protection for the Portland metro levee system. Encourage inclusion of climate, community, economic and environmental considerations.</p> <p>Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions # 6, 45, 71; consistent with Climate Action Plan 15A</p>										
		Prioritization Criteria										
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
		Fairview	Public Works Director	3	2	3	2	3	13	General Fund	Levee Ready Columbia	
		Wood Village	Public Works	1	1	3	1	3	9	General Fund	Levee Ready Columbia	
		Troutdale	City Manager	3	3	1	3	3	13	General Fund	Levee Ready Columbia	
MCDD	MCDD - Executive Leadership	3	3	3	3	3	15	Local Resources, Oregon Infrastructure Finance Authority Loans, U.S. Army Corps of Engineers In-kind or Grants	Levee Ready Columbia			
Sandy Drainage Improvement Company (SDIC)	SDIC - Executive Leadership	3	3	3	3	3	15	Local Resources, Oregon Infrastructure Finance Authority Loans, U.S. Army Corps of Engineers In-kind or Grants	Levee Ready Columbia			

24	<p>Partners who signed the Declaration of Cooperation to continue participation in Levee Ready Columbia will seek funding to support maintaining certification and accreditation of the Columbia River levee systems, determine appropriate level of flood protection, and educate the public on the benefits and residual risks associated with the levees.</p> <p>Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2, 3 Carry-over and Consistency Notes: New action</p>										
			Prioritization Criteria								
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Fairview	Public Works Director	3	2	3	2	3	13	General Fund	Levee Ready Columbia	
	Troutdale	City Manager	3	3	2	2	3	13	General Fund	Levee Ready Columbia	
MCDD	MCDD - Executive Leadership	3	3	3	3	3	15	Local Resources	Levee Ready Columbia		
SDIC	SDIC - Executive Leadership	3	3	3	3	3	15	Local Resources	Levee Ready Columbia		
25	<p>Identify target areas for flood mitigation projects, such as high-risk/repetitive risk problem areas. Identify specific mitigation projects and grants for, e.g. land acquisition, home elevation, business flood proofing, floodplain restoration, stormwater infrastructure. Consider if there are areas at risk to multiple hazards that could be targeted for increased cost benefit, e.g. flood + landslide + liquefaction + lahar.</p> <p>Community System: Economic, Housing, Infrastructure, Natural and Cultural Resource Action Type: Natural Systems and Local Plans and Regulations NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: Revises local NHMP actions #8,10, 43, 46, 47, 141, and Climate Action Plan action 13D</p>										
			Prioritization Criteria								
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
Gresham	Natural Resources	3	3	2	2	3	13	Federal Emergency Management Administration Hazard Mitigation Grant	Comprehensive Land Use Plan	Utilize the updated 2017 FEMA Flood Risk Maps to identify any new problem areas.	
26	<p>Assess whether local regulations should be updated to better protect citizens based on channel migration zone (CMZ) data. Currently, CMZs are mapped for the Sandy River, including an area around Troutdale. In late 2016, a statewide analysis of CMZ susceptibility will be released. This new data will help prioritize future CMZ mapping projects that may include other portions of the Planning Area.</p> <p>Community System: Housing Action Type: Local Plans and Regulations NHMP Goals: 1, 2 Carry-over and Consistency Notes: New action</p>										
			Prioritization Criteria								
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
Multnomah County	DCS, Land Use Planning Division	1	2	3	3	2	11	General Fund	Land Use Ordinance Adoption		

FLOOD

27	<p>Identify stormwater stakeholders to participate on the steering committee during the next update. These subject matter experts will help determine how stormwater management planning and projects should be addressed in the next plan update. Explore if a stormwater subcommittee would be beneficial, or if each jurisdiction will track stormwater projects individually through master plans and Capital Improvement Plans. Consider if mitigation grants should be pursued in funding stormwater projects. Consider opportunities to manage stormwater naturally and prepare for increased stormwater runoff from climate change.</p> <p>Community System: Infrastructure Action Type: Planning Process and Analysis NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions #7, 11, 49, 50, 73, 74, 103, 104, 142, 143, 144; consistent with Climate Action Plan action 15B</p>										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Wood Village	Public Works	1	1	2	1	3	8	Stormwater Utility Fund	Storm Water Master Plan Capital Improvement Projects	
Gresham	Natural Resources	2	2	3	1	3	11	Stormwater Utility Fund	Comprehensive Land Use Plan	Identify, prioritize, and implement restoration projects that benefit floodplain conditions, fish habitat, and water quality.	
28	<p>Flood-proof wastewater manholes and pipelines within the 100-year floodplain.</p> <p>Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Local NHMP Action #140, and FEMA Best Practice</p>										
	Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Wood Village	Public Works	1	2	3	1	3	10	Sewer Fund	Infill and Infiltration Plan	There is no flood hazard area (100-year floodplain) within Wood Village, but the city does actively flood-proof wastewater manholes and pipelines.
	Troutdale	Public Works	1	2	3	1	3	10	Utility Funds	Capital Improvement Plan: wastewater	
Gresham	Wastewater Services	1	2	2	2	2	9	Utility Funds	Capital Improvement Plan	Repair/rehabilitate leaking manholes and raise/flood-proof those manholes below the flood plain elevation.	

29	<p>Coordinate with MCDD, SDIC and the Sauvie Island Drainage Improvement Company (SIDIC; collectively, the Districts) when development is proposed in, on or near the levee systems managed by these entities to ensure minimal impact to the levee systems. Land Use, Planning or similar departments will notify the Districts of development that may impact their flood management systems and give them an opportunity to review the plans for impacts to their systems, per U.S. Army Corps of Engineers standards.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: New action</p>										
			Prioritization Criteria								
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Multnomah County	Department of Community Services, Land Use Planning Division	3	2	3	3	3	14	General Fund	Interagency coordination during development review process	
	Troutdale	Public Works, Planning Department	3	3	3	3	3	12	Utility Funds	Pursuant to permits	
	MCDD	MCDD Engineering	3	3	3	3	3	15	Local Resources	Interagency coordination during development review process	
SDIC	SDIC Engineering	3	3	3	3	3	15	Local Resources	Interagency coordination during development review process		
30	<p>Replace, and potentially increase capacity of, the primary stormwater pumping station for the SDIC within the next three years. The current capacity is 37,000 gallons per minute and serves more than 1,550 acres, eight miles of ditches, the Troutdale Airport and a variety of property owners, including a major shipping logistics center and traded-sector manufacturers. Currently, the Port of Portland's Troutdale Reynolds Industrial Park (TRIP) has 350 acres of developable land for sale. Future development will increase impervious area in SDIC, greatly increasing the amount of stormwater entering the system. The pump station may need to have a higher capacity for this reason, and appropriate capacity will be explored as part of the project.</p> <p>Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2, 3</p> <p>Carry-over and Consistency Notes: New action</p>										
			Prioritization Criteria								
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
SDIC	SDIC Executive Leadership and Engineering	3	3	1	3	3	13	Local Resources, U.S. Economic Development Administration Grants, FEMA Mitigation Grants, U.S. Environmental Protection Agency Grants, Oregon Infrastructure Finance Authority Loans	SDIC Capital Improvement Plan		

FLOOD

31

Replace the flow control structure regulating water levels on the TRIP wetland mitigation site within the next year. The current flow control structure insufficiently manages water through two 36-inch culverts placed at different invert elevations. A new flow control structure with an adjustable concrete weir structure and larger diameter culvert with gate valve is needed to properly control the flow of stormwater with greater flexibility to adjust flow in support of flood control in the upstream segment of Salmon Creek and environmental protection.

Community System: Infrastructure Action Type: Structure and Infrastructure Projects NHMP Goals: 1, 2

Carry-over and Consistency Notes: New action

Jurisdiction	Lead	Prioritization Criteria						Potential Funding	Potential Implementation Mechanism	Notes
		Equity	Benefit	Cost	Risk	Capacity	Priority Score			
SDIC	SDIC Executive Leadership and Engineering	2	3	2	3	3	13	Local Resources, Bonds and Grants	Troutdale Reynolds Industrial Park (TRIP)	

LANDSLIDE

32

Consider new DOGAMI landslide data to identify development and infrastructure at risk. This project will be completed by early 2017. Develop and prioritize mitigation projects based on new data. Incorporate new data into other planning mechanisms, such as comprehensive plans and development codes.

Community System: Economic, Housing, Infrastructure Action Type: Planning Process and Analysis and Local Plan and Regulations NHMP Goals: 1, 2

Carry-over and Consistency Notes: Revises local NHMP actions # 12, 51, 52, 53, 54, 55, 75, 76, 105, 106, 126, 136; and consistent with Climate Action Plan action 15F

Jurisdiction	Lead	Prioritization Criteria						Potential Funding	Potential Implementation Mechanism	Notes
		Equity	Benefit	Cost	Risk	Capacity	Priority Score			
Multnomah County	Department of Community Services, Land Use Planning Division	2	2	3	3	3	13	General Fund	Land Use Ordinance Adoption	
Wood Village	Public Works	1	1	3	3	3	11	General Fund, Urban Renewal Funds	Comprehensive Land Use Plan, Development Code	
Troutdale	Planning Dept.	3	3	3	2	3	14	General Fund	Comprehensive Land Use Plan, Zoning Ordinance	

Develop and adopt standards for managing stormwater in landslide hazard areas in accordance with best management practices.

Community System: All Action Type: Natural Systems Protection and Infrastructure NHMP Goals: 1, 2

Carry-over and Consistency Notes: New action

33	Jurisdiction	Lead	Prioritization Criteria					Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
			Equity	Benefit	Cost	Risk	Capacity				
Multnomah County	Department of Community Services, Land Use Planning Division	2	2	3	3	3	10	General Fund	Land Use Ordinance Adoption		
Wood Village	Public Works	1	2	3	3	3	12	Stormwater Utility Funds	Public Works standards		
Troutdale	Planning Dept., Public Works	2	2	3	3	3	13	General Fund	Capital Improvement Plan: wastewater; Comprehensive Land Use Plan		

Use new landslide hazard information, available from DOGAMI in early 2017, to examine road and utility maintenance practices.

Community System: Natural and Cultural Resources Action Type: Natural Systems Protection and Infrastructure NHMP Goals: 1, 2

Carry-over and Consistency Notes: New action

34	Jurisdiction	Lead	Prioritization Criteria					Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
			Equity	Benefit	Cost	Risk	Capacity				
Multnomah County	Department of Community Services, Land Use Planning Division	2	2	3	3	3	13	General Fund	Land Use Ordinance Adoption	See DOGAMI Special Paper 46 for examples of specialized maintenance practices for landslides conducted in the Bull Run area.	
Wood Village	Public Works	1	2	3	2	3	11	Stormwater Utility Funds	Public Works standards		
Troutdale	Public works	3	3	3	2	3	14	Utility Funds	Capital Improvement Plan		

SEVERE WEATHER	35	Encourage retrofits that make mobile homes safer in high winds.										
		Community System: Housing Action Type: Education and Awareness Programs NHMP Goals: 1, 2										
		Carry-over and Consistency Notes: Revises local NHMP action # 121										
		Prioritization Criteria										
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	Emergency Management	2	2	3	3	2	12	Emergency Management Program Grant and General Fund	Emergency Management Outreach Program	Roughly 20% of the housing stock east of the Sandy River within Multnomah County consists of manufactured homes.	
	Wood Village	City Manager	3	2	1	3	2	11	General Fund	Outreach Program	Roughly 30% of the housing stock in Wood Village consists of manufactured homes.	
	Troutdale	Building Dept.	1	2	3	3	3	12	Code Specialties	Administration		
VOLCANO	36	Explore the feasibility of limiting critical facilities and/or high-density facilities in the lahar zone (e.g., Pierce County, Washington), and if disclosure of lahar hazard can be included in the permitting processes. (e.g., Orting, Washington).										
		Community System: Economic, Housing, Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2										
		Carry-over and Consistency Notes: New action										
	Prioritization Criteria											
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Troutdale	Planning Dept.	3	1	2	3	2	11	General Fund	Comprehensive Land Use Plan		
WILDFIRE	37	Update the Community Wildfire Protection Plan (CWPP). Integrate the CWPP into the next NHMP update.										
		Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2										
		Carry-over and Consistency Notes: Revises local NHMP action # 65, consistent with Climate Action Plan action 14M and the Community Wildfire Protection Plan										
	Prioritization Criteria											
	Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes	
	Multnomah County	Emergency Management	1	2	3	3	3	12	Emergency Management Program Grant Funds and Other Grant Sources	Community Wildfire Protection Plan		

WILDFIRE

38	<p>Provide educational materials, presentations and demonstration projects on defensible space and wildfire mitigation techniques to communities at risk.</p> <p>Community System: Housing; Economic; Health and Human Services Action Type: Education and Awareness Programs NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Revises local NHMP action # 135, and summarizes Community Wildfire Protection Plan actions #2, 3, 10, 13, 25, 28, 29</p>																																																
	<table border="1"> <thead> <tr> <th rowspan="2">Jurisdiction</th> <th rowspan="2">Lead</th> <th colspan="6">Prioritization Criteria</th> <th rowspan="2">Potential Funding</th> <th rowspan="2">Potential Implementation Mechanism</th> <th rowspan="2">Notes</th> </tr> <tr> <th>Equity</th> <th>Benefit</th> <th>Cost</th> <th>Risk</th> <th>Capacity</th> <th>Priority Score</th> </tr> </thead> <tbody> <tr> <td>Troutdale</td> <td>Emergency Manager</td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>11</td> <td>General Fund</td> <td>Outreach Program (e.g., champion newsletter, Facebook page and community classes)</td> <td></td> </tr> </tbody> </table>										Jurisdiction	Lead	Prioritization Criteria						Potential Funding	Potential Implementation Mechanism	Notes	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Troutdale	Emergency Manager	3	2	2	2	2	11	General Fund	Outreach Program (e.g., champion newsletter, Facebook page and community classes)												
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Equity			Benefit	Cost	Risk	Capacity	Priority Score																																										
Troutdale	Emergency Manager	3	2	2	2	2	11	General Fund	Outreach Program (e.g., champion newsletter, Facebook page and community classes)																																								
39	<p>Develop and maintain a prioritized list of potential fuels-reduction projects (i.e., combustible materials) in high-risk areas, including fuel reduction prescriptions and cost estimates. Conduct outreach to community/property owners for priority projects to get buy-in for reduction projects. Seek funding for priority projects with community support.</p> <p>Community System: Natural and Cultural Resources; Housing; Economic; Health and Human Services Action Type: Natural Systems Protection NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Summarizes Community Wildfire Protection Plan actions # 19, 20, and 16</p>																																																
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Troutdale	Fire Department	1	3	2	3	3	12	Emergency Management Program Grant Funds and Other Grant Sources	Outreach Program																																								
40	<p>Promote fire-safe construction practices for existing and new construction in high-risk areas.</p> <p>Community System: All Action Type: Education and Awareness Programs NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Local NHMP action # 89</p>																																																
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	Jurisdiction	Lead	Prioritization Criteria						Potential Funding	Potential Implementation Mechanism			Notes																																				
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Multnomah County	Dept. of Community Services, Land Use Planning Division	2	3	3	3	3	14	General Fund	Land Use Ordinance Adoption																																								
Troutdale	Dept. of Community Services, Land Use Planning Division	2	3	3	3	3	14	General Fund	Uniform Building Code amendment and administration; Comprehensive Land Use Plan and Development Code amendment																																								

WILDFIRE	Consider regulations that require fire-safe construction in high-risk areas using Wildland Urban Interface (WUI) overlays.											
	Community System: All Action Type: Local Plans and Regulations NHMP Goals: 1, 2											
	Carry-over and Consistency Notes: New action, consistent with Community Wildfire Protection Plan											
	41			Prioritization Criteria								
		Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes
	Multnomah County	Dept. of Community Services, Land Use Planning Division	2	3	3	3	3	14	General Fund		Land Use Ordinance Adoption	
	42	Use best available data to consider impacts of wildfire risk when developing policy.										
		Community System: All Action Type: Local Plans and Regulations NHMP Goals: 1, 2										
		Carry-over and Consistency Notes: New action, consistent with Community Wildfire Protection Plan										
				Prioritization Criteria								
Jurisdiction	Lead	Equity	Benefit	Cost	Risk	Capacity	Priority Score	Potential Funding	Potential Implementation Mechanism	Notes		
Multnomah County	Dept. of Community Services, Land Use Planning Division	2	3	3	3	3	14	General Fund		Land Use Ordinance Adoption		

Table 4.2-4 Other Mitigation Actions

Hazard	Action ID	Other Mitigation Actions
All Hazard	43	<p>Assess resources needed for plan implementation and develop capacity options for consideration by participating jurisdictions to pool resources. Develop a cross-jurisdictional team to work on analysis, stakeholder coordination and grant writing. Partner with state, regional and academic organizations to coordinate projects related to risk analysis and reduction. Seek opportunities to coordinate planning processes of related plans with similar update cycles, e.g., NHMP, CWPP, Climate Action Plan.</p> <p>Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: Revises local NHMP action # 130; consistent with Climate Action Plan actions 20C, 20J, 20N</p>
	44	<p>Communicate with utility agencies about NHMP actions and priorities, and encourage integration into their planning.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2 Carry-over and Consistency Notes: New action</p>
Earthquake	45	<p>Determine a practical method to track existing public buildings that have had seismic upgrades, and to what degree. This information can be included in future risk assessments to provide more accuracy. The public also would benefit from knowing the seismic status of buildings they occupy or visit. Include seismic data for schools, as available. The Portland Public School District will be developing a stand-alone NHMP.</p> <p>Community System: Economic, Housing Action Type: Planning Process and Analysis NHMP Goals: 1, 2 Carry-over and Consistency Notes: Revises local NHMP actions #2, 67, 97; consistent with public input (6/4/15)</p>
Flood	46	<p>Seek funding to develop future conditions modeling to inform comprehensive planning in floodplain areas.</p> <p>Community System: All Action Type: Local Plans and Regulations NHMP Goals: 1, 2 Carry-over and Consistency Notes: Consistent with Climate Action Plan action 15A</p>
	47	<p>Identify target areas for flood mitigation projects. Are there any high-risk/repetitive risk problem areas that should be studied in more detail? Are there specific mitigation projects that should be developed and for which grants should be pursued, e.g., land acquisition, home elevation, business flood-proofing, floodplain restoration, stormwater infrastructure. Consider if there are areas at risk to multiple hazards that could be targeted for increased cost benefit, e.g., flood + landslide + liquefaction + lahar.</p> <p>Community System: Economic, Housing, Infrastructure, Natural and Cultural Resources Action Type: Natural Systems and Local Plans and Regulations NHMP Goals: 1, 2, 4 Carry-over and Consistency Notes: Revises local NHMP actions #8,10, 43, 46, 47, 141 and Climate Action Plan action 13D</p>
Severe Weather	48	<p>Collaborate with the Climate Action Plan Committee and City of Portland to decrease the urban heat island effect, especially in areas with populations most vulnerable to heat, through strategies such as revegetation, tree preservation planting and maintenance, depaving and porous pavement, green infrastructure such as bioswales and eeroofs, and site development performance standards.</p> <p>Community System: Health and Social Services, Natural and Cultural Resources Action Type: Local Plans and Regulations NHMP Goals: 1, 2 Carry-over and Consistency Notes: Consistent with Climate Action Plan action 14A and FEMA Best Practice</p>

Severe Weather	49	<p>Use new guidance on planning drought-ready communities to develop a focused project on drought mitigation planning and outreach.</p> <p>Community System: Health and Social Services, Natural and Cultural Resources Action Type: Natural Systems Protection NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Consistent with Climate Action Plan actions 14G, 14I</p>
	50	<p>Determine what actions are needed to incorporate emergency management criteria into normal maintenance practices to reduce power disruptions from severe weather.</p> <p>Community System: Infrastructure Action Type: Local Plans and Regulations NHMP Goals: 1, 2, 4</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions # 29, 32, 33, 57, 58, 60, 92, 94, 95, 124, 122</p>
Wildfire	51	<p>Work with local fire agencies to (1) integrate new local wildfire data with the regional data in the West-wide Wildfire Risk Assessment for the Planning Area, then (2) update the Wildland Urban Interface (WUI) areas within the Planning Area as needed. Once WUI areas are updated, develop a strategy for tracking vulnerable properties and identifying appropriate mitigation strategies. Prioritize properties with fire response access limitations.</p> <p>Community System: All Action Type: Planning Process and Analysis NHMP Goals: 1, 2</p> <p>Carry-over and Consistency Notes: Revises local NHMP actions # 88, 126, Community Wildfire Protection Plan actions # 24, 23, 30 and Climate Action Plan action 14M</p>

4.3 Implementation

4.3.1 Coordinating Body

The steering committee is responsible for the coordination and implementation of the mitigation actions, and for undertaking the formal plan monitoring, evaluating and update process. Each jurisdiction in the Planning Area will continue to provide staffing to ensure the successful implementation of the plan over the next five years. See **5.2 Maintaining the Plan** for more information on monitoring and evaluation, plan updates and public involvement during the update process.

4.3.2 Mechanisms

Integration into Other Plans

Many of the plan’s top mitigation actions are consistent with the goals and objectives of existing plans and policies in the Planning Area. When possible, each jurisdiction will implement the plan’s top actions through existing planning mechanisms. This integration is critical in moving the detailed hazard risk information from this non-regulatory document into regulatory planning mechanisms that guide the growth and development of the Planning Area. Implementing mitigation actions through such plans and policies increases their likelihood of being supported and implemented.

Table 4.2-3 Mitigation Actions lists existing local plans and policies with goals and objectives that are consistent with each action, where applicable.

The types of mechanisms that mitigation actions are often integrated into include comprehensive plans, zoning ordinances, land development codes, Capital Improvement Plans, jurisdiction and agency strategic plans and budgets, economic development plans, Transportation Systems Plans (TSP), park plans, Climate Action Plans, and Community Wildfire Protection Plans.

Table 4.3-1 Planning Mechanisms by Jurisdiction lists the planning mechanisms relevant to hazard mitigation in each community. In **Appendix F: Implementation Mechanisms**, each of these plans, programs and policies is described in detail, including:

- Date of last revision
- Plan owner
- Plan cycle
- Relationship to hazard mitigation
- Funding source
- Suggestions to integrate mitigation into the planning mechanism
- Where more information can be found on the Internet

Benefits of Integrating the NHMP into Existing Planning Mechanisms:

- *Reduce a community’s vulnerability to disasters*
- *Support effective pre- and post-disaster decision making*
- *Create effective planning tools*
- *Speed the return of an impacted community to normalcy following a hazard event*
- *Provide a forum for analysis of potentially sensitive issues*

— *Integrating the Local Natural Hazard Mitigation Plan into a Community’s Comprehensive Plan: A Guidebook for Local Governments (FEMA, 2013)*

Table 4.3-1 Local Planning Mechanisms by Jurisdiction

Planning Mechanism	Jurisdiction				
	Multnomah County	Gresham	Fairview	Troutdale	Wood Village
Comprehensive Plan	X	X	X	X	X
Sub-Area Plans	-	X	-	X	X
Development/Zoning Code	X	X	X	X	X
Annual Budget	X	X	X	X	X
Transportation System Plan	X	X	X	X	X
Capital Improvement Program	X	X	X	X	-
Stormwater Management Plan	X	X	X	X	X
Parks Master Plan	-	X	X	X	X
Emergency Operations Plan	X	X	X	-	X
Urban Renewal Plan	-	X	-	X	X
City Council/Commission Work Plan	-	X	X	-	-
Wildfire Protection Plan	X	-	-	-	-
Climate Action Plan	X	-	-	-	-
Safety Programs	X	-	-	-	-
Facilities Maintenance Plan	X	-	-	-	-
Recovery Plan	X	-	-	-	-
Water Division Emergency Response Plan	-	X	-	-	-
Public Facilities Plan	-	-	-	X	-

4.3.3 Funding

There are a few state and federal grant programs specifically focused on hazard mitigation. However, there are many other state and federal grant programs that address other goals but could be applied to hazard mitigation projects. Federal mitigation funding typically is very competitive.

State Programs

Oregon Department of Land Conservation and Development (DLCD) Technical Assistance (TA) Grant Program

DLCD offers grants to local and tribal governments to complete projects that update and modernize comprehensive plans, land use ordinances, development codes and other planning regulations. TA grant awards are guided by the Grants Allocation Plan. Grant Allocation Plan priorities include economic development, streamlining planning processes, natural hazards planning, updating codes to comply with changes in state law, and infrastructure finance planning.

Website: <https://www.oregon.gov/LCD/Pages/grants.aspx>

Oregon Military Department, Office of Emergency Management (OEM)

The OEM provides grant guidance on hazard mitigation programs.

Website: http://www.oregon.gov/OMD/OEM/pages/all_grants.aspx (see Hazard_Mitigation_Grants)

Oregon Seismic Rehabilitation Grant Program (SRGP)

In 2009, Oregon established the SRGP to fund seismic retrofits for schools and emergency services facilities. SRGP has two advantages relative to federal grant programs: no match requirement, although there is a maximum limit; and statewide competition versus federal competition. Eligible schools include buildings owned by public K-12 school districts, education service districts, community colleges and the Oregon University System. Eligible emergency services facilities include hospital buildings with acute inpatient care, fire stations, police stations, sheriff's offices, and other facilities used by state, county, district or municipal law enforcement agencies.

Website: <http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/>

Oregon Watershed Enhancement Board (OWEB)

While OWEB primarily supports projects that address coastal salmon restoration and improve water quality statewide, these projects also can reduce flood and landslide hazards. OWEB also coordinates watershed workshops for landowners, watershed councils, educators and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees and other sources. OWEB awards approximately \$20 million in funding annually.

Website: <http://www.oregon.gov/OWEB/Pages/index.aspx>

Federal Programs: Pre-Disaster

Flood Mitigation Assistance (FMA) Program

The FMA Program is administered through the Federal Emergency Management Agency (FEMA). The overall goal of FMA is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other National Flood Insurance Program (NFIP) insurable structures.

Website: <https://www.fema.gov/flood-mitigation-assistance-grant-program>

Pre-Disaster Mitigation (PDM) Grant Program

PDM is a FEMA grant program that provides funds to states, territories, tribal governments, communities and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis and without reference to state allocations, quotas or other formula-based allocation of funds.

Website: <http://www.fema.gov/pre-disaster-mitigation-grant-program>

Federal Programs: Post-Disaster

Community Development Block Grant (CDBG) Program

The CDBG Program is a U. S. Department of Housing and Urban Development (HUD) program that promotes viable communities by providing (1) decent housing, (2) quality living environments, and (3) economic opportunities, especially for low and moderate income persons. Eligible activities most relevant to hazard mitigation include the acquisition of property for public purposes, the construction/reconstruction of public infrastructure, and community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare.

Website:

http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

Community Development Block Grant–Disaster Recovery (CDBG–DR) Program

In response to presidentially declared disasters, Congress may appropriate additional funding for the CDBG Program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. CDBG-DR funds a broad range of recovery activities and can help communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration and the U.S. Army Corps of Engineers.

Website: <https://www.hudexchange.info/programs/cdbg-dr/cdbg-dr-eligibility-requirements/>

Hazard Mitigation Grant Program (HMGP)

FEMA's HMGP grants provide funding to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of HMGP is to reduce the loss of life

and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Website: <http://www.fema.gov/hazard-mitigation-grant-program>

Public Assistance (PA) — Section 406 Hazard Mitigation

Through the PA Program, FEMA provides supplemental federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private nonprofit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. This is authorized under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Website: <http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit>

Small Business Administration (SBA) Disaster Loan Program

The U. S. Small Business Administration provides low-interest disaster loans to businesses of all sizes, private nonprofit organizations, homeowners and renters. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Website: <https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster>

Federal Programs: Project Support

Agricultural Conservation Easement Program (ACEP)

The United State Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) ACEP Program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements Program, NRCS helps American Indian tribes, state and local governments and nongovernmental organizations protect working agricultural lands and limit non-agricultural uses of the land.

Website: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/>

Assistance to Firefighters Grant Program (AFG)

FEMA AFG grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER).

Website: <http://www.fema.gov/welcome-assistance-firefighters-grant-program>

Community Development Block Grant Entitlement Communities Program

HUD's CDBG Entitlement Communities program provides grants to eligible cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons.

Website: <https://www.hudexchange.info/programs/cdbg-entitlement/>

Emergency Management Performance Grants (EMPG)

These FEMA grants help state and local governments sustain and enhance their all-hazards emergency management programs.

Website: <https://www.fema.gov/emergency-management-performance-grant-program>

Emergency Watershed Protection Program, USDA-NRCS

This USDA Natural Resources Conservation Service (NRCS) program provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.

Website: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp>

Federal Lands to Parks Program

This program, operated through the U. S. Department of the Interior's National Park Service, identifies, assesses and transfers available federal real property for acquisition for state and local parks and recreation areas, such as open space.

Website: <http://www.nps.gov/nrcr/programs/flp/index.htm>

HOME Investments Partnerships Program (HOME)

HUD's HOME program provides grants to states and local government for permanent and transitional housing, including support for property acquisition and rehabilitation, for low-income persons.

Website: <http://www.hud.gov/offices/cpd/affordablehousing/programs/home/>

National Flood Insurance Program (NFIP)

FEMA's NFIP makes flood insurance available to residents of communities that adopt and enforce minimum floodplain management requirements.

Website: <http://www.fema.gov/national-flood-insurance-program>

National Fire Plan (NFP)

Together, the USDA Forest Service and the U.S. Department of the Interior are working to provide technical, financial, and resource guidance and support for wildland fire management across the United States through the NFP. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.

Website: <http://www.forestsandrangelands.gov/>

North American Wetland Conservation (NAWC) Fund

The NAWC Fund is a program through the U. S. Fish and Wildlife Service (FWS) that provides cost-share grants to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.

Website: <https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php>

Partners for Fish and Wildlife (PFW) Program

Another FWS program, the PFW provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.

Website: <http://www.fws.gov/partners/>

Public Assistance (PA) Grant Program

The objective of FEMA's PA Grant Program is to provide assistance to state, tribal and local governments, and certain types of private nonprofit organizations, so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.

Website: <http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit>

4.4 References

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Multidisciplinary Center for Earthquake Engineering Research. (2004) A Framework to Quantitatively Assess and Enhance the Seismic Resilience of Communities. Paper presented at the 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada. Retrieved from <http://www.eng.buffalo.edu/~bruneau/13WCEE%20Bruneau%20et%20al.pdf>

5 Planning Process

The planning process is as important as the plan itself. The engagement of stakeholders and the public in identifying issues and collaborating on solutions can develop partnerships and understanding that would not exist without a robust planning process. The result is a shared set of community values and widespread support to direct resources toward an agreed-upon action plan that enhances the community's resiliency.

5.1 Developing the Plan

5.1.1 Steering Committee Changes

Multnomah County and the cities of Gresham, Troutdale, Fairview and Wood Village decided to merge their stand-alone Natural Hazards Mitigation Plans (NHMPs) into one multi-jurisdictional plan. To do this, a new steering committee was created with representatives from each of the jurisdictions in the Planning Area, as well as the Multnomah County Drainage District, Sandy Drainage Improvement Company, Sauvie Island Drainage Improvement Company and the City of Portland. The steering committee oversaw the NHMP planning process and update.

5.1.2 Plan Format and Content Changes

The merging of five plans required considerable changes to the plan format and content that went beyond the normal planning process for a five-year update. This included a major update of the goals and objectives to reflect the multi-jurisdictional collaboration and to better align with the 2015 Oregon NHMP. The **2 Community Profile** was substantially enhanced to further illustrate trends in the Planning Area that indicate some people and places are more likely than others to experience greater impacts from natural hazards. The **3 Hazard Identification and Risk Assessment** subsections were reformatted, and now include local risk scores, and both common and unique aspects of each hazard across the Planning Area. New hazard data were incorporated into the Risk Assessment and vulnerabilities were updated based on state, regional and local information. Furthermore, the five Mitigation Strategies in the current NHMPs were blended and updated as described in section **5.1.3 Review of Existing Plans and Technical Information**.

5.1.3 Review of Existing Plans and Technical Information

The updates to sections **2 Community Profile**, **3 Hazard Identification and Risk Assessment** and **Annex I: Human-Caused and Technological Hazards** reference numerous technical analyses, datasets, local plans, and academic and professional sources. These are cited throughout the plan. The Multnomah County Geographical Information System (GIS) Division has a library of geographic datasets with accompanying metadata that were used in mapping and analysis.

The section **4 Mitigation Strategy** was developed by referencing current NHMPs for the Planning Area, neighboring jurisdictions' NHMPs, the 2015 Oregon NHMP, Community Wildfire Protection Plan, Multnomah County Climate Action Plan, comprehensive plans and several sources of best practice guidance. **Table 4.2-3 Top Mitigation Actions** details which plans and guidance align with each top mitigation action.

5.1.4 Stakeholder Participation

Steering Committee

The steering committee guided the development of this plan. The committee represents perspective from community development, public works and emergency management departments. For some small jurisdictions, one staff member was able to represent more than one of these fields. The steering committee consisted of the following individuals, by jurisdiction:

Multnomah County

- Chris Voss, Emergency Management Director
- Christopher Blanchard, Emergency Management Planning Division Chief
- Allison Boyd, Emergency Management Mitigation and Resilience Planner
- Lisa Corbly, Emergency Management Senior Equity Planner
- Adam Barber, Land Use Senior Planner & Department of Community Services Emergency Preparedness Coordinator
- Mike McBride, Facilities and Property Management, Compliance Section Lead

City of Gresham

- Kelle Landavazo, Emergency Management Coordinator
- Chris Strong, Transportation Division Manager

City of Fairview

- Allan Berry, Public Works Director
- Nolan Young, City Administrator
- Scott Anderson, Interim Police Chief

City of Troutdale

- Craig Ward, City Manager
- Steve Gaschler, Public Works Director

City of Wood Village

- Bill Peterson, City Administrator
- Scott Sloan, Public Works Director

Special Districts

- Angela Carkner, Multnomah County Drainage District and Sandy Drainage Improvement Company Project Manager
- Tim Couch, Sauvie Island Drainage Improvement Company

City of Portland

- Jonna Papaefthimiou, Planning and Preparedness Manager
- Danielle Butsick, Natural Hazard Mitigation Planner

The steering committee met six times during the plan update process to make critical decisions on the new plan structure and content. A testament to the impact severe weather can have on the Planning Area, the seventh committee meeting was cancelled due to inclement weather, which caused unsafe driving conditions and multiple government closures. In lieu of the meeting, the agenda and notes were emailed to the committee for feedback and completion of final outstanding needs.

Members of the committee also actively participated between meetings by providing feedback on drafts, collecting data, documenting action status, and identifying and prioritizing top actions. Committee members worked with their local leadership to ensure data, risk assessments, actions and drafts accurately represented their communities. In addition, Multnomah County Emergency Management met one-on-one, as needed, with each of the jurisdictions in the Planning Area to provide technical assistance during the update of data-heavy sections of the plan, including community-specific information for **2 Community Profile**, data in **3 Hazard Identification and Risk Assessment** and top actions in **4 Mitigation Strategy**. Furthermore, some steering committee members participated in a Strategy Workshop (October 2015) and a Local Hazard Identification and Analysis Workshop (June 2016).

Strategy Workshop

On October 1, 2015, 18 stakeholders representing the steering committee, community organizations, private institutions and regional partners gathered to begin updating the Action Plan. All jurisdictions in the Planning Area participated. The group reviewed and commented on the draft vision, goals and objectives developed by the steering committee. Draft action screening criteria and prioritization criteria also were reviewed and edited. A quick overview of major issues for each hazard included in the plan was presented. In addition, the results of informal polls at public outreach events were graphically presented and discussed.

Draft “action ideas” were then presented and discussed. These draft actions were based on the Action Plans in the five current NHMPs, the 2015 Oregon NHMP, several other plans and best practices. Comments and new action ideas are captured in the meeting minutes in **Appendix G Planning Process Documents**.

Local Hazard Identification and Analysis Workshop

On June 1, 2016, steering committee representatives from each jurisdiction in the Planning Area gathered to complete the Oregon Office of Emergency Management (OEM) refined Hazard Analysis methodology for their respective communities. Workshop participants included representation from the cities of Gresham, Fairview, Troutdale and Wood Village, the Multnomah County Drainage District and Multnomah County. Together, the group reviewed the hazards identified in the current NHMPs and agreed that the Planning Area remains subject to the same hazards. Variations in hazard nomenclature and hazard groupings were presented. All participants agreed to organize the new plan into the following six hazard categories: earthquake, flood, landslide, severe weather, volcano, and wildfire.

Finally, each jurisdiction completed the Hazard Analysis methodology to determine its community’s relative risk to each of the six hazards. Each jurisdiction reported to the group, and draft risk scores were discussed. Following the workshop, the draft risk scores were vetted and updated by a wider range of local leaders and subject matter experts in each jurisdiction. The final risk rankings and descriptions can be found on the first page of each hazard analysis in the section **3 Hazard Identification and Risk Assessment**. See **Appendix C Local OEM Hazard Analysis Scores** for a description of the methodology and risk scores for each community.

Additional Stakeholders

Additional stakeholders provided technical support, data and feedback during the plan update, including the Multnomah County Office of Sustainability, Multnomah County Department of Community Services Bridges Department, Local Emergency Planning Committee, Oregon Department of Environmental Quality, State Fire Marshal's Office, Oregon Department of Forestry, Oregon Department of Geology and Mineral Industries, Oregon Partnership for Disaster Resilience and others. Data contributions are documented in data source citations throughout the plan.

A wider stakeholder list was developed through input from the steering committee. The list includes neighboring communities, local and regional agencies, local federal offices, community-based organizations, and private-sector partners representing various sectors categorized as communications, economic, federal, fire, GIS, health and human services, education, law enforcement, nongovernmental, planning, regional, special district, state, transportation, and utilities. The people on this list were emailed directly during the public comment period and asked for input on the draft plan.

Regional Coordination

Additional mitigation coordination with neighboring jurisdictions was accomplished during this plan update. Mitigation planners from Multnomah County, City of Portland, Clackamas County, Clark County and Washington County met quarterly to share information about their respective mitigation programs and planning processes, and to look for opportunities for consistency and regional efficiency. The group developed a regional project proposal to create a toolkit for mitigation outreach. This proposal was submitted to the Regional Disaster Preparedness Organization (RDPO) and is pending consideration.

At this time, these mitigation planners are developing a proposal to become a RDPO Mitigation and Recovery Work Group. Becoming a work group within the RDPO would formalize the region's commitment to mitigation and recovery. If approved, the work group will meet quarterly to share mitigation and recovery projects and progress, identify regional mitigation and recovery priorities and combine resources to apply for Urban Area Security Initiative (UASI) funding.

The City of Portland's Mitigation Action Plan (MAP) and the Clark County NHMP were updated concurrent to this plan update. Recognizing the importance of consistency among plans, each jurisdiction remained informed of the others' update processes. In addition, both Portland and Multnomah County attended each other's steering committee meetings, reviewed and provided technical assistance on data, and aligned mitigation strategy actions when possible.

5.1.5 Public Participation

Website

In addition to the targeted stakeholder involvement described above, opportunities for the general public to be informed and get involved in the update were built into the process. Throughout the plan update, a **Natural Hazards Mitigation Planning** website provided background information on **What is mitigation?**, **Why do we need a Natural Hazards Mitigation Plan?**, **The county's role in updating the plan**, and **Community resources for hazard mitigation**. Meeting agendas, current NHMPs and other related documents were posted on the website's **Natural Hazards Mitigation Plan Document Library**. The draft plan was posted on the website during the public comment period. The website can be found at <https://multco.us/em/natural-hazard-mitigation-planning>.

Outreach Events

During the summer of 2015, seven outreach events were conducted to gather early input. At each venue, Multnomah County Emergency Management staffed a booth that focused on mitigation and preparedness. Outreach events included:

- Wood Village National Night Out
- Fairview National Night Out
- Troutdale Summer Fest
- Corbett National Night Out
- Fairview on the Green
- Sauvie Island Community Association Meeting
- An Earthquake Information Fair in outer east Portland

Figure 5.1-1 Mitigation and Preparedness Booth at Public Events



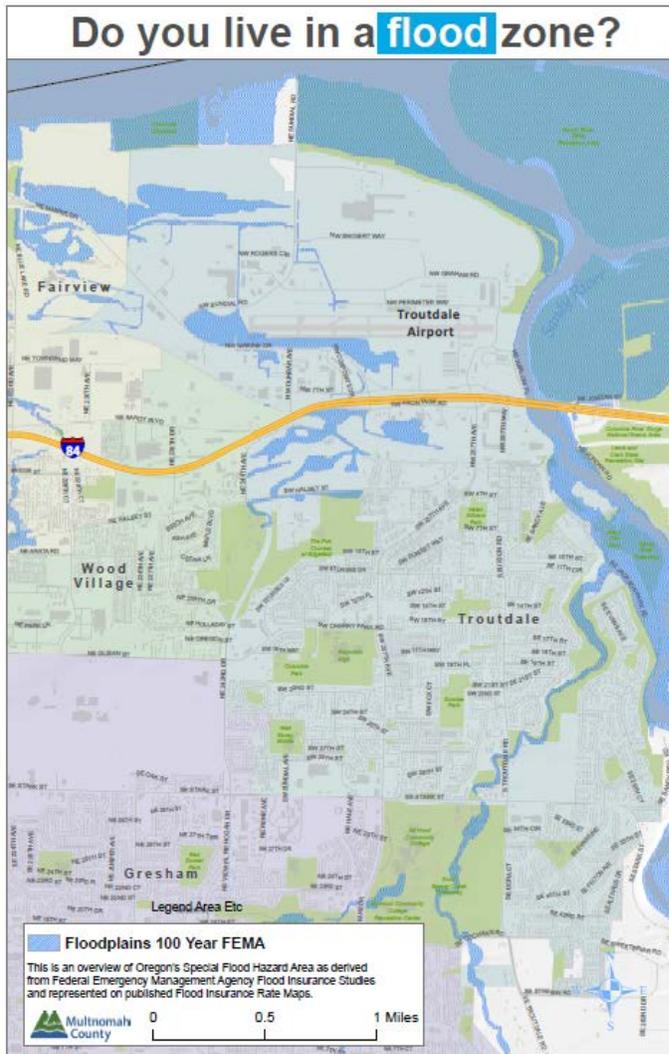
Source: Multnomah County Emergency Management

Large hazard exposure maps — specific to each community — and educational posters were developed for public events. Maps were created for these six hazards¹:

- Flood
- Flood — Bull Run Dam Inundation
- Earthquake
- Landslide
- Volcano
- Wildfire

¹ Due to lack of data for severe weather events, severe weather hazards are difficult to map.

Figure 5.1-2 Hazard Exposure Maps Developed for Public Events



Source: Multnomah County Emergency Management

Individuals were asked three questions at the emergency management booth at public events. Questions were developed to elicit each community’s perceived level of threat to each hazard, hazard priorities and information about local hazard events. Responses to these questions can help identify targeted outreach to specific communities around specific hazards.

Question 1: Which hazard do you think poses the greatest threat to your family or community over the next 20 years? Place a pebble in the container for each hazard of concern to you.

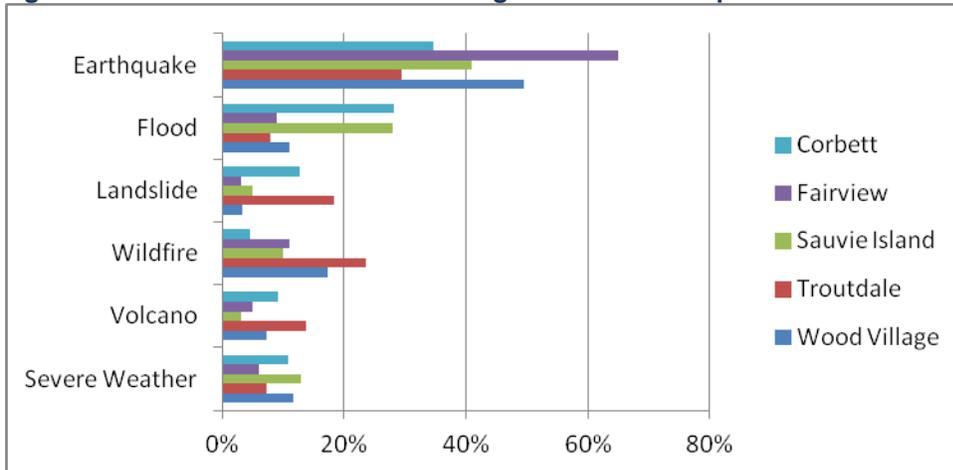
Figure 5.1-3 “Which Hazard Poses the Greatest Risk?” Voting Jars at Public Events



Source: Multnomah County Emergency Management

This activity was the most popular at all the public events. Earthquake was the most common response in all communities (**Table 5.1-3**). Notably, earthquake was identified as the greatest risk by roughly 65% of the respondents in Fairview, about half the respondents in Wood Village, and between 30% and 40% of the respondents in the other communities. In Corbett and Sauvie Island, flooding was the second most common “greatest risk” identified by respondents, about 30%. In Troutdale, roughly 20% of the respondents ranked landslide and wildfire as their greatest risk, and around 15% ranked volcanic hazards as their greatest risk.

Figure 5.1-3 Totals from Informal Polling of Public Participants at Outreach Events



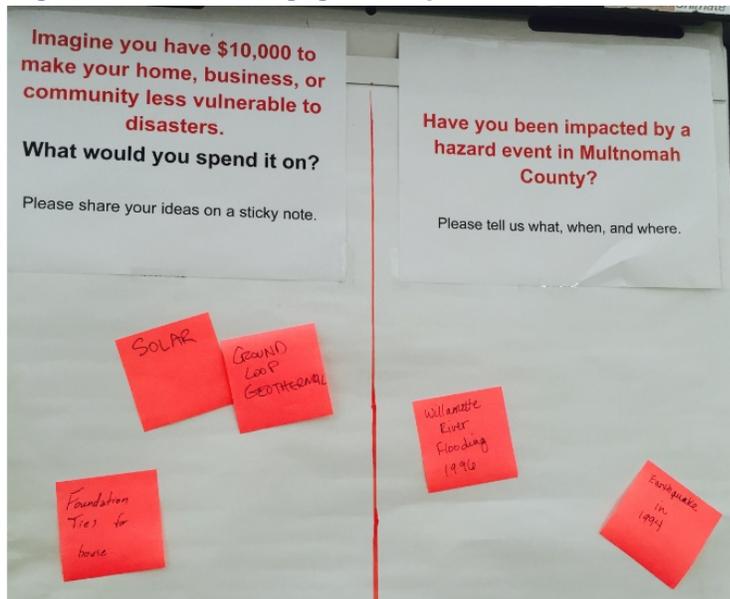
Source: Multnomah County Emergency Management

Question 2: Have you been impacted by a hazard event in Multnomah County? Please place a star on the map where the event occurred or tell us more on a sticky note.

This activity provided a visual illustration to the community of recent hazard events and locations. Responses included flooding and earthquake events.

Question 3: Imagine you received a grant to make your home, business or community less vulnerable to disasters. What would you spend it on? Please share your ideas on a sticky note. If you agree with an idea, add a star.

Figure 5.1-4 Public engagement questions



Source: Multnomah County Emergency Management

How an individual would spend a hypothetical grant indicates the individual's concerns and priorities for risk reduction. The responses to this question can inform future mitigation outreach efforts and NHMP mitigation actions. Responses ranged from stocking emergency caches to making structural improvements to securing alternate (backup) power sources, as listed here:

- Food
- Water
- Shelter
- Medical help
- Elevate home
- Community emergency cache
- Seismic upgrades
- Generator
- Generator for well
- Fuel tank
- Alternate power source: solar, geothermal

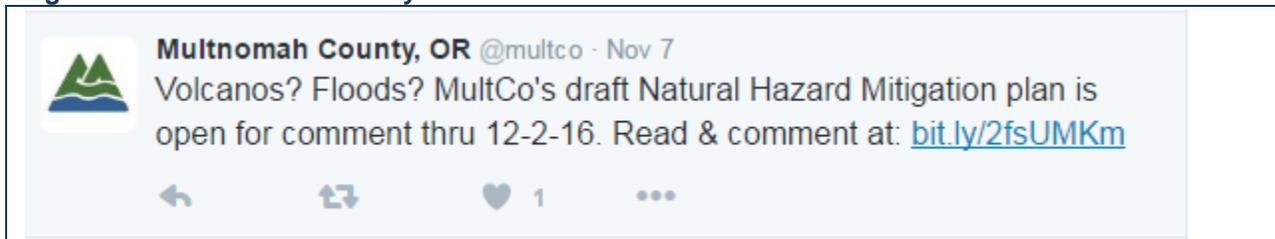
Public Comment Outreach

The draft plan was available for public comment for four weeks, from Monday, November 7, through Friday, December 2, 2016. Each community announced the public comment period in the following ways.

Multnomah County

- Briefing to the Planning Commission on Monday November 7 , 2016
- Announcement in *The Oregonian* newspaper
- Online at the Emergency Management website, <https://multco.us/em>
- Email blast to 114 local, regional, state, federal, private and community mitigation stakeholders
- Email blast to more than 300 general emergency management stakeholders
- Twitter
- Facebook

Figure 5.1-5 Multnomah County Tweet about NHMP Public Comment Period



Source: Multnomah County, retrieved from website <https://twitter.com/multco>

Fairview

- NHMP update and public comment period notice along with **Appendix C: Local OEM Hazard Analysis Scores** to the Fairview Public Safety Advisory Committee on November 7, 2016
- Staff Report and NHMP update materials presented to City Council on November 16, 2016
- Online at website <http://or-fairview.civicplus.com/CivicAlerts.aspx?AID=319>

Figure 5.1-6: City of Fairview’s Staff Report on the NHMP Update and Public Comment Period to Mayor and City Council on November 16, 2016



AGENDA STAFF REPORT

MEETING DATE	AGENDA ITEM #	REFERENCE NUMBER
November 16,2016	Work Session #1	16-2016

TO: Mayor and City Council
FROM: Nolan K. Young, City Administrator
DATE: November 8, 2016

ISSUE:
 Review and comment on Multnomah County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP)

BACKGROUND:
 Since 2015, Multnomah County Emergency Management has been developing the County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP). Staff from the City of Fairview has been serving on the advisory committee. This plan is required by the Federal Emergency Management Agency (FEMA) in order to access their programs. The plan includes unincorporated areas of Multnomah County and cities of Fairview, Gresham, Troutdale and Wood Village.

The NHMP is available for public comment through December 2 at <https://multco.us/cm/natural-hazard-mitigation-planning>. We have placed this information on our web site: <http://or-fairview.civicplus.com/CivicAlerts.aspx?AID=319>

This item is on the November 16 Council Work Session to allow the City Council to review the scoring and ranking of the six identified hazards and the potential action items that Fairview may be looking into over the next five years. Attached to this Agenda Staff Report is the following exhibits with additional information.

- Exhibit #1: Information on the purpose of the plan and the planning process.
- Exhibit #2: Appendix C which identifies our ranking of the identified six Natural Hazards.
- Exhibit #3: Top Mitigation Actions chart (50 actions) from Section 4 “Mitigation Strategy”. Fairview has identified 12 actions to engage in over the next 5 years (2017-2022): items 1-7 for all hazards, items 15, 18 & 20 for earthquakes and items 22 & 23 for floods. In addition we recommend adding item 34 for severe weather.

COUNCIL ALTERNATIVES:
 This is an opportunity for the council to identify comments we wish to submit on the plan, including our Hazard Risk Scores and Mitigation Actions.

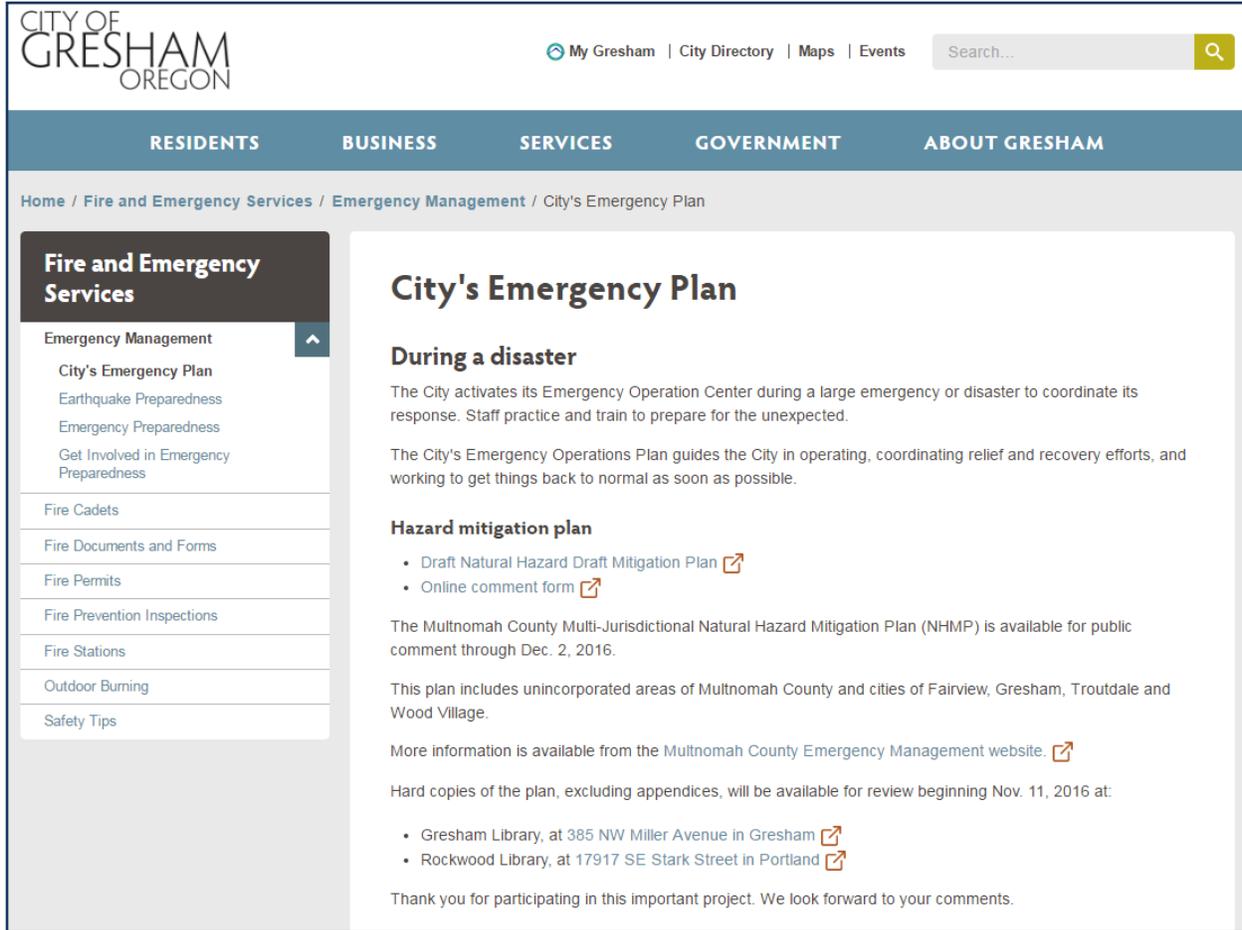
CP3

Source: City of Fairview, retrieved from website <http://or-fairview.civicplus.com/CivicAlerts.aspx?AID=319>

Gresham

- Online at website <https://greshamoregon.gov/Citys-Emergency-Plan/>
- Gresham’s electronic newsletter, *Neighborhood Connections*, with 7,800 subscribers
- The city’s social media site, www.nextdoor.com, with 6,041 registered Gresham residents

Figure 5.1-7 NHMP Public Comment Period Announcement on City of Gresham Website



Source: City of Gresham, retrieved from website <https://greshamoregon.gov/Citys-Emergency-Plan/>

Troutdale

- Announcement in the community newsletter *Troutdale Champion* November/December 2016 edition and available at website
<https://mail.google.com/mail/u/0/#search/troutdale/15928c35444d9089?projector=1>

Figure 5.1-8 Public Comment Period Announcement in the *Troutdale Champion*

Multnomah County Seeks Feedback on Draft Mitigation Plan

The public is encouraged to review and comment on the draft Natural Hazard Mitigation Plan for Gresham, Troutdale, Fairview, Wood Village and unincorporated areas of the county. Troutdale is at risk from natural hazards like earthquakes, floods and landslides. The Natural Hazard Mitigation Plan (NHMP) tells us how hazards like these can impact us and identifies ways each community plans to reduce those impacts. An electronic copy of the draft NHMP will be available on the Multnomah County Emergency Management website in November. Please visit their website at <https://multco.us/em>

Source: City of Troutdale

Wood Village

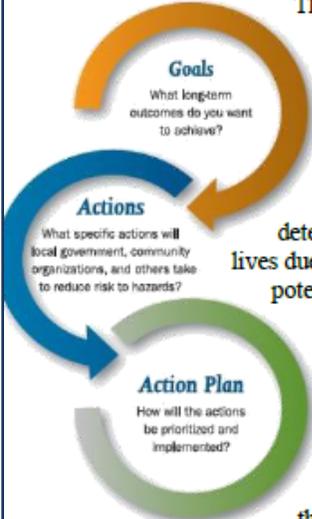
- Announcement in the November 2016 edition of the community newsletter *Village News*
- Online at website <https://www.ci.wood-village.or.us/>

Figure 5.1-9 Public Comment Period Announcement in the City of Wood Village's Newsletter *Village News*

5
The Village News

NATURAL HAZARD MITIGATION PLAN

Mitigation is the effort we take to reduce loss of life and property by lessening the impact of disasters. Mitigation planning creates safer communities, saves money, and enables individuals to recover more rapidly from disasters. Examples of mitigation actions include restoring flood plains to prevent flooding in urban areas, securing bookshelves and appliances to reduce hazards, or replacing aging public infrastructure to be more disaster resilient.



Goals
What long-term outcomes do you want to achieve?

Actions
What specific actions will local government, community organizations, and others take to reduce risk to hazards?

Action Plan
How will the actions be prioritized and implemented?

The City of Wood Village along with Multnomah County, Fairview, Gresham, Maywood Park, and Troutdale are in the process of updating the plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities. A number of potential hazards were assessed including earthquakes, floods, landslides, volcanoes, wildfires and severe storms. We have determined that severe storms pose the most immediate interruption to our daily lives due to their frequency. Earthquakes and volcanoes, although infrequent, have the potential for the greatest catastrophic damage in our area and have been ranked next. Landslides, wildfires and urban flooding have been listed as less frequent and least threatening though they still deserve to be appropriately considered.

The public is encouraged to review and comment on the draft Natural Hazard Mitigation Plan for Gresham, Troutdale, Fairview, Wood Village and unincorporated areas of the county. This plan details the impact of the various hazards and identifies the methods each community will use to help reduce those impacts. An electronic copy of the draft NHMP is available on the Multnomah County Emergency Management website: <https://multco.us/em>.



Source: City of Wood Village, retrieved from website <https://www.ci.wood-village.or.us/hot-topics/the-village-news-jan-2013/>

Hard copies of the draft plan—without appendices and the annex—were available at these locations, along with comment forms:

- Central Library, 801 SW 10th Avenue, Portland
- Fairview-Columbia Library, 1520 NE Village Street, Fairview
- Gresham Library, 385 NW Miller Avenue, Gresham
- Multnomah County Drainage District, 1880 NE Elrod Drive, Portland
- Rockwood Library, 17917 SE Stark Street, Portland
- Troutdale Library, 2451 SW Cherry Park Road, Troutdale
- Troutdale City Hall, 219 E Historic Columbia River Hwy, Troutdale
- Troutdale Planning and Community Development Department, 2200 SW 18th Way, Troutdale
- Wood Village City Hall, 2055 NE 238th Drive, Wood Village

Other Public Comment Period Outreach

The Multnomah County Drainage District (MCDD) also announced the draft NHMP public comment period on its website home page. This website included a link to the Multnomah County Emergency Management website where the draft plan and comment forms were available to view and download.

5.2 Maintaining the Plan

Plan maintenance is a critical component of the NHMP. It ensures that this plan will continue to be current and guide mitigation actions into the future. While it is unlikely that the plan's mission and goals will change significantly over time, it is almost assured that the plan's strategies and actions will require periodic review and refinement. Additionally, new scientific information occasionally becomes available that can change our understanding of hazard risk. This new information should be reflected in the plan and, if necessary, acted upon.

5.2.1 Monitoring and Evaluation

The steering committee will be responsible for monitoring and evaluating the plan during biannual meetings between plan updates. During the monitoring and evaluation phase, the committee will discuss the following:

- Funding opportunities
- New data
- Mitigation action progress
- Public comments
- Elected official comments
- New mitigation actions
- Mitigation action screening and prioritization criteria
- Lessons learned
- Mitigation success
- Priorities for the next plan update

The committee may choose to meet additional times — such as after a disaster event or if new funding opportunities arise — to review the plan's actions and reconsider priorities for implementation.

5.2.2 Plan Updates

This plan will be updated every five years, as required by the Disaster Mitigation Act of 2000. Multnomah County will act as the convener and will be responsible for convening the steering committee to address these questions:

- Are the plan goals still applicable? If no, what modification should be made?
- Do the plan's priorities align with state priorities? If no, what steps do we take to align priorities?
- What new partners should be brought to the table?
- What new local, regional, state or federal policies influencing natural hazards should be addressed?
- What mitigation activities has the community successfully implemented since the plan was last updated?
- What new issues or problems related to hazards have been identified in the community?

- What existing actions need to be reprioritized for implementation?
- Are the actions still appropriate given current resources?
- What changes in development patterns could influence the effects of hazards?
- What significant changes in the community's demographics could influence the effects of hazards?
- What new studies or data would enhance the risk assessment?
- Has the community been affected by any disasters? How did the plan accurately or inaccurately address the impacts of these events?

Discussing these questions will help the committee determine what components of the mitigation plan need updating. The committee will be responsible for updating any deficiencies found in the plan based on the questions above.

5.2.3 Continued Public Participation

Multnomah County and the cities of Gresham, Fairview, Troutdale and Wood Village are dedicated to involving the public directly in reviewing and updating the NHMP. The success of the plan implementation partially relies on the public's interest in mitigation and willingness to become involved in mitigation activities in their homes, businesses and neighborhoods. The public is generally unwilling to become involved (i.e., change their behaviors to include more mitigation activities) unless the planning process is understandable and accessible. For these reasons, public involvement is a critically important component of the mitigation plan.

Following are nine top mitigation actions that directly relate to public engagement and education. See **Table 4.2-3 Top Mitigation Actions** in section 4 **Mitigation Strategy** for a full list of top mitigation actions.

- Leverage existing hazard mitigation public outreach methods to develop a Hazard Mitigation Outreach Strategy for the Planning Area. The strategy will be culturally appropriate and inclusive of traditionally underserved and underrepresented populations, and others with access and functional needs.
- Develop Community Executive Summaries that explain the relevant portions of the Hazard Mitigation Plan to elected officials and members of specific communities. Provide annual progress report updates to the community summaries.
- Coordinate with the Joint Office for Homeless Services (JO) to reduce risk to natural hazards for people experiencing homelessness. Work with the JO to educate its staff and partner organizations about hazard exposure maps. Encourage the JO to reference hazard exposure maps when siting indoor and outdoor locations for people experiencing homelessness. Coordinate with JO on outreach standard operating procedures for people experiencing homelessness during severe weather, flooding events and other emergency situations.
- Over the next five years, install high-water-mark signs to educate the public about flooding potential in targeted locations along or within the leveed areas.
- Expand seismic retrofit incentive programs for home owners.
- Encourage retrofits that make mobile homes safer in high winds.
- Provide educational materials, presentations and demonstration projects on defensible space and wildfire mitigation techniques to communities at risk.
- Develop and maintain a prioritized list of potential fuels-reduction projects (i.e., combustible materials) in high-risk areas, including fuel-reduction prescriptions and cost estimates. Conduct

outreach to community/property owners for priority projects to get buy-in for reduction projects. Seek funding for priority projects with community support.

- Promote fire-safe construction practices for existing and new construction in high-risk areas.

Furthermore, the public will have the opportunity to provide direct feedback about the plan in a variety of ways:

- Multnomah County Emergency Management will incorporate information about the plan into its outreach programs.
- Multnomah County Emergency Management will make the plan available online and will accept comments by email.
- The cities of Gresham, Fairview, Troutdale and Wood Village will provide a link on their websites to the NHMP on the county's website.
- Multnomah County Drainage District will provide a link on its websites to the NHMP on the county's website.
- Copies of the plan will be catalogued and kept at appropriate agencies in the county and each city. The existence and location of these copies will be publicized.
- The plan also includes the address and phone number of the county's Office of Emergency Management, which is responsible for keeping track of public comments on the plan.

The steering committee will review and incorporate any public comments during the monitoring and evaluation phase.

Because the plan's action items are implemented through existing plans, policies and procedures, the public also will have an opportunity to comment on mitigation action items during every plan update cycle. These include Comprehensive Plan updates, Capital Improvement Program review, and priority-based budgeting processes. All public meetings during which portions of the NHMP are discussed will include opportunities for the public to express concerns, opinions or ideas about the plan.

5.3 References

No references for this section.

Human-Caused and Technological Hazard Identification and Risk Assessment

This report includes hazard profiles for each of the human-caused and technological hazards identified for further evaluation by the Multnomah County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) Steering Committee. It contains the following subsections:

Overview

- ❖ 1. Overview
- ❖ 2. Asset Inventory

Hazards

- ❖ 3. Transportation Incident
- ❖ 4. Hazardous Materials Incident
- ❖ 5. Pipeline Incident
- ❖ 6. Critical Infrastructure Failure

- ❖ 7. Utility Interruption/Failure
- ❖ 8. Terrorism
- ❖ 9. Workplace/School/University Violence
- ❖ 10. Fuel/Resource Shortage

Conclusion

- ❖ 11. Final Determinations

1. OVERVIEW

Each hazard profile includes a general description of the hazard, its location and extent, notable historical occurrences, and the probability of future occurrences. Each profile also includes specific items noted by members of the NHMP Steering Committee as it relates to unique historical or anecdotal hazard information for Multnomah County or a participating municipality within it.

The following human-caused and technological hazards were identified as hazards of concern for Multnomah County:

- ❖ Transportation Incident
- ❖ Hazardous Materials Incident
- ❖ Pipeline Incident
- ❖ Critical Infrastructure Failure
- ❖ Utility Interruption/Failure
- ❖ Terrorism
- ❖ Workplace/School/University Violence
- ❖ Fuel/Resource Shortage

For the scope of this analysis, only those hazards with a geospatial component and that would enhance current hazard mitigation planning efforts were included. The most data was available for analyzing Hazardous Materials Incidents and therefore the most thorough risk assessment was provided for this hazard. The other hazards were profiled and may be further analyzed in future updates. The NHMP Steering Committee advised on which hazards to include and focus on.

Table 1 provides a brief description of each of these hazards.

TABLE 1: DESCRIPTIONS OF IDENTIFIED HAZARDS

Transportation Incident	Transportation incidents come in many forms in the United States, especially given the many forms of transportation available today. The most common types of transportation incidents are motor vehicle accidents, but plane, train, and watercraft accidents occur as well and often have higher magnitude impacts.
Hazardous Materials Incident	Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways and on the water. HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well.
Pipeline Incident	A pipeline incident may also be considered a hazardous materials incident or critical infrastructure failure but has been split out as a separate hazard in this plan. This type of incident generally refers to a spill, explosion, or fire caused in the transport of flammable liquid or gas being carried by fixed pipes across the United States. These pipes often carry petroleum-based products that are dangerous to health and safety of people as well as the environment if exposed in large quantities.
Critical Infrastructure Failure	A critical infrastructure failure covers a broad range of potential failures, including roads, bridges, or important buildings. Often the impacts of natural hazards such as earthquakes are the cause of critical infrastructure failure. A failure of critical infrastructure would result in impacts that exceed those associated with the failure of other structures or infrastructure and would likely have cascading effects on the population.
Utility Interruption/Failure	Energy/power/utility failures often occur hand in hand with other hazards and are often caused by rising flood waters or high winds. These events most commonly occur when wind events knock down power lines or water treatment plants are flooded by rising waters, thereby shutting down these utilities. The impacts from these failures are often widespread and can affect thousands of people even when small areas of this infrastructure are affected.
Terrorism	Terrorism is defined by FEMA as, "the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom." Terrorist acts may include assassinations, kidnappings, hijackings, bomb scares and bombings, cyber attacks (computer-based), and the use of chemical, biological, nuclear and radiological weapons.
Workplace/School/University Violence	The Occupational Safety and Health Administration describes workplace/school/university violence as violence or the threat of violence against workers or students that can occur at or outside of the workplace or school environment. It can range from verbal abuse to physical assaults and homicides, but in the context of this plan, the focus will be on the physical aspect of this violence which can manifest itself in a number of forms including active shooters.

Resource Shortage (Water/Fuel)	A resource shortage occurs whenever supplies of a resource have been depleted to the point that there is very little to none of the resource available to the public. Most commonly resource shortages occur when there has been a steady decrease in the amount of available resource over time, but these shortages can also be the result of a major event that quickly reduces supply.
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2. ASSET INVENTORY

An inventory of geo-referenced assets within Multnomah County and its jurisdictions was compiled in order to identify and characterize those properties potentially at risk to the identified hazards. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, built environment (section 2.1) and social assets (section 2.2) were considered.

2.1. Built Environment Assets

Two categories of physical assets were identified:

1. **Improved Property:** Includes all improved properties in Multnomah County according to local parcel data provided by the county. The information has been expressed in terms of the number of parcels, total assessed value of improvements (buildings), and land use type that may be exposed to the identified hazards. In addition, building footprint data was available for all jurisdictions and it was used to improve the overall assessment by providing an accurate assessment of how many buildings are located in hazard areas. However, it should be noted that building footprint data from all jurisdictions has not been updated since 2008, so it likely underestimates building counts.
2. **Critical Facilities:** Critical facilities vary by jurisdiction and the critical facilities provided by the county are used in this section. It should be noted that this listing is not all-inclusive for assets located in the county, and it is anticipated that it may be expanded or adjusted during future plan updates as more geo-referenced data becomes available for use in GIS analysis.

Table 2 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for jurisdictions within Multnomah County.¹

TABLE 2: IMPROVED PROPERTY IN MULTNOMAH COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Number of Buildings	Total Assessed Value of Buildings
Fairview	2,499	\$896,633,460	2,769	\$508,430,610
Gresham	28,477	\$9,475,669,670	30,614	\$5,770,469,210
Lake Oswego	1,451	\$435,386,650	621	\$305,430,500
Maywood Park	326	\$91,532,100	385	\$53,970,540
Portland	225,262	\$103,453,408,640	232,590	\$65,975,029,740

¹ Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

Location	Number of Parcels	Total Assessed Value of Parcels	Number of Buildings	Total Assessed Value of Buildings
Troutdale	5,008	\$1,743,948,030	5,180	\$972,270,780
Wood Village	859	\$360,335,480	1,233	\$3,455,304,730
Unincorporated Area	9,428	\$5,493,674,920	17,213	\$196,653,810
MULTNOMAH COUNTY TOTAL	273,310	\$121,950,588,950	290,605	\$77,237,559,920

Source: Metro Data Resource Center- Watershed Sciences and Multnomah County Tax Assessors

Additionally, **Table 3** contains a breakdown of parcels based on land use code by jurisdiction.

TABLE 3: PARCELS BY LAND USE CODE IN MULTNOMAH COUNTY

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	1	90	0	2	155	1	1,875	296	79
Gresham	54	1,388	6	26	2,374	48	22,440	1,976	165
Lake Oswego	0	6	0	0	738	0	577	130	0
Maywood Park	0	3	0	0	3	0	304	18	0
Portland	66	14,135	10	185	36,318	524	160,097	12,896	1,031
Troutdale	7	222	1	3	130	8	4,233	388	16
Wood Village	1	75	0	2	152	2	560	65	2
Unincorporated Area	1,129	164	1,372	1	65	1,327	2,895	2,209	266
MULTNOMAH COUNTY TOTAL	1,258	16,083	1,389	219	39,935	1,910	192,981	17,978	1,559

AGR: Agriculture; COM: Commercial; FOR: Forest; IND: Industrial; MFR: Multi-Family Residential; SFR: Single-Family Residential; VAC: Undeveloped; N/A: No Land Use Code Associated with Parcel

Source: Metro Data Resource Center- Multnomah County Tax Assessors

Table 4, Table 5, and Table 6 list the critical facilities located in Multnomah County that were included in this analysis. These facilities were identified as critical facilities in that they are needed to maintain government functions and protect the life, health, safety, and welfare of citizens. Critical facility spatial data was provided by the Multnomah County GIS department, Metro, Oregon Department of Environmental Quality, and the Oregon Spatial Data Library.

In addition, **Figure 1, Figure 2, and Figure 3** show the locations of the primary critical facilities in Multnomah County. A complete list of the critical facilities by name, as well as the hazards that affect each facility, is included in **Table 64**. As noted previously, this list is not all-inclusive and only includes information that was readily available in geospatial format.

TABLE 4: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN MULTNOMAH COUNTY²

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	1	0
Gresham	0	6	1	5	2	3
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	31	11	54	31	17
Troutdale	0	1	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	8	0	1	0	0
MULTNOMAH COUNTY TOTAL	4	44	12	60	35	20

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Licensed Medical Facilities- Oregon Health Authority; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 5: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN MULTNOMAH COUNTY

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	1	1	4	1
Gresham	0	1	0	18	2
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	1	1	31	99	15
Troutdale	1	1	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	1	10	0
MULTNOMAH COUNTY TOTAL	2	6	34	136	19

Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

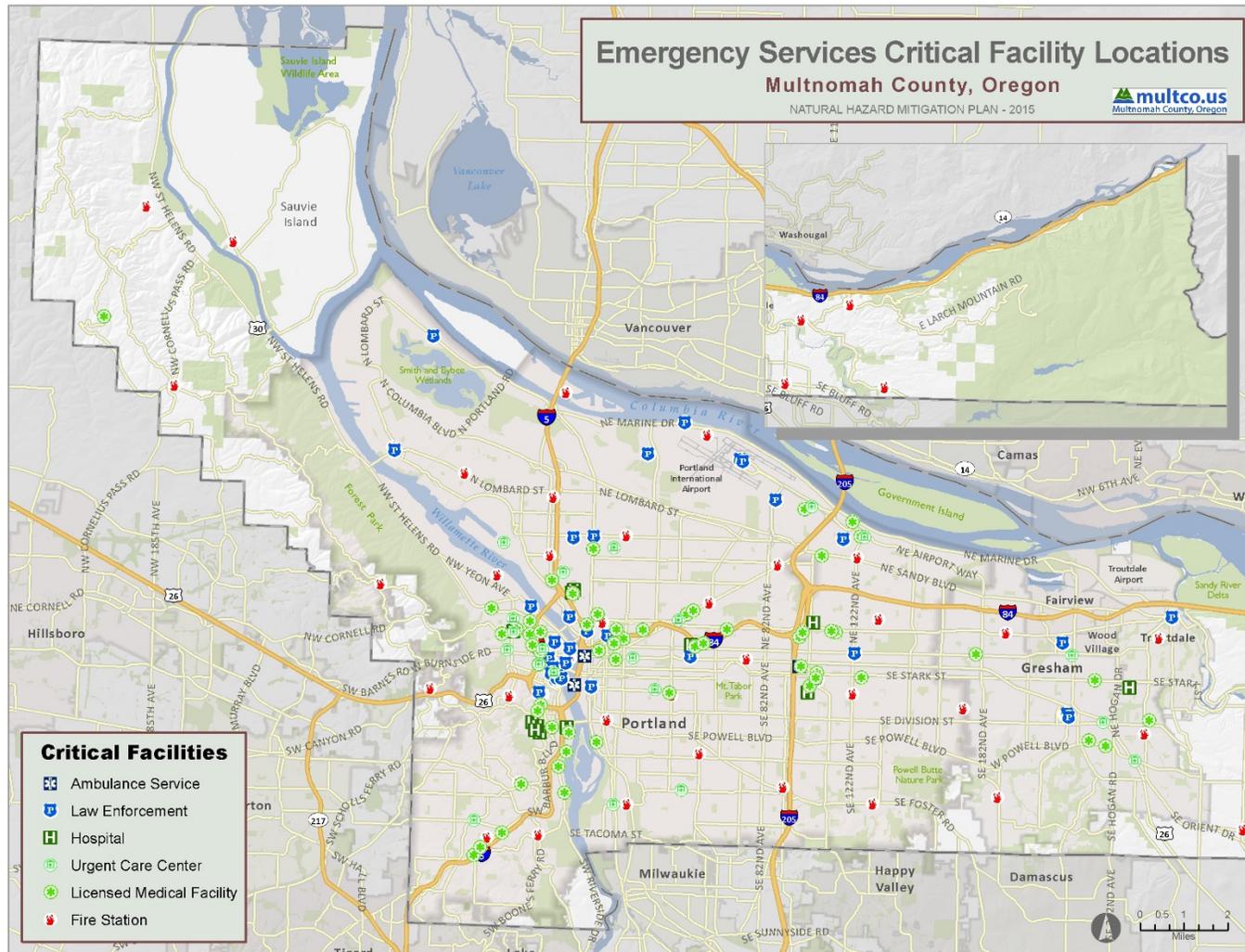
² Emergency Shelters were also identified as a Critical Facility, however, work is currently underway to update the list of these sites, so this information was not included in the current plan with the goal of adding new data to future updates.

TABLE 6: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN MULTNOMAH COUNTY

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	1	0	0	0	11
Gresham	47	0	0	32	55
Lake Oswego	2	0	0	0	4
Maywood Park	2	0	0	0	2
Portland	333	29	2	156	325
Troutdale	5	0	0	3	10
Wood Village	2	0	0	2	0
Unincorporated Area	5	0	0	0	16
MULTNOMAH COUNTY TOTAL	397	29	2	193	423

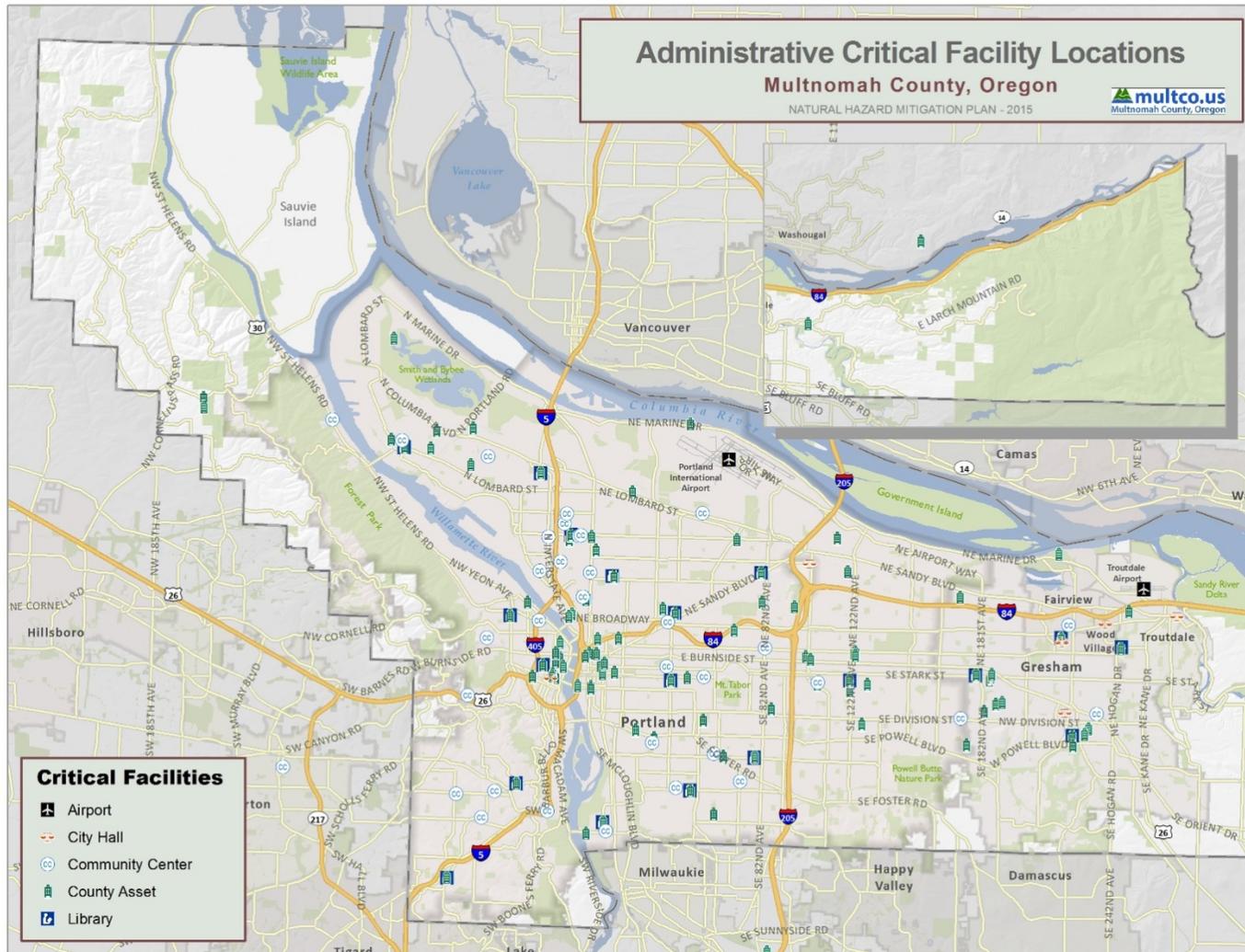
Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

FIGURE 1: EMERGENCY SERVICES CRITICAL FACILITY LOCATIONS IN MULTNOMAH COUNTY



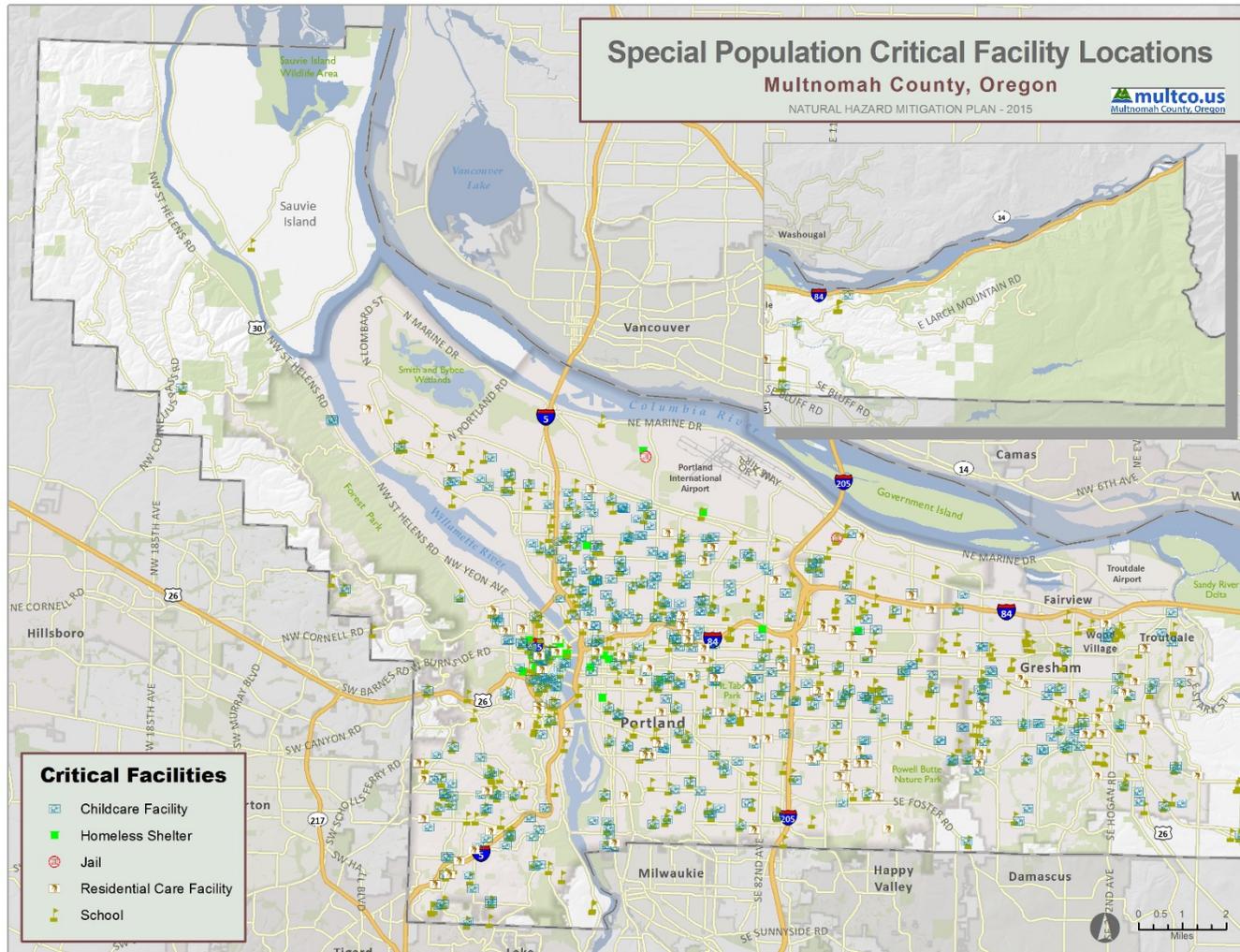
Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

FIGURE 2: ADMINISTRATIVE CRITICAL FACILITY LOCATIONS IN MULTNOMAH COUNTY



Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

FIGURE 3: SPECIAL POPULATION CRITICAL FACILITY LOCATIONS IN MULTNOMAH COUNTY



Sources: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

2.2. Social Vulnerability

In addition to identifying physical assets potentially at risk to identified hazards, it is important to identify and assess the populations in Multnomah County that are potentially at risk to these hazards. For a full assessment of population and socio-economic indicators in the county, refer to the Multnomah County Multi-Jurisdictional NHMP.

Table 7 lists the population by jurisdiction according to 2013 American Community Survey population estimates. The total population in Multnomah County is 747,641 persons.

TABLE 7: TOTAL POPULATION IN MULTNOMAH COUNTY

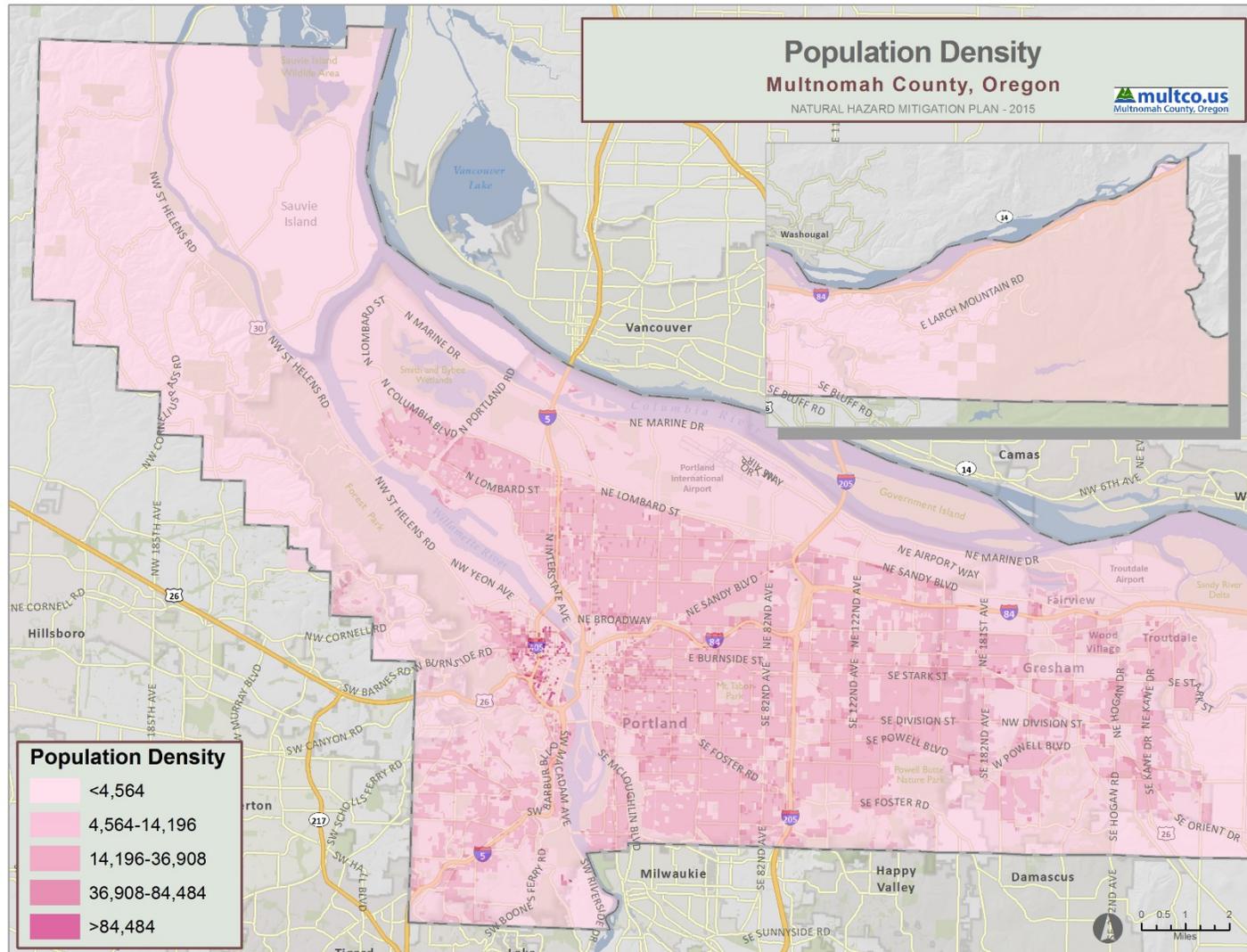
Location	Total 2013 Population Estimate
Fairview	9,003
Gresham	107,196
Lake Oswego	37,037
Maywood Park	939
Portland	594,687
Troutdale	16,188
Wood Village	3,899
MULTNOMAH COUNTY TOTAL	747,641

*The population count of Lake Oswego includes populations residing in neighboring counties. These populations are not included in the Multnomah County total.

Source: American Community Survey

In addition, **Figure 4** illustrates the population density (persons per square mile) by census block as it was reported by the U.S. Census in 2010.

FIGURE 4: POPULATION DENSITY IN MULTNOMAH COUNTY



Source: U.S. Census Bureau, 2010

3. TRANSPORTATION INCIDENT

3.1. Overview

Transportation accidents occur on a daily basis, but generally large-scale incidents that cause major disruptions to regional commerce or mass transit are uncommon. Nevertheless, these incidents can have significant impacts on the community. Multnomah County has experienced incidents involving either airplanes, trains, naval vessels, or automobiles in the past. It is notable that occurrence of minor incidents happens relatively frequently and that events of significant impact are rare. The most common impacts of smaller events are generally on travel time and localized commerce. For larger events, impacts can be longer term on the economy and can potentially cause higher numbers of fatalities and injuries.

Within Multnomah County, one of the most prominent transportation features is the Port of Portland or “Port,” which is an 800-employee, 24/7 operation with more than \$1.6 billion in marine and aviation transportation infrastructure and real estate assets that generate nearly \$250 million in annual revenues. The aviation component is comprised of Portland International Airport (PDX) and two general aviation reliever airports. General Port operations include marine and industrial development, navigation, engineering, and administrative divisions. Portland International Airport (PDX) occupies approximately 3,300 acres within the Northeast Portland Metro Region. The airport’s northern boundary is bordered by the Columbia River and is generally surrounded by businesses, neighborhoods, and industrial parks. PDX is served by three runways, five concourses, and two parking garages.³

Multnomah County is also a major thoroughfare for rail commerce and travel. The Portland light rail line is called the Metropolitan Area Express (or MAX) and passes through the downtown area along four separate lines and serves over 80 stations. Additionally, there are several freight rail lines that pass through the county, most prominently the Union Pacific and BNSF Railroads.

3.2. Historical Occurrences

There have been numerous smaller incidents in Multnomah County. One notable major incident occurred on December 28, 1978 when an airliner crashed in a suburban area of Portland. Although there were a number of survivors of the crash, ten people were killed and many were injured.⁴

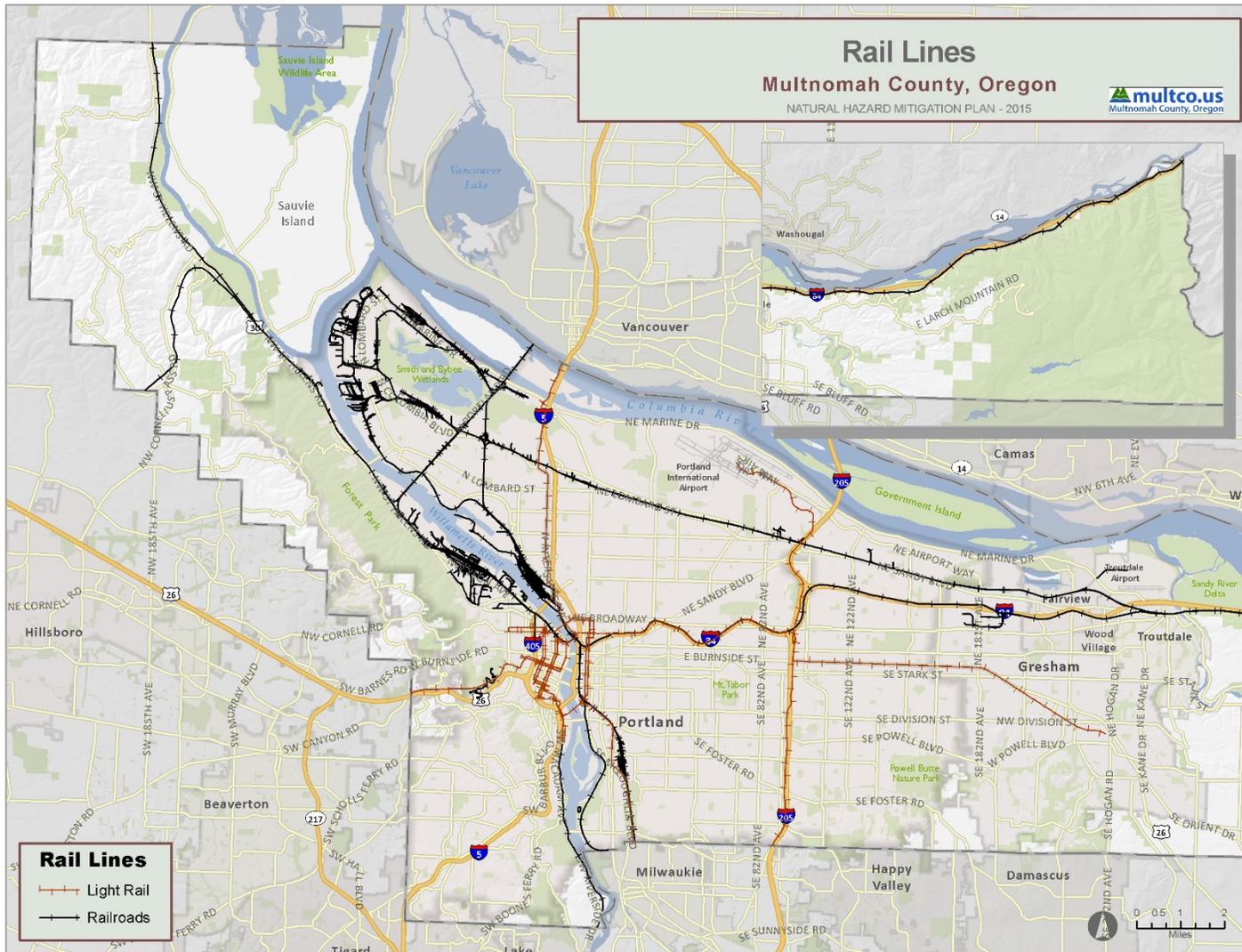
3.3. Location and Spatial Extent

Transportation incidents are most likely to occur along major transportation corridors such as highways, interstates, or railways. **Figure 5** and **Figure 6** show many of the major transportation corridors in the county, thereby demonstrating the areas that are most likely to be impacted by a transportation incident. However, transportation incidents can occur throughout the county, especially given the number of planes that take flight in and out of airports and the widespread transportation infrastructure located throughout the county.

³ PDX Airport Emergency Plan, April 2013.

⁴ The Oregonian. *Portland airliner crash in 1978 killed 10, but changed the way crews are trained*. Retrieved from: http://www.oregonlive.com/history/2014/12/portland_airliner_crash_in_197.html

FIGURE 5: RAIL LINES IN MULTNOMAH COUNTY



Source: Metro Data Resource Center, Multnomah County GIS, Oregon Department of Environmental Quality, Oregon Office of Emergency Management

FIGURE 6: MAJOR ARTERIALS IN MULTNOMAH COUNTY



Source: Metro Data Resource Center, Multnomah County GIS

3.4. Probability of Future Occurrence

Transportation incidents are a highly likely event given that automobile accidents occur nearly every single day. However, these smaller-scale transportation incidents would have a relatively low impact overall on the community. That said, transportation incidents are fairly common and the probability of a major future occurrence is high.

4. HAZARDOUS MATERIALS INCIDENT

4.1. Overview

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to property and the environment in varying degrees. This subsection on hazardous material incidents is intended to provide a general overview of the hazard. The threshold for identifying fixed and mobile sources of hazardous materials is limited to information on rail, highway, and identified fixed HAZMAT sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on roadways, and on the water. Approximately 16,602 HAZMAT events occur each year in the U.S., 14,298 of which are highway incidents, 712 are railroad incidents, and 1,592 are due to other causes.⁵ HAZMAT incidents generally consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days and some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife.

Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine; (3) release of source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.⁶ It should also be noted that HAZMAT incidents can occur as a result of, or in tandem with, natural hazard events, such as floods, high wind events, and earthquakes.

In the proceeding sections, fixed, roadway, and railway hazardous material incidents will be analyzed in terms of its risk in Multnomah County.

⁵ U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, 10 Year Incident Summary Report 2005-2014.

⁶ 42 U.S. Code § 9601. Current through Pub. L. 114-38.

4.2. Fixed Sites- Historic Occurrences

Local information on past HAZMAT incidents was provided by the Oregon Office of State Fire Marshal (OSFM) from 1986 through 2009 and from 2010 through 2015. Since different information was reported for the incidents which occurred between 1986 and 2009 than the incidents which occurred between 2010 and 2015, the incidents cannot be readily combined across the two time periods. It should also be noted that both fixed site incidents and mobile incidents are included in these data sets.

From 1986 to 2009, 2,007 incidents were reported in Multnomah County. These incidents resulted in almost \$20.8 million (2015 dollars) in total losses (including vehicle and cargo as well as fixed property losses).⁷ **Table 8** presents a summary of these incidents and **Table 9** identifies the causes of incidents by jurisdiction.

TABLE 8: SUMMARY OF HAZMAT INCIDENTS IN MULTNOMAH COUNTY (1986-2009)

Location	Number of Occurrences	Vehicle and Cargo Loss (2015 Dollars)	Fixed Property Loss (2015 Dollars)	Total Loss (2015 Dollars)
Fairview	5	\$593	\$269	\$862
Gresham	101	\$310,864	\$97,358	\$408,223
Lake Oswego	0	\$0	\$0	\$0
Maywood Park	0	\$0	\$0	\$0
Portland	1,840	\$5,986,404	\$13,523,520	\$19,509,924
Troutdale	28	\$167,943	\$87,843	\$255,786
Wood Village	5	\$288,768	\$0	\$288,768
Unincorporated Area	28	\$330,877	\$5,088	\$335,965
MULTNOMAH COUNTY TOTAL	2,007	\$7,085,450	\$13,714,078	\$20,799,528

Note: Some of these occurrences are also accounted for in the PHMSA incident data in Table 9 and Table 10 above.

Source: Oregon Office of State Fire Marshal

⁷ Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. For 2015, the October 2015 monthly index was used.

TABLE 9: HAZMAT INCIDENTS BY CAUSE IN MULTNOMAH COUNTY (1986-2009)

Location	Abandoned	Clandestine Drug Lab	Container Rupture	Derailment	Equipment Malfunction	Excavation	Fire/Explosion	Improper Handling	Improper Storage	Intentional Release	Motor Vehicle Accident	Unknown
Fairview	0	1	0	0	1	0	0	0	0	0	0	3
Gresham	5	25	1	0	0	1	6	0	13	0	3	47
Lake Oswego	0	0	0	0	0	0	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0	0	0	0	0	0	0
Portland	118	400	16	9	18	28	53	22	255	7	69	845
Troutdale	1	4	0	0	1	1	2	0	1	1	3	14
Wood Village	0	1	0	0	1	0	0	0	0	0	2	1
Unincorporated Area	1	7	0	0	2	0	1	1	1	1	4	10
MULTNOMAH COUNTY TOTAL	125	438	17	9	23	30	62	23	270	9	81	920

Note: Some of these occurrences are also accounted for in the PHMSA incident data in Table 26 and Table 27.

Source: Oregon Office of State Fire Marshal

From 2010 to 2015, 506 incidents were reported in Multnomah County.⁸ These incidents resulted in 30 evacuations and 1 injury. **Table 10** presents a summary of these incidents and **Table 11** identifies the types of incidents by jurisdiction.

TABLE 10: SUMMARY OF HAZMAT INCIDENTS IN MULTNOMAH COUNTY (2010-2015)

Location	Number of Occurrences	Number of Evacuations	Deaths / Injuries
Fairview	23	0	0/0
Gresham	282	3	0/0
Lake Oswego	0	0	0/0
Maywood Park	0	0	0/0
Portland	121	25	0/1
Troutdale	65	2	0/0
Wood Village	14	0	0/0
Unincorporated Area	1	0	0/0
MULTNOMAH COUNTY TOTAL	506	30	0/1

Note: Some of these occurrences are also accounted for in the PHMSA incident data in Table 26 and Table 27.

Source: Oregon Office of State Fire Marshal

⁸ Incidents that are identified as biological hazard, confirmed or suspected and biological hazard investigation with no hazardous condition found are not included due to their classification as confidential incident types.

TABLE 11: HAZMAT INCIDENTS BY TYPE IN MULTNOMAH COUNTY (2010-2015)

Location	Carbon Monoxide Incident	Chemical Hazard (no spill or leak)	Chemical Spill or Leak	Combustible/ Flammable Gas/Liquid Condition, Other	Gas Leak (natural gas or LPG)	Gasoline or Other Flammable Liquid Spill	HAZMAT Release Investigation w/no HAZMAT	Oil or Other Combustible Liquid Spill	Refrigeration Leak	Toxic Condition, Other
Fairview	3	0	1	1	4	7	3	3	0	1
Gresham	28	8	19	17	78	47	46	29	6	4
Lake Oswego	0	0	0	0	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0	0	0	0	0
Portland	2	2	41	9	28	14	10	7	0	8
Troutdale	4	3	2	14	13	12	15	1	1	0
Wood Village	1	0	1	1	5	5	1	0	0	0
Unincorporated Area	0	0	1	0	0	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	38	13	65	42	128	85	75	40	7	13

Note: Some of these occurrences are also accounted for in the PHMSA incident data in Table 9 and Table 10 above.

Source: Oregon Office of State Fire Marshal

4.3. Fixed Sites- Location and Spatial Extent

Information on facilities and their locations was provided by the Oregon Office of the State Fire Marshal. This information is collected through the Hazardous Substance Information Survey (HSIS), which is a database that allows the user to search, sort, and filter facilities depending on a number of different variables including hazard class and quantity. As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency (EPA) provides public information on hazardous materials. One facet of the program is to collect information on significant quantities of hazardous chemicals maintained at fixed facilities. These facilities are known as Tier II facilities. According to the HSIS, which is the State of Oregon's system for Tier II reporting, there are 2,022 Tier II facilities in Multnomah County. Public access to HSIS can be obtained by visiting the Oregon Office of State Fire Marshal website.⁹

The purpose of Tier II reporting is to provide state and local officials and the public with specific information on hazardous chemicals present at facilities during the past year. This information can be used for local government personnel training, HAZMAT pre-planning, and local/regional response to spills and releases. In Oregon, the Hazardous Substances Information Survey form is used by businesses and government entities to comply with state and federal Community Right to Know Requirements for the reporting of hazardous substances. Reportable quantities of hazardous substances that are used, stored, manufactured, or disposed of at business and government sites in Oregon are required to be reported annually.

⁹ http://www.oregon.gov/osp/SFM/pages/cr2k_infoavailable.aspx

The Hazard Planning Priority Number (HPPN) used in this analysis is collected from the HSIS database and is an index on a scale of 1 to 15 that identifies the level of severity of a hazardous substance that is located at a facility (see **Table 12**). On this scale, lower numbers represent a higher priority, so a facility with a HPPN of 1 should be considered a higher priority for planning than a facility with a HPPN of 15.

In or within one mile of Multnomah County, there are more than 1,700 facilities that contain substances that are classified as high priority (HPPN 1-5). However, many of these facilities contain relatively small amounts of these substances and some of the substances in the high priority categorization are much less likely to have impacts outside of the facility itself in the event of an incident. **Table 13** includes a breakdown of all of the facilities in Multnomah County that contain each classification of hazardous material (HPPN 1-15) by jurisdiction. It should be noted that many facilities contain materials from multiple hazard classifications and therefore may be counted multiple times. **Figure 7**, **Figure 8**, and **Figure 9** show the locations of these facilities based on the HPPN of chemicals located at each facility.

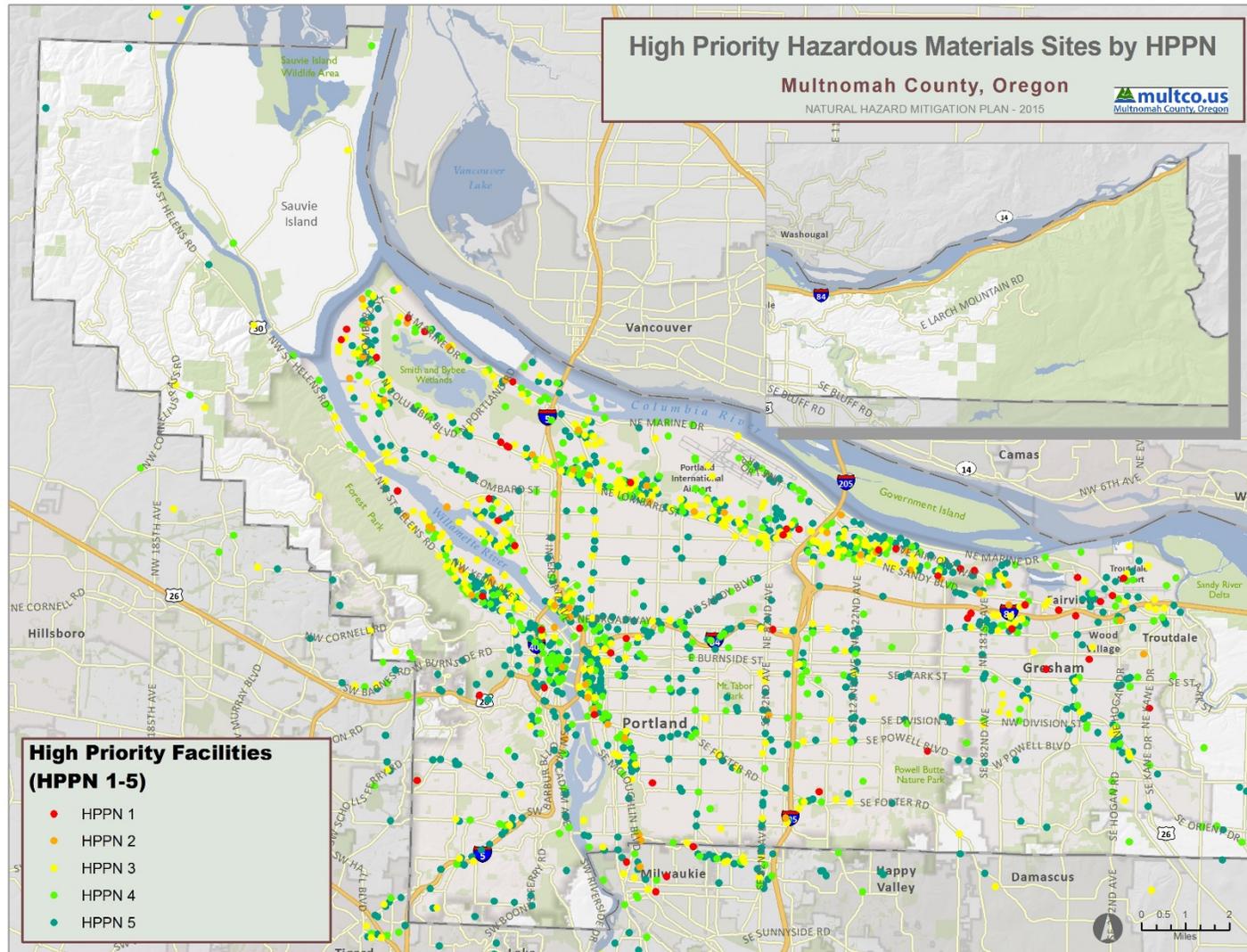
TABLE 12: OFFICE OF STATE FIRE MARSHAL HAZARD PLANNING PRIORITY NUMBERS

	Priority Number	Hazard Class	Hazard Class Description
High Priority	1	2.3	Poisonous Gases
	2	6.1	Poisonous Materials
	3	2.1	Flammable Gases
	4	3.1, 3.2, 3.3	Flammable Liquids
	5	6.3	Acute Health Hazards
Moderate Priority	6	4.1, 4.2, 4.3, 4.4	Flammable Solids, Spontaneously Combustible Materials, Dangerous When Wet, Reactive Materials
	7	1.1, 1.2, 1.3, 1.4, 1.5	Explosives
	8	5.1, 5.2	Oxidizers and Organic Peroxides
	9	4.5	Combustible Materials
	10	8.0	Corrosive Materials
Low Priority	11	6.2, 6.4	Etiologic Materials and Chronic Health Hazard
	12	6.5	Pesticides
	13	7.3	Radioactive Materials
	14	2.2	Non-flammable Gases
	15	9.0	Miscellaneous Hazardous Materials

TABLE 13: SUMMARY OF HAZARDOUS MATERIALS SITES IN MULTNOMAH COUNTY BY HPPN

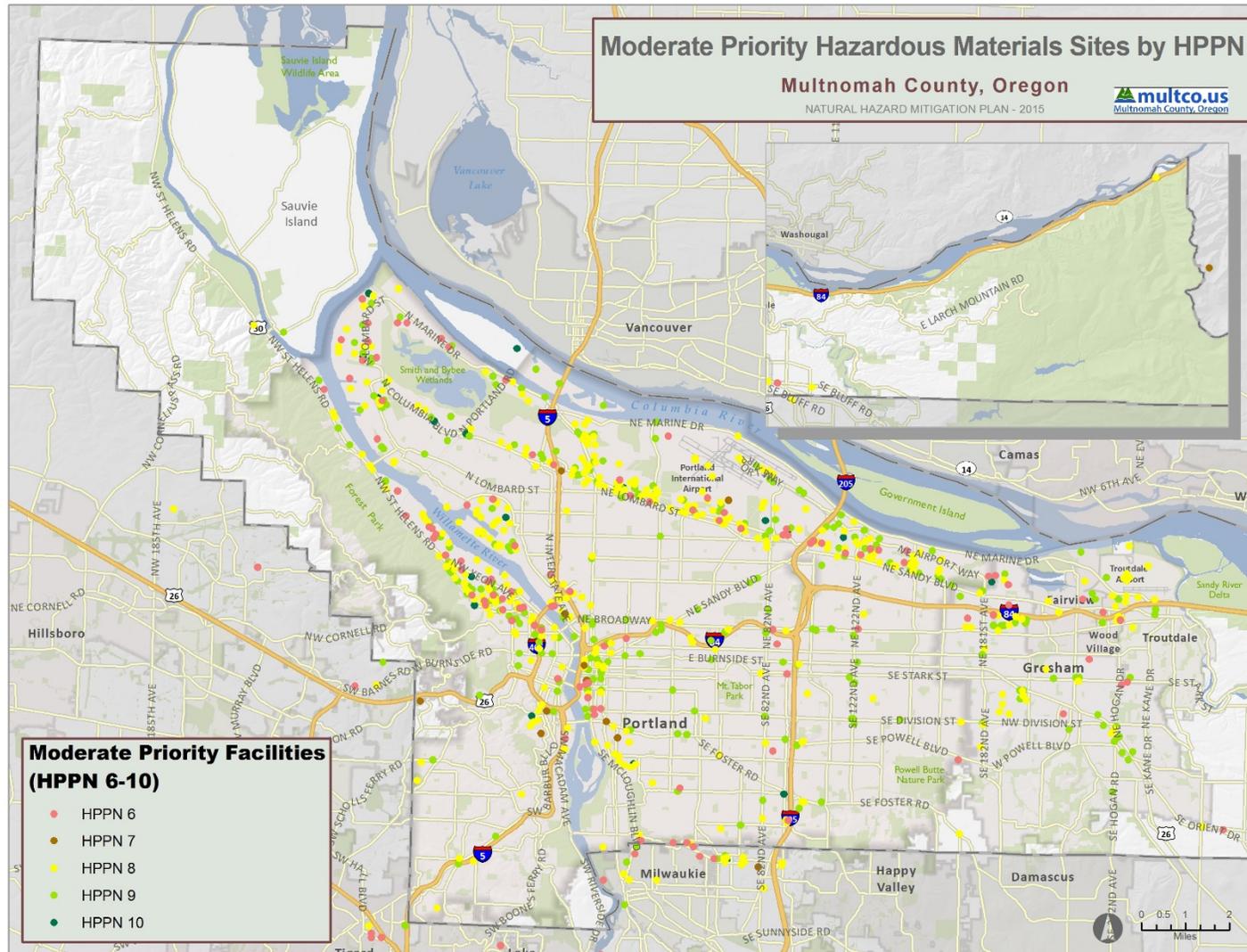
Location	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Class 14	Class 15
Fairview	4	1	5	7	9	1	0	3	4	0	0	0	0	2	2
Gresham	7	5	30	45	106	9	2	25	43	7	5	0	2	27	27
Lake Oswego	0	0	0	4	13	1	0	0	3	0	0	0	0	0	3
Maywood Park	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Portland	36	52	330	496	1,036	91	11	345	373	80	99	6	27	287	245
Troutdale	2	1	10	13	27	0	0	11	8	1	0	0	0	8	4
Wood Village	0	1	1	3	9	2	0	4	3	1	0	0	0	3	1
Unincorporated Area	4	3	45	68	126	12	3	28	15	6	12	2	3	31	28
MULTNOMAH COUNTY TOTAL	53	63	421	636	1,326	116	16	416	449	95	116	8	32	358	310

FIGURE 7: FIXED HAZARDOUS MATERIALS SITES WITH HIGH HPPN



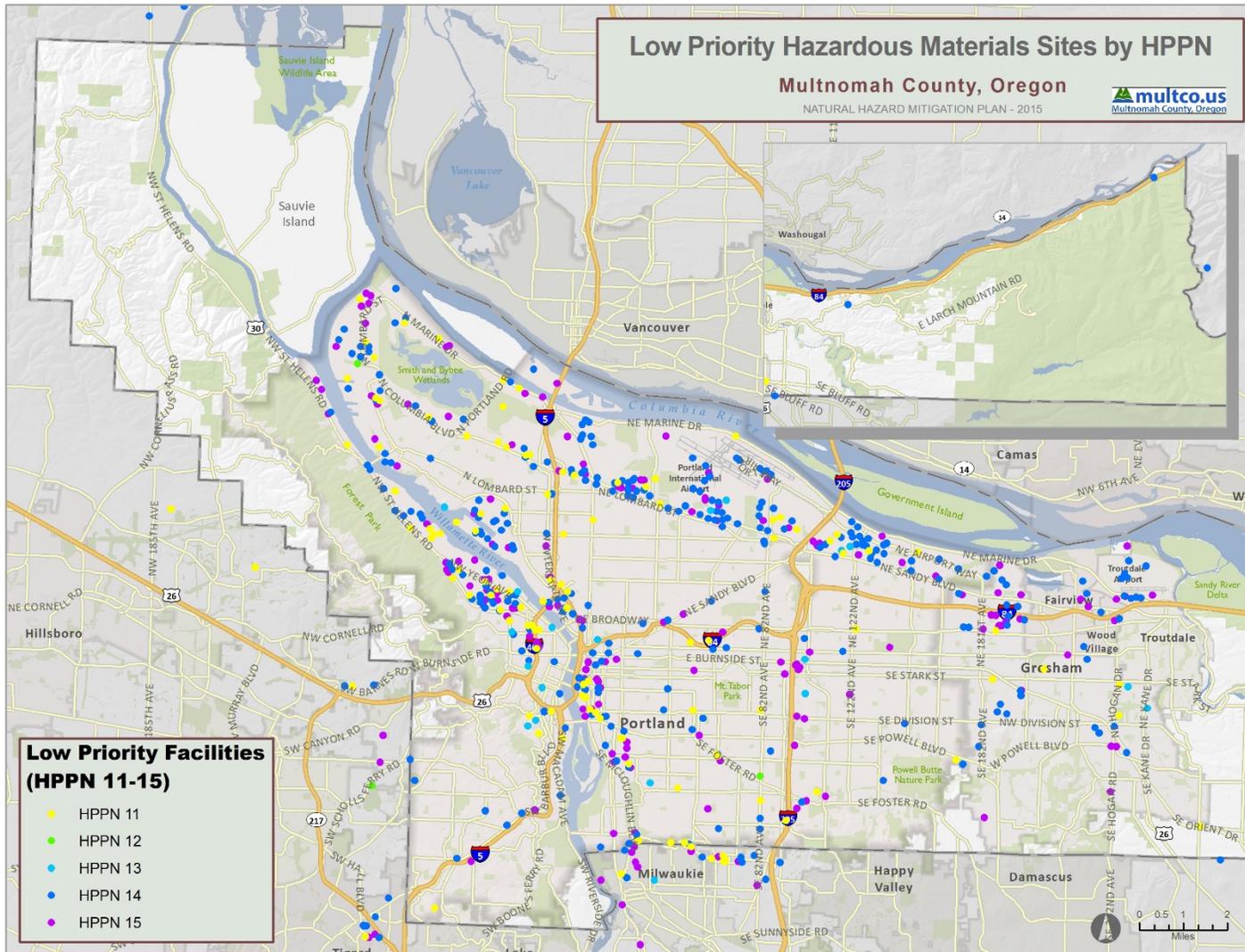
Source: State of Oregon Hazardous Substance Information Survey CR2K

FIGURE 8: FIXED HAZARDOUS MATERIALS SITES WITH MODERATE HPPN



Source: State of Oregon Hazardous Substance Information Survey CR2K

FIGURE 9: FIXED HAZARDOUS MATERIALS SITES WITH LOW HPPN



Source: State of Oregon Hazardous Substance Information Survey CR2K

For the scope of this analysis, it was determined that poisonous gases posed the greatest threat of causing off-site impacts such as injury or fatalities to people since they have a higher likelihood of being dispersed beyond the site on which they are released. Poisonous gas compounds may be respiratory hazards, neurotoxicants, and/or carcinogens. As a result, the release of poisonous gases can cause various health impacts, and there are several factors which can influence the degree of poisoning caused by a chemical. These include route of entry into the body, amount or dose entering the body, toxicity of the chemical, removal from the body, and biological variation.

Acute toxicity, caused by one-time, sudden, high exposures, can result in health effects which may be temporary, including difficulty breathing, nausea, abdominal pain, vomiting, blindness, and mental impairment. Chronic toxicity, caused by repeated exposure day after day over many years, can result in cell damage, disease, or even cancer. Additional information on the impacts of specific poisonous gases is available through the Centers for Disease Control and Prevention website.¹⁰

There are 53 sites in Multnomah County that contain poisonous gases (HPPN=1). The location of these sites is summarized in **Table 14**.

TABLE 14: SUMMARY OF POISONOUS GAS SITES (HPPN=1) IN MULTNOMAH COUNTY

Location	Total
Fairview	4
Gresham	7
Lake Oswego	0
Maywood Park	0
Portland	36
Troutdale	2
Wood Village	0
Unincorporated Area	4
MULTNOMAH COUNTY TOTAL	53

It is also important to note that different sites contain different amounts of each of the gases listed above. Although every facility is potentially susceptible to an incident and any incident can cause negative health impacts, facilities that contain larger volumes of chemicals may experience larger incidents that cause greater impacts to more people.

Information regarding the exact quantity of chemicals stored at each site is considered confidential and thus, was not available for inclusion in this report. However, the number of sites that contain various quantity ranges can be reported and are summarized in **Table 15**. This information is presented in terms of the number of units of gaseous chemical at each site (in gallons or cubic feet).

¹⁰ <http://emergency.cdc.gov/chemical/overview.asp>

TABLE 15: SUMMARY OF POISONOUS GAS SITES (HPPN=1) BY QUANTITY

Number of Units of Volume	Number of Sites
10-19	2
20-49	4
50-199	12
200-499	2
500-999	4
1,000-4,999	17
5,000-9,999	7
10,000-49,999	4
7,500,000-9,999,999	1
Total	53

Despite the fact that a number of facilities contain these poisonous gases, it should be noted that there have been very few incidents of release of these chemicals in Multnomah County (see historical occurrences section above). This can be mainly attributed to the rigorous safety measures that are in place to regulate facilities that contain larger quantities of these chemicals and the precautions taken by facility managers to ensure safe storage and treatment of hazardous substances. Generally, because of the care and attention paid to these substances, the risk of a spill or release under normal conditions is very low.

Of more concern for local emergency management and response officials is the potential for a release that results from another hazard event such as an earthquake. An earthquake could compromise the integrity of storage tanks or containers, thereby releasing larger quantities of the chemical and creating a public health emergency. This would be especially challenging for local officials because the quick and unpredictable onset of earthquakes could make it difficult to respond to and prepare for the size and location of such an event. Response officials can find pertinent information on the health impacts of various chemicals through the National Institute for Occupational Safety and Health's Emergency Response Safety and Health Database.¹¹

4.4. Fixed Sites- Risk Analysis

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed site impact areas with population data, building footprints, and parcels.¹² In this scenario, two sizes of buffers were used to identify potential impact areas for each scenario. These impact areas were selected based on guidance from the PHMSA Emergency Response Guidebook.

For the fixed site analysis, poisonous gas sites were selected for further analysis as these substances were identified as having the potential to cause severe injury or fatalities to those exposed if they were

¹¹ <http://www.cdc.gov/niosh/ershdb/about.html>

¹² This type of analysis will likely yield inflated results (generally higher than what is actually reported after an actual event) because structures or parcels that are on the edge of the identified buffer zones and are only located partially with the projected impact area are counted as if they were completely within the impact area, even though only part of the structure/parcel may be susceptible.

released in an incident. As noted above, poisonous gases were determined to be the most important to analyze because of their potential for causing off-site impacts to human health. Utilizing the Pipeline and Hazardous Materials Safety Administration's (PHMSA) Emergency Resource Guidebook (ERG) criteria, potential impact areas were identified for these sites based on criteria for the most common poisonous gas in Multnomah County and these buffer distances were used for all HPPN=1 sites.¹³

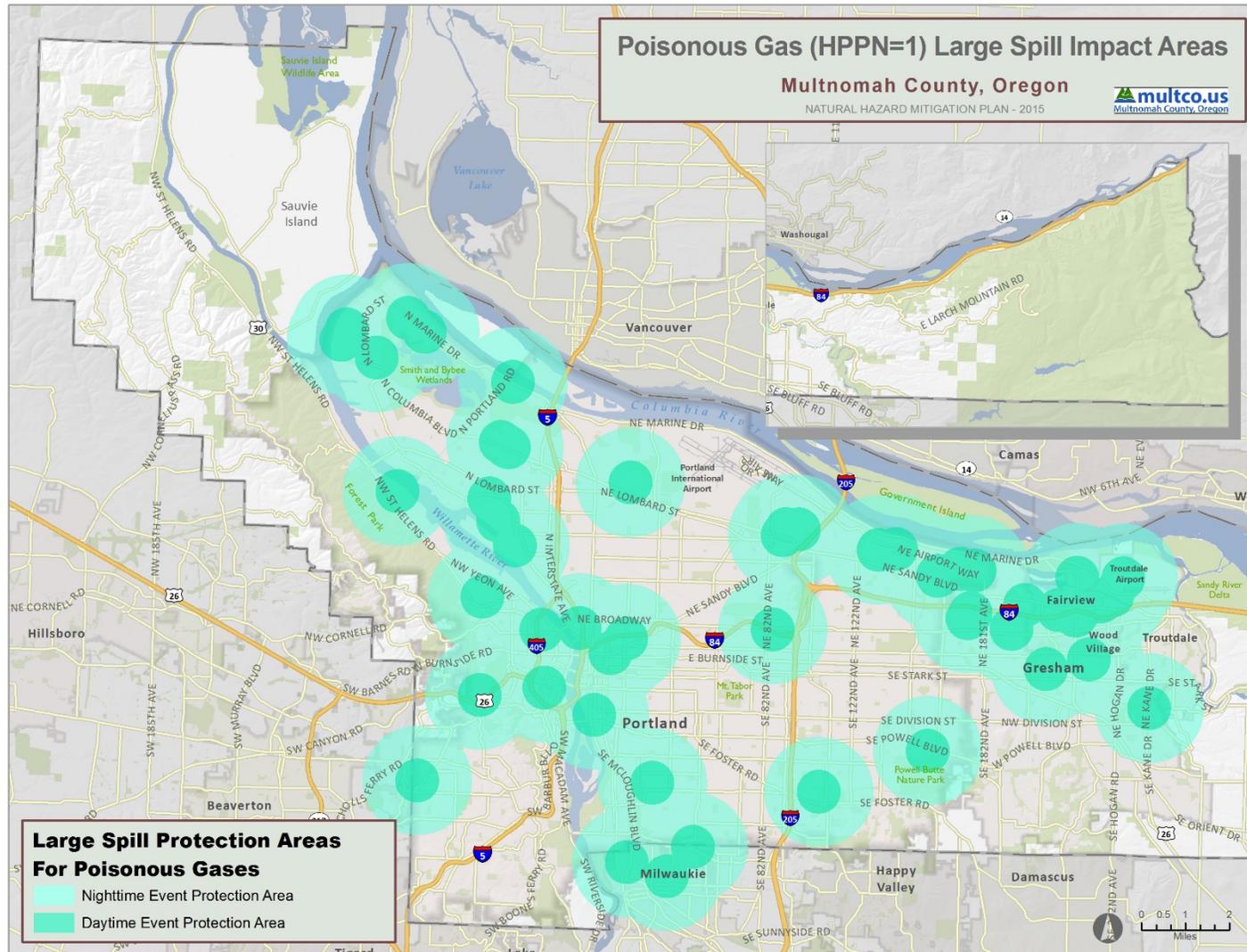
The ERG defines a spill in terms of several criteria, the first of which is the size or quantity of the spill. Small spills are defined as those that release less than 55 gallons of the substance and large spills are defined as those that release more than 55 gallons of the substance.

The second criteria relates to whether the incident takes place during the day (sunrise to sunset) or at night (sunset to sunrise). Hazardous materials incidents that involve poisonous gases are often much more dangerous during nighttime hours because during the day, the ground heats up and creates more turbulence and wind, which ultimately causes toxic gases to disperse more quickly. At night, there is generally less turbulence so a dense cloud of gas can travel further without dispersion.

Based on a review of these criteria, two protective action zones were identified for a poisonous gas chemical release based on the time of day of the spill (see **Figure 10**). According the PHMSA Emergency Response Guidebook, the Protective Action Zone defines an area downwind from an incident in which persons may become incapacitated and unable to take protective action and/or incur serious or irreversible health effects. Although the size of a spill was evaluated as a criterion and small spills can have an impact on people and the surrounding environment, this analysis focuses specifically on large spills for both scenarios, since these would have a much more significant impact on a much larger area. It should be noted that one facility was removed from the large spill analysis because it stores less than 50 gallons of poisonous gas on site. All other facilities store 55 gallons or more.

¹³ It should be noted that specific chemical identities cannot be revealed in this report due to confidentiality restrictions.

FIGURE 10: PROTECTIVE ACTION AREAS FOR A LARGE SPILL OF POISONOUS GAS IN MULTNOMAH COUNTY



Source: State of Oregon Hazardous Substance Information Survey CR2K

Table 16 shows the results of the analysis in terms of the approximate number of parcels/buildings and improved value located within each zone.

TABLE 16: EXPOSURE OF IMPROVED PROPERTY TO LARGE POISONOUS GAS SPILL

Location	Daytime Spill Buffer Area			Nighttime Spill Buffer Area)		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ¹⁴	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ¹⁵
Fairview	2,046	2,384	\$379,773,040	2,468	2,862	\$475,931,460
Gresham	3,245	4,225	\$1,187,395,690	12,744	15,304	\$3,200,571,310
Lake Oswego	0	0	\$0	0	0	\$0
Maywood Park	0	0	\$0	320	378	\$53,100,810
Portland	34,330	24,435	\$17,093,281,030	134,697	134,956	\$46,159,603,590
Troutdale	74	79	\$139,596,140	2,903	3,211	\$656,665,150
Wood Village	212	468	\$106,924,110	848	1,267	\$181,294,850
Unincorporated Area	213	144	\$286,916,640	1,842	1,664	\$1,028,275,240
MULTNOMAH COUNTY TOTAL	40,120	31,735	\$19,193,886,650	155,822	159,642	\$51,755,442,410

Additionally, **Table 17** and **Table 18** contain a breakdown of parcels at risk based on land use code.

TABLE 17: PARCELS LOCATED IN DAYTIME BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	73	0	1	141	1	1,530	223	77
Gresham	6	189	0	22	415	0	2,369	205	39
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0	0	0	0
Portland	14	3,439	0	108	15,184	97	13,347	1,913	228
Troutdale	0	40	0	2	0	0	2	28	2
Wood Village	1	47	0	1	1	0	124	37	1
Unincorporated Area	5	17	0	7	5	3	125	41	10
MULTNOMAH COUNTY TOTAL	26	3,805	0	141	15,746	101	17,497	2,447	357

Source: Metro Data Resource Center- Multnomah County Tax Assessors

¹⁴ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the daytime buffer, since building footprints were not associated with dollar value data.

¹⁵ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the nighttime buffer, since building footprints were not associated with dollar value data.

TABLE 18: PARCELS LOCATED IN NIGHTTIME BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	85	0	1	151	1	1,862	290	78
Gresham	10	845	0	25	1,798	0	9,373	617	76
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	3	0	0	1	0	299	17	0
Portland	39	10,142	0	168	29,684	339	86,202	7,442	681
Troutdale	5	140	0	2	103	6	2,405	232	10
Wood Village	1	73	0	1	150	0	559	62	2
Unincorporated Area	72	48	5	8	67	39	1,218	359	26
MULTNOMAH COUNTY TOTAL	127	11,336	5	205	31,954	385	101,918	9,019	873

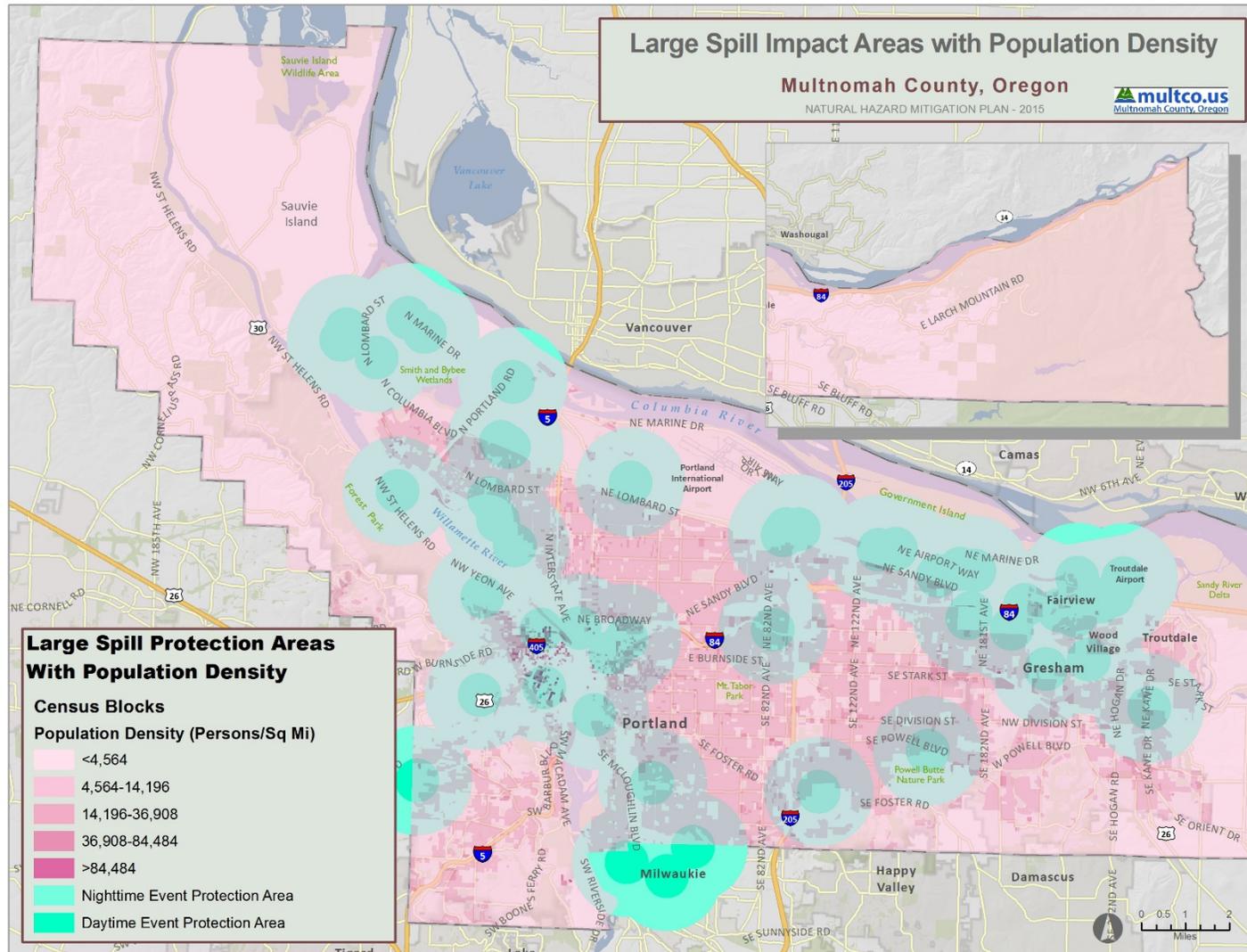
Source: Metro Data Resource Center- Multnomah County Tax Assessors

To determine the population potentially at risk of being impacted by a poisonous gas hazardous materials incident, Census blocks were intersected with the buffer areas described above. The results of this analysis are presented in **Table 19** and **Figure 11**

TABLE 19: COUNTS OF PEOPLE LOCATED WITHIN FIXED SITE BUFFER AREA

Location	Daytime Buffer Area	Nighttime Buffer Area
Fairview	8,470	8,920
Gresham	20,346	60,562
Lake Oswego	0	0
Maywood Park	0	752
Portland	97,384	367,419
Troutdale	5	12,418
Wood Village	2,904	3,878
Unincorporated Area	575	3,974
MULTNOMAH COUNTY TOTAL	129,684	457,923

FIGURE 11: POPULATION DENSITY IN MULTNOMAH COUNTY WITH LARGE SPILL PROTECTION AREAS



Source: U.S. Census Bureau, 2010, State of Oregon Hazardous Substance Information Survey CR2K

Several critical facilities were located within the large spill areas for poisonous gases. There were 849 facilities located within the nighttime protection area. Of these, 224 were located within the daytime protection area. A summary of the number of critical facilities located in each protection area by jurisdiction can be found in **Table 20**, **Table 21**, **Table 22**, **Table 23**, **Table 24**, and **Table 25**. These facilities are shown overlaid on the buffer areas in **Figure 12**, **Figure 13**, and **Figure 14**.

TABLE 20: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN DAYTIME PROTECTION AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	0	0
Gresham	0	1	0	1	0	1
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	0	4	0	18	13	5
Troutdale	0	0	0	0	0	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	0	5	0	19	13	6

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 21: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN DAYTIME PROTECTION AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	0	1	0	0
Gresham	0	0	0	1	0
Lake Oswego	0	0	0	0	0
Maywood Park	0	0	0	0	0
Portland	0	1	4	20	1
Troutdale	0	0	0	0	0
Wood Village	0	0	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	0	1	5	21	1

Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 22: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN DAYTIME PROTECTION AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	1	0	0	0	6
Gresham	5	0	0	4	6
Lake Oswego	0	0	0	0	0

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Maywood Park	0	0	0	0	0
Portland	49	8	0	25	42
Troutdale	0	0	0	0	0
Wood Village	0	0	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	55	8	0	29	54

Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

TABLE 23: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN NIGHTTIME PROTECTION AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	1	0
Gresham	0	3	1	3	2	3
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	18	9	36	22	12
Troutdale	0	0	0	0	0	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	4	21	10	39	25	15

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 24: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN NIGHTTIME PROTECTION AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	1	1	4	1
Gresham	0	1	1	8	0
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	0	1	17	67	7
Troutdale	1	0	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	1	5	19	83	9

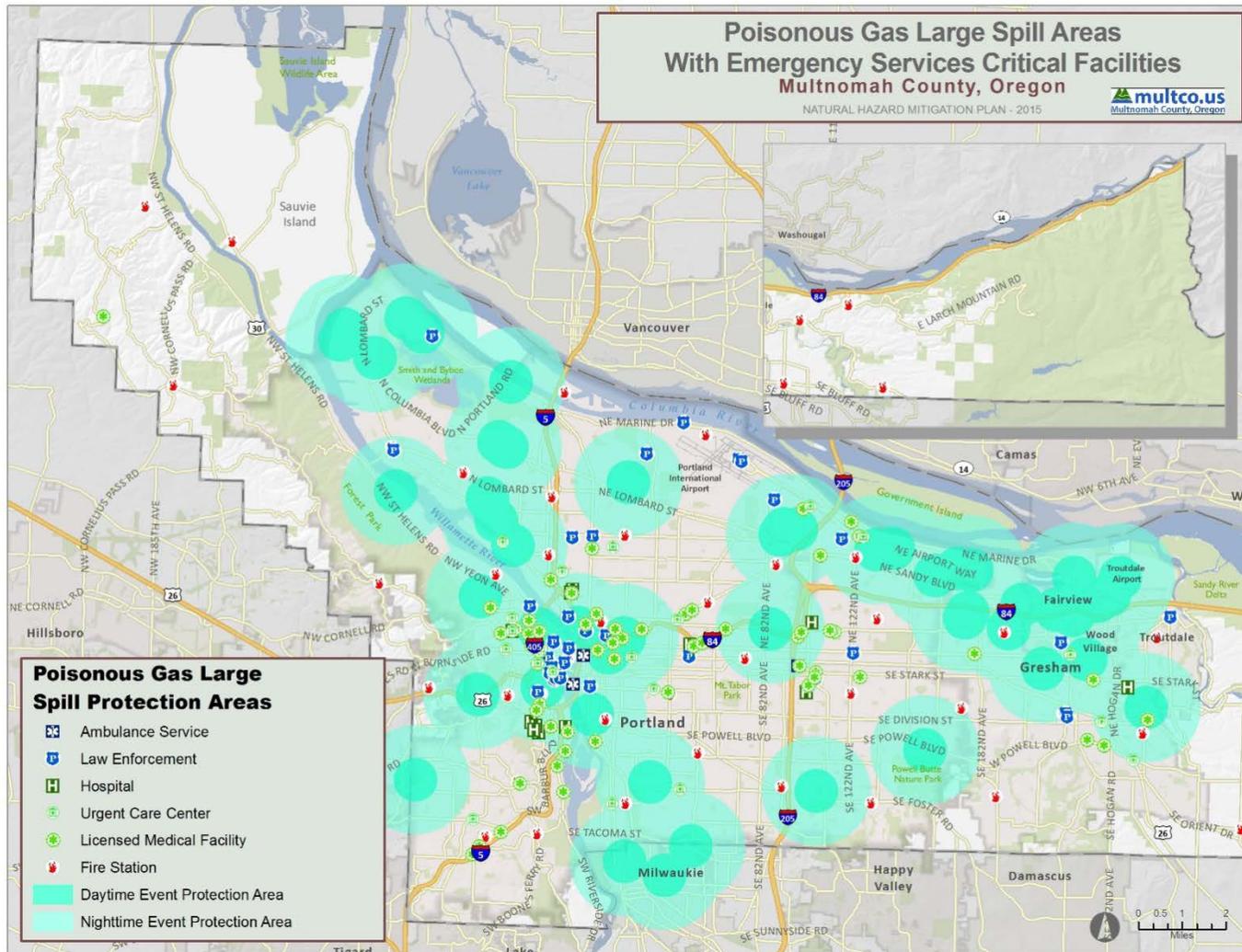
Source: Airports- Metro's Regional Land Information System; Bridges-Multnomah County GIS; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 25: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN NIGHTTIME PROTECTION AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	1	0	0	0	11
Gresham	17	0	0	20	29
Lake Oswego	0	0	0	0	0
Maywood Park	2	0	0	0	2
Portland	197	26	2	91	188
Troutdale	2	0	0	0	9
Wood Village	2	0	0	2	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	221	26	2	113	239

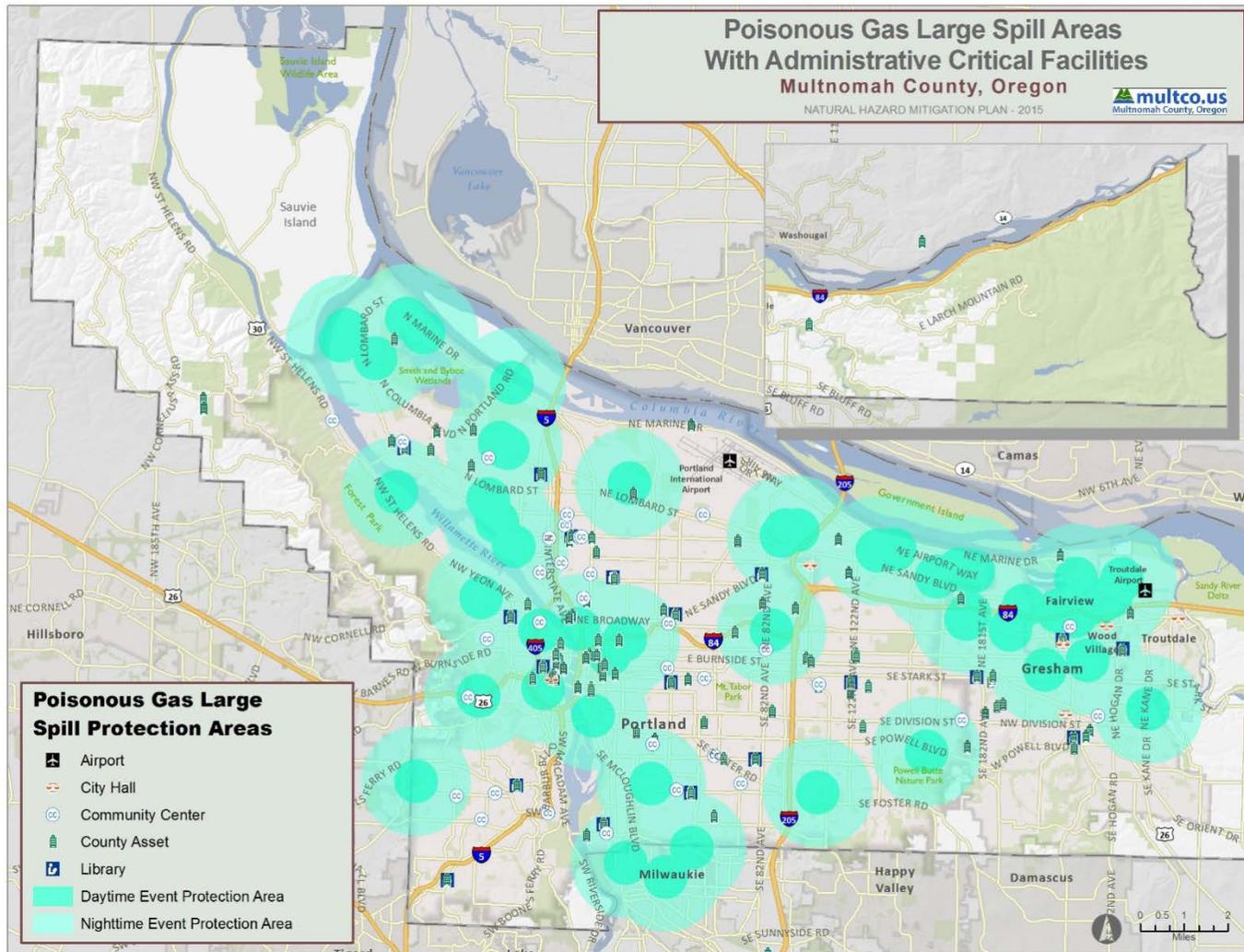
Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

FIGURE 12: EMERGENCY SERVICES CRITICAL FACILITIES WITH POISONOUS GAS LARGE SPILL PROTECTION AREA



Source: State of Oregon Hazardous Substance Information Survey CR2K, Hazardous Substance Information System; Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

FIGURE 13: ADMINISTRATIVE CRITICAL FACILITIES WITH POISONOUS GAS LARGE SPILL PROTECTION AREA



Source: State of Oregon Hazardous Substance Information Survey CR2K; Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

4.5. Mobile Incidents- Historical Occurrences

Many of the mobile incidents that have occurred in the county are outlined in the historic data presented above (in the Fixed Sites sub-section). However, in addition to that local information, the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical mobile occurrences throughout the nation. In this data, a “serious incident” is a hazardous materials incident that involves¹⁶:

- ❖ a fatality or major injury caused by the release of a hazardous material,
- ❖ the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- ❖ a release or exposure to fire which results in the closure of a major transportation artery,
- ❖ the alteration of an aircraft flight plan or operation,
- ❖ the release of radioactive materials from Type B packaging,
- ❖ the release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or
- ❖ the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

There have been a total of 4,983 recorded mobile HAZMAT incidents in Multnomah County since 1971 (**Table 26**). These events resulted in nearly \$3.0 million (2015 dollars) of property damage, 1 fatality, and 99 injuries.¹⁷ **Table 27** presents detailed information on serious HAZMAT incidents in Multnomah County as reported by the PHMSA.

TABLE 26: SUMMARY OF MOBILE HAZMAT INCIDENTS IN MULTNOMAH COUNTY (1971-2015)

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2015 Dollars)
Fairview	1	0/0	\$537
Gresham	3	0/1	\$4,497
Lake Oswego	2	0/1	\$173,197
Maywood Park	0	0/0	\$0
Portland	4,751	1/96	\$2,817,392
Troutdale	88	0/0	\$2,079
Wood Village	1	0/0	\$0
Unincorporated Area	137	0/0	\$1,052
MULTNOMAH COUNTY TOTAL	4,983	1/98	\$2,998,754

Source: United States Department of Transportation Pipeline and Hazardous Materials Safety Administration

¹⁶ Prior to 2002, a hazardous materials “serious incident” was defined as: 1) a fatality or major injury due to a hazardous material, 2) closure of a major transportation artery or facility or evacuation of six or more person due to the presence of hazardous material, or 3) a vehicle accident or derailment resulting in the release of a hazardous material.

¹⁷ Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. For 2015, the October 2015 monthly index was used.

TABLE 27: SERIOUS MOBILE HAZMAT INCIDENTS IN MULTNOMAH COUNTY (1971-2015)

Report Number	Date	City	Mode	Fatalities / Injuries	Property Damage (2015 Dollars)	Quantity Released* (2015 Dollars)
Fairview						
<i>None Reported</i>	--		--	--	--	--
Gresham						
<i>None Reported</i>	--		--	--	--	--
Lake Oswego						
I-1997020875	1/21/1997	LAKE OSWEGO	Highway	0/0	\$173,197	783 LGA
Maywood Park						
<i>None Reported</i>	--		--	--	--	--
Portland						
I-1977050654	4/8/1975	PORTLAND	Highway	0/0	\$0	4,600 LGA
I-1977020468	6/21/1976	PORTLAND	Highway	0/0	\$0	2,231 LGA
I-1976100532	9/28/1976	PORTLAND	Highway	0/0	\$0	4,000 LGA
I-1978031066	1/10/1978	PORTLAND	Rail	0/0	\$0	4 LGA
I-1978031066	1/10/1978	PORTLAND	Rail	0/0	\$0	120 LGA
I-1978031066	1/10/1978	PORTLAND	Rail	0/0	\$0	12 LGA
I-1978051443	5/15/1978	PORTLAND	Highway	0/0	\$0	3,570 LGA
I-1979040503	11/2/1978	PORTLAND	Rail	0/0	\$0	7,000 SLB
I-1979010665	11/16/1978	PORTLAND	Highway	0/0	\$0	300 LGA
I-1978121012	11/20/1978	PORTLAND	Rail	0/0	\$0	7,000 SLB
I-1978120568	11/29/1978	PORTLAND	Rail	0/0	\$0	5,500 SLB
I-1978120566	12/1/1978	PORTLAND	Rail	0/0	\$0	8,000 SLB
I-1978120567	12/6/1978	PORTLAND	Rail	0/0	\$0	7,000 LGA
I-1978121013	12/12/1978	PORTLAND	Rail	0/0	\$0	2,500 SLB
I-1979030296	12/13/1978	PORTLAND	Rail	0/0	\$0	10,000 SLB
I-1980020192	12/27/1979	PORTLAND	Rail	0/0	\$0	13,750 SLB
I-1980020560	2/1/1980	PORTLAND	Highway	0/0	\$0	2,000 LGA
I-1980061521	5/13/1980	PORTLAND	Rail	0/0	\$0	180 LGA
I-1983030261	1/22/1983	PORTLAND	Highway	0/0	\$0	650 LGA
I-1983070221	6/24/1983	PORTLAND	Highway	0/0	\$0	1,431 LGA
I-1983100094	9/14/1983	PORTLAND	Highway	0/0	\$0	1,166 LGA
I-1983120065	11/28/1983	PORTLAND	Highway	0/0	\$0	130 LGA
I-1984020407	1/16/1984	PORTLAND	Highway	0/0	\$0	690 LGA
I-1986120086	11/22/1986	PORTLAND	Rail	0/0	\$0	24,916 LGA
I-1987050002	4/15/1987	PORTLAND	Highway	0/0	\$0	664 LGA
I-1987110108	10/24/1987	PORTLAND	Highway	0/0	\$0	450 LGA
I-1989010122	12/19/1988	PORTLAND	Highway	0/1	\$0	500 LGA
I-1990080588	7/24/1990	PORTLAND	Rail	0/0	\$7,464	800 LGA
I-1991060321	5/17/1991	PORTLAND	Highway	0/0	\$7,233	250 LGA
I-1991080485	8/7/1991	PORTLAND	Highway	0/0	\$18,789	400 LGA
I-1992040082	4/6/1992	PORTLAND	Highway	0/0	\$254	2,400 SLB
I-1992060230	5/30/1992	PORTLAND	Highway	0/0	\$7,462	400 LGA
I-1995020025	1/25/1995	PORTLAND	Highway	0/0	\$0	9,900 LGA
I-1995091476	9/5/1995	PORTLAND	Highway	0/0	\$0	167 LGA

07/25/2017

Report Number	Date	City	Mode	Fatalities / Injuries	Property Damage (2015 Dollars)	Quantity Released* (2015 Dollars)
I-1996041209	3/26/1996	PORTLAND	Highway	0/0	\$2,493	200 LGA
I-1996070135	6/6/1996	PORTLAND	Rail	0/0	\$4,266	325 LGA
I-1996110061	9/9/1996	PORTLAND	Highway	0/0	\$0	150 LGA
I-1997120231	11/8/1997	PORTLAND	Highway	0/0	\$0	0.132086 LGA
I-1998010834	12/2/1997	PORTLAND	Highway	0/0	\$59,523	150 LGA
I-1998101421	9/30/1998	PORTLAND	Highway	0/1	\$432	120.31 GCF
I-2002110265	2/20/2001	PORTLAND	Water	0/0	\$29,884	170 LGA
I-2001091109	8/15/2001	PORTLAND	Highway	0/0	\$3,231	200 LGA
I-2001090241	8/17/2001	PORTLAND	Highway	0/0	\$168	4,827.7402 LGA
I-2002021168	11/30/2001	PORTLAND	Highway	0/0	\$51,055	250 LGA
I-2002060219	5/15/2002	PORTLAND	Air	0/0	\$0	66.139999 SLB
I-2003031047	3/6/2003	PORTLAND	Highway	0/0	\$0	2,000 LGA
I-2005060931	6/2/2005	PORTLAND	Highway	0/0	\$3,826	250 LGA
E-2005080051	7/28/2005	PORTLAND	Highway	0/0	\$0	340 LGA
I-2005090996	8/6/2005	PORTLAND	Rail	0/0	\$20,624	10 LGA
I-2005090996	8/6/2005	PORTLAND	Rail	0/0	\$20,624	20 LGA
I-2007040705	2/20/2007	PORTLAND	Rail	0/0	\$808	7,000 LGA
E-2007080137	7/12/2007	PORTLAND	Highway	0/0	\$1,148	500 LGA
I-2007110559	10/18/2007	PORTLAND	Highway	0/0	\$0	2,000 SLB
I-2008020458	1/15/2008	PORTLAND	Rail	0/0	\$2,599	0.125 LGA
I-2010020266	2/3/2010	PORTLAND	Highway	0/0	\$7,311	11 SLB
I-2011100330	7/24/2011	PORTLAND	Highway	0/0	\$247,666	700 LGA
I-2011080270	7/29/2011	PORTLAND	Highway	0/0	\$0	9 SLB
X-2012020001	1/4/2012	Portland	Rail	0/0	\$16,064	0.26736 GCF
E-2012080540	5/30/2012	PORTLAND	Highway	0/12	\$0	81.375 LGA
I-2012100183	7/16/2012	PORTLAND	Highway	0/1	\$0	54 LGA
E-2013070575	6/29/2013	PORTLAND	Highway	0/0	\$10,214	600 LGA
I-2014080318	8/6/2014	PORTLAND	Highway	0/2	\$0	0.13209 LGA
Troutdale						
I-1977070485	6/16/1977	TROUTDALE	Highway	0/0	\$0	300 LGA
Wood Village						
None Reported	--		--	--	--	--
Unincorporated Area						
None Reported	--		--	--	--	--

*LGA: Liquid Gallons; SLB: Solid Pounds; GCF: Gas Cubic Feet

Source: United States Department of Transportation Pipeline and Hazardous Materials Safety Administration

4.6. Mobile Incidents- Location and Spatial Extent

Many roads in the county are subject to hazardous materials transport and all roads that permit hazardous material transport are considered potentially at risk to an incident. In this analysis, it was determined that all interstates should be analyzed since they are likely to be utilized by a much higher number of vehicles carrying hazardous materials, thereby increasing the chances of an incident. The

Oregon Department of Transportation's (ODOT) Commodity Flow Study¹⁸ on Hazardous Materials, which analyzed Oregon highways over the course of a one year period, shows that over 80% of the hazardous materials trips that occur on highways in the two ODOT districts that cover Multnomah County happen on one of the major interstates. **Table 28** shows the estimated number of trips carrying hazardous materials on Oregon highways over two annual study periods using a sample selection from weigh stations. It should be noted that these estimates likely underestimate the number of trips that occurred since weigh stations are not open 24 hours a day.

Additional information on roads that are likely used frequently for hazardous materials transport was gathered from the Portland Metro Regional Freight Plan 2035. Although the Freight Plan does not specifically identify roads that are used for hazardous materials transport, it does identify major roadways that are highly trafficked. It is likely that more hazardous material transport takes place on these highly trafficked roads. The Freight Plan confirmed the high traffic on interstate routes and also identified several primary and connector roads that were used in this plan's analysis. **Figure 15** shows the major roadways that are utilized in the roadway hazardous materials analysis.

TABLE 28: ESTIMATED NUMBER OF TRIPS CARRYING HAZARDOUS MATERIALS IN ODOT DISTRICTS 2B AND 2C (MULTNOMAH COUNTY)

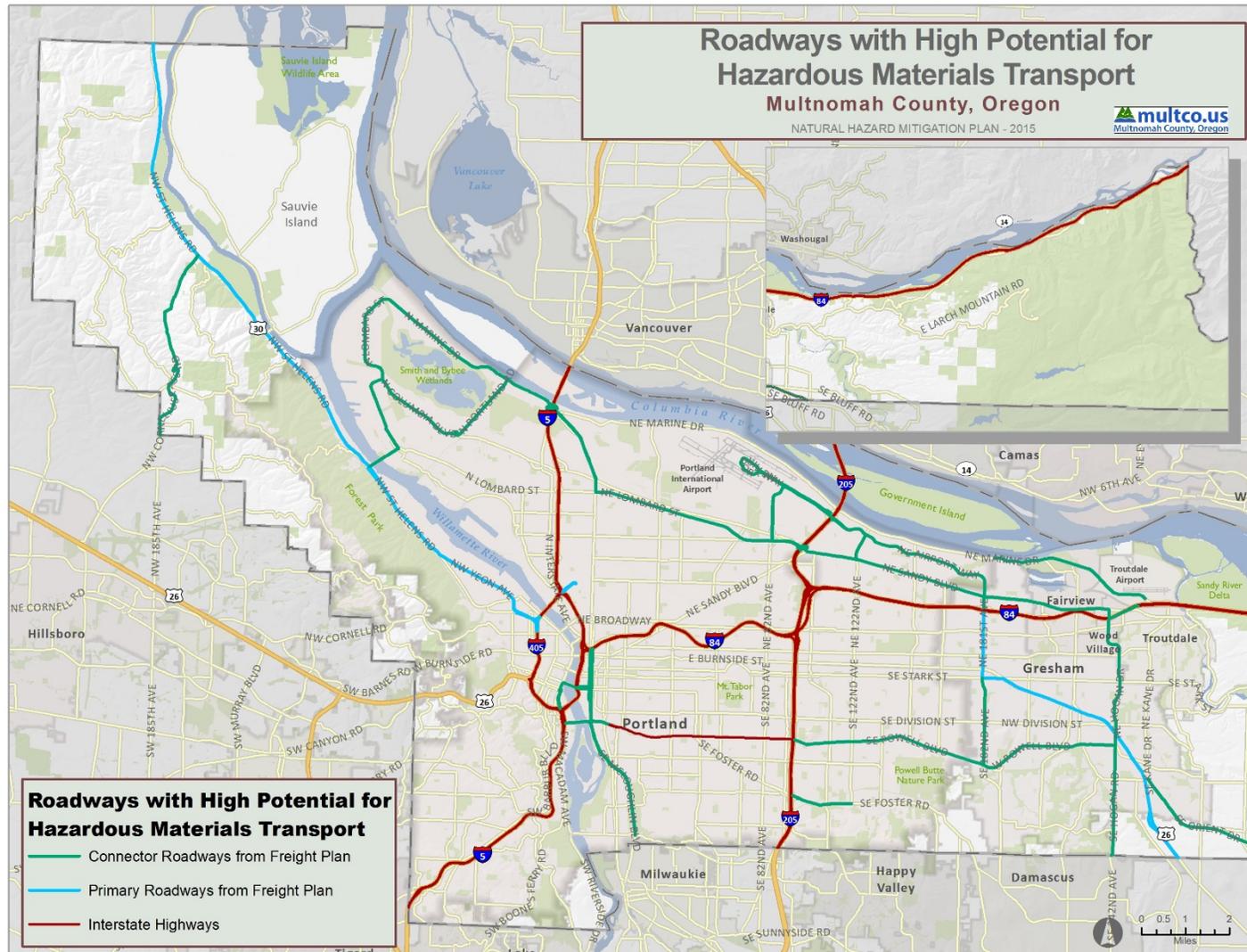
Highway	Estimated Number of Trips 2002-2003	Estimated Number of Trips 2010
District 2B (Western and Central Multnomah County)		
Interstate 5	7,611	7,588
Interstate 405	2,137	2,124
Interstate 84	4,791	3,772
Interstate 205	2,271	2,745
Highway 30	2,546	2,215
Highway 26	404	368
Highway 99E	203	231
Highway 224	174	28
Highway 212	294	60
Highway 99W	52	--
Highway 213	113	--
Highway 30BYP	577	--
District 2C (Eastern Multnomah County)		
Interstate 84	4,691	3,375
Highway 26	527	488
Highway 35	33	15
Highway 211	16	--
Highway 224	31	--
Highway 212	23	--
MULTNOMAH COUNTY TOTAL	26,494	23,009

*Note: The trip counts in this table is inclusive of all trips that occurred on interstates/highways in these ODOT districts, event those outside of Multnomah County.

Source: Oregon Department of Transportation Commodity Flow Study

¹⁸ Oregon Department of Transportation. Procedures and Results of Oregon Department of Transportation Study on the Transportation Patterns of Hazardous Materials in Oregon. November 7, 2011.

FIGURE 15: ROADWAYS WITH HIGHER POTENTIAL FOR HAZARDOUS MATERIALS TRANSPORT IN MULTNOMAH COUNTY

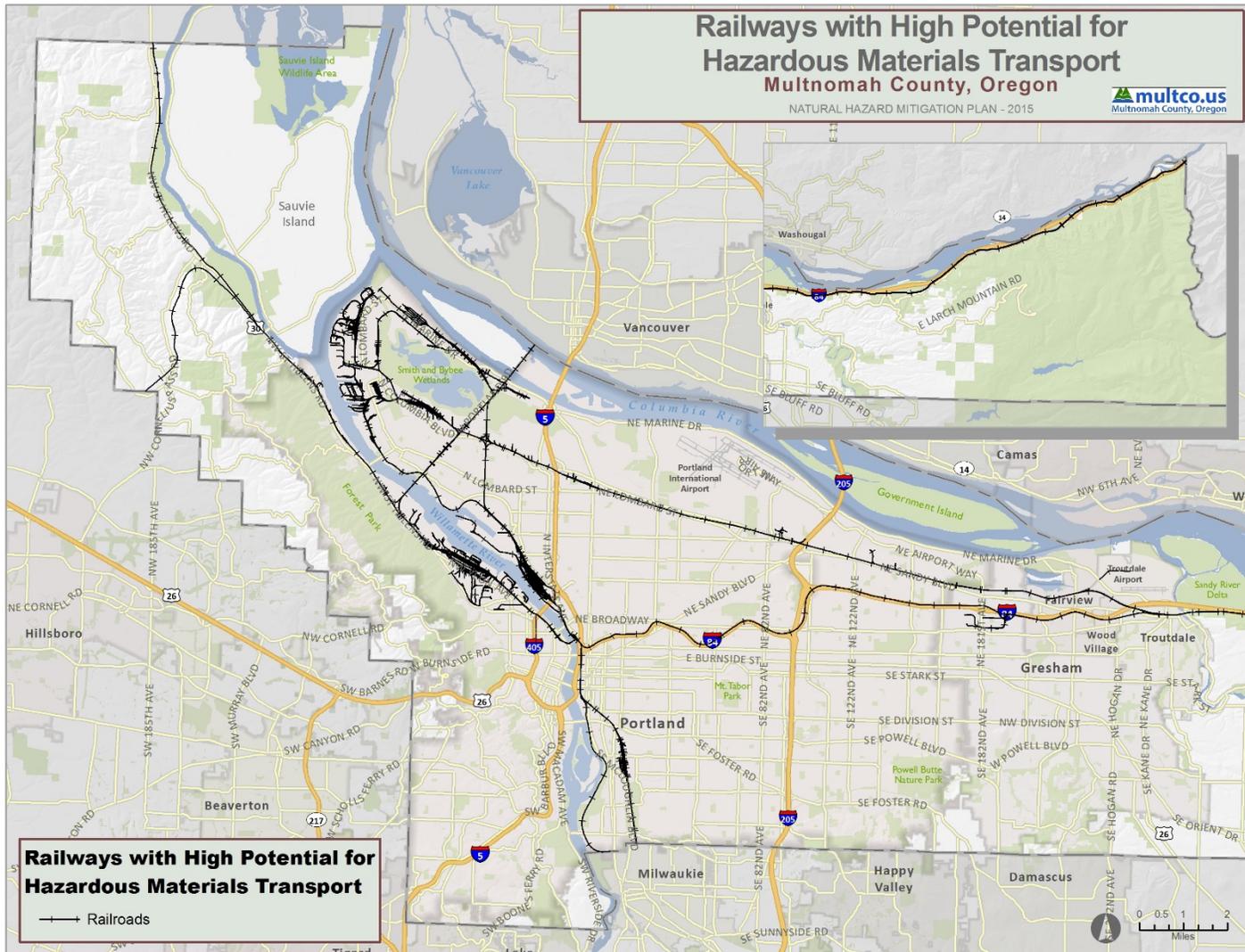


Source: Metro Data Resource Center, Multnomah County GIS, Oregon Commodity Flow Study, Portland Metro Regional Freight Plan 2035

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In addition to roadways, railways also pose a significant threat for hazardous materials release in that many of the same materials that are transported via roads are also transported by rail systems. In general, railroad systems are classified as either heavy or light rail lines, the latter of which are primarily used for passenger transport. Heavy rail lines are often used for both passenger and freight transport, so these lines were identified and used for further analysis. It should be noted that some railways that have been classified as heavy rail lines, such as the Willamette Shore Trolley, Oaks Park Railroad and Washington Park and Zoo Railway, were removed from this analysis because they were known to only carry passengers and would not pose a hazardous materials threat. **Figure 16** shows the major railroad lines that are used in the railways hazardous materials analysis.

FIGURE 16: RAILWAYS WITH HIGHER POTENTIAL FOR HAZARDOUS MATERIALS TRANSPORT IN MULTNOMAH COUNTY

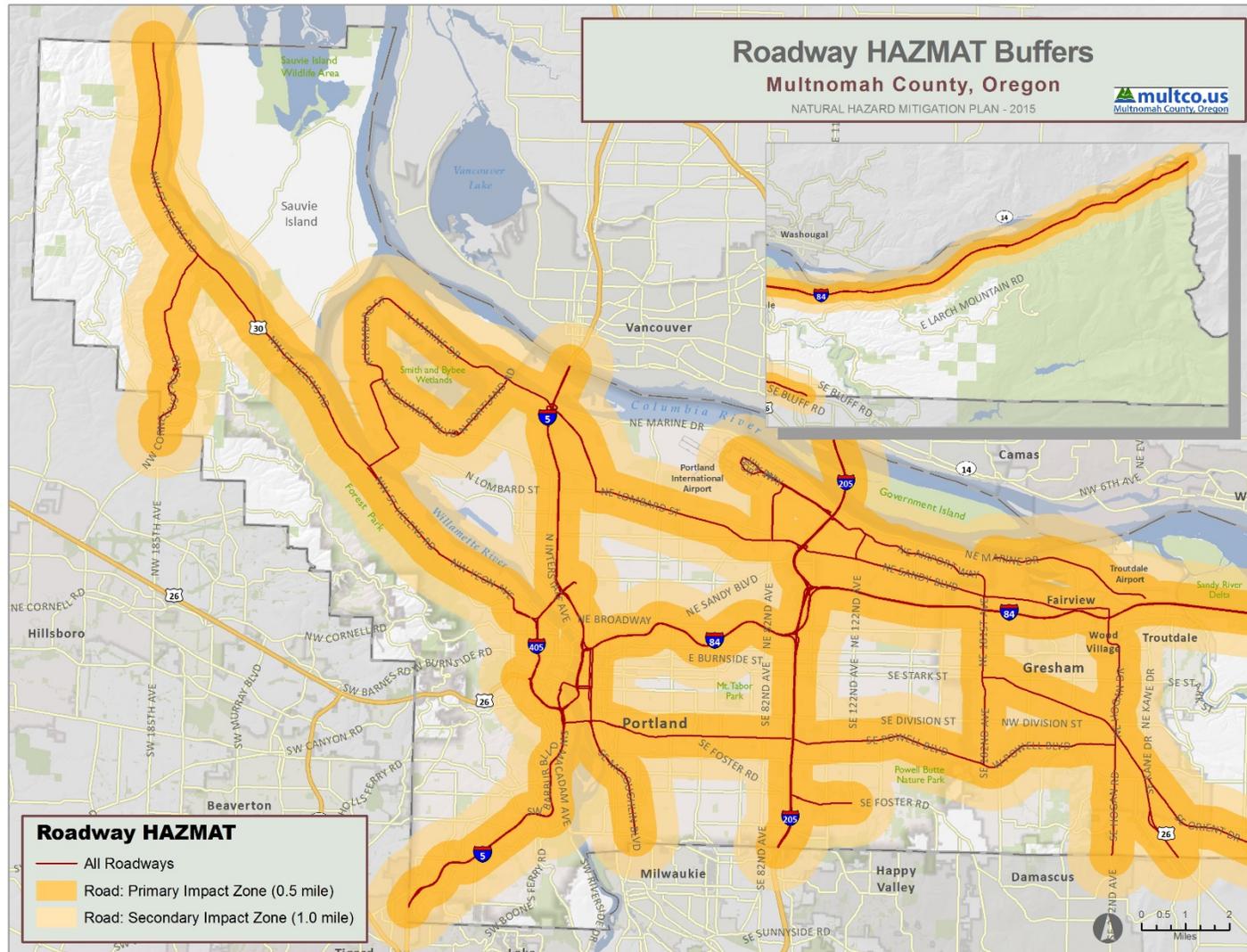


Source: Metro Data Resource Center, Multnomah County GIS, Oregon Department of Transportation

4.7. Mobile Incidents- Risk Analysis

For the mobile analysis, potential impact areas for the major roads (Interstate highways and other roads identified from the Freight Plan) where hazardous materials are most likely to be transported in higher numbers were analyzed. For these roads, buffer areas of 0.5 mile and 1.0 mile were used to estimate areas that may experience impacts or be evacuated due to a HAZMAT incident at a point along the road. **Figure 17** shows the areas used for mobile toxic release buffer analysis for roads. The results of the analysis indicate the approximate number of parcels/buildings and improved value, as shown in **Table 29**.

FIGURE 17: ROADWAY HAZMAT BUFFERS IN MULTNOMAH COUNTY



Source: Multnomah County GIS, Oregon Commodity Flow Study, Portland Metro Regional Freight Plan 2035

**TABLE 29: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL
(MOBILE ANALYSIS - ROAD)**

Location	0.5-mile buffer			1.0-mile buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ¹⁹	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ²⁰
Fairview	2,105	2,481	\$371,292,200	2,468	2,862	\$475,931,460
Gresham	19,393	22,252	\$4,283,788,980	26,652	29,875	\$5,380,045,480
Lake Oswego	0	0	\$0	591	425	\$128,878,040
Maywood Park	325	385	\$53,970,540	325	385	\$53,970,540
Portland	121,446	118,018	\$42,671,628,740	189,733	201,150	\$57,746,375,010
Troutdale	1,218	1,260	\$344,560,790	3,141	3,595	\$730,291,000
Wood Village	836	1,134	\$160,533,460	848	1,267	\$181,294,850
Unincorporated Area	2,895	3,116	\$2,294,710,490	4,267	5,129	\$2,696,787,170
MULTNOMAH COUNTY TOTAL	148,218	148,646	\$50,180,485,200	228,025	244,688	\$67,393,573,550

Additionally, Table 30 and Table 31 contain a breakdown of parcels at risk based on land use code.

TABLE 30: PARCELS LOCATED IN 0.5 MILE BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	71	0	1	143	1	1,560	253	76
Gresham	15	1250	0	25	1,880	4	14,863	1,217	139
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	3	0	0	1	0	304	17	0
Portland	33	10,392	0	167	29,856	317	73,041	6,960	680
Troutdale	1	184	0	2	94	5	731	192	9
Wood Village	1	61	0	1	150	0	559	62	2
Unincorporated Area	213	103	272	6	14	440	739	990	118
MULTNOMAH COUNTY TOTAL	263	12,064	272	202	32,138	767	91,797	9,691	1,024

Source: Metro Data Resource Center- Multnomah County Tax Assessors

¹⁹ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.

²⁰ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-mile buffer, since building footprints were not associated with dollar value data.

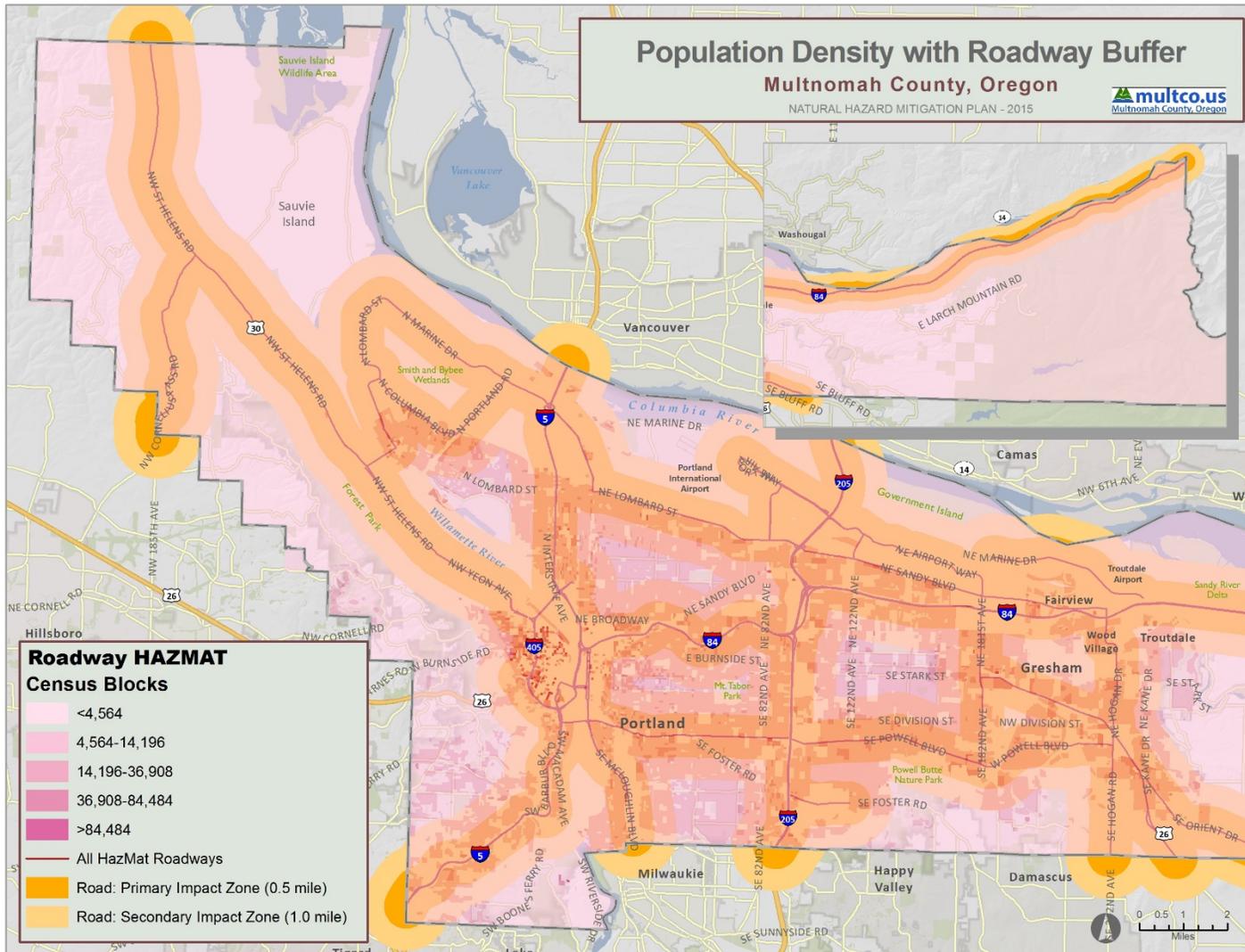
TABLE 31: PARCELS LOCATED IN 1.0 MILE BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	85	0	1	151	1	1,862	290	78
Gresham	28	1,374	3	25	2,371	9	20,951	1,734	157
Lake Oswego	0	0	0	0	168	0	354	69	0
Maywood Park	0	3	0	0	1	0	304	17	0
Portland	44	13,123	0	176	34,494	430	130,288	10,243	935
Troutdale	2	213	0	2	120	7	2,479	304	14
Wood Village	1	73	0	1	150	0	559	62	2
Unincorporated Area	497	137	459	7	35	693	1,035	1,234	170
MULTNOMAH COUNTY TOTAL	572	15,008	462	212	37,490	1,140	157,832	13,953	1,356

Source: Metro Data Resource Center- Multnomah County Tax Assessors

To determine the population potentially at risk of being impacted by a roadway hazardous materials incident, Census blocks were intersected with the buffer areas described above. The results of this analysis are presented in **Table 32** and **Figure 18**.

FIGURE 18: POPULATION DENSITY IN MULTNOMAH COUNTY WITH ROADWAY BUFFER ANALYSIS



Source: U.S. Census Bureau, 2010, Metro Data Resource Center, Oregon Commodity Flow Study, Portland Metro Regional Freight Plan 2035

TABLE 32: COUNTS OF PEOPLE LOCATED WITHIN ROADWAY BUFFER AREA

Location	0.5-mile buffer	1.0-mile buffer
Fairview	8,384	8,920
Gresham	85,611	102,829
Lake Oswego	0	2,050
Maywood Park	752	752
Portland	341,895	505,400
Troutdale	6,209	11,799
Wood Village	3,721	3,878
Unincorporated Area	3,721	8,097
MULTNOMAH COUNTY TOTAL	450,293	643,725

Given high susceptibility across Multnomah County, it is assumed that the entire population is at some risk to roadway hazardous materials incidents. However, it should be noted that people within the identified impact areas are more likely to be impacted and areas of population concentration may be at an elevated risk due to a greater burden to evacuate large populations from a relatively small area.

The critical facility analysis for road corridors revealed that there are 1,224 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads. The 0.5-mile road buffer area includes 902 of those facilities. A summary of the number of critical facilities located in each protection area by jurisdiction can be found in **Table 33, Table 34, Table 35, Table 36, Table 37, and Table 38**. These facilities are shown overlaid on the buffer areas in **Figure 19, Figure 20, and Figure 21**.

TABLE 33: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	0	0
Gresham	0	2	1	3	2	2
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	20	9	44	25	10
Troutdale	0	0	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	3	0	0	0	0
MULTNOMAH COUNTY TOTAL	4	25	10	47	28	12

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 34: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	0	1	3	0
Gresham	0	1	1	18	2
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	1	1	17	69	8
Troutdale	1	1	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	2	5	19	94	11

Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 35: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	0	0	0	0	4
Gresham	40	0	0	26	46
Lake Oswego	0	0	0	0	0
Maywood Park	2	0	0	0	2
Portland	189	0	1	88	181
Troutdale	1	0	0	0	6
Wood Village	2	0	0	2	0
Unincorporated Area	3	0	0	0	3
MULTNOMAH COUNTY TOTAL	237	25	1	116	242

Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

TABLE 36: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	1	0
Gresham	0	4	1	5	2	3
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	29	11	53	28	14
Troutdale	0	1	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	5	0	0	0	0
MULTNOMAH COUNTY TOTAL	4	39	12	58	32	17

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 37: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	1	1	4	1
Gresham	0	1	1	18	2
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	1	1	27	81	12
Troutdale	1	1	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	4	0
MULTNOMAH COUNTY TOTAL	2	6	29	111	16

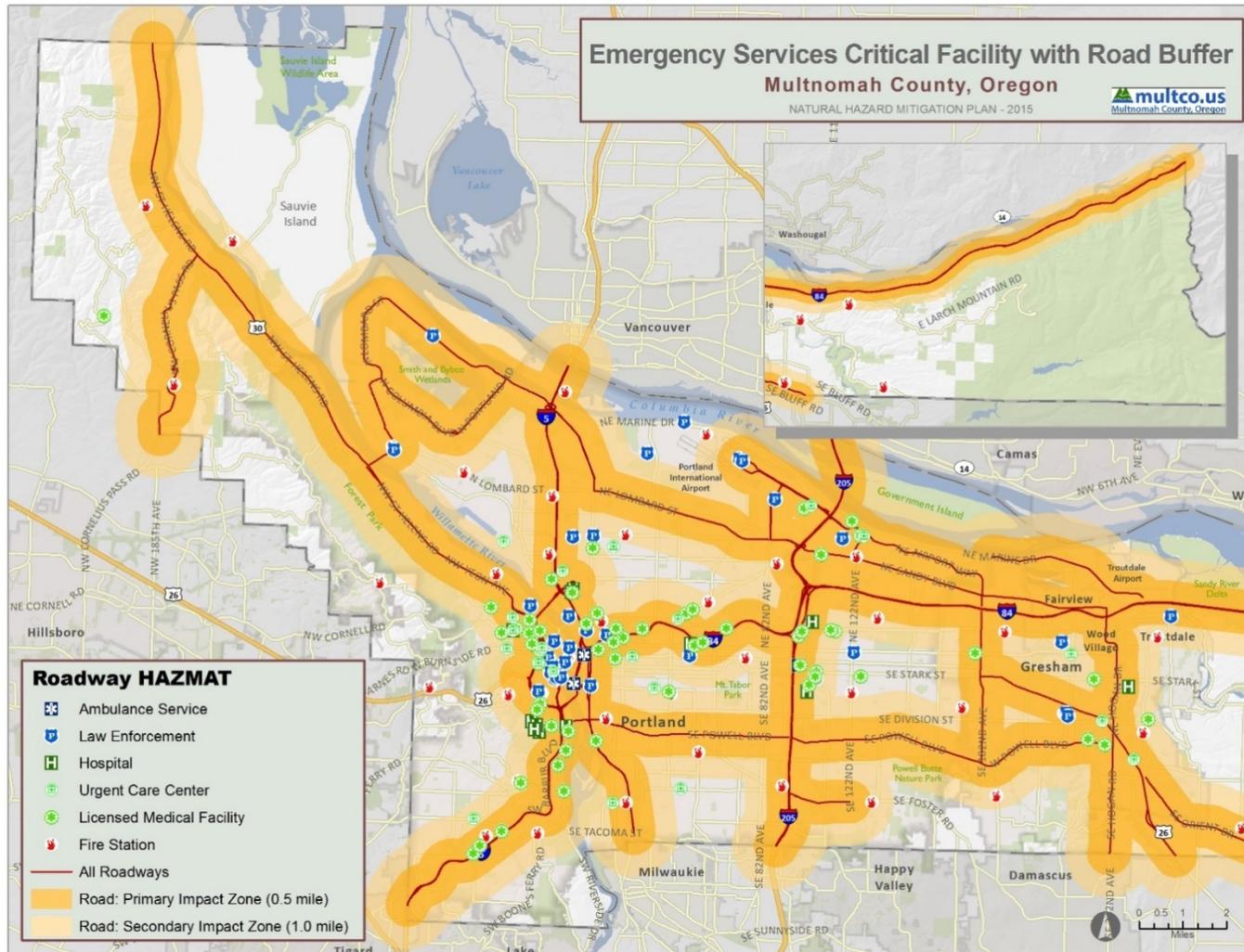
Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 38: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	1	0	0	0	11
Gresham	44	0	0	32	54
Lake Oswego	1	0	0	0	2
Maywood Park	2	0	0	0	2
Portland	274	27	1	130	262
Troutdale	4	0	0	2	8
Wood Village	2	0	0	2	0
Unincorporated Area	3	0	0	0	8
MULTNOMAH COUNTY TOTAL	331	27	1	166	347

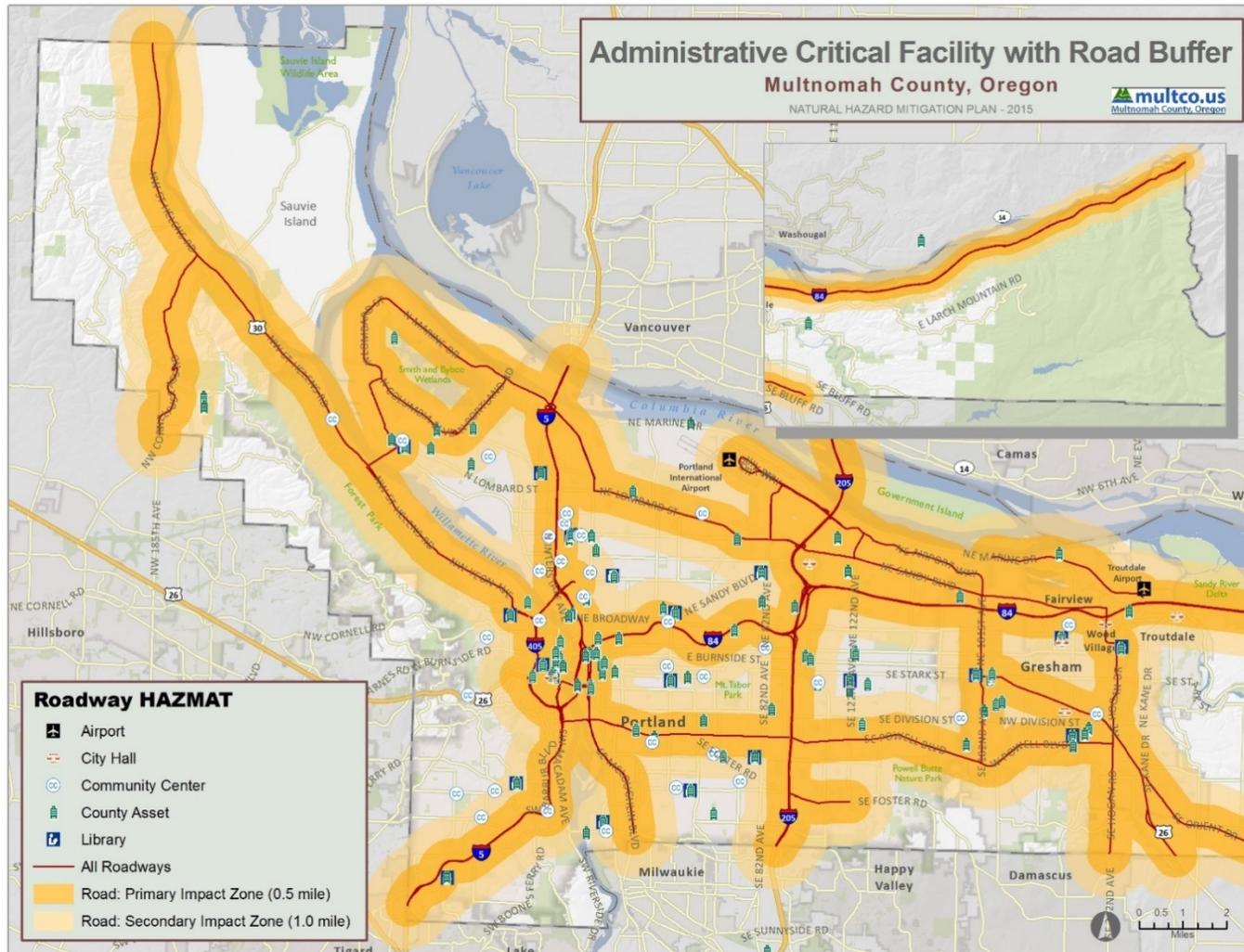
Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

FIGURE 19: EMERGENCY SERVICES CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH ROADWAY BUFFER ANALYSIS



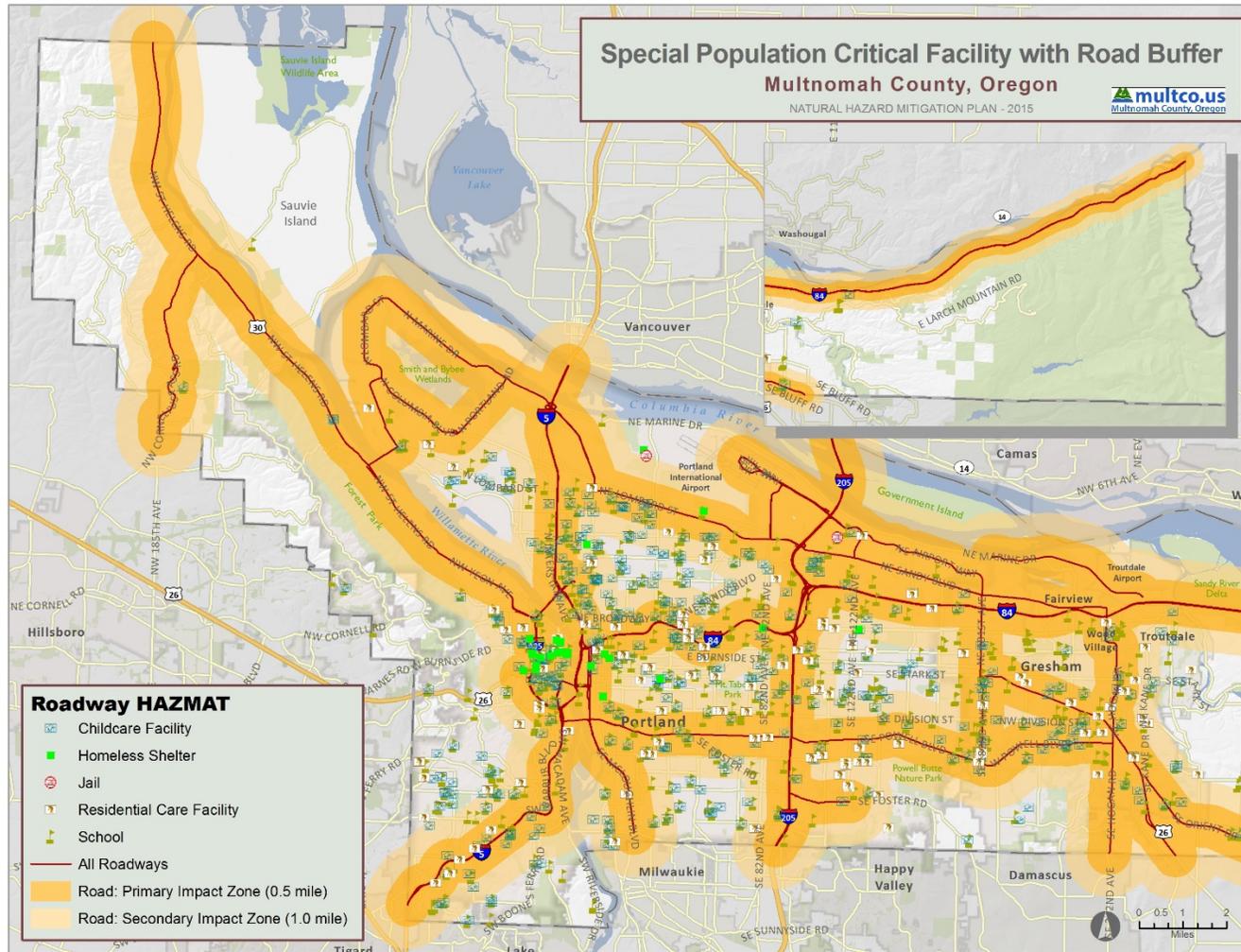
Source: Metro Data Resource Center; Oregon Commodity Flow Study; Portland Metro Regional Freight Plan 2035; Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

FIGURE 20: ADMINISTRATIVE CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH ROADWAY BUFFER ANALYSIS



Source: Metro Data Resource Center; Oregon Commodity Flow Study; Portland Metro Regional Freight Plan 2035; Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

FIGURE 21: SPECIAL POPULATION CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH ROADWAY BUFFER ANALYSIS

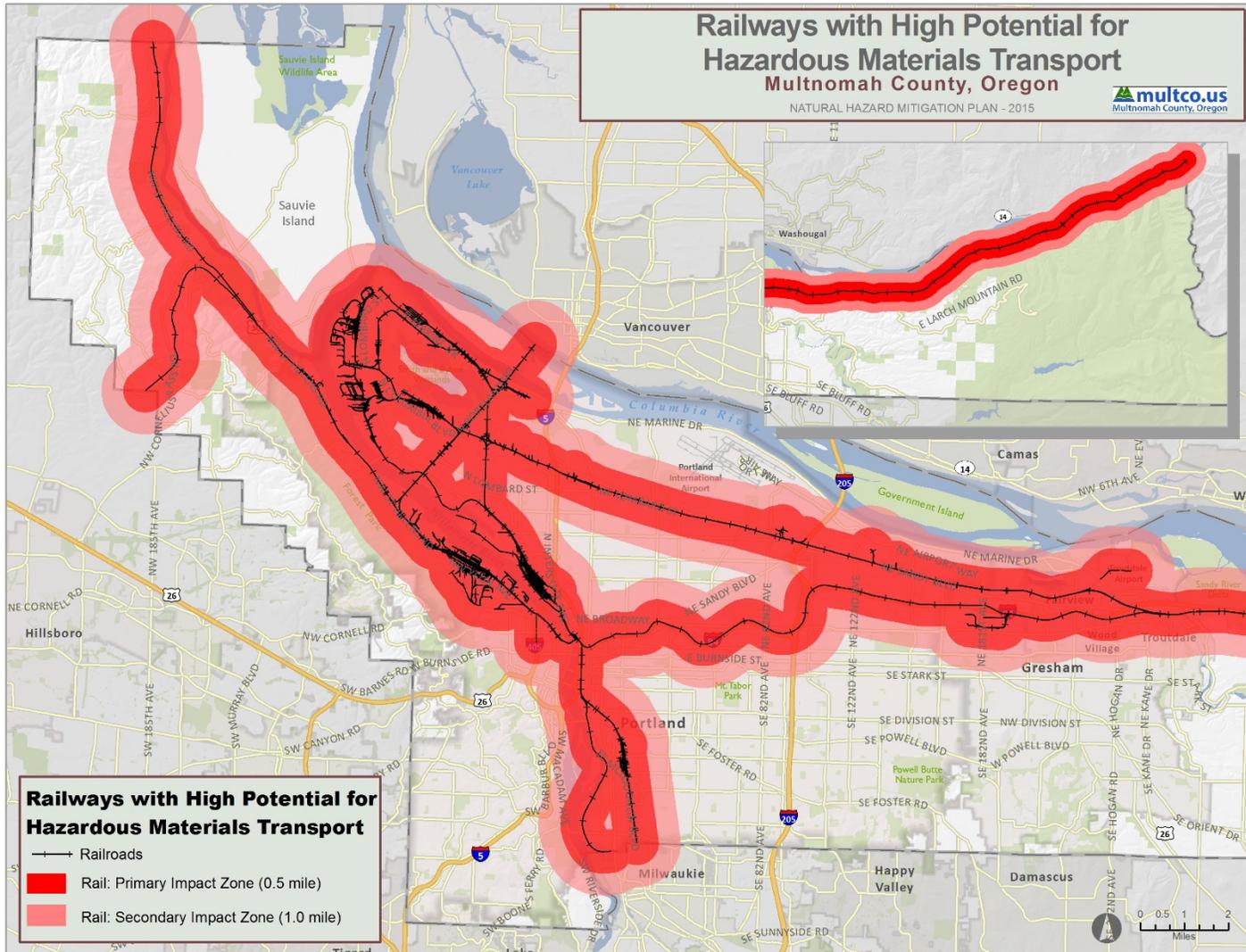


Source: Metro Data Resource Center; Oregon Commodity Flow Study; Portland Metro Regional Freight Plan 2035; Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

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In addition to roadway analysis, the mobile analysis in this plan identified potential impact areas for the major railways where hazardous materials are most likely to be transported in higher numbers were analyzed. For these rails, buffer areas of 0.5 mile and 1.0 mile were used to estimate areas that may experience impacts or be evacuated due to a HAZMAT incident at a point along the rail line. **Figure 22** shows the areas used for mobile toxic release buffer analysis for rails. The results of the analysis indicate the approximate number of parcels/buildings and improved value, as shown in **Table 39**.

FIGURE 22: RAILWAY HAZMAT BUFFERS IN MULTNOMAH COUNTY



Source: Metro Data Resource Center, Multnomah County GIS, Oregon Department of Transportation

**TABLE 39: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL
(MOBILE ANALYSIS - RAIL)**

Location	0.5-mile buffer			1.0-mile buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ²¹	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ²²
Fairview	2,117	2,437	\$385,731,640	2,468	2,862	\$475,931,460
Gresham	1,745	2,433	\$915,599,690	3,908	5,313	\$1,278,592,400
Lake Oswego	0	0	\$0	0	0	\$0
Maywood Park	273	320	\$45,942,940	325	385	\$53,970,540
Portland	77,943	75,129	\$27,480,652,060	129,743	132,962	\$44,962,122,770
Troutdale	989	1,121	\$362,051,670	2,694	3,007	\$634,158,030
Wood Village	597	837	\$105,049,180	848	1,267	\$181,294,850
Unincorporated Area	2,031	1,873	\$1,984,158,810	3,278	3,615	\$2,395,739,910
MULTNOMAH COUNTY TOTAL	85,695	84,150	\$31,279,185,990	143,264	149,411	\$49,981,809,960

Additionally, **Table 40** and **Table 41** contain a breakdown of parcels at risk based on land use code.

TABLE 40: PARCELS LOCATED IN 0.5 MILE BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	75	0	1	148	1	1,563	253	76
Gresham	7	150	0	22	145	0	1,278	129	14
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	3	0	0	0	0	257	13	0
Portland	27	7,441	0	180	20,901	212	44,354	4,323	505
Troutdale	1	169	0	2	95	2	540	172	8
Wood Village	0	52	0	1	110	0	399	34	1
Unincorporated Area	113	56	242	4	9	160	518	862	67
MULTNOMAH COUNTY TOTAL	148	7,946	242	210	21,408	375	48,909	5,786	671

Source: Metro Data Resource Center- Multnomah County Tax Assessors

²¹ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.

²² Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-mile buffer, since building footprints were not associated with dollar value data.

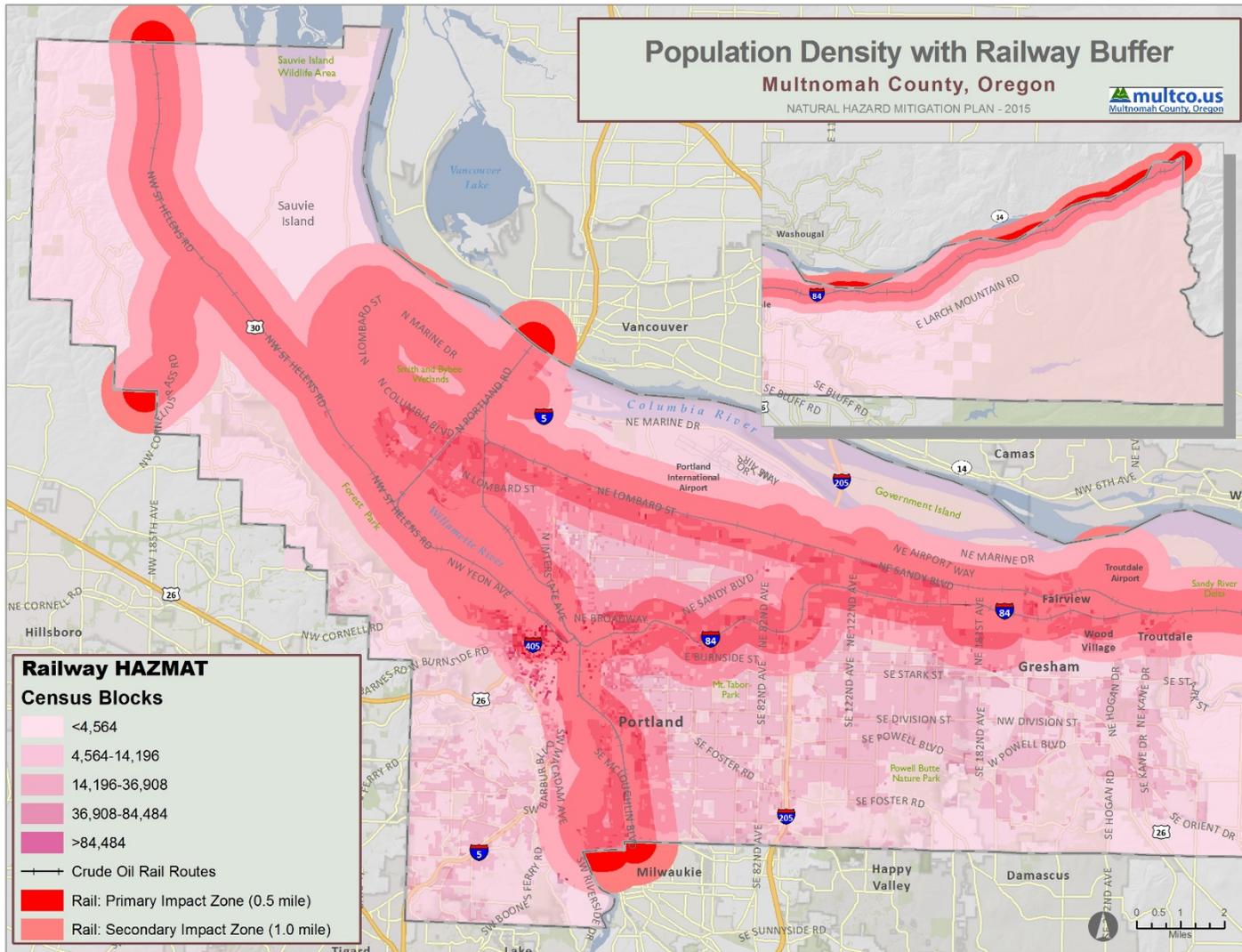
TABLE 41: PARCELS LOCATED IN 1.0 MILE BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	85	0	1	151	1	1,862	290	78
Gresham	8	252	0	24	189	0	3,095	216	24
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	3	0	0	1	0	304	17	0
Portland	28	10,546	0	180	30,168	312	81,506	6,369	634
Troutdale	2	192	0	2	100	6	2,098	285	9
Wood Village	1	73	0	1	150	0	559	62	2
Unincorporated Area	305	78	451	5	30	297	920	1,089	103
MULTNOMAH COUNTY TOTAL	344	11,229	451	213	30,789	616	90,344	8,328	850

Source: Metro Data Resource Center- Multnomah County Tax Assessors

To determine the population potentially at risk of being impacted by a railway hazardous materials incident, Census blocks were intersected with the buffer areas described above. The results of this analysis are presented in **Table 42** and **Figure 23**

FIGURE 23: POPULATION DENSITY IN MULTNOMAH COUNTY WITH RAILWAY BUFFER ANALYSIS



Source: U.S. Census Bureau, 2010, Metro Data Resource Center, Multnomah County GIS, Oregon Department of Transportation

TABLE 42: COUNTS OF PEOPLE LOCATED WITHIN RAILWAY BUFFER AREA

Location	0.5-mile buffer	1.0-mile buffer
Fairview	8,524	8,920
Gresham	9,021	19,207
Lake Oswego	0	0
Maywood Park	714	752
Portland	198,438	329,562
Troutdale	4,321	10,120
Wood Village	3,651	3,878
Unincorporated Area	4,064	6,321
MULTNOMAH COUNTY TOTAL	228,733	378,760

Given high susceptibility across Multnomah County, there is a large portion of the population that may be affected by a railway hazardous materials incident. However, it should be noted that people within the identified impact areas are more likely to be impacted and areas of population concentration may be at an elevated risk due to a greater burden to evacuate large populations from a relatively small area.

The critical facility analysis for rail corridors revealed that there are 800 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for railways. The 0.5-mile rail buffer area includes 499 of those facilities. A summary of the number of critical facilities located in each protection area by jurisdiction can be found in **Table 43**, **Table 44**, **Table 45**, **Table 46**, **Table 47**, and **Table 48**. These facilities are shown overlaid on the buffer areas in **Figure 24**, **Figure 25**, and **Figure 26**.

TABLE A43: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	0	0
Gresham	0	1	0	0	0	0
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	3	11	4	29	15	8
Troutdale	0	0	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	2	0	0	0	0
MULTNOMAH COUNTY TOTAL	3	14	4	29	16	8

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 44: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	0	1	0	1
Gresham	0	0	0	1	0
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	0	0	9	52	5
Troutdale	1	1	0	3	0
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	1	3	10	56	6

Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 45: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 0.5 MILE BUFFER AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	0	0	0	0	5
Gresham	4	0	0	0	3
Lake Oswego	0	0	0	0	0
Maywood Park	2	0	0	0	2
Portland	113	23	1	52	112
Troutdale	2	0	0	0	5
Wood Village	2	0	0	2	0
Unincorporated Area	2	0	0	0	1
MULTNOMAH COUNTY TOTAL	125	23	1	54	128

Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

TABLE 46: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	1	0
Gresham	0	1	0	1	0	1
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	4	19	6	43	22	13
Troutdale	0	1	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	4	0	0	0	0
MULTNOMAH COUNTY TOTAL	4	25	6	44	24	14

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 47: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	1	1	4	1
Gresham	0	0	0	1	0
Lake Oswego	0	0	0	0	0
Maywood Park	0	1	0	0	0
Portland	0	1	19	68	7
Troutdale	1	1	0	4	1
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	1	0
MULTNOMAH COUNTY TOTAL	1	5	20	78	9

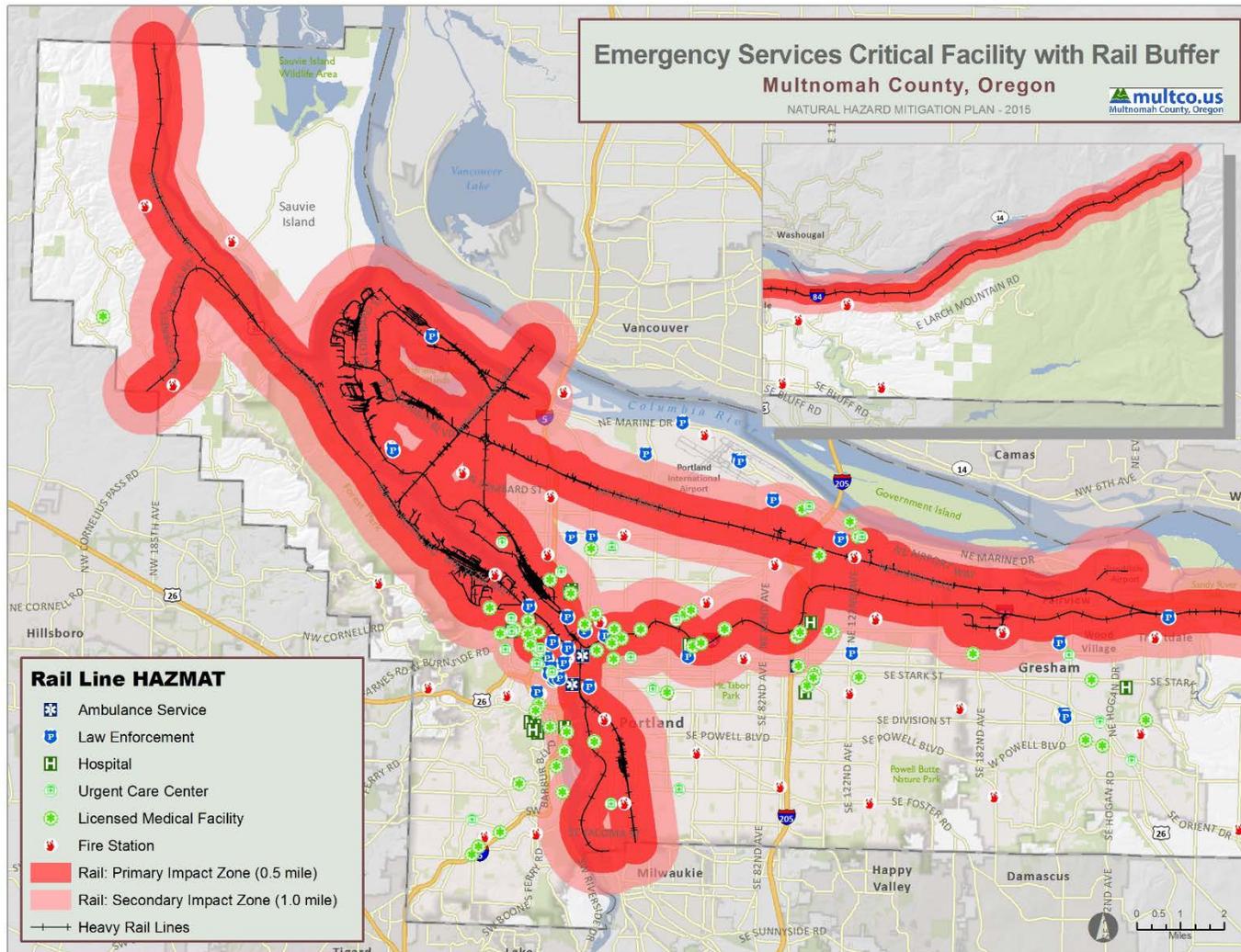
Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 48: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 1.0 MILE BUFFER AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	1	0	0	0	11
Gresham	5	0	0	1	8
Lake Oswego	0	0	0	0	0
Maywood Park	2	0	0	0	2
Portland	206	26	2	81	181
Troutdale	3	0	0	2	6
Wood Village	2	0	0	2	0
Unincorporated Area	2	0	0	0	7
MULTNOMAH COUNTY TOTAL	221	26	2	86	215

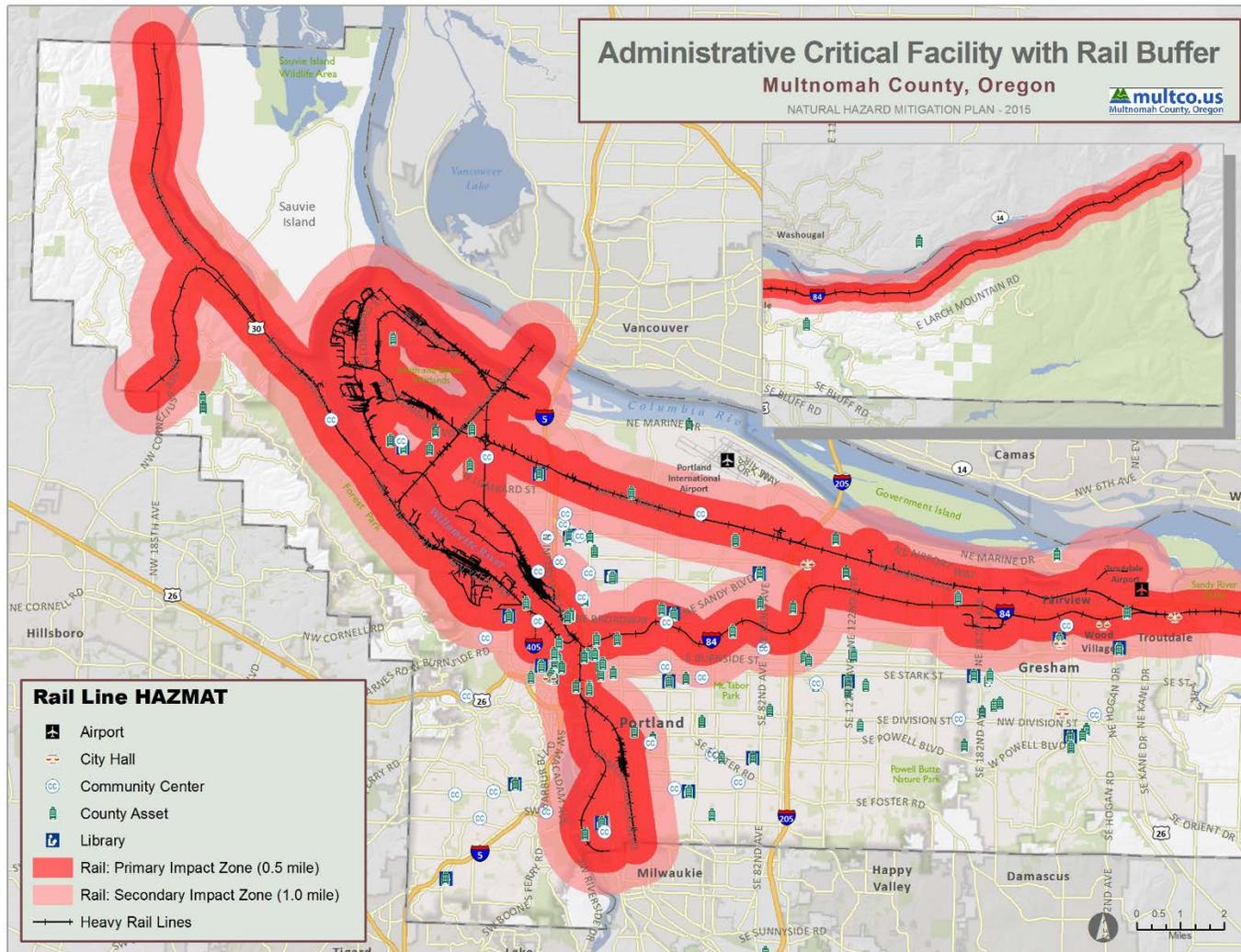
Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

FIGURE 24: EMERGENCY SERVICES CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH RAILWAY BUFFER ANALYSIS



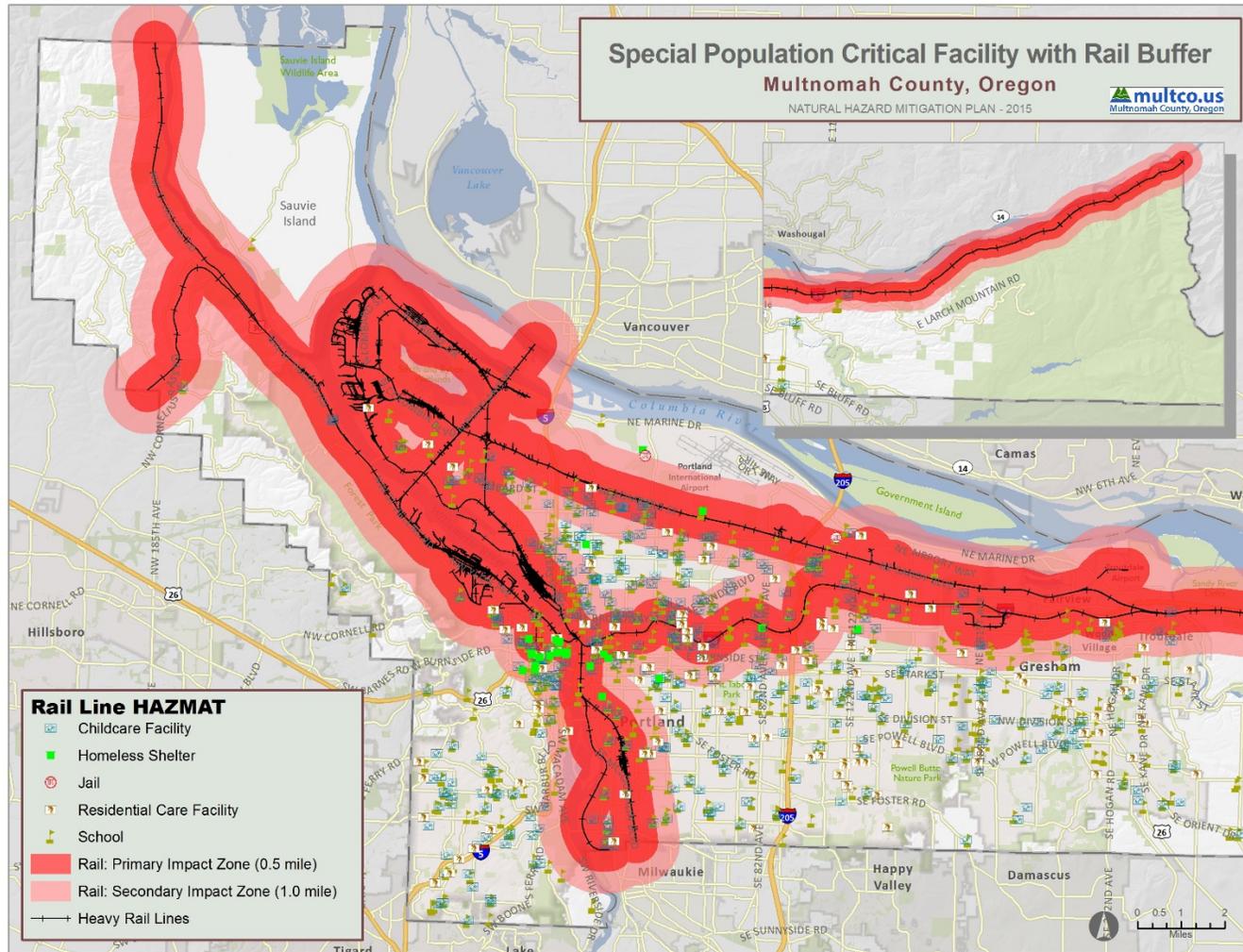
Source: Metro Data Resource Center; Oregon Department of Transportation, Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

FIGURE 25: ADMINISTRATIVE CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH RAILWAY BUFFER ANALYSIS



Source: Metro Data Resource Center; Oregon Department of Transportation; Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

FIGURE 26: SPECIAL POPULATION CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH RAILWAY BUFFER ANALYSIS



Source: Metro Data Resource Center; Oregon Department of Transportation; Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

4.8. Oil Train Incidents- Historical Occurrences

Historical rail-related hazardous materials incidents were included in the history of mobile incidents above and it should be noted that most industrial rail lines have been used to transport hazardous materials at some point. However, through research and analysis of potential risk to a rail incident, it was determined that oil train incidents posed an especially significant threat for Multnomah County and should also be a special focus of the hazardous materials rail analysis in this plan.

During the last decade, overall rail accidents have declined, along with accidents involving the transport of hazardous materials. According to the Federal Railroad Administration, the number of derailments on long-haul tracks in the United States has declined by around 21 percent since 2009 (to 2014). However, in spite of that decline in overall derailments, the number of accidents related to fire or violent rupture nearly doubled from 20 in 2009 to 38 in 2014.²³

Moreover, rail industry statistics indicate that major railroads delivered 435,560 rail cars of crude oil in 2013, which is roughly 300 million barrels. This is a sharp increase compared to 2008 when there were only around 9,500 railcars. Through the first half of 2014, approximately 258,541 railcars of crude oil were transported and delivered domestically, indicating that transport of crude oil via rail continues to increase.²⁴ For example, in neighboring Washington, the railroads reported moving 19 unit trains of Bakken oil through the state each week in 2014, which amounts to nearly 3 million gallons of oil. If the full build-out of proposed oil facilities is allowed, some projections estimate the number of unit trains per week could increase from 19 to 137.

While historically there have not been a large number of oil train incidents, the numbers above indicate that there is likely an increasing risk of these incidents occurring. Since they can occur at any time and pose potentially devastating consequences to the public, local communities, and the environment, an oil train incident presents tremendous challenges for local planning and response officials. Given the location of several rail lines that transport crude oil in Multnomah County, there is a moderate risk to this hazard with the potential for serious consequences such as fatalities and widespread damage to property and public health.

Although there have not been any major oil train incidents recorded in Multnomah County, there have been several major incidents throughout the United States and Canada as evidenced by the incidents outlined in **Table 49**.

²³ Russell Gold and Paul Vieira. *Wrecks Hit Tougher Oil Railcars*. The Wall Street Journal. March 9, 2015.

²⁴ Bakken Crude Oil Pamphlet distributed by the NW Area Committee, February 2015

TABLE 49: RECENT OIL TRAIN INCIDENTS IN THE UNITED STATES AND CANADA²⁵

Date	Location	Description
07/05/2013	Lac-Mégantic, Quebec, Canada	An unattended freight train transporting petroleum crude oil rolled down a descending grade and subsequently 63 cars derailed. The subsequent fires, along with other effects of the accident, resulted in the confirmed deaths of 47 individuals. In addition, extensive damage to the town center and the evacuation of approximately 2,000 people.
10/19/2013	Gainford, Alberta, Canada	9 tank cars of propane and 4 tank cars of crude oil derailed. About 100 residents were evacuated. 3 propane cars burned, but the oil cars pushed away and did not burn.
11/07/2013	Aliceville, Alabama	26 cars derailed, resulting in 11 cars impinged by a crude oil pool fire. An undetermined amount of petroleum crude oil escaped from derailed cars and found its way into wetlands area nearby the derailment site.
12/30/2013	Castleton, North Dakota	A separation derailment resulted in the derailment of 21 cars of petroleum crude oil. 18 cars ruptured, and an estimated 400,000 gallons of petroleum crude oil was released. The ruptured tank cars ignited, causing a significant fire. Approximately 1,400 people were evacuated.
01/07/2014	Plaster Rock, New Brunswick, Canada	17 cars of a mixed train hauling crude oil, propane, and other goods derailed. 5 cars carrying crude oil caught fire and exploded. 45 homes were evacuated but no injuries were reported.
04/30/2014	Lynchburg, VA	105 tank cars loaded with petroleum crude oil derailed. Seventeen cars derailed, and one breached. A fire ensued. 350 evacuated from immediate area. Three cars came to rest in James River, spilling up to 30,000 gallons of oil into river.

4.9. Oil Train Incidents- Location and Spatial Extent

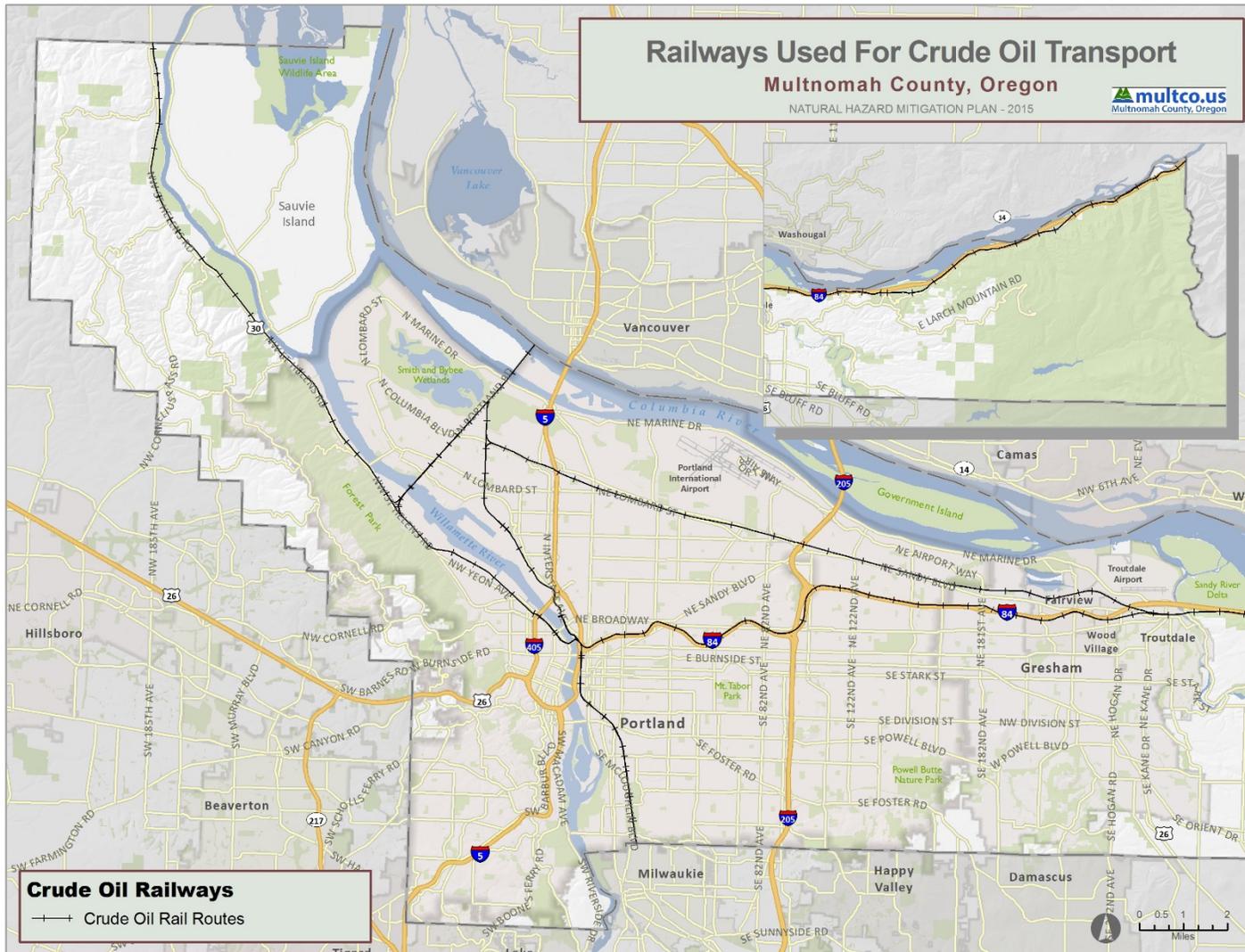
A majority of crude oil is transported by railways. Currently the Emergency Restriction/Prohibition Order applies to all railroad carriers that transport a specified amount of crude oil within its rail cars. To determine the rail carriers of hazardous materials moving through an area and ascertain if crude oil is one of the products being transported, communities are allowed to contact the rail carrier and request a list of hazardous commodities being transported through their community as per the Association of American Railroads (AAR) Circular No. OT-55 protocol. Further, the OT-55 protocol explains that all rail carriers subject to the Order must provide certain information to the State Emergency Response Commission (SERC) concerning trains transporting at or above the threshold. This allows for the identification of railway lines and infrastructure (tracks, bridges, adjacent roadways, etc.) that are at risk for a crude oil incident.

For this analysis, major freight rail lines that are used for the transport of crude oil were identified by the State of Oregon's Office of Emergency Management (OEM) using the information collected by the State Emergency Response Commission.²⁶ The railroads identified by OEM were utilized in the analysis as these are the most likely lines on which a hazardous materials oil incident might occur. These rail lines can be found in **Figure 27**.

²⁵ Bakken Crude Oil Pamphlet distributed by the NW Area Committee, February 2015

²⁶ State of Oregon Office of Emergency Management. OR-IRIS Crude Oil Rail Routes GIS Shapefile. 2015.

FIGURE 27: RAILWAYS IN MULTNOMAH COUNTY USED FOR CRUDE OIL TRANSPORT



Source: Oregon Department of Transportation, Geographic Information Services Unit, Oregon Office of Emergency Management

4.10. Oil Train Incidents- Risk Analysis

Crude oil incidents present various hazardous risks.

Potential Hazards Related to Crude Oil²⁷:

- Highly Flammable: Will be easily ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

Table 50 describes the characteristics of the five different types of oil classifications.

²⁷ Bakken Crude Oil Pamphlet distributed by the NW Area Committee, February 2015

TABLE 50: CHARACTERISTICS OF THE FIVE TYPES OF OIL CLASSIFICATIONS²⁸

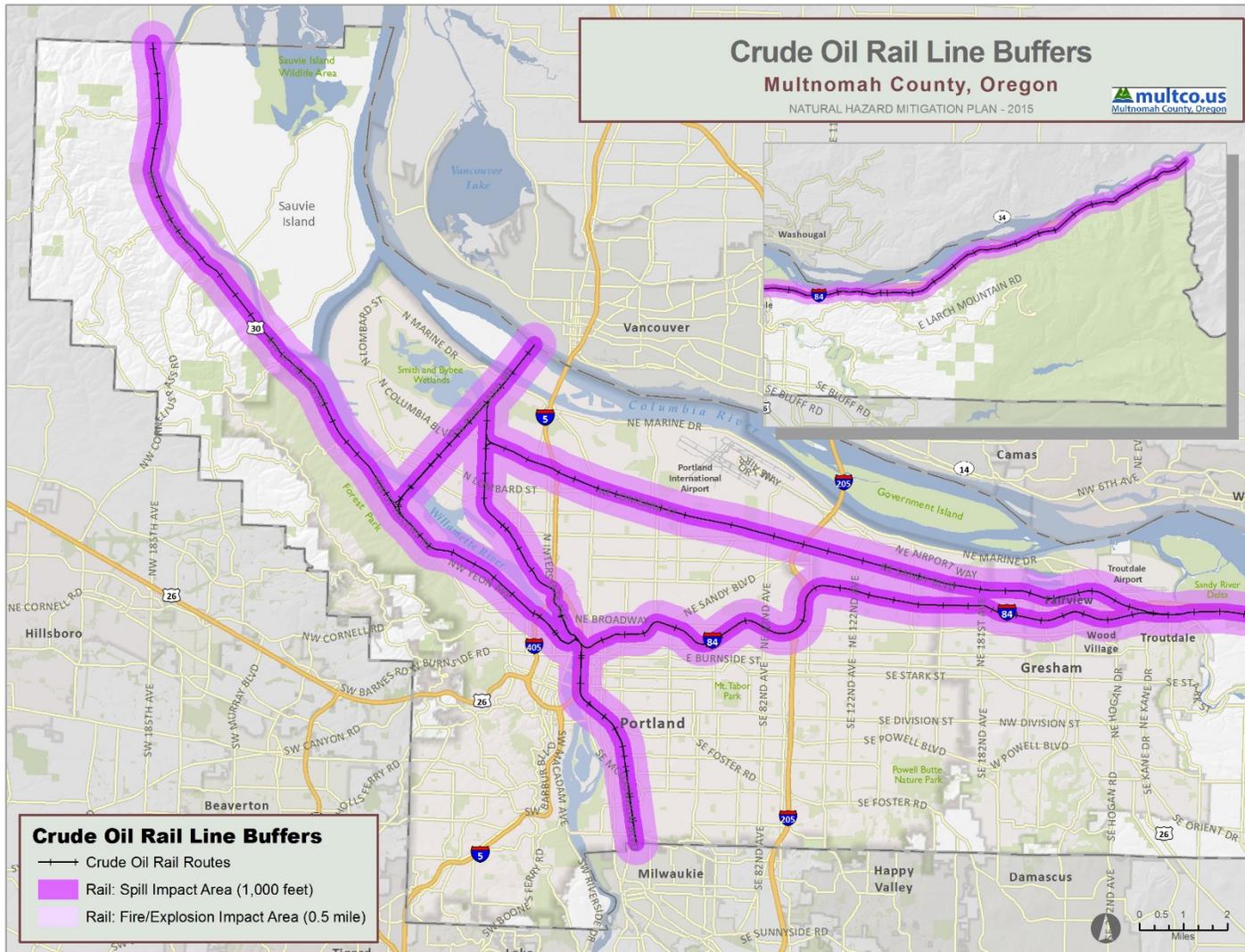
Gasoline Products (Group I)	Diesel-like Products and Light Crude Oils (Group II)	Medium-grade Crude Oils and Intermediate Products (Group III)	Heavy Crude Oils and Residual Products (Group IV)	Low API Oils - heavier than water (Group V)
<ul style="list-style-type: none"> Examples – Gasoline 	<ul style="list-style-type: none"> Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude 	<ul style="list-style-type: none"> Examples – North Slope crude, South Louisiana crude, No. 4 fuel oil, IFO 180, lube oils 	<ul style="list-style-type: none"> Examples – Venezuela crude, San Joaquin Valley crude, Bunker C, No. 6 fuel oil 	<ul style="list-style-type: none"> Examples – Very heavy No. 6 fuel oil, Residual Oils, Vacuum Bottoms, Heavy slurry oils
<ul style="list-style-type: none"> Very volatile and highly flammable (flash point near 100°F/40°C) 	<ul style="list-style-type: none"> Moderately volatile (flash point varies 100-150°F/40-65°C) 	<ul style="list-style-type: none"> Moderately volatile (flash point higher than 125°F/50°C) 	<ul style="list-style-type: none"> Slightly volatile (flash point greater than 150°F/65°C) 	<ul style="list-style-type: none"> Very low volatility
<ul style="list-style-type: none"> High evaporation rates; narrow cut fraction with no residues 	<ul style="list-style-type: none"> Refined products can evaporate to no residue; crude oils do have a residue after evaporation is completed 	<ul style="list-style-type: none"> Up to one-third will evaporate in the first 24 hours 	<ul style="list-style-type: none"> Very little product loss by evaporation 	<ul style="list-style-type: none"> No evaporation when submerged
<ul style="list-style-type: none"> Low viscosity; spread rapidly to a thin sheen 	<ul style="list-style-type: none"> Low to moderate viscosity; spread rapidly into thin slicks Specific gravity of <0.85; API gravity of 35-45 	<ul style="list-style-type: none"> Moderate to high viscosity Specific gravity of 0.85-0.95; API gravity of 17.5-35 	<ul style="list-style-type: none"> Very viscous to semisolid Specific gravity of 0.95-1.00; API gravity of 10-17.5 	<ul style="list-style-type: none"> Very viscous to semisolid Specific gravity greater than 1.00; API gravity less than 10
<ul style="list-style-type: none"> High acute toxicity to biota 	<ul style="list-style-type: none"> Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds 	<ul style="list-style-type: none"> Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds 	<ul style="list-style-type: none"> Low acute toxicity relative to other oil types 	<ul style="list-style-type: none"> Low acute toxicity relative to other oil types

Figure 28 shows buffer areas for the major oil train railway lines that could impact Multnomah County. The Oregon Office of the State Fire Marshall recommends that in the event of a large oil train incident/spill, initial downwind evacuation should be at least 1,000 feet (300 meters). Further, if the tank or car is involved in a fire, officials should isolate and consider evacuation for 0.5 mile (800 meters) in all directions.²⁹ Therefore, the buffer areas that have been selected for this analysis are 1,000 feet (spill area) and 0.5 mile (fire/explosion area). The results of the analysis indicate the approximate number of parcels/buildings and improved value, as shown in **Table 51**.

²⁸ Bakken Crude Oil Pamphlet distributed by the NW Area Committee, February 2015

²⁹ Office of State Fire Marshal Survey Findings and Recommendations on Crude Oil, January 8, 2015

FIGURE 28: CRUDE OIL RAIL LINE HAZMAT BUFFERS IN MULTNOMAH COUNTY



Source: Oregon Department of Transportation, Geographic Information Services Unit, Oregon Office of Emergency Management

TABLE 51: EXPOSURE OF IMPROVED PROPERTY TO CRUDE OIL RAIL HAZARDOUS MATERIALS SPILL

Location	1,000 feet buffer			0.5-mile buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ³⁰	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value ³¹
Fairview	1,331	1,371	\$225,384,810	2,118	2,360	\$392,328,560
Gresham	212	433	\$499,197,610	630	1,088	\$727,378,680
Lake Oswego	0	0	\$0	0	0	\$0
Maywood Park	14	16	\$2,286,710	272	318	\$45,656,950
Portland	23,014	19,141	\$8,559,378,110	65,068	62,035	\$22,319,588,560
Troutdale	374	226	\$139,384,610	968	880	\$264,319,340
Wood Village	109	199	\$56,053,960	605	2,622	\$105,731,230
Unincorporated Area	965	1,346	\$106,454,650	1,607	811	\$1,937,644,260
MULTNOMAH COUNTY TOTAL	26,019	22,732	\$9,588,140,460	71,268	70,114	\$25,792,647,580

Additionally, **Table 52** and **Table 53** contain a breakdown of parcels at risk based on land use code.

TABLE 52: PARCELS LOCATED IN 1,000 FEET BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	42	0	0	29	1	1,025	169	65
Gresham	7	55	0	14	2	0	76	52	6
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0	14	0	0
Portland	17	2,967	0	69	6,136	62	11,679	1,764	320
Troutdale	1	102	0	0	4	0	160	103	4
Wood Village	0	44	0	1	0	0	43	19	1
Unincorporated Area	29	36	53	4	4	89	178	535	37
MULTNOMAH COUNTY TOTAL	54	3,246	53	88	6,175	152	13,175	2,642	433

Source: Metro Data Resource Center- Multnomah County Tax Assessors

³⁰ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1,000 feet buffer, since building footprints were not associated with dollar value data.

³¹ Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.

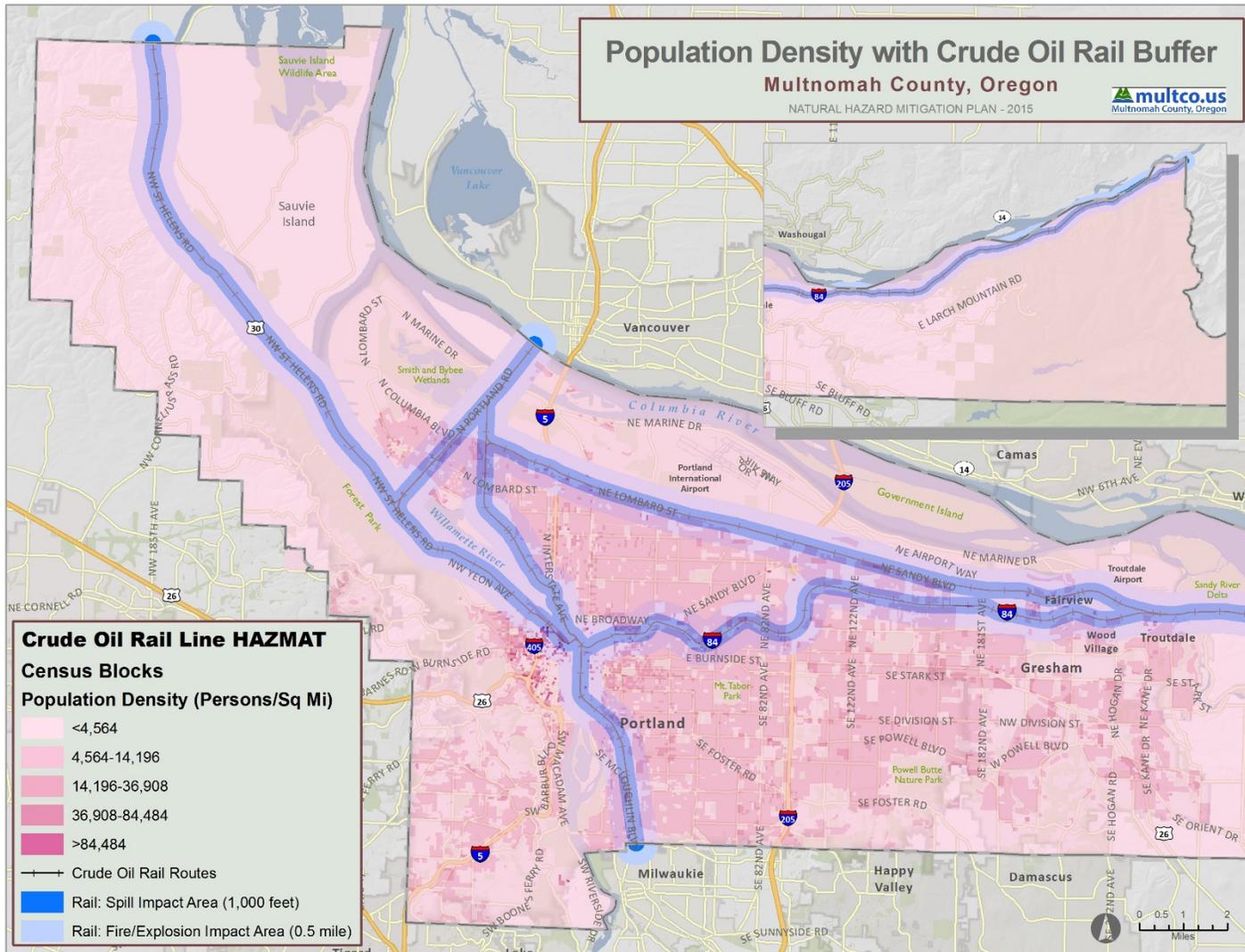
TABLE 53: PARCELS LOCATED IN 0.5 MILE BUFFER AREA BY LAND USE CODE

Location	AGR	COM	FOR	IND	MFR	RUR	SFR	VAC	N/A
Fairview	0	75	0	1	150	1	1562	253	76
Gresham	7	113	0	22	21	0	378	77	12
Lake Oswego	0	0	0	0	0	0	0	0	0
Maywood Park	0	3	0	0	0	0	256	13	0
Portland	27	6426	0	144	15674	168	38631	3597	401
Troutdale	1	157	0	2	95	2	537	167	7
Wood Village	0	52	0	1	115	0	402	34	1
Unincorporated Area	74	50	125	4	8	157	411	724	54
MULTNOMAH COUNTY TOTAL	109	6,876	125	174	16,063	328	42,177	4,865	551

Source: Metro Data Resource Center- Multnomah County Tax Assessors

To determine the population potentially at risk of being impacted by a crude oil rail incident, Census blocks were intersected with the buffer areas described above. The results of this analysis are presented in **Table 54** and **Figure 29**

FIGURE 29: POPULATION DENSITY IN MULTNOMAH COUNTY WITH CRUDE OIL RAIL BUFFER ANALYSIS



Source: U.S. Census Bureau, 2010, Oregon Department of Transportation, Geographic Information Services Unit, Oregon Office of Emergency Management

TABLE 54: COUNTS OF PEOPLE LOCATED WITHIN CRUDE OIL RAILWAY BUFFER AREA

Location	1,000 feet buffer	0.5-mile buffer
Fairview	6,159	8,524
Gresham	2,049	3,469
Lake Oswego	0	0
Maywood Park	106	714
Portland	67,717	169,372
Troutdale	2,929	4,321
Wood Village	1,480	3,651
Unincorporated Area	2,382	3,374
MULTNOMAH COUNTY TOTAL	82,822	193,425

The analysis of the crude oil railroad buffer areas shows that there are 409 facilities in any hazard area, with 162 facilities located in only the spill area. A summary of the number of critical facilities located in each protection area by jurisdiction can be found in **Table 55**, **Table 56**, **Table 57**, **Table 58**, **Table 59**, and **Table 60**. These facilities are shown overlaid on the buffer areas in **Figure 30**, **Figure 31**, and **Figure 32**.

TABLE 55: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 1,000 FEET BUFFER AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	0	0
Gresham	0	0	0	0	0	0
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	3	5	1	13	6	1
Troutdale	0	0	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	3	5	1	13	7	1

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 56: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 1,000 FEET BUFFER AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	0	0	0	0
Gresham	0	0	0	0	0
Lake Oswego	0	0	0	1	0
Maywood Park	0	0	0	0	0
Portland	0	0	6	17	0
Troutdale	0	1	0	3	0
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	0	2	6	21	0

Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 57: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 1,000 FEET BUFFER AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	0	0	0	0	2
Gresham	2	0	0	0	1
Lake Oswego	0	0	0	0	0
Maywood Park	0	0	0	0	0
Portland	35	6	0	20	25
Troutdale	1	0	0	0	0
Wood Village	0	0	0	2	0
Unincorporated Area	1	0		0	0
MULTNOMAH COUNTY TOTAL	39	6	0	22	28

Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

TABLE 58: EMERGENCY SERVICES CRITICAL FACILITY INVENTORY IN 0.5 MILE AREA

Location	Ambulance Services	Fire Stations	Hospitals	Licensed Medical Facilities	Law Enforcement	Urgent Care Centers
Fairview	0	0	0	0	0	0
Gresham	0	1	0	0	0	0
Lake Oswego	0	0	0	0	0	0
Maywood Park	0	0	0	0	0	0
Portland	3	9	4	19	12	6
Troutdale	0	0	0	0	1	0
Wood Village	0	0	0	0	0	0
Unincorporated Area	0	1	0	0	0	0
MULTNOMAH COUNTY TOTAL	3	11	4	19	13	6

Source: Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

TABLE 59: ADMINISTRATIVE CRITICAL FACILITY INVENTORY IN 0.5 MILE AREA

Location	Airports	City Halls	Community Centers	County Assets	Libraries
Fairview	0	0	1	0	1
Gresham	0	0	0	1	0
Lake Oswego	0	0	0	0	
Maywood Park	0	1	0	0	0
Portland	0	0	7	47	3
Troutdale	1	1	0	3	0
Wood Village	0	1	0	0	0
Unincorporated Area	0	0	0	0	0
MULTNOMAH COUNTY TOTAL	1	3	8	51	4

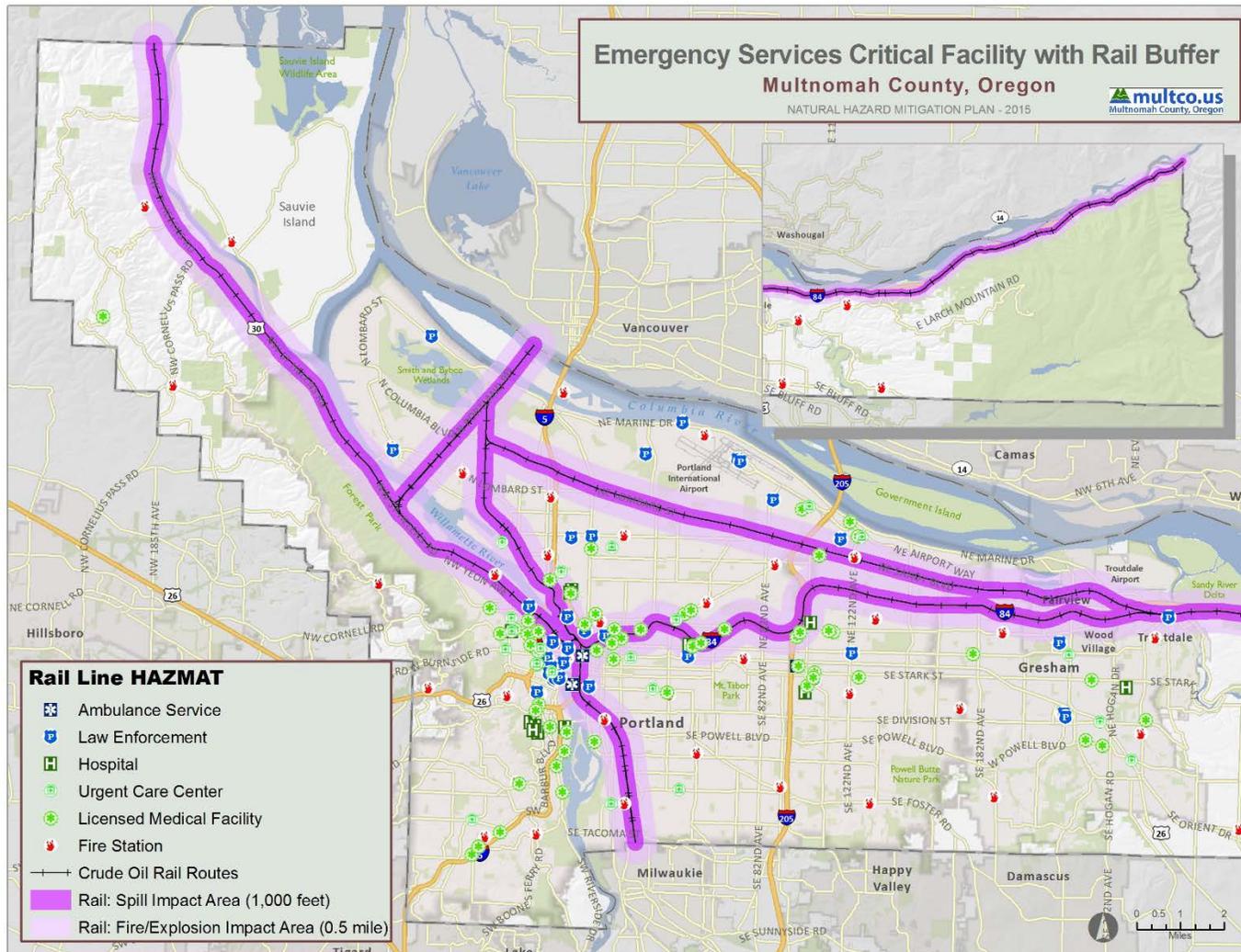
Source: Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

TABLE 60: SPECIAL POPULATION CRITICAL FACILITY INVENTORY IN 0.5 MILE AREA

Location	Childcare Facilities	Homeless Shelters	Jails	Residential Care Facilities	Schools
Fairview	0	0	0	0	5
Gresham	2	0	0	0	1
Lake Oswego	0	0	0	0	0
Maywood Park	2	0	0	0	2
Portland	91	18	1	40	95
Troutdale	2	0	0	0	5
Wood Village	2	0	0	2	0
Unincorporated Area	1	0	0	0	0
MULTNOMAH COUNTY TOTAL	100	18	1	42	108

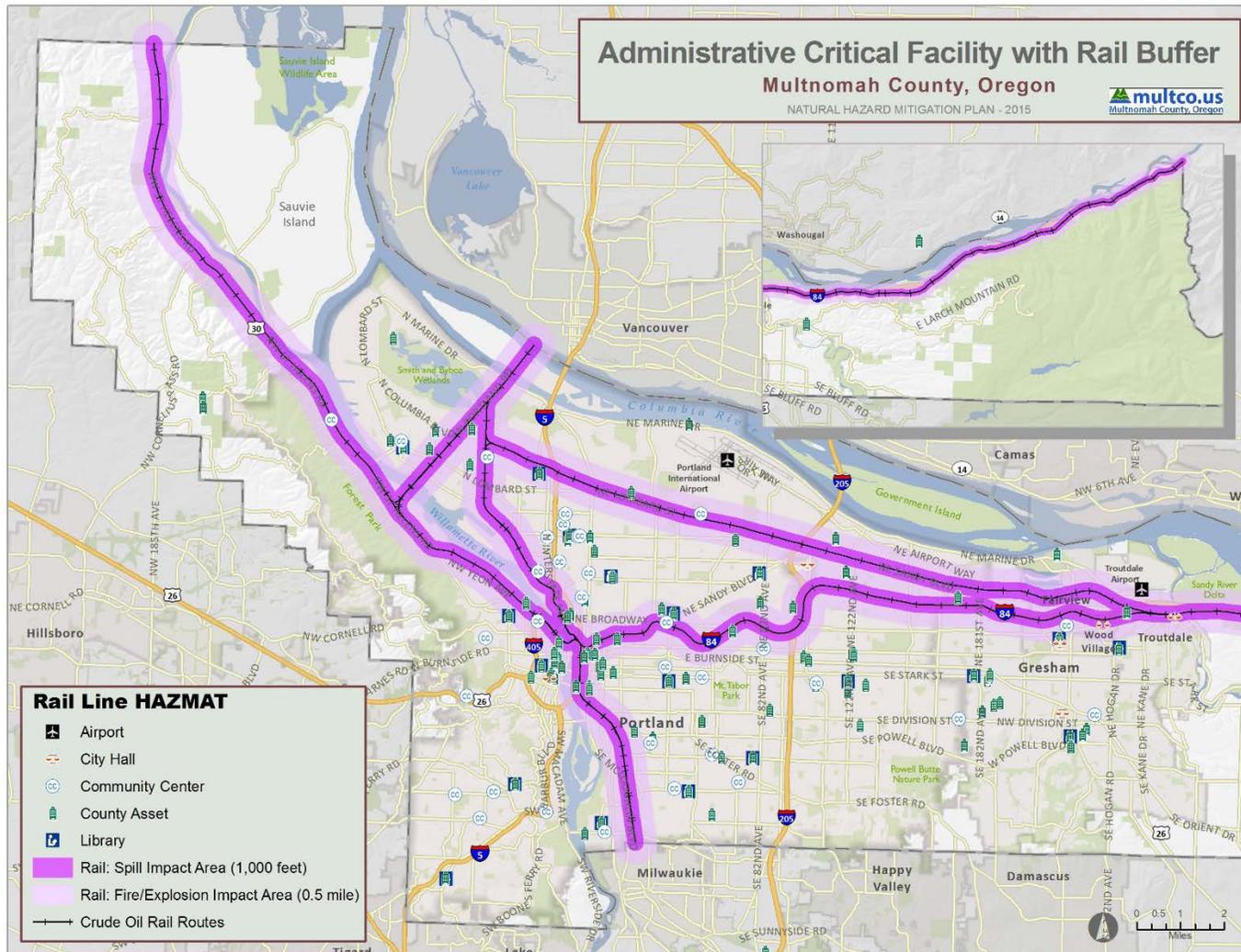
Source: Childcare Facilities- Oregon DHS, Portland State University-College of Spatial Analysis and Research; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

FIGURE 30: EMERGENCY SERVICES CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH CRUDE OIL RAIL BUFFER ANALYSIS



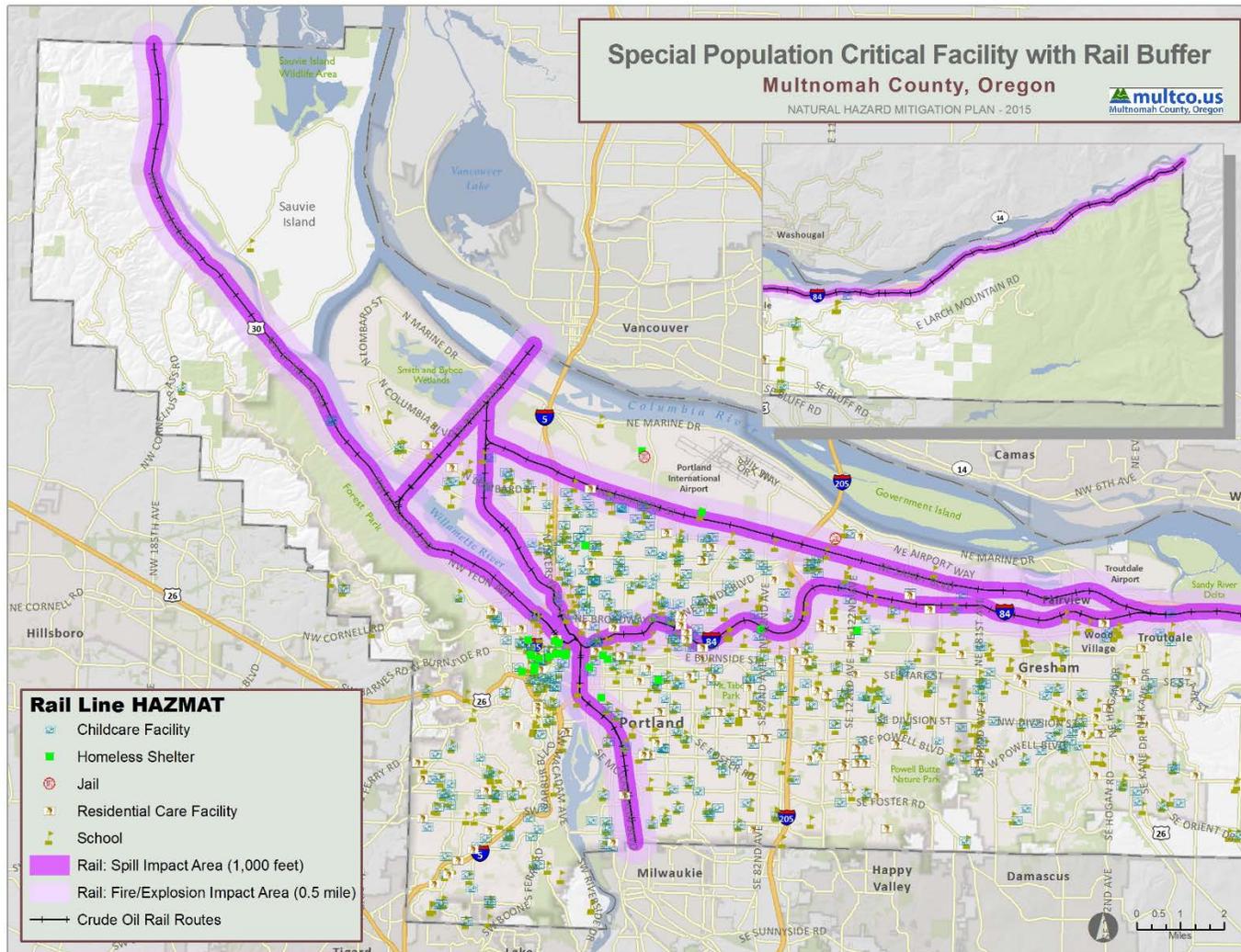
Source: Oregon Department of Transportation; Geographic Information Services Unit; Oregon Office of Emergency Management; Ambulance Services-Multnomah County GIS; Law Enforcement- Oregon Spatial Data Library, Oregon Department of Geology and Mineral Industries, OR-IRIS Version 2; Hospitals- Metro's Regional Land Information System; Urgent Care Centers- Oregon Department of Environmental Quality; Fire Stations- Metro's Regional Land Information System

FIGURE 31: ADMINISTRATIVE CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH CRUDE OIL RAIL BUFFER ANALYSIS



Source: Oregon Department of Transportation; Geographic Information Services Unit; Oregon Office of Emergency Management; Airports- Metro's Regional Land Information System; City Halls- Metro's Regional Land Information System; Community Centers- Metro's Regional Land Information System Parks Layer; County Assets- Metro's Regional Land Information System; Libraries- Metro's Regional Land Information System

FIGURE 32: SPECIAL POPULATION CRITICAL FACILITIES IN MULTNOMAH COUNTY WITH CRUDE OIL RAIL BUFFER ANALYSIS



Source: Oregon Department of Transportation; Geographic Information Services Unit; Oregon Office of Emergency Management; Homeless Shelters- Multnomah GIS; Jails- Multnomah GIS; Residential Care Facilities- Oregon Public Health, Portland State University-College of Spatial Analysis and Research, Oregon Health Authority; Schools- Oregon Department of Education Open Institution List

4.11. Probability of Future Occurrence

Given the location of numerous Tier II facilities (as identified by HSIS) in Multnomah County as well as prior roadway, railway, air, water, and other hazardous materials incidents it is highly likely that a hazardous material incident may occur in the county. Over the 44-year PHMSA reporting period, there have been 5,003 roadway, railway, air, and water incidents, so on average there have been 114 incidents per year. Over the 29-year OSFM reporting period, there have been 2,513 hazardous material incidents, so on average there were 87 incidents per year. Based on these figures, the county can reasonably expect at least 80 hazardous materials incidents a year going forward. However, county and municipal officials are extremely vigilant and recognize this possibility, which allows them to analyze these potential risks and take safety measures to reduce the likelihood that these events will occur.

Furthermore, county response teams have an excellent record when it comes to responding to hazardous materials events. As noted above, there have been a number of hazardous materials incidents in the county, but most have been contained before major injuries or loss of life have occurred. The fact that few major incidents have occurred in the county is a testament to the emphasis that local officials have put on preparedness and their efforts to develop detailed plans to respond to an occurrence. Response personnel in the county are focused on ensuring citizens are well-protected from a hazardous materials event and that the proper actions are taken when an event does occur.

4.12. Conclusions on Hazardous Materials Incidents

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Multnomah County. Those areas in a smaller buffer for each analysis are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area, such as direction and speed of wind and volume of release.

In terms of jurisdiction-specific risk, the City of Portland carries the most risk due to the high concentration of population and structures located in the city. The high density of people living and working in the city, combined with the location of a number of fixed sites and transportation routes makes Portland especially high risk to future hazardous materials incidents. In addition, it should be noted that according to PHMSA records, most of the mobile hazardous materials incidents and related injuries that have occurred historically in the county have been within Portland, so there is a notable history that indicates a high likelihood of future incidents.

Although Portland certainly has a higher absolute risk than the other jurisdictions in the county because of its size and density, other jurisdictions also face significant risk. In some cases, their risk relative to their sizes is much higher than Portland's relative risk. For instance, even though Gresham has a population that is roughly 1/6th the size of Portland, local records from the Oregon Office of State Fire Marshal show that in the last 5 years (2010-2015) it has experienced more than twice as many hazardous materials incidents. Moreover, when comparing the percentage of total population located in impact areas for a poisonous gas release, both Portland and Gresham have roughly the same percent of their population located in each impact area. This indicates that although Portland has a higher absolute number of people and property at risk, Gresham faces the same level of relative risk.

Similarly, most of the other jurisdictions in the county face high relative risks in terms of their overall population that is susceptible to an incident. In some cases, smaller jurisdictions face an even higher

relative risk than larger jurisdictions. For example, nearly the entire population of Fairview, Maywood Park, Troutdale, and Wood Village are located within the potential impact area for a nighttime incident at an HPPN=1 fixed site. Similarly, due to the location of a crude oil route directly through Fairview, nearly 80 percent of its population is potentially at risk to a rail oil spill and almost 95 percent is at risk to a fire/explosion from such a spill.

In terms of infrastructure and critical facilities, it should be noted that many facilities were determined to be located in the defined impact areas for this analysis. The summary tables above provide a general overview of the number of critical facilities located in each impact area by jurisdiction, but a list of specific critical facilities and their associated risk can also be found in **Table 64** at the end of this section.

These examples illustrate that most jurisdictions within the county face significant risks when it comes to hazardous materials. Although the greatest amounts of people and property are at risk in Portland when compared to other jurisdictions, a majority of the jurisdictions have high relative risks to hazardous materials incidents and must develop appropriate strategies to mitigate these risks.

5. PIPELINE INCIDENT

5.1. Overview

Pipelines in the United States are used to transport and distribute a number of products from their extraction point to sites where those materials are utilized throughout the country. Pipelines are most commonly used to transport energy sources such as natural gas and petroleum products, but are also often used in the transportation of other hazardous liquids. Transportation of these products via pipeline is abundant in the United States due to the cost-effectiveness of the process which allows quick movement with relatively minimal cost.

Generally pipelines are safe and effective, transporting materials where they are needed without incident. However, many pipelines in the United States were installed over 60 years ago and were made with materials such as cast and wrought iron or bare steel which degrade over time. This presents a definitive danger to people and property as a leak or spill of hazardous products from a degraded pipeline could prove disastrous, causing costly damage to property and injury or death.

As a result, there has been a recent movement to replace many of these older pipelines with newer materials such as plastics that can reduce the risk of a pipeline failure and a hazard incident. In 2011, the Pipeline Safety, Regulatory Certainty, and Job Creation Act was passed and called for the US Department of Transportation to conduct a state by state survey of pipelines and accelerate repairs of aging infrastructure. The following website provides a state by state update of the progress of this initiative: <http://primis.phmsa.dot.gov/comm/states.htm?nocache=4496>.

Not only do pipelines present potential damage to an area and its residents but infrastructure related to pipeline functioning contributes to vulnerability considerations. Pumps, compressor stations, breakout tanks, tank farms, and valves can cause possible negative impacts related to the overall pipeline hazard.

To determine the potential vulnerability to pipelines and other energy infrastructure, site-specific analysis is required. Due to lack of availability of the exact location of pipelines (which is not released to the public for reasons of confidentiality), this kind of site-specific analysis was not performed in this

plan. Local officials interested in performing site-specific analysis should note that the PHMSA recommends that consultation zones be delineated along major pipelines to restrict construction and safely develop in these areas. Although the buffer distance utilized for a pipeline should be based on site-specific characteristics, if insufficient information is available, a standard consultation zone of 660 feet on either side of the pipe centerline should be used for natural gas transmission pipelines and a range of 660 to 1,000 feet should be used for hazardous liquid pipelines.³²

5.2. Historical Occurrences

There have been no reported incidents of major pipeline disruptions or failures within Multnomah County. However, there have been significant pipeline spills and other incidents in nearby areas and similar incidents could occur within Multnomah County. One of the most notable pipeline incidents to occur in the Pacific Northwest in recent history was the Olympic Pipeline explosion in 1999. This incident occurred in Bellingham, Washington within Whatcom Falls Park.

The Olympic Pipeline explosion was the result of a failure to identify and repair damage to the pipe that had been caused several years prior, causing the pipeline to burst and spill hundreds of thousands of gallons of gas. This resulted in three deaths and a number of injuries due to both the fumes and the ensuing explosion. In addition, there was extensive damage to nearby buildings and infrastructure including the city's water treatment plant which caused the city to have to manually treat water while the plant was rebuilt. In the end, the pipeline operators were held responsible in the ensuing legal proceedings, leading to the first conviction against a pipeline company under the 1979 Hazardous Liquid Pipeline Safety Act.³³

Pipeline accidents can originate in a number of different ways. According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), some of the most prominent causes of pipeline accidents include: corrosion, excavation damage, incorrect operation, material/weld/equipment failure, natural force damage, and other outside force damage.³⁴

Table 61 and **Table 62** describe incidents caused by natural forces for liquid and gas pipelines throughout the United States from 2004 to 2013. Although these tables only include incidents that resulted from natural causes, the percentage values reflect the percent based on incidents of all types, not just those from natural causes.

³² United States Department of Transportation Pipeline and Hazardous Materials Safety Administration, 2015. Hazard Mitigation Planning: Practices for Land Use Planning and Development near Pipelines.

³³ McClary, Daryl C. June 11, 2003. Olympic Pipe Line accident in Bellingham kills three youths on June 10, 1999. Historylink.org

³⁴ United States Department of Transportation Pipeline and Hazardous Materials Safety Administration, 2015. Hazard Mitigation Planning: Practices for Land Use Planning and Development near Pipelines.

**TABLE 61: HAZARDOUS LIQUID PIPELINE INCIDENTS CAUSED BY NATURAL FORCES
(2004-2013)³⁵**

Reported Cause of incident	Number of incidents	% of all incidents	Fatalities	Injuries	Property damage	% of property damage from all incidents & causes
Temperature	54	1.5%	0	0	\$9,087,167	0.3%
Unspecified Natural Force	35	0.9%	0	0	\$326,397	0.0%
Heavy Rains/Floods	31	0.8%	0	0	\$205,421,552	8.2%
High Winds	30	0.8%	0	0	\$244,985,232	9.8%
Lightning	20	0.5%	0	0	\$42,889,182	1.7%
Earth Movement	19	0.5%	0	0	\$62,829,034	2.5%
Other Natural Force Damage	4	0.1%	0	0	\$581,732	0.0%
Sub Total	193	5.3%	0	0	\$566,120,296	22.7%

Source: Oregon Office of State Fire Marshal

**TABLE 62: HAZARDOUS GAS PIPELINE INCIDENTS CAUSED BY NATURAL FORCES
(2004-2013)³⁶**

Reported Cause of incident	Number of incidents	% of all incidents	Fatalities	Injuries	Property damage	% of property damage from all incidents & causes
Heavy Rains/Floods	90	7.7%	0	0	\$280,235,208	20.5%
Earth Movement	23	1.9%	0	0	\$13,424,896	0.9%
Lightning	17	1.4%	0	0	\$1,901,676	0.1%
High Winds	14	1.2%	0	0	\$108,472,981	7.9%
Temperature	10	0.8%	0	0	\$752,059	0.0%
Other Natural Force Damage	5	0.4%	0	0	\$4,840,820	0.3%
Sub Total	159	13.6%	0	0	\$409,627,640	30.0%

Source: Oregon Office of State Fire Marshal

5.3. Location and Spatial Extent

Pipeline impacts can vary when it comes to people and the environment, ranging from personal injuries such as inhalation of toxins to ecological damage and water contamination. Pipeline incidents can affect local and regional economies resulting in potential shortages and/or increases in energy costs. A vulnerability assessment of pipeline impacts greatly depends on various factors such as location, severity of incident, environmental factors, proximity to waterways, and infrastructure operation.

³⁵ United States Department of Transportation Pipeline and Hazardous Materials Safety Administration, 2015. Hazard Mitigation Planning: Practices for Land Use Planning and Development near Pipelines.

³⁶ United States Department of Transportation Pipeline and Hazardous Materials Safety Administration, 2015. Hazard Mitigation Planning: Practices for Land Use Planning and Development near Pipelines.

However, as mentioned above, due to the unavailability of precise location data for pipelines across the county, a thorough analysis of pipeline incidents was not carried out in this plan.

Pipelines are located throughout the state of Oregon and in Multnomah County. Across the state, there are over 416 miles of hazardous liquid line, 2,499 miles of gas transmission gathering lines, and 15,522 miles of gas distribution main lines. In Multnomah County, there are a number of these gas and liquid lines that are for both gathering and transmission.

In addition to transmission and gathering lines, it should be noted that Oregon's critical energy infrastructure hub resides in Multnomah County. According to the Oregon State Energy Assurance Plan, a concentration of this infrastructure is located in the heart of the high seismic hazard area along an eight mile stretch of the lower reach of the Willamette River in northwest Portland. This infrastructure includes marine oil terminals, fuel tank farms, liquefied natural gas, natural gas, and power transmission systems. This area acts as a regional crossroads for the transport of fuel and energy via pipelines, rail, shipping, and trucking.³⁷ The Critical Energy Infrastructure Hub (CEI Hub) sits on top of very poor soils that are highly susceptible to earthquake-induced permanent ground deformation, placing this concentration of key infrastructure at risk of failure.³⁸

Figure 33, Figure 34, Figure 35, and Figure 36 illustrate the location of several types of pipeline infrastructure including gas transmission lines, hazardous liquid lines, liquefied natural gas (LNG) plants, and breakout tanks.

³⁷ Portland Local Energy Assurance Plan, June 2012.

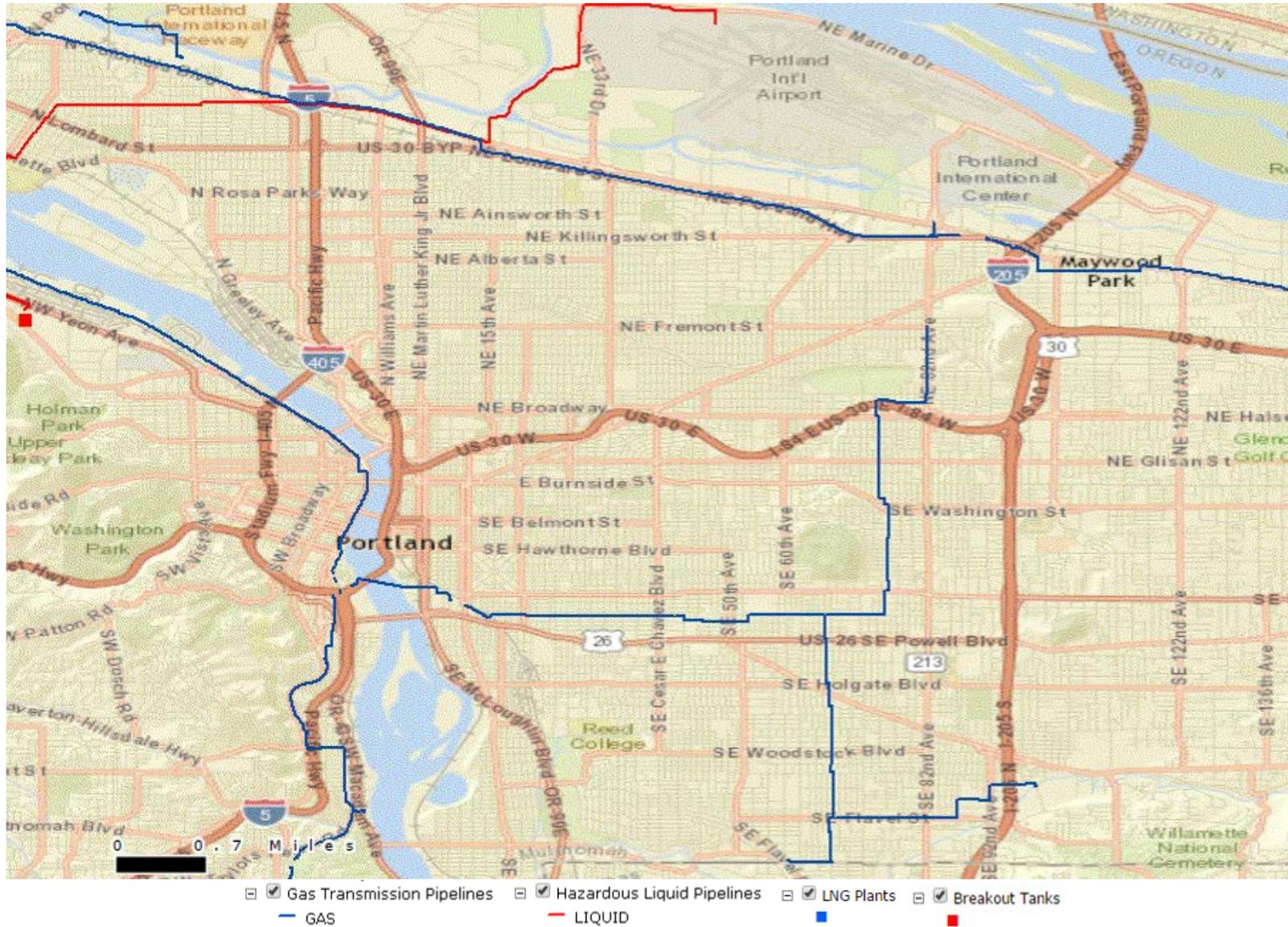
³⁸ Oregon State Energy Assurance Plan, March 2011.

FIGURE 34: PIPELINES AND CRITICAL ENERGY INFRASTRUCTURE IN EASTERN MUNICIPALITIES



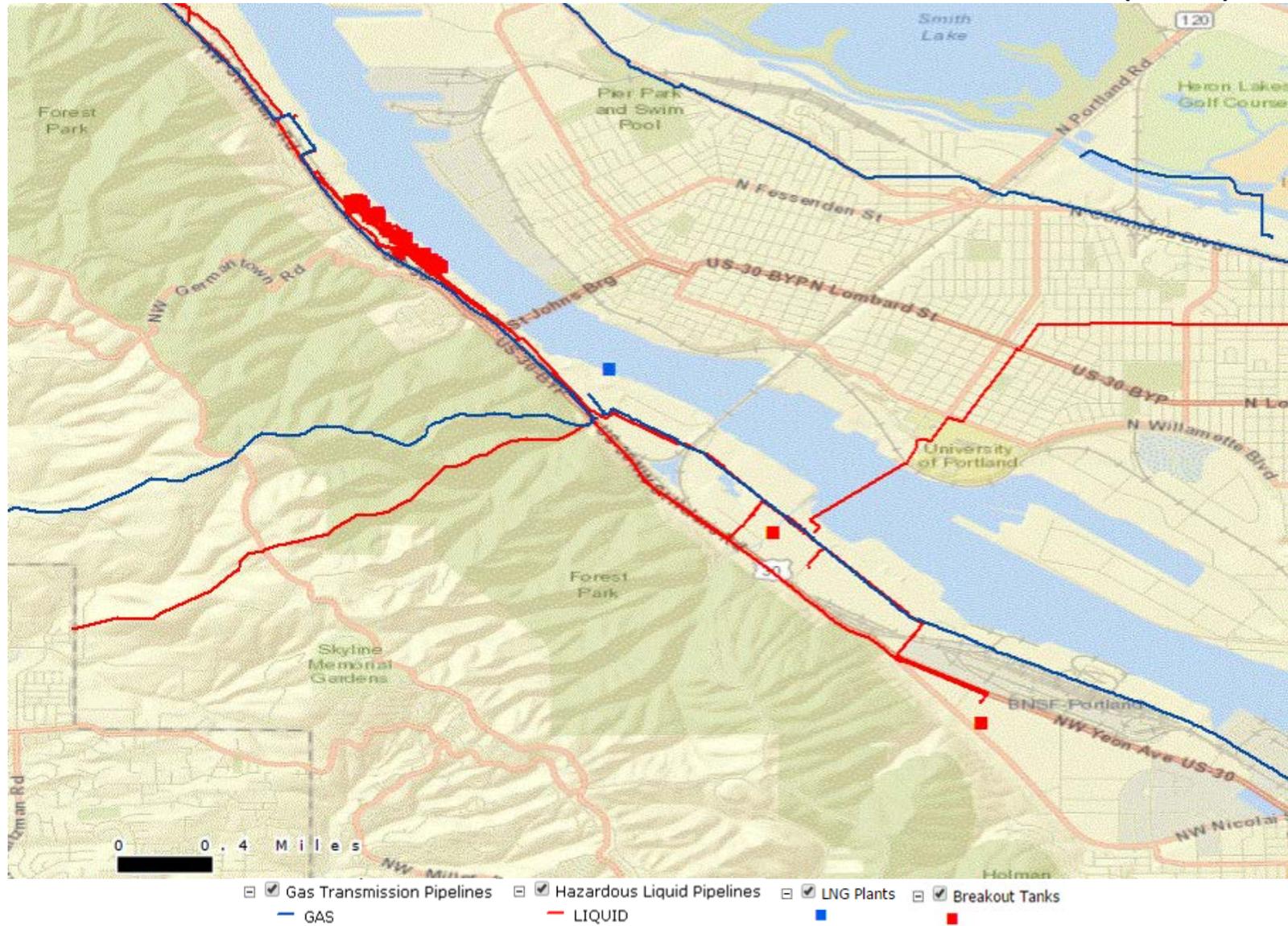
Source: PHMSA

FIGURE 35: PIPELINES AND CRITICAL ENERGY INFRASTRUCTURE IN PORTLAND AREA



Source: PHMSA

FIGURE 36: PIPELINES AND CRITICAL ENERGY INFRASTRUCTURE IN NORTHWEST MULTNOMAH COUNTY (CEI HUB)



Source: PHMSA

5.4. Probability of Future Occurrence

Although there have been few historic incidents to indicate a high likelihood of a pipeline incident occurring, there is some possibility that this type of hazard could occur, especially in conjunction with a major earthquake or other natural disaster. Therefore the probability of future occurrence has been classified as possible.

6. CRITICAL INFRASTRUCTURE FAILURE

6.1. Overview

A Critical Infrastructure Failure can describe many different scenarios in which a component of infrastructure is prevented from carrying out its intended purpose. For example, it could be caused by destruction or damage to the infrastructure or it could be that the service was merely disrupted. One example of this type of failure would be damage to a roadway or bridge that renders the asset no longer passable by motor vehicles.

A failure of infrastructure can be caused by a number of precipitating events including many natural hazards such as earthquakes or flooding. A critical infrastructure failure can also be caused by aging infrastructure that needs to be replaced, or could be human caused through accidental or purposeful damage to the structure.

This type of event can have serious consequences in terms of maintaining daily operations and can create a danger to life and safety if damage to the infrastructure is not repaired in a timely manner or is carried out improperly. There can also be longer term impacts to commerce as a result of restrictions on travel to and from the area or businesses that must be temporarily shut down.

6.2. Historical Occurrences

Although there have not been any major, notable instances of infrastructure failure in the Multnomah County area, there have certainly been past events in other areas of the country. Many of these infrastructure failures resulted from natural hazard events such as earthquakes such as in the case of the Loma Prieta earthquake of 1989 in the San Francisco area. During this event, many components of critical infrastructure failed including a number of transportation structures and other public utilities which experienced catastrophic failure. For example, the Bay Bridge failed and a large section of the Nimitz Freeway in Oakland collapsed.

Although critical infrastructure failures are most often associated with other natural hazard events, some past critical infrastructure failures have resulted from poor construction or old age. For example, in 2007, a large section of I-35W collapsed into the Mississippi River in Minneapolis, Minnesota. This failure was ultimately attributed to a design flaw in the bridge that had been stressed over many years and collapsed under the weight of rush hour traffic.

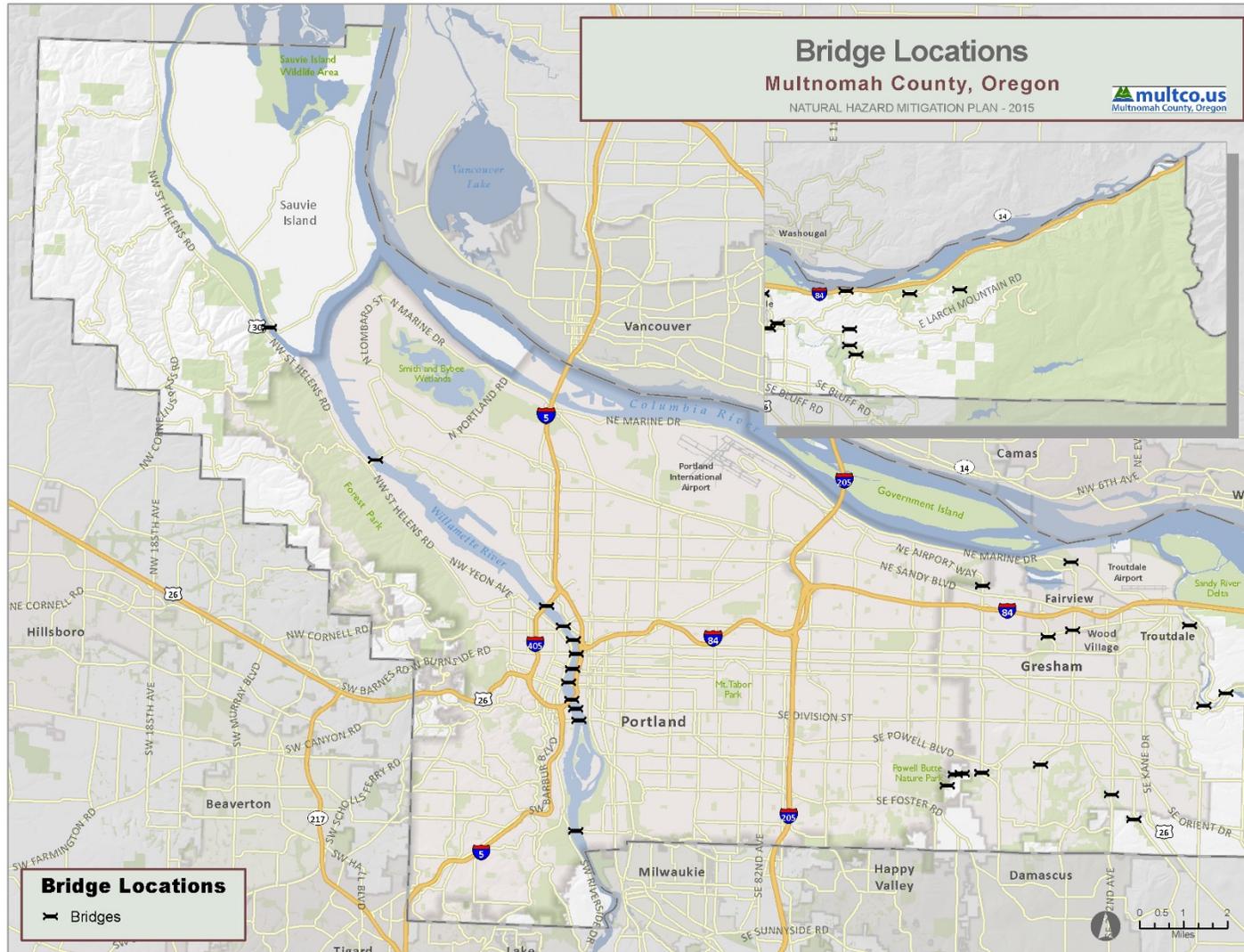
Therefore, while there have not been any incidents of infrastructure failure in Multnomah County that have been noteworthy on a national scale, these events can be unpredictable and the fact that there have been incidents in other parts of the United States should be kept in mind. In addition, local officials

have some understanding of what infrastructure and facilities are more vulnerable to failures that might result from an earthquake event due to poor design or age.

6.3. Location and Spatial Extent

Since there is critical infrastructure located throughout most of the county and the impacts of any infrastructure failure will be widespread, the entire county is considered susceptible to this hazard. Although this report does not go in to detail on the location of every type of critical infrastructure, this may be carried out in future updates of the report. **Figure 37** shows an example of one type of critical infrastructure by identifying the location of county-maintained bridges throughout the county. Similar information for other types of critical infrastructure may be added in the future.

FIGURE 37: BRIDGE LOCATIONS IN MULTNOMAH COUNTY



Source: Multnomah County GIS

6.4. Probability of Future Occurrence

Although there have been a limited number of major infrastructure failures in the past in Multnomah County, evidence from other areas of the country suggests that an infrastructure failure could occur at any time. Some of these failures may result from natural hazards, such as earthquakes, which can have major impacts. Based on the likelihood of an earthquake event occurring, which would be the most likely cause of a critical infrastructure failure, there is a high probability that the county will be impacted by a major critical infrastructure failure in the future.

7. UTILITY INTERRUPTION/FAILURE

7.1. Overview

There are a number of different types of utility failure that can cause an interruption to the daily lives of citizens and normal government operations. Among these are failures of water/sewer systems, gas lines, and electricity/power systems. A long-term outage of any of these systems would present significant challenges, though each of these would have different impacts on the public and may be the result of different precipitating events. This report focuses on power system interruptions/failures, though other utility system failures may be evaluated in future updates.

For example, a failure in the power distribution network can happen for varying reasons. Some possible examples include the physical failure of power lines due to other hazards such as ice or wind events, or it may be the result of problems within the network itself including faults at a power station, shorts or overloading in a circuit(s), or physical damages at a substation.

There are three different types of power outages - transient faults, brownouts, and blackouts. A transient fault is a brief outage caused by a fault in a power line. The issue is corrected when the power flow clears the faulty part of the circuit, and power is returned. A brownout occurs when voltage falls to an inadequate level. A blackout occurs when there is a complete loss in the power supply. Blackouts are generally longer lasting outages than the previous two examples and may involve significant repairs. These outages can range from minutes to weeks or more depending on the significance of the failure in the network.

According to the Oregon Energy Assurance Plan, the vulnerability of energy facilities and systems across the petroleum, electricity, and natural gas sectors vary to a great extent. Some facilities have infrastructure that is over 100 years old and which was built using antiquated standards, while others have new infrastructure that has been built to the current state-of-practice standards. Because of this wide range of ages and associated construction practices, the seismic vulnerability of the facilities also spans a wide range.

All of the facilities in the CEI Hub are considered vulnerable to seismic hazards. As explained in the Portland Local Energy Assurance Plan (LEAP), ground shaking from a magnitude 8 or 9 Cascadia Subduction Zone earthquake would make the NW Industrial Area susceptible to earthquake-induced liquefaction, lateral spreading and landslides. Secondary seismic hazards including destructive fires and hazardous material releases may also be triggered by an earthquake.³⁹

³⁹ Portland Local Energy Assurance Plan, June 2012.

7.2. Historical Occurrences

Earthquakes and severe weather pose the highest threat in terms of long term utility interruption and/or failure. Multnomah County faces danger from two types of earthquakes. They include Crustal earthquakes and the Cascadia Subduction Zone earthquakes. Both types could produce widespread damage and have potentially significant consequences.⁴⁰

In addition, many power outages that have occurred in Multnomah County have been due to other natural hazards such as winter storms. One recent example that caused widespread power outages in Multnomah County was in December 1996. During these types of events, ice accumulation can cause branches, trees, and power lines to break or fall, ultimately creating power disruptions or outages. Power outages can vary depending on the amount of precipitation, its location, and its form. Many of the natural hazards discussed in the Multnomah County Multi-Jurisdictional NHMP, including high wind events and winter weather, could potentially cause a long term power outage and a full list of historic events can be found in the main body of the plan.

It should also be noted that power outages can result from non-weather-related events. Recently in December 2013, the Portland downtown core experienced a power outage for several days causing several business and government buildings to shut down. The outage was caused by a fire in the vaults underneath downtown Portland and affected several blocks. A larger example, in 2003, was the Northeast Blackout that demonstrated how large networks that serve many customers are potentially vulnerable to widespread outages. During this event, an estimated 55 million people were without power after a critical failure in the network. Many power plants in Ontario, Canada and the Northeast went offline and there was no single cause that could be attributed to this incident. Instead, several issues led to a cascading failure. In short, overload protection could not isolate a small problem in the system and stop it from affecting other parts of the system, leading to larger scale effects throughout the area.

7.3. Location and Spatial Extent

Due to the unpredictable nature of where exactly a power or utility outage will occur, the entire county is considered to be susceptible to this hazard. However, in areas where power lines are located underground, there will likely be a significantly reduced threat of power outage, especially from high wind and winter storm events.

⁴⁰ Oregon State Energy Assurance Plan, March 2011.

7.4. Probability of Future Occurrence

Based on the high number of outages that have occurred in past years according to the Multnomah County Hazard Multi-Jurisdictional NHMP, the probability of a power or utility failure is considered high in the future.

8. TERRORISM

8.1. Overview

Terrorism is defined in the United States by the Code of Federal Regulations as: “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.”⁴¹ Academic literature identifies some overarching political goals that terrorism seeks to achieve, including spreading anxiety and alarm among immediate victims, families, and the general public; eliminating opponents and destroying symbolic targets; and generating direct damage on society, such as affecting business confidence.

There are two general types of terrorist groups: network and hierarchical. The type of organization a group adopts largely depends on how long the group has existed. More recently developed groups tend to organize or adapt to the possibilities of the network model. Older, more established groups lean toward the hierarchical structure and are often more associated with violence of a political nature.⁴² Terrorist acts can be committed by large, formally organized groups with terrorist cells in different parts of the world, or they can originate from smaller groups or individuals from a small city or domestic “homegrown” location. In the United States, terrorists that are “homegrown” do not belong to a defined group, may operate very effectively “under the radar,” and may pose the biggest threat initially at the local level.⁴³

8.2. Historical Occurrences

Perhaps the most notable terrorist incident in recent memory was the attacks on the World Trade Center and Pentagon on September 11, 2001. These events resulted in more than an estimated 3,000 deaths and caused destruction of many buildings including both of the World Trade Center buildings. Prior to this, in 1995, the bombing of the federal office building in Oklahoma City was one of the most devastating attacks on U.S. soil, causing more than 150 deaths and damage to more than 200 buildings.

Because of Oregon’s key role in international commerce and U.S. border security, numerous investigations into potential terrorist threats have been conducted by the Portland Division of the Federal Bureau of Investigation (FBI). One of the most serious threats involved a group of Americans who sought to join international terrorists in attacking the United States. In 2002, following an extensive Portland Division investigation later named the “Portland Seven” case, a federal grand jury indicted five men with Portland ties on charges that they planned to travel to Afghanistan to wage war against U.S.

⁴¹ U.S. Code of Federal Regulations. 23 C.F.R. Section 0.85

⁴² Terrorism Research. *Terrorist groups*. Retrieved December 27, 2011, from <http://www.terrorism-research.com/groups/>

⁴³ *Ibid.*

troops. An additional person was indicted on money laundering charges related to the conspiracy and a seventh subject was picked up as a material witness and later charged in the case.⁴⁴

8.3. Location and Spatial Extent

A terror threat could potentially occur at any location in the county. However, the very definition of a terrorist event indicates that it is most likely to be targeted at a critical or symbolic resource/location/event. Ensuring and protecting the continuity of critical infrastructure and key resources (CIKR) of the United States is essential to the Nation's security, public health and safety, economic vitality, and way of life. CIKR includes physical and/or virtual systems or assets that, if damaged, would have a detrimental impact on national security, including large-scale human casualties, property destruction, economic disruption, and significant damage to morale and public confidence. **Table 63** lists the U.S. Department of Homeland Security's (DHS) identified main critical infrastructure sectors.

TABLE 63: U.S. DEPARTMENT OF HOMELAND SECURITY CRITICAL INFRASTRUCTURE SECTORS

<ul style="list-style-type: none"> ▪ Agriculture and Food ▪ Banking and Finance ▪ Chemical ▪ Commercial Facilities ▪ Communications ▪ Critical Manufacturing ▪ Dams ▪ Defense Industrial Base ▪ Emergency Services ▪ Energy 	<ul style="list-style-type: none"> ▪ Government Facilities ▪ Healthcare and Public Health ▪ Information Technology ▪ National Monuments and Icons ▪ Nuclear Reactors, Materials, and Waste ▪ Postal and Shipping ▪ Transportation Systems ▪ Water
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8.4. Probability of Future Occurrences

Multnomah County has had no recorded major terrorist events. However, since Portland is the largest city in Oregon and it is home to many government complexes, notable structures, and significant landmarks, there is a possibility that a terrorist incident might occur. Due to few recorded incidents against the county, the probability of future occurrences of a terrorist attack may be low but would require more classified information to be determined.

9. WORKPLACE/SCHOOL/UNIVERSITY VIOLENCE

9.1 Overview

Workplace/school/university violence can be a devastating event in the community because these sometimes violent events often result in injuries or deaths and have a strong, negative impact on the

⁴⁴ Federal Bureau of Investigation. Portland Division. A Brief History. <https://www.fbi.gov/portland/about-us/history-1>

emotions of the internal sub-community in which they occur. Although this type of event is primarily thought of as physical, violence can also come in the form of oral or written threats against a person.

In any case, violence at education centers and places of work is extremely detrimental to the community and the people who learn and work in this location. Whether the threat is from an active shooter or from a threat that a student makes towards another student, this type of action has consequences on the well-being of the community overall.

9.2. Historical Occurrences

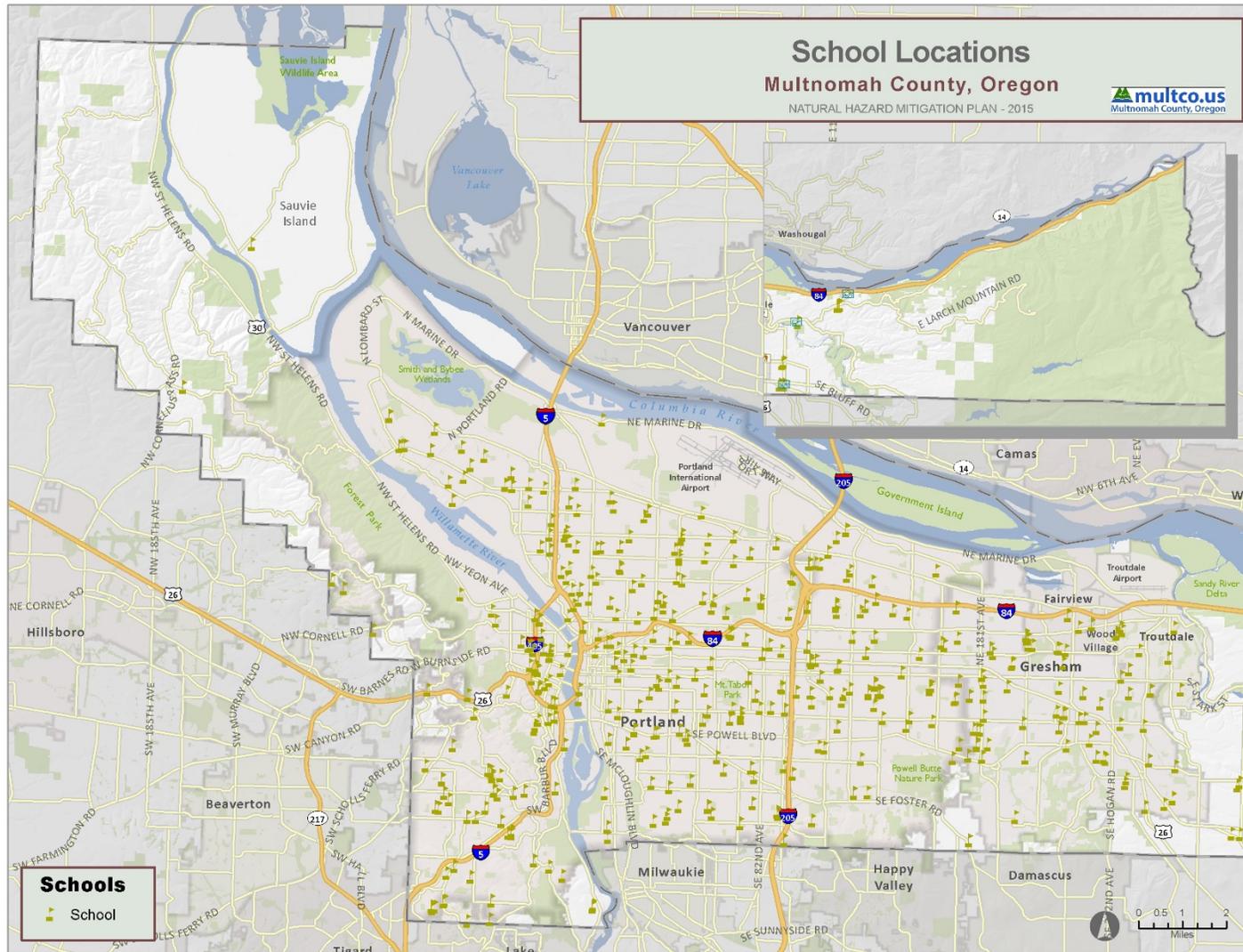
There have been some incidents of school/workplace violence in Multnomah County in the past. Though these incidents have not had as much national attention as some of the larger scale incidents in places like Newtown, Connecticut or Columbine, Colorado, they are indicative of the fact that school and workplace violence can occur anywhere. The effects of these incidents on communities can be devastating due to their sudden and unpredictable occurrence.

Recent examples of violence occurred in Multnomah County involving firearms at or near school campuses. One was in December of 2014 when a man fired shots at several high school students in Portland, injuring four of them. Another recent incident occurred in June of 2014 when a gunman who was a student at a school in Troutdale shot and killed another student and then took his own life. There have also been several other incidents that occurred outside of Multnomah County, but within the Portland Metro Region. In November 2009, a man began firing into the Legacy Metrolab in Tualatin, Oregon, his wife's place of employment after she filed for divorce one week earlier. His wife was killed and two others were wounded. The shooter committed suicide before the police arrived. Additionally, in December 2012, a man began shooting at people waiting to see Santa Claus in the Clackamas Town Center Mall in Happy Valley, Oregon. Two people were killed and one was wounded. The shooter committed suicide before police arrived.

9.3. Location and Spatial Extent

Workplace/school/university violence can occur in many locations throughout the county, but by definition, it will take place in a work or school location. Because workplaces are prevalent throughout the county, an exact spatial location is not available. School locations are identified in **Figure 38**. However, it should be noted that this type of violence can occur countywide.

FIGURE 38: PRIMARY AND SECONDARY SCHOOL LOCATIONS IN MULTNOMAH COUNTY (PUBLIC AND PRIVATE)



Source: Oregon Department of Education Open Institution List

9.4. Probability of Future Occurrence

There have been few occurrences of this type of violence in Multnomah County, but these types of events are often unpredictable, so the probability of future occurrences is possible. Between 2009 and 2014, there have been five incidents of workplace/school violence in and around Multnomah County, so on average there has been one incident per year. Based on this figure, the county can reasonably expect and should prepare for additional incidents to occur.

10. FUEL/RESOURCE SHORTAGE

10.1. Overview

Without critical resources, the public's way of life can be significantly impacted. Water, electricity, and fuel are among the most critical resources and are also subject to failures and supply problems. Power outages were addressed in the Utility Interruption/Failure section, so this section will primarily address water and fuel shortages.

Petroleum fuel is also a limited resource that is used for a number of different purposes. Petroleum alone makes up about 40% of the total energy consumption in the United States.⁴⁵ Shortages of fuel can cause major interruptions to regular activities and commerce of the area. Often, difficult decisions must be made to maintain levels of service within the government, such as first response capabilities. Rationing or the elimination of nonessential activities is often necessary to maintain these functions and preserve life and safety.

In Multnomah County, a resource shortage that results from an earthquake may have the most prominent impacts. Fuel and water storage and transmission lines may rupture during an earthquake event, causing a loss of service. This may lead to long term unavailability of resources through traditional transmission systems, requiring government officials to find other ways to provide these resources to citizens.

To address potential future concerns regarding fuel shortages, the Oregon Department of Energy maintains an Oregon Petroleum Emergency Preparedness Plan which outlines the priorities for fuel consumption and describes how continuity of operations would be maintained in the event of a fuel crisis.

10.2. Historical Occurrences

Probably the most memorable fuel shortage situation in the area occurred during the OPEC fuel crisis in 1973 and 1974. Some gas stations implemented limits on refueling which showed how the geopolitical climate can have a significant impact on the supply of fuel in the United States.

⁴⁵ The National Academy of Sciences, *What You Need to Know About Energy – Supply and Demand*, <http://www.nap.edu/reports/energy/supply.html>

10.3. Location and Spatial Extent

Since a water or fuel shortage would impact the entire county when it occurs, the location of this hazard is considered to be countywide.

10.4. Probability of Future Occurrence

Water shortages are becoming more common in the western U.S. as many areas are experiencing severe drought conditions. However, Multnomah County has not yet had to deal with a major shortage of water supplies due to drought since most of the population is provided for by the Bull Run Watershed as a primary source and ground water as a secondary source. Fuel shortages have impacted the county, notably during the 1970s oil crisis, and could occur again. Major resource shortages are most likely to occur due to impacts from a Cascadia Subduction Zone Earthquake damaging critical infrastructure. Due to this concern, the probability of future occurrences is likely.

11. FINAL DETERMINATIONS

The results of this analysis are useful in at least three ways:

- ❖ Improving our understanding of the risk associated with the human-caused hazards in Multnomah County through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- ❖ Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in Multnomah County. Updating this risk “snapshot” with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- ❖ Comparing the risk among the hazards addressed. The ability to compare the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This final step in the risk assessment provides the necessary information for local officials to craft a strategy to focus resources on those hazards that pose the most threat to Multnomah County and its municipalities.

The conclusions drawn from the hazard profiling process and analysis for Multnomah County should provide useful information to local officials making decisions about the threats they face from human-caused hazards. This information can help local officials better understand what hazards they face and provide more detailed data on what people and property are at the greatest risk of being impacted.

Notably, an in-depth analysis of the hazardous materials-related hazards in this plan has provided a basis for understanding potential impact areas from various types of hazardous materials incidents that might occur in the county. These potential impact areas can be used for identifying areas in need of additional evacuation planning or which may require additional public outreach to inform residents and businesses of their potential risk.

07/25/2017

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to some of the identified hazards including Transportation Incident, Critical Infrastructure Failure, Utility Interruption/Failure, Terrorism, Workplace/School/University Violence, and Fuel/Resource Shortage. **Table 64** shows the critical facilities vulnerable to the hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an “X”).

07/25/2017

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TABLE 64: AT-RISK CRITICAL FACILITIES IN MULTNOMAH COUNTY

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMAT 0.5-mile (road)	Mobile HAZMAT 1.0-mile (road)	Mobile HAZMAT 0.5-mile (rail)	Mobile HAZMAT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Fairview									
207th Avenue Bridge	Bridge		X	X	X	X	X		X
223rd/Marine Drive Overpass	Bridge	X	X	X	X		X		
Halsey Street Box Culvert	Bridge	X	X	X	X	X	X		X
La Petite Academy - Fairview	Childcare Facility	X	X		X		X		
Fairview City Hall	City Hall		X		X		X		
Fairview Community Center	Community Center	X	X	X	X	X	X		X
Fairview Library	County Asset		X		X		X		
River Patrol Chinook Landing	County Asset		X	X	X		X		
River Patrol Chinook Landing Boathouse	County Asset		X	X	X		X		
River Patrol Chinook Landing Garage	County Asset		X	X	X		X		
Fairview Police Department	Law Enforcement		X		X		X		
Fairview-Columbia Library	Library		X		X	X	X		X
La Petite Academy of Fairview	School- Private	X	X		X		X		
MHCC Head Start-Fairview Site	School- Private	X	X	X	X	X	X	X	X
Fairview Elementary	School- Public	X	X	X	X	X	X	X	X
MESD Program at Reynolds MS	School- Public		X		X	X	X		X
MESD Program at Woodland Elementary	School- Public		X		X		X		
Multisensory Learning Academy	School- Public	X	X	X	X	X	X		X
Reynolds Learning Academy	School- Public	X	X	X	X	X	X		X
Reynolds Middle	School- Public	X	X		X		X		
Reynolds SD 7	School- Public		X		X		X		
Salish Ponds Elementary	School- Public		X		X		X		
Woodland Elementary	School- Public		X		X		X		
Gresham									
209th/Towle Av Bridge	Bridge			X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
242nd/Hogan Road Bridge	Bridge			X	X				
Highland Road Bridge	Bridge			X	X				
A Step Above The Rest	Childcare Facility			X	X				
Ascension Early Childhood Center	Childcare Facility			X	X				
Champions - Butler Creek	Childcare Facility								
Champions - Hall	Childcare Facility	X	X	X	X				
Champions - Highland	Childcare Facility		X	X	X				
Champions - Hogan Cedars	Childcare Facility			X	X				
Champions - Hollydale	Childcare Facility			X	X				
Champions - North Gresham	Childcare Facility		X	X	X				
Champions - Powell Valley	Childcare Facility				X				
Champions - West Gresham	Childcare Facility			X	X				
Children's Learning Center-Powell	Childcare Facility			X	X				
Children's World-Hogan	Childcare Facility		X	X	X				
Children's World-NE 181st	Childcare Facility		X	X	X	X	X		
Discovery Preschool EHC	Childcare Facility			X	X				
Discovery Preschool Kindergarten-CC	Childcare Facility			X	X				
Eastside Christian School	Childcare Facility		X	X	X				
Goodman Family Childcare	Childcare Facility		X	X	X				
Gresham Heights Learning Center	Childcare Facility			X	X				
Gresham Montessori Center	Childcare Facility			X	X				
Heidi Ho Rockwood DC Inc	Childcare Facility		X	X	X		X		
Highland Community Church Preschool	Childcare Facility			X	X				
Kellie's Daycare	Childcare Facility								
Kiddie Koop	Childcare Facility			X	X				
Kids And Company-Powell Valley After Pro	Childcare Facility				X				
Kindercare - Division	Childcare Facility		X	X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Kindercare Learning Center-Hogan Drive	Childcare Facility		X	X	X				
Kindercare Learning Center-NE 181st Ave	Childcare Facility		X	X	X	X	X		
Kindercare-Division	Childcare Facility			X	X				
King's Kids Adventist PSC	Childcare Facility			X	X				
Learning Tree- Highland Powell	Childcare Facility			X	X				
Little Friends Day School	Childcare Facility			X	X				
Love Bug Daycare	Childcare Facility			X	X				
Morningstar Montessori House Of Children	Childcare Facility			X	X				
Mt Hood Christian Activity Center	Childcare Facility			X	X				
Mt Hood Comm Clg Head Start-Kellys PLC	Childcare Facility			X	X				
Mt Hood Community College Child Development	Childcare Facility	X	X		X				
New Beginnings Child Development Center	Childcare Facility	X	X	X	X	X	X	X	X
Oregon Child Development Center-Anderson	Childcare Facility			X	X				
Pilgrim Christian D.C.	Childcare Facility			X	X				
Portland Luth. Ext Care	Childcare Facility			X	X				
Small World Learning Ctr	Childcare Facility		X		X				
Stepping Stone Day School Center Inc	Childcare Facility			X	X				
Tinker Tots Childcare	Childcare Facility	X	X	X	X				
Trinity Lutheran Ctr	Childcare Facility			X	X				
United Methodist Preschool	Childcare Facility			X	X				
YMCA - Portland Lutheran	Childcare Facility			X	X				
YMCA - Wilkes Elementary	Childcare Facility	X	X	X	X	X	X	X	X
Gresham City Hall	City Hall		X	X	X				
GSI Community Center	Community Center		X	X	X				
Centennial High School	County Asset		X	X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Columbia Gorge Corporate Center	County Asset	X	X	X	X	X	X	X	X
East County Courthouse	County Asset			X	X				
East County Office Building	County Asset		X	X	X				
Gresham District Court	County Asset			X	X				
Gresham Library	County Asset			X	X				
Gresham Probation	County Asset			X	X				
John B Yeon Annex	County Asset		X	X	X				
John B Yeon Facility	County Asset		X	X	X				
Multnomah County East	County Asset			X	X				
Rockwood Community Health Center	County Asset			X	X				
Rockwood Fred Meyer Retail Development	County Asset		X	X	X				
Rockwood Library	County Asset			X	X				
Vance Crusher Pump House	County Asset			X	X				
Vance Crusher Road Shop	County Asset			X	X				
Vance Crusher Storage Building	County Asset			X	X				
Yeon Car Wash	County Asset		X	X	X				
Yeon Gas Station	County Asset		X	X	X				
Gresham Fire & Emerg Srvcs 71	Fire Station		X	X	X				
Gresham Fire & Emerg Srvcs 72	Fire Station		X		X				
Gresham Fire & Emerg Srvcs 73	Fire Station				X				
Gresham Fire & Emerg Srvcs 74	Fire Station		X	X	X	X	X		X
Legacy Mount Hood	Hospital		X	X	X				
Gresham Police Department	Law Enforcement		X	X	X				
Gresham Police Dept	Law Enforcement		X	X	X				
Gresham Library	Library			X	X				
Rockwood Library	Library			X	X				
Comfort Hospice And Palliative Care LLC	Licensed Medical Facility		X	X	X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
FMC Dialysis Services Of Mt Hood	Licensed Medical Facility		X		X				
Good Samaritan Society - Services At Home	Licensed Medical Facility	X	X		X				
US Renal Care Gresham Dialysis	Licensed Medical Facility			X	X				
Visiting Angels	Licensed Medical Facility			X	X				
Alterra Wynwood Of Mt. Hood	Residential Care Facility		X	X	X				
Chestnut Lane Assisted Living Community	Residential Care Facility		X	X	X				
Courtyard Fountains	Residential Care Facility		X	X	X				
Encore Senior Village At Portland	Residential Care Facility			X	X				
Encore Senior Village Retirement	Residential Care Facility			X	X				
Fairlawn Good Samaritan Village And Health Center	Residential Care Facility	X	X		X				
Fairlawn Good Samaritan Village Retirement	Residential Care Facility	X	X		X				
Farmington Square	Residential Care Facility		X	X	X				
Farmington Square - Gresham	Residential Care Facility		X	X	X				
Good Samaritan Society - Fairlawn Village	Residential Care Facility	X	X		X				
Good Samaritan Society-Fairlawn Village	Residential Care Facility	X	X		X				
Gresham Manor Retirement	Residential Care Facility		X	X	X				
Gresham Rehab & Specialty Care	Residential Care Facility			X	X				
Gresham Rehab And Specialty Care	Residential Care Facility			X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Huntington Terrace	Residential Care Facility		X	X	X				
Huntington Terrace Assisted Living Residence	Residential Care Facility		X	X	X				
Marquis Care At Centennial	Residential Care Facility		X	X	X				
Marquis Care Centennial	Residential Care Facility		X	X	X				
Mattie Younkin Manor Retirement	Residential Care Facility		X	X	X				
Oharas Manor Inc	Residential Care Facility			X	X				
Pacific Gardens Alzheimers Special Cre Ctr	Residential Care Facility		X	X	X		X		
Powell Valley Asstd Living-Memory Care	Residential Care Facility			X	X				
Powell Valley Memory Care Community	Residential Care Facility			X	X				
Powell Vista Manor Retirement	Residential Care Facility			X	X				
Regency Gresham Nursing & Rehabilitation Center	Residential Care Facility				X				
Regency Gresham Rehabilitation-Nursing	Residential Care Facility				X				
Silvia & John's Residential Care	Residential Care Facility		X	X	X				
The Village Retirement Center	Residential Care Facility		X	X	X				
Villa North Retirement Center	Residential Care Facility		X	X	X				
Village Health Care	Residential Care Facility			X	X				
Village Health Care I LLC	Residential Care Facility			X	X				
Wynwood-Mt Hood Retirement	Residential Care Facility		X	X	X				
Apostolic Christian Academy	School- Private		X	X	X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Ascension Early Childhood	School- Private			X	X				
Eastside Christian School	School- Private		X	X	X				
Gresham Heights Learning Center	School- Private			X	X				
Gresham United Methodist Preschool	School- Private			X	X				
Highland Community Preschool	School- Private			X	X				
Kindercare Learning Centers, Gresham	School- Private		X	X	X				
MHCC Head Start-Kelly Place Site	School- Private			X	X				
MHCC Head Start-Mt. Hood Site	School- Private	X	X		X				
Phonics Phactory	School- Private			X	X				
Portland Adventist Elementary	School- Private			X	X				
Portland Lutheran	School- Private			X	X				
Rosemary Anderson High -East Campus	School- Private			X	X				
SOAR Academy	School- Private		X	X	X				
The Phonics Phactory	School- Private	X	X		X				
Adult Living Program	School- Public		X	X	X				
Alpha High	School- Public		X	X	X				
Butler Creek Elementary	School- Public								
Centennial High	School- Public		X	X	X				
Centennial Learning Center	School- Public			X	X				
Centennial Middle	School- Public		X	X	X				
Centennial School District 28j	School- Public			X	X				
Center For Advanced Learning	School- Public		X	X	X				
Clear Creek Middle	School- Public	X	X		X				
Davis Elementary	School- Public		X	X	X		X		
Dexter McCarty Middle	School- Public			X	X				
East Gresham Elementary	School- Public			X	X				
Gordon Russell Middle	School- Public		X	X	X				
Gresham Arthur Academy	School- Public			X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Gresham High	School- Public			X	X				
Gresham-Barlow SD 10j	School- Public		X	X	X				
Gresham-Barlow Web Academy	School- Public			X	X				
Hall Elementary	School- Public	X	X	X	X				
Hartley Elementary	School- Public		X	X	X	X	X		
Hauton B Lee Middle	School- Public		X		X	X	X		
Highland Elementary	School- Public		X	X	X				
Hogan Cedars Elementary	School- Public			X	X				
Hollydale Elementary	School- Public			X	X				
Kelly Creek Elementary	School- Public			X	X				
Kerr Youth & Family Center DTP	School- Public		X		X		X		
Kerr Youth Center/Wynne Watts School	School- Public		X		X		X		
KNOVA Learning School	School- Public		X	X	X				
Lynch Meadows Elementary	School- Public			X	X				
MESD Program At Centennial HS	School- Public		X	X	X				
MESD Program At Davis Elementary	School- Public		X	X	X		X		
MESD Program At Kelly Creek Elementary	School- Public			X	X				
Mt. Hood Community College	School- Public	X	X		X				
North Gresham Elementary	School- Public		X	X	X				
Oregon Child Development Coalition Of MC	School- Public			X	X				
Pathways Community School	School- Public			X	X				
Powell Valley Elementary	School- Public				X				
Springwater Trail High	School- Public			X	X				
West Gresham Elementary	School- Public			X	X				
Wilkes Elementary	School- Public	X	X	X	X	X	X	X	X
77 Dollar Urgent Care	Urgent Care Center		X	X	X				
Gohealth Urgent Care - Fairview	Urgent Care Center	X	X		X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Gohealth Urgent Care - Gresham	Urgent Care Center		X	X	X				
Lake Oswego									
PCC Sylvania Child Dev Center	Childcare Facility				X				
Sonshine Express Preschool And Kindergar	Childcare Facility								
Alternative Services Oregon Inc.	School- Private				X				
Kindercare	School- Private								
Sonshine Express Preschool MPC	School- Private								
Student Visions	School- Private				X				
Maywood Park									
Headstart-Knott Center	Childcare Facility		X	X	X	X	X		X
Theodore Bear Day Care	Childcare Facility		X	X	X	X	X		X
Maywood Park City Hall	City Hall		X	X	X	X	X		X
MHCC Maywood Campus	School- Public		X	X	X	X	X		X
Mt. Hood Community College Head Start	School- Public		X	X	X	X	X		X
Portland									
Portland International Airport	Airport			X	X				
American Medical Response Northwest	Ambulance Service		X	X	X	X	X	X	X
American Medical Response-Multnomah Co	Ambulance Service		X	X	X	X	X	X	X
Community Ambulance	Ambulance Service		X	X	X		X		
Portland Fire And Rescue-EMS	Ambulance Service		X	X	X	X	X	X	X
Airport Way Bridge	Bridge	X	X	X	X	X	X	X	X
Broadway Bridge	Bridge	X	X	X	X	X	X	X	X
Burnside Bridge	Bridge		X	X	X	X	X	X	X
Circle Avenue Bridge #1	Bridge		X	X	X				
Fremont Bridge	Bridge		X	X	X	X	X		X
Hawthorne Bridge	Bridge		X	X	X	X	X		X
Marquam Bridge	Bridge		X	X	X	X	X		X

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Morrison Bridge	Bridge		X	X	X	X	X		X
Ross Island Bridge	Bridge	X	X	X	X	X	X		X
Sellwood Bridge	Bridge				X	X	X		
St. Johns Bridge	Bridge		X	X	X	X	X	X	X
Steel Bridge RR	Bridge	X	X	X	X	X	X	X	X
Tilikum Crossing Bridge	Bridge	X	X	X	X	X	X		X
A Mothers Love Childcare	Childcare Facility	X	X	X	X	X	X		X
ABC & 123 Day Care	Childcare Facility		X	X	X	X	X		X
ABC Kids Childcare And Preschool	Childcare Facility		X	X	X				
ABC University Preschool At Linnton Comm	Childcare Facility			X	X	X	X	X	X
Active Learning Center	Childcare Facility								
Adventure Camp/After Bell	Childcare Facility	X	X	X	X	X	X	X	X
Ainsworth After School Association	Childcare Facility		X	X	X				
Airport Learning Tree	Childcare Facility		X	X	X		X		
Alameda Beaumont Childcare	Childcare Facility								
Alberta Early Learning Community	Childcare Facility								
Albina Brooklyn	Childcare Facility		X		X		X		
Albina Carlton Court Head Start	Childcare Facility			X	X	X	X		X
Albina Early Head Start - University Park	Childcare Facility	X	X		X	X	X	X	X
Albina Early Head Start-Infant Room	Childcare Facility		X	X	X		X		
Albina Early Head Start-Normandale	Childcare Facility			X	X	X	X	X	X
Albina Head Start	Childcare Facility		X		X		X		
Albina Head Start - Benjamin M Priestley	Childcare Facility		X	X	X		X		
Albina Head Start - Hughes Center	Childcare Facility			X	X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Albina Head Start - Lutheran Center	Childcare Facility				X				
Albina Head Start-Dekum Court	Childcare Facility		X	X	X	X	X	X	X
Albina Head Start-Jackson Center	Childcare Facility		X		X		X		
Albina Head Start-Maya Angelou Ctr	Childcare Facility			X	X		X		
Albina Head Start-Mccormack-Matthews	Childcare Facility			X	X		X		
Albina Head Start-Richard C Brown Ctr	Childcare Facility		X	X	X		X		
Albina Head Start-Salvation Army	Childcare Facility				X				
Albina Head Start-Young Center	Childcare Facility				X				
Albina-Tina Clegg Center	Childcare Facility		X		X		X		
Alder Street Learning Center	Childcare Facility		X	X	X	X	X		
Allroads Learning Community	Childcare Facility								
Andi Panda Childcare And Enrichment Ctr	Childcare Facility		X		X		X		
Angel Academy	Childcare Facility				X		X		
Angel Loft Preschool	Childcare Facility		X	X	X	X	X	X	X
Annie's Quality Care	Childcare Facility		X	X	X	X	X		X
Apple Blossom Nursery School	Childcare Facility								
Archbishop Howard School	Childcare Facility				X		X		
Arleta Baptist Child Ctr	Childcare Facility				X				
Art 4 Life - Abernathy	Childcare Facility	X	X	X	X	X	X		X
Art 4 Life - Maplewood School	Childcare Facility		X						
Art 4 Life - Sunnyside	Childcare Facility		X						
Art 4 Life-The Emerson School	Childcare Facility		X	X	X	X	X		X
Art 4 Life-Winterhaven	Childcare Facility		X	X	X	X	X		X
As I Grow Childcare	Childcare Facility								
ASPSU Children's Center	Childcare Facility	X	X	X	X		X		
Aunt Genes Childcare	Childcare Facility				X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Beaumont Children's Ctr	Childcare Facility						X		
Belmont Schools Inc DBA Belmont Academy	Childcare Facility								
Bethany Elementary School	Childcare Facility	X	X	X	X	X	X	X	X
Blossom House Preschool	Childcare Facility		X	X	X	X	X	X	X
Boise-Eliot Elem-Sun Program	Childcare Facility		X	X	X	X	X		X
Bottles-2-Books Childcare	Childcare Facility			X	X	X	X		X
Bright Beginnings	Childcare Facility				X				
Building Blocks Playschool	Childcare Facility			X	X				
Busy Bee Daycare And Preschool	Childcare Facility				X				
Calvary Christian DC	Childcare Facility		X	X	X				
CDC/Little Persons	Childcare Facility	X	X	X	X		X		
CDC/Portland Heights DC	Childcare Facility		X	X	X		X		
CDC/Young Friends	Childcare Facility				X		X		
CDI-Early Head Start CRN	Childcare Facility		X		X	X	X		
CDI-Early Head Start-Gladstone	Childcare Facility		X	X	X		X		
CDI-Early Head Start-North	Childcare Facility		X	X	X		X		
Cedar Montessori Preschool	Childcare Facility			X	X		X		
Champions - Cherry Park	Childcare Facility			X	X				
Champions - Earl Boyles	Childcare Facility		X	X	X				
Champions - Gilbert Heights	Childcare Facility			X	X				
Champions - Gilbert Park	Childcare Facility			X	X				
Champions - Harold Oliver	Childcare Facility								
Champions - International School	Childcare Facility	X	X	X	X		X		
Champions - Lincoln Park	Childcare Facility				X				
Champions - Menlo	Childcare Facility								
Champions - Mill Park	Childcare Facility				X				
Champions - Ventura Park	Childcare Facility								
Champions - West Powellhurst	Childcare Facility			X	X				
Childcare At Laveta's	Childcare Facility		X		X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Childpeace Montessori (105 NW Park Ave)	Childcare Facility		X		X	X	X		X
Childpeace Montessori (1516 NW Thurman St)	Childcare Facility	X	X		X	X	X	X	X
Childpeace Montessori The Terrace	Childcare Facility		X		X		X		
Children's Club Inc (PO Box 14834)	Childcare Facility	X	X		X	X	X	X	X
Children's Club Inc (3520 SE Yamhill St)	Childcare Facility		X						
Children's Elite Home	Childcare Facility				X				
Children's Garden Day Care And Preschool	Childcare Facility		X		X	X	X		
Children's Relief Nursery	Childcare Facility		X		X	X	X		
Child's Reach Childcare	Childcare Facility	X	X			X	X	X	X
Childs View Montessori School	Childcare Facility				X				
Childswork Learning Ctr Inc	Childcare Facility								
Chrysalis Home School	Childcare Facility				X		X		
Circle Of Life-Maplewood	Childcare Facility	X	X	X	X		X		
Clark Little Feet	Childcare Facility			X	X				
Class Academy	Childcare Facility	X	X	X	X	X	X	X	X
Cloud Nine Childcare	Childcare Facility			X	X				
Cloud Nine Too Childcare	Childcare Facility			X	X				
Columbia Academy	Childcare Facility								
Community Childcare-RLC	Childcare Facility		X		X		X		
Community Learning Center School	Childcare Facility								
Cong Nev Shalom Found Sch	Childcare Facility								
Creative Minds Learning Center-Gateway	Childcare Facility								
Creative Minds Learning Center-Woodstock	Childcare Facility		X						
Daddy Daycare	Childcare Facility		X	X	X	X	X	X	X

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Danforth Associates After Care Program	Childcare Facility		X	X	X	X	X		
David Douglas Child Development Center	Childcare Facility								
David Douglas Day Care Inc	Childcare Facility				X				
Debs House Childcare	Childcare Facility	X	X			X	X		X
Discoveryland Child Care Center	Childcare Facility				X		X		
DNCW & Associates AS	Childcare Facility		X	X	X	X	X		X
Duniway After School	Childcare Facility		X	X	X	X	X		X
Early Years Development Center	Childcare Facility				X		X		
Easy Spirit Childcare	Childcare Facility	X	X		X	X	X		X
Emanuel Child Care Center	Childcare Facility		X	X	X		X		
Emmanuel Helping Hands	Childcare Facility		X	X	X		X		
Escuela Viva Childcare	Childcare Facility			X	X		X		
Escuela Viva Two	Childcare Facility	X	X	X	X		X		
Faubion Elementary-YMCA After School	Childcare Facility		X	X	X	X	X		X
First Christian Ch Center	Childcare Facility	X	X	X	X		X		
First Presbyterian Church	Childcare Facility		X	X	X	X	X		
Franciscan Montessori School	Childcare Facility		X	X	X				
French American School	Childcare Facility		X						
Friendly Chaps Child Dev (1445 NW 26th Ave)	Childcare Facility		X	X	X	X	X		
Friendly Chaps-Com Center (2617 NW Savier St)	Childcare Facility		X	X	X	X	X		
Friendly House Childcare	Childcare Facility		X	X	X	X	X		
Fruit And Flower Child Care Center	Childcare Facility		X		X		X		
Gateway Hunny Hollow D.S.	Childcare Facility		X	X	X		X		
German American School	Childcare Facility	X	X	X	X	X	X	X	X
Golden Key Children's Ctr	Childcare Facility		X	X	X		X		
Grace Collins Mem Center	Childcare Facility		X	X	X		X		

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Grand Central Station	Childcare Facility				X				
Grandmas Place - Center Village	Childcare Facility			X	X	X	X	X	X
Grandmas Place - Columbia Knoll	Childcare Facility		X		X		X		
Grandmas Place - Rose Quarter	Childcare Facility	X	X	X	X	X	X		X
Grandmas Place Childcare - Lloyd Place	Childcare Facility	X	X	X	X	X	X		X
Great Beginning Childcare	Childcare Facility		X		X				
Growing Seed Childcare	Childcare Facility	X	X	X	X	X	X		X
Growing Seeds - North	Childcare Facility		X	X	X		X		
GSR Community Support Childcare	Childcare Facility		X	X	X	X	X		X
GSR Phase II Infant And Toddler Center	Childcare Facility		X	X	X	X	X		X
Hand In Hand - Rose City Park School (9046 E Burnside St)	Childcare Facility		X	X	X		X		
Hand In Hand-Rose City Pk (2334 NE 57th Ave)	Childcare Facility				X		X		
Happy Bear Day Care (3001 NE Ainsworth St)	Childcare Facility		X	X	X	X	X		
Happy Bear Day Care Center (4326 NE Killingsworth St)	Childcare Facility				X		X		X
Happy Day-CCM	Childcare Facility			X	X				
Happy Hearts Childcare	Childcare Facility			X	X				
Harmony Montessori School	Childcare Facility				X				
Headstart-Thompson ES	Childcare Facility		X	X	X	X	X		X
Heartwood Preschool	Childcare Facility			X	X	X	X		X
Helen Gordon Child Development Ctr	Childcare Facility	X	X	X	X		X		
Helping Hands Family Daycare	Childcare Facility		X			X	X		X
Holladayland Day Nursery	Childcare Facility		X	X	X	X	X		X
Holy Family Ext. Care	Childcare Facility		X		X		X		
Holy Redeemer Beyond The Classroom	Childcare Facility			X	X		X		

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Huggy Bear Day Care Ctr	Childcare Facility		X	X	X		X		
Huggy Bear Infant Toddler	Childcare Facility		X	X	X		X		
Imagination Station Daycare Center	Childcare Facility		X			X	X		
Immanuel Lutheran Preschool	Childcare Facility		X		X		X		
In A Childs Path-Ford	Childcare Facility				X		X		
In A Childs Path-Wiederhold	Childcare Facility				X		X		
International School	Childcare Facility	X	X	X	X		X		
Irvington Extended DC	Childcare Facility		X		X		X		
Joyful Learning Preschool And Childcare	Childcare Facility	X	X	X	X	X	X	X	X
Joyful Noise - City Kids	Childcare Facility	X	X	X	X		X		
Joyful Noise - Metro Kids	Childcare Facility	X	X	X	X	X	X	X	X
Joyful Noise Childcare Center	Childcare Facility		X	X	X	X	X		X
Just Little People CC	Childcare Facility								
Just Little People Preschool	Childcare Facility								
Kiddie Academy	Childcare Facility				X		X		
Kids Community Learning Center	Childcare Facility		X	X	X	X	X		
Kids Klub Too!	Childcare Facility		X	X	X		X		
Kidz Korner	Childcare Facility			X	X				
Kidz Own Daycare	Childcare Facility			X	X	X	X		X
Kindercare - Downtown	Childcare Facility	X	X	X	X		X		
Kindercare - Legacy Northwest	Childcare Facility		X	X	X	X	X		
Kindercare Learning Center	Childcare Facility	X	X	X	X		X		
Kindercare-Fred Meyer	Childcare Facility		X	X	X	X	X	X	X
Kindercare-Naegli	Childcare Facility	X	X	X	X				
Lad 'N' Lassie Nursery	Childcare Facility	X	X	X	X				
Laurelhurst Montessori Preschool	Childcare Facility		X	X	X	X	X		X
Lauries House	Childcare Facility				X				
Learn And Play	Childcare Facility		X	X	X		X		

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LICM Community Ctr	Childcare Facility	X	X	X	X	X	X	X	X
Lily Garden Montessori Preschool	Childcare Facility			X	X	X	X		X
Linnton Community Center	Childcare Facility			X	X	X	X	X	X
Little Angels Daycare	Childcare Facility		X		X				
Little Footsteps Inc	Childcare Facility	X	X		X		X		
Little Lambs Lutheran Preschool	Childcare Facility			X	X				
Little Pandas Playschool	Childcare Facility		X		X		X		
Little Red Wagon DC Ctr	Childcare Facility		X	X	X				
Love N Learn	Childcare Facility		X						
Luv N' Fun DC Center	Childcare Facility								
Markham Child Care Assn (PO Box 19849)	Childcare Facility	X	X	X	X	X	X	X	X
Markham Childrens Care Association Inc (10531 SW Capitol Hwy)	Childcare Facility			X	X				
Martis Place Childcare	Childcare Facility			X	X	X	X		X
Marysville Sch Daycare	Childcare Facility				X				
Meadowlark Chld Dev Ctr	Childcare Facility	X	X	X	X	X	X	X	X
Middendorf Mary E	Childcare Facility		X						
Mittleman Jewish-Early	Childcare Facility				X				
Montessori Of Alameda	Childcare Facility				X		X		
Morning Star School	Childcare Facility		X						
Mountain Valley Homecare And Preschool	Childcare Facility			X	X				
Mounthood Comm CLG Head Start	Childcare Facility								
Mt Carmel Preschool And Daycare	Childcare Facility								
Mt Hood Comm Clg Head Start-Russellville	Childcare Facility		X	X	X		X		
Mult Co-Child Dev Ctr	Childcare Facility		X	X	X	X	X		X
Multnomah Afterschool Ctr	Childcare Facility		X	X	X	X	X		

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Neveh Shalom Foundation School	Childcare Facility								
New Day Sunrise School	Childcare Facility		X	X	X	X	X		X
Northeast Community Child Development	Childcare Facility		X	X	X	X	X		X
NW Community Child Care	Childcare Facility		X	X	X	X	X		
Open Bible Day Care	Childcare Facility			X	X				
Open Minds Childcare	Childcare Facility								
Our Lady Of Sorrows EC	Childcare Facility		X						
Our Lady Of The Lake	Childcare Facility			X	X				
Parkrose Daycare	Childcare Facility		X	X	X	X	X		X
Parkrose Daycare II	Childcare Facility		X	X	X	X	X		X
PCC Sylvania Child Dev Ct	Childcare Facility				X				
PCS-Toddler Devel Center	Childcare Facility	X	X	X	X	X	X		X
Peace Child Dev Center	Childcare Facility				X				
Peninsula Childrens Center - Astor	Childcare Facility		X		X	X	X		
Peninsula Childrens Center - Boise Eliot (620 N Fremont St)	Childcare Facility		X	X	X	X	X		X
Peninsula Children's Center - Maryland	Childcare Facility		X	X	X		X		
Peninsula Children's Center Latch Key (8125 N Emerald Ave)	Childcare Facility		X		X		X		
Peninsula Children's Center-Sabin School	Childcare Facility		X						
Peninsula-Boise Eliot (2408 N Farragut St)	Childcare Facility		X	X	X		X		
Peninsula-Latchkey (4720 N Maryland Ave)	Childcare Facility		X				X		
Piedmont Peace Place After School Prgm	Childcare Facility		X	X	X				
Pixie Day Nursery	Childcare Facility		X	X	X				
PJA Child Care	Childcare Facility				X				
PJA Kidspace At Forrest Park	Childcare Facility								

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PJA Kidzone	Childcare Facility				X		X		
Play School Daycare	Childcare Facility								
Pocketful Of Posies I	Childcare Facility		X	X	X	X	X		X
Pocketful Of Posies II	Childcare Facility			X	X	X	X		X
Pockets Full Of Posies	Childcare Facility				X				
Portland Jewish Academy Kids Corner	Childcare Facility				X				
Portland Metro A/G Church	Childcare Facility				X				
Portland Public School Head Start	Childcare Facility		X	X	X		X		
Powellhurst Day Care - John Barbs	Childcare Facility			X	X				
Powellhurst Day Nursery	Childcare Facility			X	X				
Project Networklifeworks Northwest	Childcare Facility		X	X	X	X	X	X	X
Providence Montessori School	Childcare Facility			X	X	X	X	X	X
Providence Wee Care (4805 NE Glisan St)	Childcare Facility			X	X	X	X	X	X
Providence Wee Care (830 NE 47 th Ave)	Childcare Facility			X	X	X	X	X	X
PSU Helen Gordon Child Ct	Childcare Facility	X	X	X	X	X	X	X	X
Puddletown Preschool	Childcare Facility		X	X	X		X		
Raleigh Park After S C A	Childcare Facility	X	X	X	X	X	X	X	X
Rivercrest Church After School	Childcare Facility		X	X	X	X	X		X
Rocking Horse Day School	Childcare Facility			X	X				
Rosa Watson Day Care G.H.	Childcare Facility		X	X	X	X	X		
Rose City Day Nursery	Childcare Facility				X		X		
Rowanberry Preschool	Childcare Facility		X	X	X	X	X		X
Sabin Daycare Center	Childcare Facility	X	X	X	X	X	X	X	X
Schoolita Alegria	Childcare Facility		X	X	X	X	X	X	X
SE YMCA Child Development Center	Childcare Facility			X	X				

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Sellwood-Bilingual Childcare-Preschool	Childcare Facility	X	X		X	X	X		
Shannon's Day Care	Childcare Facility			X	X				
Shepherds Door Childrens Center	Childcare Facility				X		X		
Smiling Faces Daycare	Childcare Facility		X		X		X		
Sonbeam Day Care Ctr	Childcare Facility	X	X	X	X	X	X		X
Sonshine Christian DC	Childcare Facility	X	X			X	X	X	X
Spindlewood Preschool	Childcare Facility		X	X	X		X		
St Agatha School	Childcare Facility		X		X		X		
St Clare After Sch Prgm	Childcare Facility			X	X				
St James Child Development Center	Childcare Facility	X	X	X	X		X		
St John Fisher Sch Ext.	Childcare Facility		X						
St Stephens School	Childcare Facility				X				
Step By Step CDC 5	Childcare Facility				X		X		
Stephenson Childrens Care Association	Childcare Facility								
Sunflower School	Childcare Facility		X		X		X		
Sunshine Daycare School	Childcare Facility			X	X				
SW School-Kinderland	Childcare Facility		X						
The Creative Learning Place	Childcare Facility		X		X	X	X		
The Day Watch - DBA Lil Rookies	Childcare Facility	X	X	X	X		X		
The Jackson Club After School	Childcare Facility			X	X				
The Madeleine Youth Development Program	Childcare Facility		X				X		
The Salvation Army-White Shield Center	Childcare Facility	X	X		X	X	X		
Trinity Learning Center	Childcare Facility		X	X	X	X	X		X
Vermont Hill Family Life-After School-Rieke	Childcare Facility			X	X				
Vermont Hills - Atkinson	Childcare Facility				X				
Vermont Hills - Bridger	Childcare Facility				X				

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Vermont Hills - Bridlemile	Childcare Facility		X						
Vermont Hills - Buckman	Childcare Facility	X	X		X		X		
Vermont Hills - Creston Elementary	Childcare Facility			X	X				
Vermont Hills - Hayhurst	Childcare Facility		X						
Vermont Hills - Jason Lee School	Childcare Facility		X	X	X	X	X		X
Vermont Hills - Kelly Elementary	Childcare Facility		X	X	X				
Vermont Hills - Rieke School	Childcare Facility			X	X				
Vermont Hills - St Andrews	Childcare Facility								
Vermont Hills - St Ignatius	Childcare Facility			X	X				
Vermont Hills - St John Fisher	Childcare Facility		X						
Vermont Hills - VA	Childcare Facility		X	X	X				
Vermont Hills - Whitman School	Childcare Facility		X		X				
Vermont Hills Fam Life Ct	Childcare Facility	X	X						
VHFLC-Barnes School	Childcare Facility	X	X	X	X	X	X	X	X
VHFLC-Holladay	Childcare Facility	X	X	X	X	X	X	X	X
VHFLC-St Claire	Childcare Facility			X	X				
Village Child Care At Immaculate Heart	Childcare Facility		X	X	X		X		
Violet Garden Waldorf Preschool	Childcare Facility		X		X	X	X		
Visions Childcare	Childcare Facility		X		X	X	X		
VOA-Cottage	Childcare Facility		X	X	X	X	X		X
Volunteers Of America Oregon Family Religious	Childcare Facility	X	X	X	X	X	X		X
Wee Care Day Care	Childcare Facility		X						
Wee Works (2106 NE 40th Ave)	Childcare Facility			X	X	X	X		X
Wee Works (3918 NE Hancock St)	Childcare Facility		X	X	X	X	X		X
West Hills Early Childhood Learning Cent	Childcare Facility				X				
West Hills Mont II Preschool	Childcare Facility		X						
West Hills Montessori	Childcare Facility		X						

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Wonderworks-All Saints	Childcare Facility				X		X		
YMCA - Alameda	Childcare Facility				X		X		
YMCA - Beach School	Childcare Facility		X	X	X	X	X		X
YMCA - Grout	Childcare Facility		X	X	X	X	X		
YMCA - Hollyrood	Childcare Facility		X	X	X	X	X		X
YMCA - Humboldt	Childcare Facility			X	X				
YMCA - Llewellyn	Childcare Facility		X		X	X	X		
YMCA - Richmond	Childcare Facility				X				
YMCA - Tabor Heights	Childcare Facility				X		X		
YMCA - Vernon	Childcare Facility				X		X		
YMCA - Vestal School	Childcare Facility		X		X		X		
YMCA - Woodlawn	Childcare Facility		X	X	X	X	X	X	X
YMCA - Woodstock	Childcare Facility		X						
YMCA - YS Choice Child Development Ctr	Childcare Facility				X		X		
YMCA Before After School - Arleta	Childcare Facility				X				
YMCA Before After School - Arthur Academy	Childcare Facility				X				
YMCA Before After School - David Douglas	Childcare Facility		X	X	X				
YMCA Before After School - Faubian	Childcare Facility		X	X	X	X	X		X
YMCA Before After School - Harvey Scott	Childcare Facility		X		X		X		
YMCA Before After School - Laurelhurst	Childcare Facility		X	X	X	X	X		X
YMCA Before After School - Lewis	Childcare Facility		X						
YMCA Before After School - Rigler	Childcare Facility				X		X		
YMCA Before After School - Trinity Lutheran	Childcare Facility			X	X	X	X		X
YMCA Child Dev Center	Childcare Facility		X	X	X	X	X	X	X
YMCA Childcare - St Anthony's	Childcare Facility			X	X				

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YMCA ODS Towers Child Development Center	Childcare Facility		X	X	X	X	X		X
YMCA Preschool-Before-After - King Elem	Childcare Facility				X				
YMCA SE-Brooklyn	Childcare Facility		X	X	X		X		
Young Wonders Preschool	Childcare Facility								
Youth Employment Institute Childcare	Childcare Facility		X	X	X	X	X		X
Ys Choice Childcare	Childcare Facility				X		X		
Portland City Hall	City Hall	X	X	X	X		X		
Charles Jordan Community Center	Community Center	X	X		X	X	X	X	X
Community Music Center	Community Center		X	X	X		X		
East Portland Community Center	Community Center				X				
Ethos Music Center	Community Center		X	X	X		X		
Fulton Park Community Center	Community Center			X	X		X		
Hillside Community Center	Community Center		X		X		X		
Historic Overlook House Community Center	Community Center		X	X	X	X	X	X	X
In Other Words Feminist Community Center	Community Center				X				
June Key Delta Community Center	Community Center			X	X				
Laurelhurst Dance Studio	Community Center		X		X		X		
Linnton Community Center	Community Center			X	X	X	X	X	X
Matt Dishman Community Center	Community Center		X	X	X		X		
Mittleman Jewish Community Center	Community Center				X				
Montavilla Community Center	Community Center	X	X	X	X	X	X		X
Moore Street Community & Worship Center	Community Center				X				
Mt Scott Community Center	Community Center								
Multnomah Arts Center	Community Center				X				

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Muslim Community Center Of Portland	Community Center			X	X		X		
Native American Youth And Family Center	Community Center			X	X	X	X	X	X
Northeast Community Center	Community Center		X	X	X	X	X	X	X
Peninsula Park Community Center	Community Center			X	X		X		
Portland Children's Museum	Community Center	X	X						
Q Center	Community Center		X	X	X		X		
Sellwood Community Center	Community Center		X		X	X	X		
Slavic Community Center Of NW	Community Center		X	X	X				
Southwest Community Center	Community Center		X						
St Johns Community Center	Community Center		X	X	X	X	X		
Taborspace	Community Center				X		X		
Woodstock Community Center	Community Center		X						
YMCA Arts Center	Community Center			X	X				
Zimmerman Community Center	Community Center	X	X	X	X	X	X	X	X
Albina Library	County Asset				X				
Baltazar F Ortiz Community Center	County Asset		X	X	X	X	X		X
Belmont Library	County Asset								
Blanchard Fleet Shops	County Asset	X	X	X	X	X	X	X	X
Bridge Shop Modular Office 1	County Asset		X	X	X	X	X	X	X
Bridge Shops	County Asset		X	X	X	X	X	X	X
Capitol Hill Library	County Asset			X	X				
Central Library	County Asset	X	X	X	X		X		
Central Office	County Asset	X	X	X	X	X	X		X
Cesar Chavez K-8 School	County Asset		X		X	X	X		X
Cherry Blossom Plaza	County Asset				X				
Cleveland High School	County Asset		X	X	X	X	X		X
Columbia Pacific Plaza	County Asset	X	X	X	X	X	X	X	X

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David Douglas Modular Office	County Asset								
East Portland Community Center	County Asset	X	X		X		X		
Elections Building	County Asset		X	X	X	X	X		X
Franklin High School	County Asset			X	X				
Gateway Childrens Center MDT Building	County Asset		X	X	X		X		
Gateway Childrens Center Residential Building	County Asset		X	X	X		X		
Gateway Childrens Center Service Building	County Asset		X	X	X		X		
George Middle School	County Asset			X	X	X	X		X
Gladys McCoy Building	County Asset		X	X	X	X	X		X
Grant High School	County Asset		X	X	X	X	X		X
Gregory Heights Library	County Asset		X		X		X		
Hansen Building	County Asset								
Hansen Building A	County Asset								
Hansen Building B	County Asset								
Hansen Building C	County Asset								
Hansen Building D	County Asset								
Hansen Station	County Asset								
Harrison Park School	County Asset			X	X				
Hillsdale Library	County Asset				X				
Holgate Library	County Asset			X	X				
Hollywood Library	County Asset			X	X	X	X		X
Hooper Memorial Center	County Asset	X	X	X	X	X	X	X	X
James Hawthorne Apartments	County Asset	X	X	X	X		X		
Jefferson High School	County Asset			X	X				
Justice Center	County Asset	X	X	X	X		X		
Juvenile Justice Complex	County Asset		X	X	X	X	X	X	X
Kenton Library	County Asset		X	X	X	X	X		X
Lane Middle School	County Asset		X						

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Library Administration	County Asset		X	X	X		X		
Lincoln Bldg	County Asset		X	X	X	X	X		X
Lloyd Corporate Plaza	County Asset	X	X	X	X	X	X	X	X
Madison High School	County Asset		X	X	X	X	X		X
Martin Luther King Jr Neighborhood Facility	County Asset				X				
Mead Building	County Asset		X	X	X		X		
Medford Building	County Asset		X	X	X	X	X	X	X
Mid-County District Office	County Asset								
Mid-County Health Center	County Asset			X	X				
Midland Library	County Asset								
Motor Pool Modular Office	County Asset		X	X	X	X	X		X
Multnomah Building	County Asset		X	X	X	X	X		X
Multnomah Building Garage	County Asset		X	X	X	X	X		X
Multnomah County Court House	County Asset	X	X	X	X		X		
Multnomah County Inverness Jail Laundry	County Asset		X	X	X	X	X		X
Multnomah County Inverness Jail Storage	County Asset		X	X	X	X	X		X
Multnomah County Inverness Jail Work Crew Shed	County Asset		X	X	X	X	X		X
Multnomah County Wapato Facility	County Asset		X		X	X	X		
North Portland Health Clinic	County Asset		X	X	X	X	X		
North Portland Library	County Asset			X	X				
Northwest Library	County Asset		X	X	X	X	X		X
Old Town Recovery Center	County Asset		X	X	X	X	X		X
Parking Attendant Booth	County Asset		X	X	X	X	X		X
Parkrose High School	County Asset		X	X	X	X	X		X
Portage Storage Building	County Asset								
Portland Building	County Asset	X	X	X	X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Professional Plaza 102	County Asset		X	X	X		X		
River Patrol Columbia	County Asset								
River Patrol Columbia Boathouse 1	County Asset								
River Patrol Columbia Boathouse 2	County Asset								
River Patrol Columbia Boathouse 3	County Asset								
River Patrol Columbia Boathouse 4	County Asset								
River Patrol Willamette	County Asset		X	X	X	X	X	X	X
River Patrol Willamette Boathouse	County Asset		X	X	X	X	X	X	X
Robert W Blanchard Education Service Center	County Asset	X	X	X	X	X	X	X	X
Robert W Blanchard Maintenance Building 1	County Asset	X	X	X	X	X	X	X	X
Robert W Blanchard Maintenance Building 2	County Asset	X	X	X	X	X	X		X
Robert W Blanchard Parking Shed	County Asset	X	X	X	X	X	X		X
Rocky Butte	County Asset		X	X	X	X	X		X
Roosevelt High School	County Asset		X	X	X	X	X		X
Sellwood Bridge Modular Office	County Asset		X		X	X	X		
Sellwood Lofts	County Asset		X		X	X	X		
Southeast Health Center	County Asset		X	X	X		X		
St Francis Dining Hall	County Asset	X	X	X	X	X	X		X
St Johns Library	County Asset		X	X	X	X	X		
State Office Building	County Asset	X	X	X	X	X	X	X	X
Tabor Square Office Building	County Asset				X		X		
Title Wave Bookstore	County Asset		X	X	X		X		
Towne Building	County Asset		X	X	X	X	X	X	X
Vector Control	County Asset		X	X	X	X	X	X	X
Vector Control Modular Office	County Asset		X	X	X	X	X	X	X

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Vector Control Parking Shed	County Asset		X	X	X	X	X	X	X
Walnut Park Complex	County Asset				X				
Wikman Building	County Asset			X	X				
Womens Transition 1	County Asset	X	X	X	X	X	X		X
Womens Transition 2	County Asset	X	X	X	X	X	X		X
Womens Transition 3	County Asset	X	X	X	X	X	X		X
Woodstock Library	County Asset		X						
Mult Co Fd #8 PDX (Port Of Portland) 80	Fire Station				X				
Portland Fire & Rescue 1	Fire Station		X	X	X	X	X		X
Portland Fire & Rescue 10	Fire Station			X	X				
Portland Fire & Rescue 11	Fire Station		X	X	X				
Portland Fire & Rescue 12	Fire Station		X	X	X		X		
Portland Fire & Rescue 13	Fire Station		X	X	X	X	X		X
Portland Fire & Rescue 14	Fire Station		X		X		X		
Portland Fire & Rescue 15	Fire Station		X		X				
Portland Fire & Rescue 16	Fire Station		X						
Portland Fire & Rescue 17	Fire Station			X	X		X		
Portland Fire & Rescue 18	Fire Station			X	X				
Portland Fire & Rescue 19	Fire Station		X		X		X		
Portland Fire & Rescue 2	Fire Station	X	X	X	X	X	X	X	X
Portland Fire & Rescue 20	Fire Station		X	X	X	X	X	X	X
Portland Fire & Rescue 21	Fire Station		X	X	X	X	X	X	X
Portland Fire & Rescue 22	Fire Station		X	X	X	X	X		
Portland Fire & Rescue 23	Fire Station	X	X	X	X	X	X	X	X
Portland Fire & Rescue 24	Fire Station		X	X	X	X	X		
Portland Fire & Rescue 25	Fire Station			X	X				
Portland Fire & Rescue 26	Fire Station		X		X	X	X		X
Portland Fire & Rescue 28	Fire Station				X		X		
Portland Fire & Rescue 29	Fire Station				X				

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Portland Fire & Rescue 3	Fire Station	X	X	X	X	X	X		X
Portland Fire & Rescue 30	Fire Station			X	X		X		
Portland Fire & Rescue 4	Fire Station	X	X	X	X		X		
Portland Fire & Rescue 5	Fire Station				X				
Portland Fire & Rescue 6	Fire Station		X	X	X	X	X	X	X
Portland Fire & Rescue 7	Fire Station								
Portland Fire & Rescue 8	Fire Station			X	X		X		
Portland Fire & Rescue 9	Fire Station				X				
Portland/Gresham - Shared 31	Fire Station			X	X				
13 Salmon Family Center	Homeless Shelter	X	X	X	X		X		
Catholic Charities Housing Transit	Homeless Shelter	X	X	X	X	X	X		X
City Team Ministries	Homeless Shelter		X	X	X	X	X		X
Common Cup Shelter	Homeless Shelter		X						
DayWatch Operated-Julia West House	Homeless Shelter		X	X	X	X	X		
Dignity Village	Homeless Shelter		X						
Downtown Chapel	Homeless Shelter		X	X	X	X	X		X
Family Winter Warming Center	Homeless Shelter				X		X		
Goose Hollow Shelter	Homeless Shelter		X	X	X		X		
Janus Youth Program	Homeless Shelter		X	X	X	X	X		
JOIN	Homeless Shelter	X	X	X	X	X	X	X	X
MACE Center Calvary Christian Center	Homeless Shelter				X				
Native American Youth and Family	Homeless Shelter			X	X	X	X	X	X
New Avenues for Youth -NAFY	Homeless Shelter		X	X	X	X	X		X
Outside In OI	Homeless Shelter	X	X	X	X		X		
Porchlight Crisis Shelter	Homeless Shelter		X	X	X	X	X		
Portland Rescue Mission	Homeless Shelter		X	X	X	X	X		X

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Red Cross Severe Weather Emergency	Homeless Shelter	X	X	X	X	X	X		X
Rose Haven	Homeless Shelter	X	X	X	X	X	X		
Salvation Army Female Emergency Shelter	Homeless Shelter		X	X	X	X	X		X
Salvation Army Harbor Light Men's	Homeless Shelter		X	X	X	X	X		X
Salvation Army Men's Day Center	Homeless Shelter		X	X	X	X	X		X
Streetlight Youth Shelter	Homeless Shelter		X	X	X	X	X		
Transition Projects Community Svc	Homeless Shelter		X	X	X	X	X	X	X
Transition Projects Clark Center	Homeless Shelter	X	X	X	X	X	X	X	X
Transition Projects Glisan Shelter	Homeless Shelter		X	X	X	X	X	X	X
Transition Projects Jeans Place	Homeless Shelter	X	X	X	X	X	X		X
Union Gospel Mission	Homeless Shelter		X	X	X	X	X		X
Women's Winter Warming Center	Homeless Shelter		X	X	X	X	X	X	X
Adventist Medical Center	Hospital			X	X				
Legacy Emanuel	Hospital		X	X	X	X	X		X
Legacy Good Samaritan	Hospital		X	X	X		X		
OHSU Center For Health & Healing	Hospital		X	X	X		X		
OHSU Doernbecher Children's Hospital	Hospital		X		X				
Oregon Health & Science University	Hospital		X	X	X				
Portland VA Medical Center	Hospital		X		X				
Providence Portland	Hospital			X	X	X	X		X
Randall Children's Hospital At Legacy Emanuel	Hospital		X	X	X	X	X		X
Shriners Hospitals For Children	Hospital		X	X	X				
Vibra Specialty Hospital	Hospital		X	X	X	X	X		X
Columbia River Correctional	Jail		X				X		

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Multnomah County Inverness Jail	Jail		X	X	X	X	X		X
Bureau Of Alcohol Tobacco Firearms And Explosives - Portland I	Law Enforcement	X	X	X	X	X	X		X
Bureau Of Land Management - Oregon State Field Office	Law Enforcement		X	X	X	X	X		X
Bureau Of Reclamation - Lower Columbia Area Field Office	Law Enforcement	X	X	X	X	X	X		X
Columbia River Correctional Institution	Law Enforcement		X						
Multnomah County Inverness Jail	Law Enforcement		X	X	X	X	X		X
Multnomah County Sheriff	Law Enforcement		X	X	X	X	X		X
Multnomah County Sheriff	Law Enforcement	X	X	X	X	X	X		
Multnomah County Sheriff's Ofc	Law Enforcement	X	X	X	X	X	X		X
Multnomah County Sheriffs Office	Law Enforcement		X	X	X	X	X		X
Multnomah County Sheriffs Office	Law Enforcement								
Multnomah County Sheriffs Office - Columbia River Patrol Office	Law Enforcement								
Oregon State Police - Portland	Law Enforcement				X				
Port Of Portland Police	Law Enforcement			X	X				
Port Of Portland Police	Law Enforcement			X	X				
Portland Police Bureau - East Precinct	Law Enforcement				X				
Portland Police Bureau - North Precinct	Law Enforcement		X	X	X	X	X		
Portland Police Bureau - Northeast Precinct	Law Enforcement				X				
Portland Police Bureau - Southeast Precinct	Law Enforcement			X	X	X	X		X
Portland Police Department	Law Enforcement	X	X	X	X		X		
Portland Police Dept	Law Enforcement			X	X				

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Portland School Police	Law Enforcement	X	X	X	X	X	X	X	X
Portland State University Campus Public Safety	Law Enforcement	X	X	X	X		X		
Portland Transit Police Division	Law Enforcement		X	X	X	X	X	X	X
United States Customs And Border Protection - Portland Deferred Inspection Site	Law Enforcement	X	X	X	X	X	X	X	X
United States Customs And Border Protection - Service Port - Portland	Law Enforcement		X	X	X		X		
United States Drug Enforcement Administration - Portland	Law Enforcement	X	X	X	X		X		
United States Marshals Service - District Headquarters	Law Enforcement	X	X	X	X		X		
United States Marshals Service - Portland	Law Enforcement	X	X	X	X		X		
United States Marshals Service - Portland	Law Enforcement	X	X	X	X		X		
United States Marshals Service - Portland	Law Enforcement	X	X	X	X	X	X		X
United States Postal Inspection Service - Portland Office	Law Enforcement		X	X	X	X	X		
Albina Library	Library				X				
Belmont Library	Library								
Capitol Hill Library	Library			X	X				
Central Library	Library	X	X	X	X		X		
Gregory Heights Library	Library		X		X		X		
Hillsdale Library	Library				X				
Holgate Library	Library			X	X				
Hollywood Library	Library			X	X	X	X		X
Kenton Library	Library		X	X	X	X	X		X
Midland Library	Library								
North Portland Library	Library			X	X				

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Northwest Library	Library		X	X	X	X	X		X
Sellwood-Moreland Library	Library		X		X	X	X		
St. Johns Library	Library		X	X	X	X	X		
Woodstock Library	Library		X						
Adventist Health Home Health	Licensed Medical Facility	X	X	X	X	X	X		
Adventist Health Hospice	Licensed Medical Facility	X	X	X	X	X	X		
Aesthetic Breast And Cosmetic Surgery Center	Licensed Medical Facility			X	X				
Alma Midwifery Services, LLC	Licensed Medical Facility	X	X	X	X		X		
Andaluz Birth Center	Licensed Medical Facility		X	X	X		X		
Assured Community-Based Services	Licensed Medical Facility			X	X		X		
Brightstar Care Of Portland North & East	Licensed Medical Facility	X	X	X	X	X	X	X	X
Calaroga Terrace Ambassador Program	Licensed Medical Facility	X	X	X	X	X	X		X
Care Givers Northwest	Licensed Medical Facility		X	X	X	X	X	X	X
Caregiver Connection, Inc	Licensed Medical Facility			X	X				
Circle Of Care Caregivers Services, Inc	Licensed Medical Facility				X				
Columbia River Surgery Center	Licensed Medical Facility	X	X	X	X		X		
Connected Home Health	Licensed Medical Facility				X		X		
FMC Maywood Park	Licensed Medical Facility		X	X	X		X		
Futures Outpatient Surgical Center	Licensed Medical Facility	X	X	X	X	X	X		X
Healthy Living At Home - Portland, LLC	Licensed Medical Facility		X	X	X		X		

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Holladay Park Plaza	Licensed Medical Facility	X	X	X	X	X	X	X	X
Home Instead Senior Care	Licensed Medical Facility			X	X	X	X		X
Homewatch Caregivers Of Portland	Licensed Medical Facility		X	X	X	X	X		
Hospice Care Of The Northwest, LLC	Licensed Medical Facility	X	X	X	X	X	X	X	X
Housecall Providers Hospice	Licensed Medical Facility			X	X		X		
Interim Healthcare Of Oregon, Inc	Licensed Medical Facility			X	X				
Interstate Ambulatory Surgical Center	Licensed Medical Facility		X	X	X	X	X	X	X
Kaiser Permanente Continuing Care Services Hospice	Licensed Medical Facility	X	X	X	X	X	X		
Kaiser Permanente Home Health Agency	Licensed Medical Facility	X	X	X	X	X	X		
Legacy Hopewell House Hospice	Licensed Medical Facility				X				
Legacy Hospice Services	Licensed Medical Facility	X	X	X	X	X	X	X	X
Lovejoy Surgicenter, Inc	Licensed Medical Facility		X		X		X		
Mirabella Portland Home Care	Licensed Medical Facility		X	X	X	X	X		
NGC Endoscopy Services, LLC	Licensed Medical Facility		X	X	X	X	X		
Northeast Portland Renal Center	Licensed Medical Facility		X	X	X		X		
Northwest Ambulatory Surgery Center, LLC	Licensed Medical Facility	X	X	X	X	X	X		X
Northwest Senior Management Services	Licensed Medical Facility				X		X		
Oregon Kidney Center	Licensed Medical Facility			X	X	X	X	X	X

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Pacific Cataract & Laser Institute, Inc	Licensed Medical Facility	X	X	X	X	X	X		X
Pearl Surgicenter, Inc.	Licensed Medical Facility	X	X	X	X	X	X		
Pegasus Social Services - Portland	Licensed Medical Facility		X	X	X		X		
Pinnacle Hospice Care Of Portland	Licensed Medical Facility				X				
Plaza Ambulatory Surgery Center, LLC	Licensed Medical Facility			X	X	X	X	X	X
PNRS Emanuel Pediatric Dialysis	Licensed Medical Facility		X	X	X	X	X		X
PNRS Hollywood Dialysis Center	Licensed Medical Facility	X	X	X	X	X	X	X	X
PNRS Portland Home Dialysis	Licensed Medical Facility	X	X	X	X		X		
PNRS Rose Quarter Dialysis Center	Licensed Medical Facility				X				
Portland Gateway Dialysis	Licensed Medical Facility		X	X	X	X	X	X	X
Providence Home Health	Licensed Medical Facility		X	X	X	X	X	X	X
Providence Hospice	Licensed Medical Facility		X	X	X	X	X	X	X
Senior Helpers	Licensed Medical Facility								
Senior Helpers Of Portland	Licensed Medical Facility	X	X	X	X	X	X		
Terwilliger Plaza In-Home Care Services	Licensed Medical Facility		X	X	X				
The Oregon Clinic Endoscopy Center	Licensed Medical Facility		X	X	X	X	X	X	X
The Portland Clinic Surgical Center	Licensed Medical Facility		X	X	X	X	X		
Us Renal Care East Portland Home Dialysis	Licensed Medical Facility				X		X		

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Us Renal Care Portland Dialysis	Licensed Medical Facility				X				
VOTO Health Care, Inc	Licensed Medical Facility			X	X				
Addus Healthcare In Home Support Services	Residential Care Facility			X	X	X	X		
Addus Healthcare, Inc.	Residential Care Facility			X	X	X	X		X
Adventist Health Home Health Agency	Residential Care Facility	X	X	X	X	X	X		X
Adventist Health Hospice	Residential Care Facility	X	X	X	X	X	X		
All Comfort Residential Care	Residential Care Facility			X	X				
ASA Care	Residential Care Facility		X		X				
Assisted Living At Summer Place	Residential Care Facility		X	X	X	X	X	X	X
Assumption Village	Residential Care Facility			X	X	X	X		X
At Your Home Care, Inc.	Residential Care Facility								
Avamere Crestview Of Portland	Residential Care Facility								
Avamere Crestview Of Portland	Residential Care Facility								
Calaroga Terrace	Residential Care Facility	X	X	X	X	X	X		X
Calaroga Terrace	Residential Care Facility	X	X	X	X	X	X		X
Care Center East	Residential Care Facility				X		X		
Care Center East Health & Specialty Care Center	Residential Care Facility				X		X		
Cascade Terrace Care Center	Residential Care Facility		X	X	X				

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Cascade Terrace Nursing Center	Residential Care Facility		X	X	X				
Catered Living At Laurelhurst Village-The Gardens	Residential Care Facility		X		X		X		
Chaucer Court Apartments	Residential Care Facility	X	X	X	X		X		
Cherry Blossom Cottage	Residential Care Facility				X				
Cherry Blossom Cottage Retirement	Residential Care Facility				X				
Cherrywood Village Retirement Community	Residential Care Facility				X				
Clarendon Court Alzheimers Residence	Residential Care Facility		X	X	X				
Clarendon Court Alzheimer's Residence	Residential Care Facility		X	X	X				
Cornerstone Care Option	Residential Care Facility			X	X				
Cornerstone Care Option	Residential Care Facility			X	X				
Cornerstone Residential Option	Residential Care Facility			X	X				
Court Yard Senior Living	Residential Care Facility				X				
Courtyard Senior Living	Residential Care Facility				X				
Courtyard Senior Living	Residential Care Facility				X				
Courtyard Senior Plaza	Residential Care Facility				X				
Donham Care Home	Residential Care Facility		X		X	X	X		X
Donham Place	Residential Care Facility		X		X	X	X		X
Dr Linus Johnson Assisted Living	Residential Care Facility		X	X	X	X	X		X

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Emerson House	Residential Care Facility				X				
Emilie House	Residential Care Facility			X	X	X	X	X	X
Evergreen Portland Health And Rehabilitation Cent*	Residential Care Facility								
Expressions At Summerplace	Residential Care Facility		X	X	X	X	X	X	X
Fernhill Estates	Residential Care Facility			X	X		X		
Fernhill Estates	Residential Care Facility			X	X		X		
Firwood Garden Retirement	Residential Care Facility								
Friendship Health Center	Residential Care Facility		X	X	X		X		
Gateway Care & Retirement Center	Residential Care Facility		X	X	X		X		
Gateway Care And Retirement Center	Residential Care Facility		X	X	X		X		
Gateway Care And Retirement Center	Residential Care Facility		X	X	X		X		
Glisan Care Center	Residential Care Facility		X	X	X	X	X		X
Glisan Care Center	Residential Care Facility		X	X	X	X	X		X
Golden Acres Retirement Center	Residential Care Facility		X		X				
Golden Acres Retirement Center	Residential Care Facility		X		X				
Gracelen Terrace Care Center	Residential Care Facility		X	X	X				
Gracelen Terrace Long Term Care Facility	Residential Care Facility		X	X	X				
Harbor Care Reedwood	Residential Care Facility		X	X	X		X		

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Harbor Care Reedwood	Residential Care Facility		X	X	X		X		
Harvest Homes	Residential Care Facility		X	X	X	X	X		
Harvest Homes Inc Retirement	Residential Care Facility		X	X	X	X	X		
Harvest Homes RCF	Residential Care Facility		X	X	X	X	X		
Hawthorne Gardens Memory Care Community	Residential Care Facility		X						
Hawthorne Gardens Senior Living Community	Residential Care Facility		X						
Healthcare At Foster Creek	Residential Care Facility				X				
Healthcare At Foster Creek	Residential Care Facility				X				
Helping Hands Home Care	Residential Care Facility		X	X	X				
Hill House	Residential Care Facility		X		X				
Holgate Center	Residential Care Facility		X	X	X		X		
Holladay Park Plaza	Residential Care Facility	X	X	X	X	X	X	X	X
Holladay Park Plaza	Residential Care Facility	X	X	X	X	X	X	X	X
Holladay Park Plaza Nursing Home	Residential Care Facility	X	X	X	X	X	X	X	X
Holladay Park Plaza, Inc.	Residential Care Facility	X	X	X	X	X	X	X	X
Home Instead Senior Care	Residential Care Facility			X	X	X	X		X
Home Instead Senior Care	Residential Care Facility			X	X				
Home Lifecare, Inc.	Residential Care Facility			X	X	X	X	X	X

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Hope N Care	Residential Care Facility		X		X				
Irvington Village	Residential Care Facility				X				
Johnson Assisted Living	Residential Care Facility		X	X	X	X	X		X
Kaiser Permanente Home Health Agency	Residential Care Facility	X	X	X	X	X	X		
Kaiser Permanente Home Health/Hospice	Residential Care Facility	X	X	X	X	X	X		
Kenilworth Park Plaza	Residential Care Facility		X	X	X		X		
Kirkland Union Manor	Residential Care Facility			X	X				
Laurel Hurst Village	Residential Care Facility		X		X		X		
Laurelhurst House	Residential Care Facility			X	X	X	X		X
Laurelhurst Village	Residential Care Facility				X		X		
Lawrence Convalescent Center	Residential Care Facility				X		X		
Lawrence Convalescent Center	Residential Care Facility				X		X		
Legacy Hopewell House Hospice	Residential Care Facility				X				
Legacy VNA Hospice	Residential Care Facility	X	X	X	X	X	X	X	X
Macdonald Residence	Residential Care Facility		X	X	X	X	X		X
Macdonald Residence	Residential Care Facility		X	X	X	X	X		X
Markham House Retirement Community	Residential Care Facility			X	X				
Marquis Care At Mt Tabor Nursing Home	Residential Care Facility				X		X		

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Marquis Care At Mt. Tabor	Residential Care Facility				X		X		
Marquis Care At Piedmont	Residential Care Facility		X	X	X	X	X	X	X
Marquis Care At Piedmont Nursing Home	Residential Care Facility		X	X	X	X	X	X	X
Marquis Care At Powellhurst	Residential Care Facility				X				
Marquis Care At Powellhurst	Residential Care Facility				X				
Marquis Care At Vermont Hills	Residential Care Facility	X	X						
Marquis Care At Vermont Hills	Residential Care Facility	X	X						
Marquis Vintage Suites At Piedmont	Residential Care Facility		X	X	X	X	X	X	X
Marshall Union Manor	Residential Care Facility	X	X	X	X	X	X		X
Maxim Healthcare Services, Inc.	Residential Care Facility			X	X				
Maxim Healthcare Services, Inc.	Residential Care Facility			X	X				
Menlo Park Health Care	Residential Care Facility								
Menlo Park Health Care	Residential Care Facility								
Mirabella Portland Home Care	Residential Care Facility		X	X	X	X	X		
Mt Scott Residential Care-Residential	Residential Care Facility				X				
Northwest Place	Residential Care Facility		X	X	X	X	X		
Northwest Senior Management Systems, Inc.	Residential Care Facility				X		X		
Odd Fellows Retirement Home	Residential Care Facility		X	X	X	X	X		X

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Oregon Baptist Retirement Homes	Residential Care Facility		X	X	X	X	X		X
Oregon Elder Options	Residential Care Facility		X	X	X		X		
Paradigm Senior Living	Residential Care Facility	X	X	X	X	X	X	X	X
Park Forest Care Center	Residential Care Facility		X	X	X		X		
Park Forest Care Center	Residential Care Facility		X	X	X		X		
Parkrose Chateau Retirement	Residential Care Facility		X	X	X	X	X	X	X
Porthaven Care Center	Residential Care Facility				X		X		
Porthaven Healthcare Center	Residential Care Facility				X		X		
Portland Health And Rehab Ctr	Residential Care Facility								
Premier Enhanced Care Facility	Residential Care Facility		X		X				
Premier Living Center	Residential Care Facility		X		X				
Providence Child Center	Residential Care Facility			X	X	X	X	X	X
Providence Child Center SNF	Residential Care Facility			X	X	X	X	X	X
Providence Elder Place-Glendover	Residential Care Facility								
Providence Elderplace In Cully	Residential Care Facility				X		X		
Providence Elderplace In Glendoveer	Residential Care Facility								
Providence Home Health	Residential Care Facility			X	X	X	X	X	X
Providence Hospice	Residential Care Facility			X	X	X	X	X	X

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Robison Jewish Health Center	Residential Care Facility	X	X						
Robison Jewish Health Center	Residential Care Facility	X	X						
Robison Residence, The	Residential Care Facility	X	X						
Rose City Nursing Home	Residential Care Facility	X	X	X	X	X	X		X
Rose City Nursing Home	Residential Care Facility	X	X	X	X	X	X		X
Rose Schnitzer Manor	Residential Care Facility	X	X						
Rose Schnitzner Manor	Residential Care Facility	X	X						
Royal Anne Assisted Living Facility	Residential Care Facility				X				
Saint Andrews Care Center	Residential Care Facility				X				
Saint Anthony Village	Residential Care Facility			X	X				
Sellwood Landing Assisted Living Community	Residential Care Facility	X	X	X	X	X	X		
Senior Care Inc	Residential Care Facility		X		X				
St. Andrews Care Center	Residential Care Facility				X				
St. Anthony Village	Residential Care Facility				X				
Summerplace Assisted Living Community	Residential Care Facility		X		X	X	X	X	X
Tabor Crest Residential Care	Residential Care Facility				X				
Tabor Crest Residential Care	Residential Care Facility				X				
Taft Home	Residential Care Facility		X	X	X	X	X		

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Taft Home, The	Residential Care Facility		X	X	X	X	X		
Terrace At Laurelhurst Village, The	Residential Care Facility		X		X		X		
Terwilliger Plaza - Metcalf Unit	Residential Care Facility		X	X	X				
Terwilliger Plaza Retirement	Residential Care Facility		X	X	X				
Terwilliger Terrace Assisted Living Facility	Residential Care Facility	X	X	X	X		X		
The Grandparents House-Adult Foster Home	Residential Care Facility			X	X				
The Terrace	Residential Care Facility		X		X		X		
Trinity Mission Health & Rehab Of Portland	Residential Care Facility		X	X	X				
Trinity Mission Hlth And Rehab-Portland	Residential Care Facility		X	X	X				
West Hills Health & Rehabilitation Center	Residential Care Facility		X						
West Hills Health And Rehab	Residential Care Facility		X						
West Hills Village	Residential Care Facility		X						
West Hills Village	Residential Care Facility		X						
Westmorelands Union Manor	Residential Care Facility		X	X	X	X	X	X	X
A Renaissance School Of Arts And Sciences	School- Private	X	X	X	X	X	X		
Albina Headstart	School- Private			X	X		X		
Albina Youth Opportunity School	School- Private			X	X	X	X		X
All Saints School	School- Private		X	X	X	X	X		X
Archbishop Howard School	School- Private				X		X		
Belmont Academy	School- Private				X				

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Bridges Middle	School- Private				X				
Cathedral School	School- Private		X	X	X	X	X		
Cedarwood Waldorf School	School- Private		X	X	X		X		
Central Catholic High School	School- Private		X		X		X		
Childpeace Montessori Community School	School- Private	X	X	X	X	X	X	X	X
Childpeace Montessori School	School- Private		X	X	X	X	X		X
Children's Relief Nursery – Mill Park Site	School- Private								
Children's Relief Nursery – St. Johns Site	School- Private		X	X	X	X	X		
Childroots NW	School- Private	X	X	X	X	X	X		
Childwork Learning Center	School- Private								
City Christian School	School- Private		X	X	X		X		
Class Academy	School- Private	X	X	X	X	X	X		
Columbia Christian	School- Private		X	X	X	X	X		X
Community Transitional School	School- Private		X	X	X	X	X		X
Concordia University	School- Private		X	X	X	X	X		X
Crossroads Christian	School- Private		X	X	X	X	X	X	X
De La Salle North Catholic High School	School- Private			X	X	X	X		
Early Childhood Learning Center	School- Private				X				
Edwards Day Treatment	School- Private				X				
Franciscan Montessori Earth School SFA	School- Private		X	X	X				
French American International School	School- Private								
Gabriel Park Preschool	School- Private	X	X						
Grace Lutheran	School- Private			X	X				
Greenhouse Alternative High School	School- Private		X	X	X	X	X		X
Hancock Street Preschool	School- Private		X	X	X	X	X		X

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Helen Gordon Child Development Center-PSU	School- Private	X	X	X	X		X		
Hilltop Preschool & Kindergarten	School- Private								
Hilltop School Of Music	School- Private								
Holy Cross Catholic School	School- Private		X			X	X		X
Holy Family Catholic School	School- Private		X		X		X		
Holy Redeemer Catholic School	School- Private			X	X		X		
Insight School Of Oregon-OAHS	School- Private	X	X	X	X	X	X	X	X
IRCO Africa House	School- Private		X	X	X		X		
Islamic School Of Portland	School- Private			X	X				
Judon Academy	School- Private			X	X				
Kindercare Learning Centers, Downtown Portland	School- Private	X	X	X	X		X		
Kindercare Learning Centers, Fred Meyer	School- Private		X	X	X	X	X	X	X
Kindercare Learning Centers, Powell	School- Private		X	X	X				
Lee Owen Stone Preschool	School- Private		X		X		X		
Lewis & Clark College	School- Private						X		
Lewis & Clark Law School	School- Private								
Maimonides Jewish Day School	School- Private				X				
MARTINIAMINC School For Entrepreneurship	School- Private		X	X	X	X	X		X
MHCC Head Start David Douglas Site	School- Private								
MHCC Head Start-Cascade Crossing	School- Private		X		X		X		
MHCC Head Start-Gateway Children's	School- Private			X	X		X		
MHCC Head Start-Harold Oliver Site	School- Private								
MHCC Head Start-Lynchwood Site	School- Private		X		X				
MHCC Head Start-Russellville Site	School- Private			X	X		X		

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MHCC Head Start-Thompson Site	School- Private			X	X	X	X		X
Mill Park Preschool	School- Private								
Montessori Alameda	School- Private				X		X		
Mt. Scott Learning Center High	School- Private				X				
Multnomah Playschool	School- Private								
Multnomah University	School- Private	X	X	X	X	X	X		X
National College Of Natural Medicine	School- Private	X	X	X	X		X		
National College Of Natural Medicine	School- Private		X	X	X		X		
NAYA Early College Academy	School- Private			X	X	X	X		X
Neveh Shalom Foundation School	School- Private								
New Avenues For Youth	School- Private		X	X	X	X	X		X
New Day Ananda Marga School Of Portland	School- Private		X	X	X	X	X		X
North Portland Bible College	School- Private			X	X				
OHSU-Children's Psychiatric Day Treatment	School- Private		X		X				
OOI- The Gladys McCoy Academy	School- Private			X	X		X		
Open Meadow Alternative Schools Administration	School- Private	X	X			X	X		X
Open Meadow High	School- Private	X	X			X	X		X
Open Meadow Middle	School- Private		X				X		
Oregon College Of Oriental Medicine	School- Private		X	X	X	X	X		X
Oregon Council For Hispanic Advancement	School- Private		X	X	X	X	X		X
Oregon Museum Of Science And Industry	School- Private	X	X	X	X	X	X	X	X
Oregon Outreach Inc. Rosi Hinton High	School- Private								
Out Front House	School- Private		X		X		X		
Outside In-Urban Ed	School- Private	X	X	X	X		X		

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Pacific Crest Community School	School- Private		X	X	X	X	X		X
Pacific Northwest College Of Art	School- Private	X	X	X	X	X	X		X
Pathfinder Academy	School- Private		X	X	X	X	X		
Portland Adventist Academy	School- Private			X	X				
Portland Bible College	School- Private		X	X	X	X	X		X
Portland Chinese School	School- Private	X	X	X	X		X		
Portland Christian Elementary	School- Private								
Portland Christian Junior/Senior High	School- Private			X	X	X	X		X
Portland Jewish Academy	School- Private				X				
Portland Opportunities Industrialization Center	School- Private		X	X	X				
Portland School Of Experiential Education	School- Private		X		X		X		
Portland Tillamook Preschool	School- Private		X	X	X	X	X		X
Portland Youthbuilders	School- Private		X	X	X				
Puddletown School	School- Private		X		X		X		
Reed College	School- Private	X	X		X		X		
Rose City Cooperative Preschool	School- Private				X		X		
Rosemary Anderson High -North Campus	School- Private		X	X	X				
School Of Autism Inc.	School- Private	X	X	X	X	X	X		X
SE Works Community Learning Center	School- Private				X				
Serendipity	School- Private		X	X	X				
SERP Enterprises Inc.	School- Private		X		X				
Slavic Christian Academy-Se Portland	School- Private		X	X	X				
St. Agatha School	School- Private		X		X		X		
St. Andrew Nativity School	School- Private				X				
St. Clare Preschool	School- Private			X	X				
St. Clare School	School- Private			X	X				

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St. Ignatius School	School- Private			X	X				
St. John Fisher School	School- Private		X		X				
St. Mary's Academy School	School- Private	X	X	X	X		X		
St. Therese School	School- Private				X		X		
St. Thomas More School	School- Private	X	X						
Sunnyside Mennonite Montessori School	School- Private								
Sunshine School	School- Private			X	X				
Sunstone Montessori School	School- Private			X	X		X		
Sylvan Learning Center	School- Private								
Sylvan Learning Center #150	School- Private								
The Art Institute Of Portland	School- Private	X	X	X	X	X	X		X
The International School	School- Private	X	X	X	X		X		
The Madeleine School	School- Private		X		X		X		
The Northwest Academy	School- Private	X	X	X	X		X		
Trinity Lutheran	School- Private			X	X	X	X		X
Tucker-Maxon Oral	School- Private		X	X	X	X	X		X
University Of Portland	School- Private		X			X	X		
Urban League Of Portland Street Academy	School- Private		X	X	X	X	X		X
Village Home Education Resource Center: Pc	School- Private				X		X		
Walla Walla University-Portland Campus	School- Private			X	X				
Warner Pacific College	School- Private				X				
Wee Works Child Care Center & Preschool	School- Private		X	X	X	X	X		X
West Hills Christian	School- Private			X	X				
West Hills Schools	School- Private				X				
West Hills Schools-Montessori And Elementary	School- Private		X						

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West Hills Schools-Montessori Pathways Mc	School- Private					X			
Western Seminary	School- Private								
Western States Chiropractic College	School- Private		X	X	X	X	X	X	X
Whole Child Montessori Center, Inc.	School- Private	X	X		X		X		
Wildwood Preschool	School- Private		X						
Youth Employment Institute	School- Private		X	X	X	X	X		X
Abernethy Elementary	School- Public	X	X	X	X	X	X		X
Access Academy At Rose City Park	School- Public				X		X		
Access Alternative Program	School- Public								
ACE Academy	School- Public	X	X	X	X	X	X		X
Ainsworth Elementary	School- Public		X	X	X				
Alameda Elementary	School- Public						X		
Albina Head Start	School- Public		X		X		X		
Alder Elementary	School- Public			X	X				
Alice Ott Middle	School- Public		X	X	X				
Alliance High	School- Public				X		X		
Applegate Head Start	School- Public		X	X	X	X	X	X	X
Arleta Elementary	School- Public				X				
Arthur Academy	School- Public		X		X				
Arthur Academy (Charter)	School- Public		X	X	X				
Astor Elementary	School- Public		X			X	X		
Atkinson Elementary	School- Public				X				
Beach Elementary	School- Public		X	X	X	X	X		X
Beaumont Middle	School- Public								
Benson Polytechnic High	School- Public	X	X	X	X	X	X	X	X
Beverly Clearly At Rose City Park Campus	School- Public				X		X		

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Beverly Cleary At Fernwood Campus	School- Public		X	X	X	X	X	X	X
Beverly Cleary At Hollyrood Campus	School- Public		X	X	X	X	X		X
Boise-Eliot/Humboldt Elementary	School- Public		X	X	X	X	X		X
Breakthrough (DART)	School- Public		X	X	X	X	X	X	X
Bridger Elementary	School- Public				X				
Bridlemile Elementary	School- Public		X						
Buckman Elementary	School- Public	X	X		X		X		
Capitol Hill Elementary	School- Public			X	X				
Cesar Chavez Elementary	School- Public		X		X	X	X		X
Chapman Elementary	School- Public		X	X	X	X	X		
Cherry Park Elementary	School- Public			X	X				
Chief Joseph Elementary	School- Public		X		X		X		
Clarendon Early Learning Academy	School- Public		X	X	X	X	X		X
Clark Head Start At Creative Science School	School- Public			X	X				
Cleveland High	School- Public		X	X	X	X	X		X
Clinton (DART)	School- Public	X	X	X	X	X	X	X	X
Columbia Regional Program	School- Public		X	X	X	X	X		X
Community Transition Program	School- Public								
Community Transition Program On MLK	School- Public		X	X	X		X		
Community Transitions Program At Green Thumb	School- Public		X						
Community Transitions Program Center	School- Public		X						
Creative Science School At Clark	School- Public			X	X				
Creston Annex Head Start	School- Public			X	X				
Creston Elementary	School- Public			X	X				
Da Vinci Arts Middle	School- Public	X	X	X	X	X	X		X

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David Douglas Evening Academy	School- Public								
David Douglas High	School- Public								
David Douglas SD 40	School- Public								
Doernbecher Children's Hospital	School- Public		X		X				
Donald E. Long	School- Public		X	X	X	X	X	X	X
Duniway Elementary	School- Public		X	X	X	X	X		X
Earl Boyles Elementary	School- Public		X	X	X				
Early Learners Academy At The Ramona	School- Public	X	X	X	X	X	X	X	X
East Sylvan Middle	School- Public		X						
Emerson School (Charter)	School- Public		X	X	X	X	X		X
ESD Program At Donald E Long	School- Public		X	X	X	X	X	X	X
Faubion Elementary	School- Public		X	X	X	X	X	X	X
Fir Ridge Campus	School- Public				X				
Floyd Light Middle	School- Public				X				
Forest Park Elementary	School- Public								
Four Corners Program	School- Public								
Franklin High	School- Public			X	X				
George Middle	School- Public			X	X	X	X		X
Gilbert Heights Elementary	School- Public		X	X	X				
Gilbert Park Elementary	School- Public		X	X	X				
Glencoe Elementary	School- Public				X				
Glenfair Elementary	School- Public								
Grant High	School- Public		X	X	X	X	X		X
Gray Middle	School- Public								
Grout Elementary	School- Public		X	X	X	X	X		X
Hand In Hand (DART)	School- Public			X	X	X	X		X
Harrison Park Elementary	School- Public			X	X				
Hayhurst Elementary	School- Public		X						
Head Start Sacajawea	School- Public		X	X	X		X		

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Helensview High	School- Public	X	X	X	X	X	X	X	X
Hosford Middle	School- Public		X		X		X		
Incarcerated Youth Program At Donald E Long	School- Public		X	X	X	X	X	X	X
Inverness Jail Educational Program	School- Public		X	X	X	X	X		X
Irvington Elementary	School- Public		X		X		X		
Jackson Middle	School- Public			X	X				
James John Elementary	School- Public		X	X	X	X	X		
Janus Youth Programs	School- Public	X	X	X	X	X	X	X	X
Jason Lee Elementary	School- Public		X	X	X	X	X		X
Jefferson High	School- Public			X	X				
Kelly Center Head Start	School- Public		X	X	X				
Kelly Elementary	School- Public		X	X	X				
King Elementary	School- Public				X				
Lane Middle	School- Public		X						
Laurelhurst Elementary	School- Public		X	X	X	X	X		X
Le Monde French Immersion Pc School	School- Public	X	X	X	X		X		
Leadership And Entrepreneurship Public Charter	School- Public	X	X		X		X		
Learning Gardens Laboratory	School- Public		X						
Legacy Emanuel Hospital	School- Public		X	X	X	X	X		X
Lent Elementary	School- Public		X	X	X				
Lewis Elementary	School- Public		X						
Lincoln High	School- Public		X	X	X		X		
Lincoln Park Elementary	School- Public				X				
Llewellyn Elementary	School- Public		X		X	X	X		
Lynch View Elementary	School- Public				X				
Lynch Wood Elementary	School- Public		X	X	X				
Madison High	School- Public		X	X	X	X	X		X

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Maplewood Elementary	School- Public		X						
Margaret Scott Elementary	School- Public		X	X	X	X	X		X
Markham Elementary	School- Public			X	X				
Marysville Elementary	School- Public				X				
Menlo Park Elementary	School- Public								
MESD Multnomah Early Childhood Pa 6	School- Public		X	X	X		X		
MESD Program At Cleveland HS	School- Public		X	X	X	X	X		X
MESD Program At David Douglas HS	School- Public								
MESD Program At Harold Oliver Intermediate	School- Public								
MESD Program At Madison HS	School- Public		X		X	X	X		X
MESD Program At Ventura Park	School- Public								
Metropolitan Learning Center	School- Public		X	X	X	X	X		
MHCC Head Start-Knott Site	School- Public			X	X	X	X		X
Mill Park Elementary	School- Public				X				
Mt. Tabor Middle	School- Public			X	X	X	X		X
Multnomah Education Service District	School- Public		X	X	X		X		
Neighborhood House	School- Public				X				
Nickerson (DART)	School- Public								
North Powellhurst School	School- Public								
Ockley Green Elementary	School- Public		X	X	X		X		
Odyssey	School- Public		X						
Oliver Elementary	School- Public								
Opal Public Charter School Of The PCM	School- Public	X	X						
Oregon Health & Science University	School- Public		X		X				
Oregon State Hospital-Portland Campus	School- Public	X	X	X	X	X	X		X

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Parklane Elementary	School- Public								
Parkrose High	School- Public		X	X	X	X	X		X
Parkrose Middle	School- Public		X	X	X	X	X		X
Parkrose SD 3	School- Public		X	X	X	X	X		X
Parry Center For Children (DART)	School- Public		X	X	X		X		
Parry Center SCIP	School- Public		X	X	X		X		
PCC/Hillsboro Basic English	School- Public			X	X				
PCC/Lep (Limited English Proficiency)	School- Public				X				
PCC/Tuition Reimbursement Program	School- Public				X				
PCC-Portland Workforce Training Ctr	School- Public				X	X	X		X
Peninsula Children's Center	School- Public		X	X	X		X		
Peninsula Elementary	School- Public		X			X	X		X
Pioneer High At Tubman	School- Public		X	X	X	X	X		X
Pioneer Middle At Youngson	School- Public			X	X				
Pioneer Special School-Holladay	School- Public			X	X				
Pioneer Special School-Holladay Annex	School- Public				X				
Portland Community College-Cascade	School- Public			X	X				
Portland Community College-CLIMB Center	School- Public		X	X	X	X	X	X	X
Portland Community College-Downtown	School- Public		X	X	X	X	X		X
Portland Community College-Southeast	School- Public				X				
Portland Community College-Sylvania	School- Public				X				
Portland SD 1J	School- Public	X	X	X	X	X	X	X	X
Portland State University	School- Public	X	X	X	X		X		
Portland Village School	School- Public		X		X		X		

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Prescott Elementary	School- Public		X	X	X	X	X		X
Providence Child Center	School- Public			X	X	X	X	X	X
Richmond Elementary	School- Public				X				
Rieke Elementary	School- Public				X				
Rigler Elementary	School- Public				X		X		
Riverdale High	School- Public				X				
Ron Russell Middle	School- Public		X	X	X				
Roosevelt High	School- Public		X	X	X	X	X		X
Rosa Parks Elementary	School- Public	X	X		X	X	X	X	X
Roseway Heights Elementary	School- Public		X		X		X		
Russell Academy	School- Public			X	X	X	X		X
Sabin Elementary	School- Public								
Sacramento Elementary	School- Public				X		X		
Scott Elementary	School- Public		X		X		X		
Scuola Italiana	School- Public	X	X	X	X	X	X	X	X
SEI Academy	School- Public			X	X		X		
Sellwood Middle	School- Public		X		X	X	X		
Shaver Elementary	School- Public		X	X	X	X	X		X
Shriners Hospital	School- Public		X	X	X				
Sitton Elementary	School- Public			X	X	X	X		
Sitton Head Start	School- Public			X	X	X	X		
Southwest Charter School	School- Public		X	X	X		X		
Stephenson Elementary	School- Public								
Sunnyside Environmental	School- Public								
TAG Office At Rice School	School- Public		X	X	X	X	X		X
The Ivy Montessori Public Charter	School- Public		X	X	X		X		
The Ivy Montessori Public Charter LE	School- Public								
Trillium Public Charter	School- Public		X	X	X		X		
Ventura Park Elementary	School- Public								

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Vernon Elementary	School- Public				X		X		
Vestal Elementary	School- Public		X		X		X		
West Powellhurst Elementary	School- Public			X	X				
White Shield (DART)	School- Public	X	X		X	X	X		
Whitman Elementary	School- Public		X		X				
Wilson High	School- Public			X	X				
Winterhaven Elementary	School- Public		X	X	X	X	X		X
Woodlawn Elementary	School- Public		X	X	X	X	X	X	X
Woodmere Elementary	School- Public				X				
Woodstock Elementary	School- Public		X						
Concentra Urgent Care (12518 NE Airport Way)	Urgent Care Center	X	X	X	X	X	X		
Concentra Urgent Care (3449 N Anchor St)	Urgent Care Center	X	X		X	X	X		X
Doctors Express Urgent Care	Urgent Care Center		X		X		X		
Legacy Good Samaritan Ambulatory Care Clinic	Urgent Care Center		X	X	X		X		
Portland Urgent Care	Urgent Care Center			X	X	X	X	X	
The Portland Clinic	Urgent Care Center		X	X	X	X	X		
Zoomcare (10201 NE Cascades Pkwy)	Urgent Care Center		X	X	X		X		
Zoomcare (1400 NE Alberta St)	Urgent Care Center								
Zoomcare (1662 NW 23rd Ave)	Urgent Care Center		X	X	X	X	X		X
Zoomcare (202 NW 13th Ave)	Urgent Care Center	X	X	X	X	X	X		X
Zoomcare (2400 E Burnside St)	Urgent Care Center	X	X		X		X		
Zoomcare (3325 SE Hawthorne Blvd)	Urgent Care Center								
Zoomcare (3872 N Mississippi Ave)	Urgent Care Center			X	X	X	X		X
Zoomcare (4415 SE Woodstock Blvd)	Urgent Care Center		X						
Zoomcare (6910 SE Milwaukie Ave)	Urgent Care Center		X	X	X	X	X		X

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
Zoomcare (7855 SW Capitol Hwy)	Urgent Care Center				X				
Zoomcare (900 SW 5th Ave)	Urgent Care Center	X	X	X	X		X		
Troutdale									
Troutdale Airport	Airport		X	X	X	X	X		X
Beaver Creek Bridge	Bridge			X	X	X	X		X
Lancaster Learning Tree	Childcare Facility			X	X	X	X	X	X
Little Lambs Christian (503 SW 9th Cir)	Childcare Facility				X	X	X		X
Little Lambs Christian Learning Center (27000 SE Stark St)	Childcare Facility		X						
Mt Hood Cc Child Care Ctr	Childcare Facility		X		X				
YMCA Before After School - Troutdale	Childcare Facility				X		X		
Troutdale City Hall	City Hall			X	X	X	X	X	X
Animal Services	County Asset		X	X	X	X	X	X	X
Animal Services Modular Office	County Asset		X	X	X	X	X	X	X
Animal Services Pole Barn	County Asset		X	X	X	X	X	X	X
Troutdale Library	County Asset		X	X	X		X		
Gresham Fire & Emerg Srvcs 75	Fire Station				X		X		
Troutdale Police Department	Law Enforcement			X	X	X	X	X	X
Troutdale Library	Library		X	X	X		X		
Alterra Clare Bridge - Troutdale	Residential Care Facility				X		X		
Clare Bridge Of Troutdale	Residential Care Facility				X		X		
Home Helpers	Residential Care Facility								
Morrison Center Counterpoint Program	School- Private		X	X	X	X	X		X
Tree Of Knowledge	School- Private		X	X	X				
Arata Creek School	School- Public		X	X	X	X	X		X
Edgefield Children's Center	School- Public		X	X	X	X	X		X

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
MESD Program At Arata Creek	School- Public		X	X	X	X	X		X
Reynolds Arthur Academy	School- Public		X						
Reynolds High	School- Public		X		X		X		
Sweetbriar Elementary	School- Public		X						
Troutdale Elementary	School- Public				X	X	X		X
Walt Morey Middle	School- Public		X	X	X				
Wood Village									
Step By Step Childcare	Childcare Facility		X	X	X	X	X		X
Treehill Day School	Childcare Facility		X	X	X	X	X		X
Wood Village City Hall	City Hall		X	X	X	X	X	X	X
Village Manor	Residential Care Facility		X	X	X	X	X	X	X
Village Manor Nursing Home	Residential Care Facility		X	X	X	X	X	X	X
Unincorporated Area									
252nd Avenue Bridge	Bridge			X	X				
Circle Avenue Bridge #2	Bridge		X		X				
Corbett Hill Viaduct	Bridge			X	X	X	X	X	X
Gordon Creek Bridge	Bridge								
Gordon Creek Road Viaduct	Bridge								
Jenne Road/174th Av Bridge	Bridge		X	X	X				
Latourell Falls Road Bridge	Bridge			X	X	X	X	X	X
Littlepage Rd Box Culvert	Bridge								
Sauvie Island Bridge	Bridge			X	X	X	X	X	X
Smith Road Bridge	Bridge								
Stark Street Bridge	Bridge								
Stark Street Viaduct	Bridge								
Champions - East Orient	Childcare Facility			X	X				
Champions - Pleasant Valley	Childcare Facility								
Children's World-Corbett	Childcare Facility			X	X	X	X	X	X

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
PCS-Springdale Child Dev	Childcare Facility								
Portland Jewish Academy	Childcare Facility			X	X	X	X		
Beaverton Community Center	Community Center								
Biddle Butte	County Asset								
Skyline Road Shop	County Asset				X				
Skyline Road Shop Garage	County Asset				X				
Skyline Road Shop Pump House	County Asset				X		X		
Skyline Road Shop Shed	County Asset				X				
Spindrift Cottage	County Asset								
Springdale Road Shop	County Asset								
Springdale Road Shop Shed	County Asset								
Springdale Road Shop Storage	County Asset								
State Medical Examiner	County Asset								
Gresham Fire & Emerg Srvcs 76	Fire Station			X	X				
Multnomah Co RFPD 14 61	Fire Station								
Multnomah Co RFPD 14 62	Fire Station				X		X		
Multnomah Co RFPD 14 63	Fire Station								
Portland Fire & Rescue 27	Fire Station								
Sauvie Island Vol Fd #30 30	Fire Station				X		X		
Scappoose RFPD 436	Fire Station			X	X	X	X		X
Tualatin Valley Fire & Rescue 368	Fire Station			X	X	X	X		
5 Star Home Care Of Oregon	Licensed Medical Facility								
Springdale Job Corps Center	School- Private								
Corbett Charter	School- Public				X		X		
Corbett Elementary	School- Public				X		X		
Corbett High	School- Public				X		X		
Corbett Middle	School- Public				X		X		
Corbett SD 39	School- Public				X		X		
East Orient Elementary	School- Public			X	X				

FACILITY NAME	FACILITY TYPE	Fixed HAZMAT Daytime Buffer	Fixed HAZMAT Nighttime Buffer	Mobile HAZMT0.5-mile (road)	Mobile HAZMT1.0-mile (road)	Mobile HAZMT 0.5-mile (rail)	Mobile HAZMT 1.0-mile (rail)	Crude Oil Rail 1,000 feet	Crude Oil Rail 0.5-mile
MESD Program At Sam Barlow HS	School- Public								
Pleasant Valley Elementary	School- Public								
Riverdale Grade	School- Public								
Riverdale SD 51J	School- Public								
Sam Barlow High	School- Public								
Sauvie Island Elementary	School- Public						X		
Skyline Elementary	School- Public			X	X	X	X		
Terra Nova Community Farm	School- Public								
West Orient Middle	School- Public			X	X				

Appendix A: Local Resolutions Adopting Plan

Each jurisdiction in the Planning Area formally adopted via resolution the Multnomah County Multi-Jurisdictional Natural Hazard Mitigation Plan.

For a copy of a specific adoption by resolution, please contact the jurisdiction's local emergency manager.

Appendix B: Federal Requirements Crosswalk

Jurisdictions: Multnomah County City of Fairview City of Gresham City of Troutdale City of Wood Village	Title of Plan: Multnomah County Multi-Jurisdictional Natural Hazard Mitigation Plan	Date of Plan: December 28, 2016 Final Draft May 08, 2017 Final Draft resubmitted
Local Point of Contact: Lisa Corbly	Address: Lisa Corbly Multnomah County Office of Emergency Management 501 SE Hawthorne Boulevard, Suite 400 Portland, Oregon 97214	
Title: Senior Equity Planner		
Agency: Multnomah County Office of Emergency Management		
Phone Number: 503.988.8372	E-Mail: lisa.corbly@multco.us	

State Reviewer: Joseph Murray	Title: Planner	Date: May 31, 2017
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FEMA Reviewer: Amanda Siok 425-487-4626 Amanda.Siok@fema.dhs.gov	Title: Mitigation Planner	Date: June 6, 2017
Date Received in FEMA Region (insert #)	02/10/2017	
Plan Not Approved		
Plan Approvable Pending Adoption	06/06/2017	
Plan Approved		

SECTION 1: REGULATION CHECKLIST

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	5.1 Developing the Plan; 5.1.4 Stakeholder Participation	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	5.1.4 Stakeholder Participation	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	5.1.5 Public Participation	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	5.1.3 Review of Existing Plans and Technical Information	X		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	5.2.3 Continued Public Participation	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	5.2 Maintaining the Plan	X		
<u>ELEMENT A: REQUIRED REVISIONS</u>				
No revisions required.				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	For each hazard, sections 3.X.1 Overview	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	For each hazard, 3.X.2 History and 3.X.3 Probability	X		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	section 3.X.4 PDF 63-176 Gresham: PDF 81-83	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Flood section 3.2.4 Vulnerability, Subsection: National Flood Insurance Program	X		
<u>ELEMENT B: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	4.3.2 Mechanisms, Subsection: Integration into Other Plans; 4.3.3 Funding	X		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Flood section 3.2.4 Vulnerability, Subsection: National Flood Insurance Program PDF 112	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	4.1 Vision, Goals and Objectives	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	4.2.3 Action Plan	X		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	4.2.3 Action Plan PDF 180-181, Appendix C, Appendix E	X		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	4.2.3 Action Plan; 4.3.2 Mechanisms, Subsection: Integration into Other Plans; Appendix F: Implementation Mechanisms	X		

ELEMENT C: REQUIRED REVISIONS

REVISIONS MADE:

1. REGULATION CHECKLIST		Location in Plan	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)		(section and/or page number)		
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	2.9 Land Use and Development PDF 56-57	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Appendix E: Progress Report on Local Mitigation Projects PDF 244-264	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	1.3 Participating Jurisdictions; 5.1 Developing the Plan	X		
<u>ELEMENT D: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Forthcoming, will be in Appendix A Local Resolutions Adopting Plan		X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Forthcoming, will be in Appendix A Local Resolutions Adopting Plan		X	
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS				
(OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
The State of Oregon imposes no additional requirements upon local NHMPs.				
<u>ELEMENT E: REQUIRED REVISIONS</u>				

PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths:

-The Plan does an excellent job reviewing each jurisdiction's relating plans and describing opportunities for implementation through these plans.

-The public process for this plan was thorough and creative.

-Multiple non-jurisdictional stakeholders were invited to participate in the planning process.

-Appendix G contains planning meeting agendas and notes which document attendees, meeting dates, and meeting summaries.

-Appendix H concisely documents community comments and responses to those comments.

Opportunities for Improvement:

-Add page numbers to the table of contents and enable hyperlinks within it to allow for more efficient plan navigation.

-Include a template that will document the process of each mitigation action annually in the Plan Appendix. Record the action's progression, changes, and public feedback every year to document the implementation progress.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

-The plan compared State and local Risk Rankings and acknowledged their differences due to methodology. Appendix C contains the OEM methodology and scoring.

-The plan includes a reference section for each hazard and risk assessment, showing the reader data sources and evidence of methodology used.

-The Level of Risk Graphic is an excellent way to concisely simplify data that highlights the results of the analysis.

-The plan considers secondary hazards resulting from earthquakes including tsunami, landslide, dam and levee failures

-The Plan addresses Climate Change as an influencer to hazards, making the historical records unreliable.

Opportunities for Improvement:

-Consider using the transportation impacts under the Seismic Lifelines section on page 85 to develop problem statements to inform mitigation strategies.

-Consider using fewer acronyms in the Wildfire section (CWPP, WUI, ODF, CWFP, DLCD, RFPD, NRC)

Element C: Mitigation Strategy

Plan Strengths:

-The plan lists several mitigation actions that focus on new and future development.

-The Plan includes an appendix on implementation mechanisms for each jurisdiction.

Opportunities for Improvement:

-Consider developing problem statements from the risk assessment section to create the framework for mitigation strategies.

-Consider developing mitigation strategies specific to the County's Category 1 Critical Facilities and Category 2 Key Facilities.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths:

-The plan does a wonderful job explaining the linkage between future development and vulnerability for each jurisdiction.

-The plan utilizes the enhanced population data of the Portland State University's Population Research Center.

-The plan thoroughly addresses changes in the status of mitigation actions from past plans.

-The plan reviewed actions from the previous mitigation plan, related local plans and regulations, and guides on mitigation best practices.

Opportunities for Improvement:

-Discuss how changing conditions could impact long-term community resilience.

-Identify possible solutions to obstacles that prevented the completion of mitigation actions in the previous plan so they can be overcome in the future.

B. Resources for Implementing Your Approved Plan

The **Region 10 Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it in the FEMA Library at <http://www.fema.gov/media-library/assets/documents/89725>.

The **Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials** resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=7130>.

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=6938>.

The **Local Mitigation Planning Handbook** provides guidance to local governments on developing or updating hazard mitigation plans to meet and go above the requirements. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=7209>.

The **Integration Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned** resource is a 2014 ICLEI publication for San Diego with a clear methodology that could assist in next steps for integration impacts of climate change throughout mitigation actions. <http://icleiusa.org/wp-content/uploads/2015/08/Integrating-Hazard-Mitigation-and-Climate-Adaptation-Planning.pdf>

The **Local Mitigation Plan Review Guide and Tool** resource is available through FEMA's Library and should be referred to for the next plan update. <http://www.fema.gov/library/viewRecord.do?id=4859>

National Fire Adapted Communities Learning Network

Volcanic Eruption Mitigation Measures: For information on Mitigation Actions for Volcanic Eruptions that would satisfy the C4 requirement, please visit: <http://earthzine.org/2011/03/21/volcanic-crisis-management-and-mitigation-strategies-a-multi-risk-framework-case-study/> and <http://www.gvess.org/publ.html>.

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at <http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx>. If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Pre-Disaster Mitigation, Hazard Mitigation Grant Program, Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Angie Lane at angie.lane@mil.state.or.us, for more information.

SECTION 3: MULTI-JURISDICTION SUMMARY SHEET

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

Jurisdiction Name	Jurisdiction Type (city/ special district/ PNP)	Plan POC	Mailing Address	Email	Phone	A.	B.	C.	D.	E.
						Planning Process	HIRA	Mitigation Strategy	Plan Review, Evaluation & Implementation	Plan Adoption
Multnomah County	County	Lisa Corbly	501 SE Hawthorne Blvd, Suite 400 Portland 97214	lisa.corbly@multco.us	503.988.8372	Y	Y	Y	Y	
City of Gresham	City	Kelle Landavazo	1333 NW Eastman Pky Gresham 97030	kelle.landavazo@greshamoregon.gov	503.618.2567	Y	Y	Y	Y	
City of Wood Village	City	Bill Peterson	2055 NE 238th Drive Wood Village 97060-1095	billp@ci.wood-village.or.us	503.667.6211	Y	Y	Y	Y	
City of Fairview	City	Nolan Young	1300 NE Village Street Fairview 97024	youngn@ci.fairview.or.us	503.674.6221	Y	Y	Y	Y	
City of Troutdale	City	Ray Young	219 E. Historic Columbia River Hwy. Troutdale, 97060-2078	ray.young@troutdaleoregon.gov	503.665.5175	Y	Y	Y	Y	

Appendix C: Local OEM Hazard Analysis Scores

Overview

The methodology for this hazard analysis was first developed by the Federal Emergency Management Agency (FEMA) in the early 1980s, and was gradually refined by Oregon Emergency Management (OEM). Although nearly every jurisdiction in Oregon uses this process, the range of values is relative only within the individual jurisdiction, unless two or more jurisdictions conduct their analyses at the same time and utilize the same criteria in determining the values to apply. It is not meant to compare one jurisdiction to another under other circumstances, and the Multnomah County calculations and hazard analysis should not be applied to other jurisdictions, even those within the county, without familiarization with the process applied.

This particular hazard analysis is an early step in determining the risk — the potential for harm — facing a community. When complete, it provides a table of relative risks to help focus planning priorities on those hazards most likely to occur and cause the most damage. This analysis, therefore, is constructed to:

- Establish priorities for planning, capability development and hazard mitigation
- Identify needs for hazard mitigation measures
- Educate the public as well as public officials about hazards and vulnerabilities
- Make informed judgments about potential risks

Completing the Local OEM Hazard Analysis

Severity Ratings refer to the impact level the hazard has or potentially could have on the community. Values assigned are subjective; *one person's rare event could be another's frequent!*

DESIGNATION	DESCRIPTION	RATING
LOW	RARE	1 to 3
MODERATE	OCCASIONAL	4 to 7
HIGH	FREQUENT	8 to 10

History is the record of previous occurrences requiring a response.

- Low: 0 to 1 event in the past 10 years
- Medium: 2 to 3 events in the past 10 years
- High: 4 or more events in the past 10 years

Vulnerability is a measure of the percentage of the population and property likely to be affected during an occurrence of an incident.

- Low: Less than 1% affected
- Medium: 1% to 10% affected
- High: More than 10% affected

Maximum Threat is a measure of the highest percentage of the population or property that could be impacted under a worst-case scenario.

- Low: <5% affected
- Medium: 5% to 25% affected
- High: >25% affected

Probability is a measure of the likelihood of a future event occurring within a specified period of time.

- Low: More than 10 years between events
- Medium: 5 to 10 years between events
- High: Likely within the next 5 years

Local Hazard Risk Scores

Table C.1: Local Natural Hazard Risk Rankings by Hazard for All Jurisdictions in the Multnomah County Multi-Jurisdictional Natural Hazards Mitigation Plan (NHMP) Planning Area

	Unincorporated Multnomah County	Gresham	Troutdale	Fairview	Wood Village
HIGH	Earthquake	Earthquake	Severe Weather	Earthquake	Severe Weather
	Flood	Severe Weather		Severe Weather	
	Wildfire				
MODERATE	Severe Weather	Flood	Earthquake	Volcano	Earthquake
		Landslide	Volcano	Flood	Volcano
			Flood		Landslide
			Wildfire		
LOW-MODERATE				Flood	
LOW	Landslide	Wildfire	Landslide	Landslide	Wildfire
	Volcano	Volcano		Wildfire	

Table C.2: Unincorporated Multnomah County Natural Hazard Risk Scores

Hazard	History (Weight Factor = 2)	Average Vulnerability (Weight Factor = 5)	Max Vulnerability (Weight Factor = 10)	Probability (Weight Factor = 7)	Risk Score	Risk Ranking
Earthquake	2 x 8	5 x 10	10 x 10	7 x 7	215	High
Flood	2 x 9	5 x 9	10 x 8	7 x 9	206	High
Landslide	2 x 8	5 x 5	10 x 4	7 x 8	137	Low
Volcano	2 x 2	5 x 6	10 x 8	7 x 2	128	Low
Wildfire	2 x 7	5 x 10	10 x 8	7 x 8	200	High
Severe Weather	2 x 8	5 x 7	10 x 6	7 x 9	174	Moderate

Table C.3: Gresham Natural Hazard Risk Scores

Hazard	History (Weight Factor = 2)	Average Vulnerability (Weight Factor = 5)	Max Vulnerability (Weight Factor = 10)	Probability (Weight Factor = 7)	Risk Score	Risk Ranking
Earthquake	2 x 10	5 x 10	10 x 10	7 x 10	240	High
Flood	2 x 10	5 x 7	10 x 7	7 x 10	195	Moderate
Landslide	2 x 10	5 x 6	10 x 5	7 x 10	170	Moderate
Volcano	2 x 3	5 x 7	10 x 10	7 x 3	162	Low
Wildfire	2 x 8	5 x 7	10 x 6	7 x 8	167	Low
Severe Weather	2 x 10	5 x 10	10 x 10	7 x 10	240	High

Table C.4: Troutdale Natural Hazard Risk Scores

Hazard	History (Weight Factor = 2)	Average Vulnerability (Weight Factor = 5)	Max Vulnerability (Weight Factor = 10)	Probability (Weight Factor = 7)	Risk Score	Risk Ranking
Earthquake	2 x 1	5 x 10	10 x 10	7 x 1	159	Moderate
Flood	2 x 2	5 x 3	10 x 6	7 x 3	100	Moderate
Landslide	2 x 3	5 x 2	10 x 4	7 x 4	84	Low
Volcano	2 x 1	5 x 10	10 x 10	7 x 1	159	Moderate
Wildfire	2 x 2	5 x 4	10 x 7	7 x 5	129	Moderate
Severe Weather	2 x 7	5 x 10	10 x 10	7 x 7	213	High

Table C.5: Fairview Natural Hazard Risk Scores

Hazard	History (Weight Factor = 2)		Average Vulnerability (Weight Factor = 5)		Max Vulnerability (Weight Factor = 10)		Probability (Weight Factor = 7)	Risk Score	Risk Ranking
Earthquake	2 x	1	5 x	10	10 x	10	7 x 10	222	High
Flood	2 x	1	5 x	4	10 x	4	7 x 3	83	Moderate
Landslide	2 x	1	5 x	2	10 x	2	7 x 1	39	Low
Volcano	2 x	1	5 x	4	10 x	4	7 x 2	76	Moderate
Wildfire	2 x	1	5 x	1	10 x	1	7 x 1	24	Low
Severe Weather	2 x	10	5 x	8	10 x	8	7 x 10	210	High

Table C.6: Wood Village Natural Hazard Risk Scores

Hazard	History WF = 2		Average Vulnerability WF = 5		Max Vulnerability WF = 10		Probability WF = 7	Risk Score	Risk Ranking
Earthquake	2 x	1	5 x	10	10 x	10	7 x 1	159	Moderate
Flood	2 x	0	5 x	5	10 x	5	7 x 1	82	Low-Moderate
Landslide	2 x	1	5 x	3	10 x	10	7 x 0	117	Moderate
Volcano	2 x	1	5 x	10	10 x	10	7 x 1	159	Moderate
Wildfire	2 x	1	5 x	1	10 x	1	7 x 1	24	Low
Severe Weather	2 x	10	5 x	8	10 x	10	7 x 10	230	High

Appendix D: Multnomah County Building Priorities for Post-Disaster Restoration of Services

Building Assessment / Restoration Staging Sequence

Multnomah County Buildings: Owned and Leased

N = North/NE **D = Downtown/Core** **I = Inner East** **E = East County** **W = West Side** **O = Other**

* = Emergency Communications Towers

Category 1

Group A (11)

D-Justice Center 119
 D-River Patrol Willamette 308
 I-Bridge Shop 446
 I-Penumbra Kelly / ISD 327
 I-Multnomah Bldg (EOC) 503
 N-Blanchard Complex
 272/273/274/279
 N-Hansen Complex 313/316
 N-River Patrol Columbia 307
 E-Yeon Complex (EOC) 424/25/455
 Biddle Butte Tower 015 *
 Rocky Butte Tower 014 *

Group B (13)

D-County Courthouse 101
 D-Motor Pool (Fuel) 111
 D-Gladys McCoy Building 160
 I-Southeast Health Clinic 420
 I-WTS (4 Houses) 360/365/366/219
 N- Gateway Complex 439/448/451
 N-North Portland Health 325
 N-Northeast Health Clinic 322
 N-Juvenile Justice Center 311
 N-Banfield (Central Stores) 374 L
 E-Multnomah East 437
 E-Mid County Health 430
 E-Inverness Jail/Laundry 314/320

Category 2

Group A (8)

D-Lincoln 167 L
 D-Mead Building 161
 I-Library Admin/Title Wave 317/617
 I-Wikman Building 465
 E-Animal Services 324
 E-River Patrol Chinook 309
 E-Springdale Road Shop 432
 W-Skyline Road Shop 427

Group B (14)

D-Central Library 601
 I-E. PDX Center (ADS/SE) 339 L
 I-Central Office (DCC) 481
 I-Mid County (DCC) 304 L
 I-Elections 414
 I-Tabor Square 409 L
 N-Columbia Pacific (DCC) 221 L
 E-Gresham District Court 406 L
 E- Cherry Blossom Plaza 377 L
 E-Gresham Probation (DCC) 407
 E-MCSO Training/WHse 490
 E-Rockwood (DCC) 423 L
 E-Rockwood Clinic 398
 E-Troutdale Library 629

Category 3

Group A (21)

I-Belmont Library 603
 I-Hollywood Library 622 L
 I-Sellwood Library 625 L
 I-Woodstock Library 618
 N-Albina Library 602 L
 N-Gregory Heights Library 606
 N-King Juvenile 356 L
 N- Ortiz/La Clinica 338 L
 N-North PDX Library 612
 N-St. Johns Library 615
 N-Vector Control 297/312 L
 N-Wapato Jail (unoccupied)
 452
 E-Fairview Library 621 L
 E-Gresham Library 607
 E-Holgate Library 609
 E-Midland Library 611
 E-Rockwood Library 614
 E-9th & Kelly (DA Support) 489
 L
 W-Capitol Hill Library 605
 W-Hillsdale Library 623
 W-NW Library 619 L

Group B (5)

D-Medford (DCJ) 154 L
 N-State Court Storage 444 L
 O-Sylvan Westgate 228 L
 O-Spindrift Cottage 697
 O-Medical Examiner 525 L

Sequence

The assigned facilities and properties are sequenced into three categories (1 to 3) and two groups (A and B) based on the current county assessment of their need to be restored after a disaster, emergency or other incident. The listing is coded by location to allow for geographical response planning where practical. Essentially, the Multnomah County Department of Facilities and Property Management (FPM) used Federal Emergency Management Agency (FEMA) guidelines to list the buildings and sites considered most critical to county operations and the public it serves. Building restoration and business continuation priorities will be based largely upon this sequence, but can and will be adjusted according to the nature of the situation and condition of the building.

Category 1: Critical Facilities

Critical facilities are the first county buildings that must be restored to service. Their business operations must resume and continue as soon as possible. This category includes primary health, justice and transportation operations and services.

- **Group A:** These buildings house operations that need to be in place in order to restore other buildings, roads or bridges. These buildings should be the first facilities restored to service.
- **Group B:** These buildings support services that operate 24 hours a day, seven days a week, or house critical resources (e.g., vehicle fueling or communication hubs). These buildings house fewer personnel than Category 1-Group A buildings, or have the ability to be self-supporting for some period of time. Correctional complexes may operate independently for up to 36 hours using emergency generators.

Category 2: Key Facilities

Key facilities are the next county buildings that must be restored to service. Their business operations must resume and continue when practical. This category includes administrative facilities and support services.

- **Group A:** These buildings house administrative personnel who need to return to work after critical buildings are operational.
- **Group B:** These buildings support services that are administered by personnel housed in the Category2-Group A buildings.

Category 3: Other Facilities

These facilities include all other county buildings and sites.

- **Group A:** These buildings include branch libraries, storage facilities and smaller-scale county operations.
- **Group B:** This group includes any other county facilities and properties not previously listed.

Appendix E: Progress Report on Local Mitigation Projects

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
1	Earthquake	Fairview	Obtain funding and retrofit important public facilities with significant seismic vulnerabilities.	Administration, Public Works	No Action/Deferred	Need to find grant for funding.	Yes
2	Earthquake	Fairview	Conduct a sidewalk survey of residential, commercial and industrial buildings in Fairview using the Federal Emergency Management Agency's (FEMA) Rapid Visual Screening to identify especially vulnerable buildings, raise awareness and encourage mitigation actions.	Public Works, Community Development, Building Official	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
3	Earthquake	Fairview	Disseminate FEMA pamphlets to educate homeowners and business owners about structural and non-structural retrofitting of vulnerable buildings and encourage retrofit.	Administration, Community Development	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
4	Earthquake	Fairview	Encourage owners of other critical facilities, including fire stations and schools, to conduct similar seismic vulnerability assessments and to establish priorities for retrofit or replacement where necessary.	Administration	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
5	Earthquake	Fairview	Evaluate the seismic vulnerability of critical city-owned buildings, utilities and infrastructure and establish priorities to retrofit or replace vulnerable facilities to ensure adequate seismic performance of critical facilities.	Public Works, Building Official	No Action/Deferred	Need to find grants for funding.	Yes
6	Flood - in floodplain	Fairview	Complete inventory and geographic information systems (GIS) mapping of structures, critical facilities, and important transportation or utility system components within mapped floodplains or within areas subject to flood in the event of levee or dam failures, including elevation data and facility information.	Public Works, Community Development, Building Official	No Action/Deferred	The Multnomah County Drainage District (MCDD) has completed draft inundation maps for areas behind levees.	Yes
7	Flood - in floodplain	Fairview	Develop funding alternatives for replacement of Fairview Creek culverts at 223rd Avenue and Halsey Street and 223rd Avenue and Walnut Lane.	Public Works, Community Development, Building Official	No Action	This is a county road. Change to County action.	Yes
8	Flood - in floodplain	Fairview	Develop specific mitigation strategies for high-risk facilities identified in short-term item #1.	Public Works, Community Development	No Action/Deferred	Dependent on Action #10.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
9	Flood - outside floodplain	Fairview	Evaluate and improve notification, evacuation and response planning for areas within the potential inundation area for levee or dam failures.	Police, Public Works	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	No - response planning
10	Flood - outside floodplain	Fairview	Complete an inventory of structures, critical facilities and important transportation or utility system components in locations with a history of severe or repetitive flooding.	Public Works	No Action/Deferred	MCDD has developed inundation maps for areas behind levees (not mapped floodplain). Are there other areas with repetitive flooding that are not in a FEMA Special Flood Hazard Area?	Yes
11	Flood - outside floodplain	Fairview	For locations with repetitive flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or stormwater drainage capacity: 28 projects identified in Fairview's 2007 Consolidated Stormwater Master Plan.	Public Works	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
12	Landslide	Fairview	Complete the inventory of locations where buildings or infrastructure are subject to landslides.	Public Works	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
13	Landslide	Fairview	Consider landslide potential in the permitting process for new development in the few areas of Fairview where landslide potential is not nil.	Community Development, Building Official	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
14	Multi-Hazard	Fairview	Develop education programs aimed at mitigating the risk posed by hazards.	Community Development, Public Works	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
15	Multi-Hazard	Fairview	Develop detailed inventories of at-risk buildings and infrastructure and prioritize mitigation actions.	Community Development, Public Works	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
16	Multi-Hazard	Fairview	Develop public and private sector partnerships to foster hazard mitigation activities.	Administration, Public Works, Police	In Progress	Ongoing meetings.	Yes
17	Multi-Hazard	Fairview	Establish a formal role for the Local Mitigation Planning Team to develop a sustainable process to encourage, implement, monitor and evaluate citywide mitigation actions.	Public Works, Police	No Action/Deferred		No- part of plan implementation
18	Multi-Hazard	Fairview	Identify and pursue funding opportunities to implement mitigation actions.	Administration, Public Works, Police	In Progress	Working with Multnomah County DEM.	Yes
19	Multi-Hazard	Fairview	Integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Police	In Progress		Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
20	Multi-Hazard	Fairview	Integrate the mitigation plan findings into planning and regulatory documents and programs.	Community Development, Public Works	On going		Yes - revised
21	Volcanic Hazards	Fairview	Develop emergency evacuation protocols for lahar events and conduct exercises to test the protocols.	Police, Public Works	In Progress	The County and City of Portland procured a new Community Emergency Notification System (CENS). The county can include a lahar zone map that will enable quick call-outs to residents in the potential path of a lahar when such a warning is called for (in accordance with the protocols in the Mt. Hood Coordination Plan). The CENS system will be exercised on a regular basis.	No - response planning
22	Volcanic Hazards	Fairview	Update public education, emergency notification procedures and emergency planning for ash fall and lahar events.	Community Development, Public Works, Police	Complete	The Mt. Hood Coordination Plan identifies responsibilities of federal, regional and local agencies for public notifications and response. The county obtained public education materials from the U.S. Geological Survey (USGS) on ash and other volcanic hazards and is providing these at community outreach events (e.g., Fairview National Night Out).	No - response planning
23	Volcanic Hazards	Fairview	Quantify the lahar risk in Fairview via GIS mapping to overlay the lahar hazard zones with parcel data.	Community Development, Public Works	No Action/ Recommend Removal	GIS metadata cautions that data is recommended to be used for general planning purposes, not at the structure level.	No
24	Wildland Urban Interface Fire	Fairview	Identify and map high-risk areas.	Public Works, Gresham Fire	Complete	The 2011 Community Wildfire Protection Plan (CWPP) and new risk assessment data provided by the Oregon Dept. of Forestry (ODF) has mapped high-risk areas within Fairview. This is being included in the Natural Hazards Mitigation Plan (NHMP) update. However, the CWPP is overdue for an update.	Yes - revised

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
25	Wildland Urban Interface Fire	Fairview	Disseminate fire-wise pamphlets and other educational materials to residents in high-risk areas.	Community Development, Gresham Fire	No Action/Deferred	Significant staff cuts. Community Development department eliminated.	Yes
26	Wildland Urban Interface Fire	Fairview	Encourage fire-safe construction practices for existing and new construction in high-risk areas.	Community Development, Building Official	Complete	Ongoing.	Yes - revised
27	Wildland Urban Interface Fire	Fairview	Participate in the upcoming development of the Multnomah County CWPP.	Community Development	Complete	Gresham Fire participated in the 2011 CWPP. Fairview's NHMP Steering Committee representative will be included in future updates of the CWPP as well.	Yes - revised
28	Winter Storm	Fairview	Ensure that all critical facilities in Fairview have backup power and emergency operations plans to deal with power outages.	Public Works for city-owned, other public and private facility owners	Complete		No - complete
29	Winter Storm	Fairview	Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.	Portland General Electric (PGE)	No Action	The City does not have authority over PGE. Determine what action a City or the County can take to influence additional maintenance criteria of utilities.	Yes
30	Winter Storm	Fairview	Conduct annual hazardous tree assessment and mitigation in city parks.	Community Development, Public Works	Complete		No - complete
31	Winter Storm	Fairview	Encourage new developments to include underground power lines.	Community Development	Complete		No - complete
32	Winter Storm	Fairview	Encourage property owners to trim trees near service drops to individual customers.	PGE	No Action	The City does not have authority over PGE. Determine what action a City or the County can take to influence maintenance criteria.	Yes
33	Winter Storm	Fairview	Enhance tree trimming efforts, especially for transmission lines and trunk distribution lines.	PGE	No Action	The City does not have authority over PGE. Determine what action a City or the County can take to influence additional maintenance criteria of utilities.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
34	Earthquake	Multnomah County	Evaluate the nonstructural vulnerabilities in county buildings and implement mitigation measures where necessary, including automatic seismic shut off valves on gas lines, flexible connections to gas-fueled equipment, bracing of fire sprinklers, bracing of contents and others.	Facilities and Property Management (FPM)	In Progress	Initial nonstructural assessments were performed on identified priority facilities in 1989. Since that time, FPM has incorporated many of the common recommended actions into its renovation activities. Automatic seismic shut off valves were installed in 10 larger, high-priority facilities. Focus is now on strategically replacing facilities whenever possible (i.e., downtown courthouse and Health Department headquarters). Recommend revising action to identify remaining gaps.	Yes
35	Earthquake	Multnomah County	Seismic upgrades to the Multnomah County courthouse.	FPM	Complete	New facility being built that will meet seismic codes.	No - complete
36	Earthquake	Multnomah County	Encourage school districts, fire agencies and private building owners to evaluate the structural vulnerability of buildings and retrofit or replace when necessary. Example: grant workshops.	Multnomah County Emergency Management (MCEM)	No Action/Deferred	We have participated in state organized grant workshops for seismic retrofit, however, we have had no active role in persuading public or private owners to retrofit. This action should be modified to specific the role we can take in this effort.	Yes
37	Earthquake	Multnomah County	Complete and maintain an inventory of critical facilities and lifelines that are susceptible to severe disruption due to earthquake hazards.	MCEM	In Progress	In GIS and through the risk assessment in the NHMP and the Oregon Resilience Plan, we are beginning to identify those critical facilities and infrastructure.	Yes
38	Earthquake	Multnomah County	Enhance Multnomah County's staff earthquake expertise by attending training classes on nonstructural mitigation, post-earthquake seismic evaluations of buildings, and FEMA mitigation grants.	MCEM	Complete	County staff have taken ATC-20 classes, FEMA E-74 Reducing Risks of Nonstructural Earthquake Damage. The resilience planner has attended a webinar on new FEMA grant guidance and shared this info with steering committee.	No - complete

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
39	Earthquake	Multnomah County	Evaluate the structural vulnerability of critical county buildings and retrofit or replace when necessary.	FPM	Complete	Multiple structural assessments have been performed in the past on county buildings. These assessments are used to identify structural deficiencies. This information aids in the planning of needed upgrades and/or replacement of structures. Consider including a new action that is more specific and aligned with FPM strategy.	Yes - revised
40	Earthquake	Multnomah County	Obtain and update earthquake map data as it becomes available through the Oregon Dept. of Geology and Mineral Industries (DOGAMI) and other partners.	GIS	On going, as applicable	This is part of the NHMP risk assessment process. Revise to specify DOGAMI's new earthquake analysis project	Yes
41	Earthquake	Multnomah County	Retrofit or replace key bridges with substantial seismic vulnerabilities.	Transportation	In Progress	The Sellwood Bridge has been replaced and the new Tillicum Bridge provides another seismically safe crossing. The 2015 Bridge capital improvement plan (CIP) Update identified seismic mitigation projects for the county's Willamette River bridges.	Yes
42	Earthquake	Multnomah County	Retrofit suspended ceilings, including light fixtures, as replacement becomes necessary.	FPM	In Progress	Policy and/or code requirement supports bringing these building components up to current seismic code when they are impacted due to renovation. Additionally, discovered structural or nonstructural safety issues are addressed during the course of a renovation and prioritized accordingly. Revised action should be to identify which facilities to target and to pursue funding (grant or capital improvement) as it becomes available.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
43	Flood - in floodplain	Multnomah County	Complete an inventory and GIS mapping of structures, critical facilities, and important transportation or utility system components within mapped floodplains and/or within areas subject to flood in the event of levee or dam failures, including elevation data.	GIS	No Action	We don't have elevation of structures data. Can use HAZUS to estimate this to some degree. Should be part of regular risk assessment update.	Yes
44	Flood - in floodplain	Multnomah County	Encourage local jurisdictions to post high-water marks around the county to aid citizens and first responders in visually assessing flood hazards.	MCEM	No Action/Deferred	The Oregon Museum of Science and Industry (OMSI) has some high-water marks on the Willamette. Are there others? MCDD has this as a goal in its Levee Improvement Program.	Yes
45	Flood - in floodplain	Multnomah County	Facilitate an identification and prioritization process for the purpose of defining a candidate list of localized inundation scenarios related to levee failures that result from different hazard events.	MCEM	Complete	MCDD has developed inundation maps for areas behind levees for 100-year and 500-year flood events on the Columbia, as well as the design water surface elevation. The areas mapped are not within the FEMA Special Flood Hazard Area (SFHA).	No - complete
46	Flood - in floodplain	Multnomah County	Conduct a targeted risk assessment for all areas within the county containing public facilities, private industry and/or residential facilities that were previously flooded or flood-prone.	MCEM	No Action	The NHMP risk assessment shows flood risk. If this action stays, it should identify target areas that need more study and what the purpose of that study would be, e.g., to develop a mitigation grant to elevate or flood-proof buildings.	Yes
47	Flood - in floodplain	Multnomah County	Use targeted flood risk assessments to educate stakeholders on need to take mitigation and/or preparedness actions in order to reduce flood hazard impacts.	MCEM	No Action	Work on this action is dependent on Action #46.	Yes
48	Flood - in floodplain	Multnomah County	Implement mitigation actions for identified high-risk buildings or infrastructure as funding becomes available.	MCEM	No Action	This is not specific enough to be helpful.	Yes
49	Flood - outside floodplain	Multnomah County	Complete an inventory and GIS mapping of structures, critical facilities, and important transportation or utility system components in locations with a history of severe or repetitive flooding.	GIS	No Action	Are there areas outside the mapped flood zones that have severe or repetitive flooding? Are these areas covered by Stormwater Master Plans?	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
50	Flood - outside floodplain	Multnomah County	For locations with repetitive flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or stormwater drainage capacity.	Transportation	In Progress	Road maintenance crews notify drainage engineer when problems exist. Drainage engineer evaluates and makes recommendations. Inventory and mapping of all county culverts is underway. County maintains a five-year CIP for fish passage culverts which is updated every two years.	Yes
51	Landslide	Multnomah County	Inventory utility and communication infrastructure in areas with a history of landslides or which are within mapped landslide hazard areas.	GIS	No Action/Deferred	This will be deferred until a more detailed lidar-based analysis of landslide risk is conducted by DOGAMI in 2016. MCEM does not have access to detailed locations of utility and communication infrastructure. Discussions with those organizations will need to occur to see if they would like to share data or if they would like to conduct the analysis themselves.	Yes - revised
52	Landslide	Multnomah County	Compile inventory of county road segments with a history of landslides or which are within mapped landslide hazard areas.	Transportation	No Action/Deferred	This will be deferred until a more detailed lidar-based analysis of landslide risk is conducted by DOGAMI in 2016. Existing slope hazard maps have not been overlaid with roads.	Yes - revised
53	Landslide	Multnomah County	Review the hillside development ordinance to consider amendments that address areas at risk from landslides for areas not already identified on the County Slope Hazard Map or otherwise subject to the hillside development zoning code.	Land Use Planning	In Progress	Being considered as part of the comprehensive plan update currently underway. The focus of the Comprehensive Plan policy conversation is currently whether the hillside development maps should be updated and whether code amendments are needed to address landslide risks to hillside development. Project is roughly half-way to completion.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
54	Landslide	Multnomah County	Encourage the relocation of identified critical or essential facilities and high-occupancy facilities in high-landslide-hazard areas, or mitigation of the landslide hazard if feasible.	MCEM	No Action/Deferred	New DOGAMI analysis in 2017 using lidar should assist in identifying high-landslide-hazard areas. Next step will be to identify if there are any facilities in these areas.	Yes
55	Landslide	Multnomah County	Obtain completed detailed lidar-based inventory of historical and active landslides and areas with high landslide risk to update the county's slope hazard maps.	GIS	Complete	Have Statewide Landslide Information Database for Oregon (SLIDO) 3. Next analysis by DOGAMI due in 2017. Update action to include new data.	Yes - revised
56	Severe Weather	Multnomah County	Work with stakeholder groups to identify common criteria for defining extreme heat and cold events for the sake of determining proper mitigation, protection or preparedness strategies.	MCEM	Complete	MCEM has developed a standard operating procedure (SOP) for severe weather that defines heat and cold event triggers for monitoring and response. The Climate Change Preparedness Plan identifies impacts from high-heat days and objectives for mitigation and preparedness. Revise action to meet additional coordination needs with Joint Office on Homeless Services.	Yes - revised
57	Severe Weather	Multnomah County	Develop a strategy that encourages property owners to trim trees that could impact life safety and damage property.	MCEM	NA/ Recommend Removal	This is not a priority public education topic for MCEM. May be more appropriate for another agency.	No
58	Severe Weather	Multnomah County	Encourage utilities to upgrade lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.	MCEM	No Action	Utilities are privately owned so we cannot pursue grants on their behalf. Revise action to articulate an action local government can take to support enhanced utility maintenance practices.	Yes - revised
59	Severe Weather	Multnomah County	Ensure that all critical facilities in Multnomah County have backup power and/or coordination of operations plans in place to withstand loss of grid power.	Facilities and Property Management	In Progress	Continuity of Operations Planning (COOP) is in progress. Fuel planning needs are also being assessed. New facilities that are priority will have generator power. May want to pursue potential grant funding if facility meets criteria.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
60	Severe Weather	Multnomah County	Conduct tree trimming activities on county roads where Multnomah County Transportation has jurisdictional responsibility.	Transportation	In Progress	Road maintenance crews conduct tree trimming activities.	Yes
61	Volcanic Hazards	Multnomah County	Update public education, emergency notification procedures and emergency planning for ash fall and lahar events.	MCEM	Complete	The Mt. Hood Coordination Plan identifies responsibilities of federal, regional and local agencies for public notifications and response. The county obtained public education materials from USGS on ash and other volcanic hazards and is providing these at community outreach events (e.g., Troutdale Summerfest, National Night Out events, etc.). The county also has displayed maps with the lahar zone at Troutdale and Corbett outreach events.	No - complete
62	Volcanic Hazards	Multnomah County	Develop emergency evacuation protocols for lahar events and conduct exercises to test the protocols.	MCEM	No Action/Deferred	The county and City of Portland procured a new Community Emergency Notification System (CENS). The county can include a lahar zone map that will enable quick call-outs to residents in the potential path of a lahar when such a warning is called for (in accordance with the protocols in the Mt. Hood Coordination Plan). The CENS system will be exercised on a regular basis.	No - response planning

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
63	Wildland Urban Interface Fire	Multnomah County	Consider how Multnomah County Land Use Planning should coordinate with fire agencies' planning for wildland urban interface fires.	Land Use Planning	Complete	This action item is complete. Land Use Planning amended zoning regulations in 2011 to clarify and streamline fire agency review of development applications in unincorporated Multnomah County. County zoning code was amended to defer review of access standards to fire departments to assure either safe emergency vehicular access or the use of structural fire sprinkler systems. Land use codes currently require establishment of fire safety zones around new structures in forest zones to minimize wildfire risk. New development in all zones is currently subject to fire department review. Extending structural fire safety standards to additional zoning districts is a policy question which will be considered as part of the ongoing Comprehensive Plan update project.	Yes - revised
64	Wildland Urban Interface Fire	Multnomah County	Review and amend as necessary planning and development regulations to incorporate mitigation strategies for urban/wildland interface fires considering the recommendations in the 2011 Multnomah County CWPP.	Land Use Planning	In Progress	Policy direction for amendments to zoning regulations are being considered as part of the Comprehensive Plan update currently underway. Project is roughly half-way to completion.	Yes
65	Wildland Urban Interface Fire	Multnomah County	Track and report progress of action items in the CWPP.	MCEM	In Progress	The county is currently considering how this plan could be better integrated with the NHMP and is proposing that the CWPP Committee become a subcommittee of the NHMP Steering Committee.	Yes
66	Earthquake	Troutdale	Obtain funding and retrofit important public facilities with significant seismic vulnerabilities.	Finance	In Progress	Incorporated into ongoing training, and as circumstance and federal and state funding opportunities wax and wane.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
67	Earthquake	Troutdale	Conduct a sidewalk survey of residential, commercial and industrial buildings in Troutdale using FEMA's Rapid Visual Screening to identify especially vulnerable buildings, raise awareness and encourage mitigation actions.	Building Official	Revised	Reassigned to the building official who is better qualified to make this assessment. Over the last 18 months, the building official has reviewed all projects proposed for compliance. Sites that are not associated with a building permit have not been surveyed.	Yes
68	Earthquake	Troutdale	Disseminate FEMA pamphlets to educate homeowners and business owners about structural and nonstructural retrofitting of vulnerable buildings and encourage retrofit.	Community Development	In Progress	During pre-applications we encourage the use of underground power lines in conjunction with PGE requirements.	Yes
69	Earthquake	Troutdale	Encourage owners of other critical facilities, including fire stations and schools, to conduct similar seismic vulnerability assessments and to establish priorities for retrofit or replacement where necessary.	Administration	In Progress	Fire stations have been evaluated for seismic risk, and the most vulnerable retrofitted. City Hall was abandoned and functions moved into less vulnerable buildings, and a new police facility was constructed to current seismic standards for an Emergency Operations Center (EOC). Pre-application conferences over the last 18 months have included comments from the building official concerning seismic upgrades required under the provisions of Chapter 34 of the Oregon Structural Specialty Code (OSSC). Recent approval of a charter school in an existing building required seismic upgrades.	Yes
70	Earthquake	Troutdale	Evaluate the seismic vulnerability of critical city-owned buildings, utilities and infrastructure and establish priorities to retrofit or replace vulnerable facilities to ensure adequate seismic performance of critical facilities.	Community Development	In Progress	Fire stations have been evaluated for seismic risk, and the most vulnerable retrofitted. City Hall was abandoned and functions moved into less vulnerable buildings, and a new police facility was constructed to current seismic standards for an EOC.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
71	Flood - in floodplain	Troutdale	Complete an inventory and GIS mapping of structures, critical facilities, and important transportation or utility system components within mapped floodplains and/or within areas subject to flood in the event of levee or dam failures, including elevation data and structure/facility information.	Public Works	In Progress	Subject to revision with pending Flood Insurance Rate Maps (FIRMs). MCDD has completed draft inundation maps for areas behind levees.	Yes
72	Flood - outside floodplain	Troutdale	Evaluate and improve notification, evacuation and response planning for areas within the potential inundation area for levee or dam failures.	Police	Complete	Flood-prone properties have been identified and an evacuation drill was performed.	No - response planning
73	Flood - outside floodplain	Troutdale	Complete an inventory of structures, critical facilities and important transportation or utility system components in locations with a history of severe or repetitive flooding.	Public Works	In Progress	Subject to revision with pending FIRMs.	Yes
74	Flood - outside floodplain	Troutdale	For locations with repetitive flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or stormwater drainage capacity.	Public Works	In Progress	Locations with repetitive flooding and significant damages or road closures have been identified in the stormwater master plans and the projects are currently on our CIP list.	Yes
75	Landslide	Troutdale	Complete the inventory of locations where buildings or infrastructure are subject to landslides.	Community Development	No Action/ Deferred	Inventory of locations where buildings or infrastructures are subject to landslides are currently done as permits are issued. No additional survey has been done at this point.	Yes
76	Landslide	Troutdale	Consider landslide mitigation actions for slides seriously threatening buildings or infrastructure.	Community Development	No Action/ Deferred	Mitigation actions are part of the permit process for new and remodeled buildings. Nothing has been done to formalize a process of mitigation of existing buildings or infrastructure.	Yes
77	Landslide	Troutdale	Limit future development in high-landslide-potential areas.	Community Development	Complete	Steep slope protection standards have been adopted. Revise action to include revisiting potential landslide areas upon release of DOGAMI's new Lidar report scheduled for release in 2017.	Yes - revised
78	Multi-Hazard	Troutdale	Develop detailed inventories of at-risk buildings and infrastructure and prioritize mitigation actions.	Public Works	No Action/ Deferred	Proposed in our 2015-2016 budget, but was not funded.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
79	Multi-Hazard	Troutdale	Develop education programs aimed at mitigating the risk posed by hazards.	Administration	In Progress	Educational materials, including data on city GIS layers and pamphlets, are available to the public and permittees, and educational programs have been provided.	Yes
80	Multi-Hazard	Troutdale	Develop public and private sector partnerships to foster hazard mitigation activities.	Administration	In Progress	Regional partnerships have been developed.	Yes
81	Multi-Hazard	Troutdale	Establish a formal role for the Local Mitigation Planning Team to develop a sustainable process to encourage, implement, monitor and evaluate citywide mitigation actions.	Administration	In Progress	City Management Team meetings of the key departments and staff training is ongoing.	No- part of plan implementation
82	Multi-Hazard	Troutdale	Identify and pursue funding opportunities to implement mitigation actions.	Finance	In Progress	Ongoing.	Yes
83	Multi-Hazard	Troutdale	Integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Public Works	In Progress	Ongoing.	Yes
84	Multi-Hazard	Troutdale	Integrate the mitigation plan findings into planning and regulatory documents and programs.	Community Development	In Progress	Ongoing. The building official has integrated flood, earthquake and known landslide mitigation during both pre-application and building permit issuance.	Yes
85	Volcanic Hazards	Troutdale	Develop emergency evacuation protocols for lahar events and conduct exercises to test the protocols.	Administration	NA/ Recommend Removal	The frequency of such events and the likely advance warning time for volcanic-related activity makes such drills impractical, except as a general EOP principle.	No - response planning
86	Volcanic Hazards	Troutdale	Develop GIS overlay maps of parcel and building data within lahar zones.	Public Works	NA/ Recommend Removal	GIS metadata cautions that data is recommended to be used for general planning purposes, not at the structure level.	No

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
87	Volcanic Hazards	Troutdale	Update public education, emergency notification procedures and emergency planning for ash fall and lahar events.	Administration	Complete	The Mt. Hood Coordination Plan identifies responsibilities of federal, regional and local agencies for public notifications and response. The county obtained public education materials from USGS on ash and other volcanic hazards and is providing these at community outreach events. MCEM gave out these materials and also displayed maps with the lahar zone at the Troutdale Summerfest.	No-complete
88	Wildland Urban Interface Fire	Troutdale	Identify specific parts of Troutdale at high risk for wildland urban interface fires because of fuel loading, topography and prevailing construction practices.	Community Development	No Action/Deferred	We are currently reviewing the criteria concerning wildfire hazard zones.	Yes
89	Wildland Urban Interface Fire	Troutdale	Encourage fire-safe construction practices for existing and new construction in high-risk areas.	Community Development	In Progress	The State of Oregon amended the IRC to include wildfire hazard mitigation with the statement that wildfire hazard zones shall be determined using criteria by ODF.	Yes
90	Wildland Urban Interface Fire	Troutdale	Identify evacuation routes and procedures for high-risk areas and educate the public.	Police	In Progress	Evacuation procedures will be developed based on the wildfire zones established by ODF.	No - response planning
91	Winter Storm	Troutdale	Ensure that all critical facilities in Troutdale have backup power and emergency operations plans to deal with power outages.	Public Works	In Progress	Addressed as part of structural rehabilitation or new construction, as occurred with the new police facility.	Yes
92	Winter Storm	Troutdale	Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.	PGE	In Progress	Undergrounding power line is an ongoing program.	Yes
93	Winter Storm	Troutdale	Encourage new developments to include underground power lines.	Community Development	Complete	During pre-applications we encourage the use of underground power lines in conjunction with PGE requirements.	No - complete

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
94	Winter Storm	Troutdale	Encourage property owners to trim trees near service drops to individual customers.	Code Enforcement	In Progress	This is an ongoing task.	Yes
95	Winter Storm	Troutdale	Enhance tree trimming efforts especially for transmission lines and trunk distribution lines.	PGE	In Progress	This work is currently being completed by PGE.	Yes
96	Earthquake	Wood Village	Obtain funding and retrofit important public facilities with significant seismic vulnerabilities.	Administration	No Action/Deferred		Yes
97	Earthquake	Wood Village	Conduct a sidewalk survey of residential, commercial and industrial buildings in Wood Village using FEMA's Rapid Visual Screening to identify especially vulnerable buildings, raise awareness and encourage mitigation actions.	Public Works	No Action/Deferred	A staff member would need training to perform this type of assessment. Many homes were constructed before 1983 under different standards.	Yes
98	Earthquake	Wood Village	Disseminate FEMA pamphlets to educate homeowners and business owners about structural and nonstructural retrofitting of vulnerable buildings and encourage retrofit.	Public Works, Administration	No Action/Deferred	Make information available to public through pamphlets, newsletter articles and city website.	Yes
99	Earthquake	Wood Village	Encourage owners of other critical facilities, including fire stations and schools, to conduct similar seismic vulnerability assessments and to establish priorities for retrofit or replacement where necessary.	Public Works, Building Department	NA/Recommend Removal	Wood Village has no schools or fire stations. New development is guided by building code requirements. Make information available to public through pamphlets, newsletter articles and city website.	No
100	Earthquake	Wood Village	Evaluate the seismic vulnerability of critical city-owned buildings, utilities and infrastructure and establish priorities to retrofit or replace vulnerable facilities to ensure adequate seismic performance of critical facilities.	Public Works	In Progress	City reservoirs were evaluated for retrofit. Project would be cost-prohibitive and it was determined that the retrofit would not be effective.	Yes - revised
101	Flood - in floodplain	Wood Village	Complete an inventory and GIS mapping of structures, critical facilities, and important transportation or utility system components within mapped floodplains and/or within areas subject to flood in the event of levee or dam failures, including elevation data and structures/facility information.	Planning	NA/Recommend Removal	This information was included in the 2010 NHMP. It states that the entire city is outside the 500-year floodplain.	No
102	Flood - in floodplain	Wood Village	Evaluate and improve notification, evacuation and response planning for areas within the potential inundation area for levee or dam failures.	Public Works	NA/Recommend Removal	This information was included in the 2010 NHMP. It states that the entire city is outside the 500-year floodplain.	No

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
103	Flood - outside floodplain	Wood Village	Identify locations where improvements to the stormwater drainage system are desired.	Planning	In Progress	The Master Plan identified two city intersections and three Multnomah County intersections within Wood Village that require improvements. Other improvements are made as needed.	Yes
104	Flood - outside floodplain	Wood Village	For locations with repetitive flooding and significant damages or road closures, determine and implement mitigation measures such as upsizing culverts or stormwater drainage capacity.	Public Works	In Progress	The Master Plan identified two city intersections and three Multnomah County intersections within Wood Village that require improvements. Other improvements are made as needed.	Yes
105	Landslide	Wood Village	Complete the inventory of locations where buildings or infrastructure are subject to landslides.	Public Works	No Action/Deferred	One location was identified in the city in the 2010 NHMP, categorized as a low to moderate risk. This item deferred until the new mapping comes out.	Yes
106	Landslide	Wood Village	Consider landslide mitigation actions for slides seriously threatening buildings or infrastructure.	Public Works	No Action/Deferred	One location was identified in the city in the 2010 NHMP, categorized as a low to moderate risk. This location is in Multnomah County's Right of Way (ROW) so would be the county's responsibility.	Yes
107	Landslide	Wood Village	Limit future development in high-landslide-potential areas.	Planning	No Action/Deferred	One location was identified in the city in the 2010 NHMP, categorized as a low to moderate risk. This location is in Multnomah County's ROW so would be the county's responsibility.	Yes
108	Multi-Hazard	Wood Village	Develop detailed inventories of at-risk buildings and infrastructure and prioritize mitigation actions.	Public Works, Building Department	No Action/Deferred	A staff member would need training to perform this type of assessment.	Yes - revised
109	Multi-Hazard	Wood Village	Develop education programs aimed at mitigating the risk posed by hazards.	Administration	In Progress	Make information available to public through pamphlets, newsletter articles and city website.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
110	Multi-Hazard	Wood Village	Develop public and private sector partnerships to foster hazard mitigation activities.	Public Works, Administration	Complete	Intergovernmental Agreements are in place for staff, equipment, resource, information sharing in case of an incident. Revise to include other jurisdictions.	Yes - revised
111	Multi-Hazard	Wood Village	Establish a formal role for the Local Mitigation Planning Team to develop a sustainable process to encourage, implement, monitor and evaluate citywide mitigation actions.	Public Works	In Progress	The Public Works director is designated as the city's emergency manager. He receives ongoing training and monitors the city for issues.	No- part of plan implementation
112	Multi-Hazard	Wood Village	Identify and pursue funding opportunities to implement mitigation actions.	Administration	In Progress	All opportunities are pursued for grant funds for needed equipment, etc.	Yes
113	Multi-Hazard	Wood Village	Integrate hazard, vulnerability and risk mitigation plan findings into enhanced emergency operations planning.	Public Works	Complete	The City of Wood Village's 2010 Natural Hazard Mitigation Plan (NHMP), Water System Emergency Response Plan, Emergency Operations Plan; documents are updated as needed or required.	No - complete
114	Multi-Hazard	Wood Village	Integrate the mitigation plan findings into planning and regulatory documents and programs.	Administration	Complete	The City of Wood Village's 2010 NHMP, Water System Emergency Response Plan, Emergency Operations Plan; documents are updated as needed or required. Revise to include other jurisdictions.	Yes - revised
115	Volcanic Hazards	Wood Village	Develop emergency evacuation protocols for lahar events and conduct exercises to test the protocols.	Public Works, Administration	No Action/Deferred	Evacuation likely would follow Multnomah County routes. See Action #62.	No - response planning
116	Volcanic Hazards	Wood Village	Update public education, emergency notification procedures and emergency planning for ash fall and lahar events.	Public Works, Administration	In Progress	The city makes information available to public through pamphlets, newsletter articles and city website. MCEM provided USGS education materials on ash and other volcanic hazards at the Wood Village National Night Out event.	Yes
117	Wildland Urban Interface Fire	Wood Village	Identify specific parts of Wood Village as high-risk for wildland urban interface fires because of fuel loading, topography and prevailing construction practices.	Public Works, Gresham Fire	Complete	This information was included in the 2010 NHMP.	No - complete

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
118	Wildland Urban Interface Fire	Wood Village	Encourage fire-safe construction practices for existing and new construction in high-risk areas.	Public Works, Building Department	In Progress	Wood Village building department encourages fire-safe construction practices and materials.	Yes
119	Wildland Urban Interface Fire	Wood Village	Identify evacuation routes and procedures for high-risk areas and educate the public.	Public Works	No Action/Deferred	Make information available to public through pamphlets, newsletter articles and city website.	No - response planning
120	Winter Storm	Wood Village	Ensure that all critical facilities in Wood Village have backup power and emergency operations plans to deal with power outages, including the Public Works Operations Building and the Shea Lift Station.	Public Works	Complete	Critical facilities have backup generators and emergency procedures in place.	No - complete
121	Winter Storm	Wood Village	Evaluate the adequacy of foundations or tie-downs for mobile homes and encourage upgrades to improve wind resistance if necessary.	Public Works	In Progress	This would be determined by the Building Department, not the Public Works Department. Tie downs are required and wind resistance standards on the building codes must be followed. Revise action.	Yes - revised
122	Winter Storm	Wood Village	Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.	PGE	No Action/Deferred	PGE responsibility.	Yes - revised
123	Winter Storm	Wood Village	Encourage new developments to include underground power lines.	PGE, Planning	Complete	All new development is required to underground utilities.	No - complete
124	Winter Storm	Wood Village	Encourage property owners to trim trees near service drops to individual customers.	PGE	In Progress	The city encourages residents to trim their trees, but if too close to power lines PGE will trim them.	No - complete
125	Winter Storm	Wood Village	Enhance tree trimming efforts, especially for transmission lines and trunk distribution lines.	Public Works	Complete	Public Works will trim trees on city streets as needed; homeowners are contacted to trim trees when necessary.	No - complete
126	Multi-Hazard	Gresham	Assess the vulnerability of properties on the border of city-maintained open space to landslides and wildfire. (This assessment would cover 457 private properties along 839 acres of open space, or about 60,996 linear feet.)	Parks and Rec.	No Action		Yes - revised
127	Multi-Hazard	Gresham	Create a program for small business mitigation and preparedness outreach.	Emergency Management	Completed		No - completed

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
128	Multi-Hazard	Gresham	Develop public official information kit that can be distributed to elected officials and community decision makers. The kit should include pertinent information regarding the NHMP and the steering committee and its activities, as well as facts and figures on the natural hazard the city is facing.	Emergency Management	No Action		Yes
129	Multi-Hazard	Gresham	Establish a seasonal citizen awareness and outreach campaign.	Emergency Management	Completed		No-complete
130	Multi-Hazard	Gresham	Develop formal agreements (such as Memoranda of Understanding [MOUs]) with internal and external partners to work together on risk reduction efforts in the city.	Emergency Management	No Action		Yes - revised
131	Multi-Hazard	Gresham	Explore funding opportunities with partners (both internal and external) to implement the actions identified in the plan.	Emergency Management	Remove	Included in 2017 NHMP plan, in Mitigation Strategy.	No - part of plan implementation
132	Multi-Hazard	Gresham	Establish mitigation benchmarks to assist in evaluating and updating the plan.	Hazard Mitigation Tech Advisory Committee	Remove	Included in 2017 NHMP plan, in Mitigation Strategy.	No - part of plan implementation
133	Flood - in floodplain	Gresham	Continue participation in the National Flood Insurance Program (NFIP), and investigate participation in the Community Rating System (CRS).	Emergency Management	Remove	Not enough properties in flood plain to make participation cost effective.	No
134	Severe Weather	Gresham	Formalize hazardous tree mitigation strategies.	Department of Environmental Services / Natural Resource Program	In Progress		Yes
135	Wildland Urban Interface Fire	Gresham	Develop education program aimed at making homeowners aware of nonstructural mitigation actions options to reduce their risk from wildfires.	Fire and Emergency Services	Completed	Revise to make action an all-hazard outreach campaign for all jurisdictions in the Planning Area.	Yes - revised
136	Multi-Hazard	Gresham	Conduct analysis of the likelihood that slope/soil instability will impact wastewater collection and underground utility conveyance infrastructure. The result of the analysis should be used to prioritize mitigation actions.	Wastewater Services Division	No Action		Yes - revised
137	Multi-Hazard	Gresham	Based on the outcome of the Regional Critical Infrastructure Assessment, develop a program to mitigate any critical building that is at risk.	Emergency Management	In Progress	One remaining station to be retrofitted.	Yes

Action ID	Hazard	Jurisdiction	Action Item	Lead	Status	Comments	Included in 2017 NHMP Actions?
138	Earthquake	Gresham	Provide seismic upgrades to suspended wastewater conveyance pipelines (i.e., roadway crossings, pipe bridges, etc.).	Wastewater Services Division	No Action/Deferred		Yes
139	Earthquake	Gresham	Develop an earthquake awareness and mitigation assistance outreach program aimed at low-income residents who may not speak English.	Emergency Management	Completed	Revise to make action an all-hazard outreach campaign for all jurisdictions in the Planning Area.	Yes - revised
140	Flood - in floodplain	Gresham	Flood-proof wastewater manholes and pipelines within the 100-year floodplain.	Wastewater Services Division, Watershed Management Div.	No Action/Deferred		Yes - revised
141	Flood - in floodplain	Gresham	Seek to acquire lands that preserve open space in the floodplain from willing sellers, and elevate other homes or businesses.	Department of Environmental Services	No Action/Deferred		Yes - revised
142	Flood - outside floodplain	Gresham	Assess the condition of stormwater infrastructure on railroad mainline and state highway crossings.	Department of Environmental Services	No Action/Deferred		Yes -revised
143	Flood - outside floodplain	Gresham	Develop a stormwater management and flood mitigation plan for Pleasant Valley.	Watershed Management, Engineering Division	Completed	Revise action to expand stormwater mitigation efforts across Planning Area.	Yes - revised
144	Flood - outside floodplain	Gresham	Develop a stormwater management and flood mitigation plan for Springwater.	Stormwater Engineering Division	In Progress		Yes

Appendix F: Implementation Mechanisms

Each jurisdiction in the Planning Area has a different set of planning mechanisms that relate to natural hazard mitigation. The table below provides a dashboard view of relevant plans and policies in each jurisdiction. Following the table is a description of each planning mechanism, including date of last revision; plan owner; plan cycle; relationship to natural hazard mitigation; funding; suggestions for how to implement, or further implement, mitigation into that plan/policy/program; and where to find more information online.

Planning Mechanism	Jurisdiction				
	Multnomah County	Gresham	Fairview	Troutdale	Wood Village
Comprehensive Plan	X	X	X	X	X
Sub-Area Plans	-	X	-	X	X
Development/Zoning Code	X	X	X	X	X
Annual Budget	X	X	X	X	X
Transportation System Plan	X	X	X	X	X
Capital Improvement Program	X	X	X	X	-
Water Management Plan	X	X	X	X	X
Parks Master Plan	-	X	X	X	X
Emergency Operations Plan	X	X	X	X	X
Urban Renewal Plan	-	X	-	X	X
City Council/Commission Work Plan	-	X	X	-	-
Wildfire Protection Plan	X	-	-	-	-
Climate Change/Adaptation Plan	X	-	-	-	-
Facilities Maintenance Plan	X	-	-	-	-
Recovery Plan	X	-	-	-	-
Water Division Emergency Response Plan	-	X	-	-	-
Public Facilities Plan	-	-	-	X	-

Multnomah County

Multnomah County Comprehensive Framework Plan

The Multnomah County Comprehensive Framework Plan steers future growth and development in unincorporated areas of the county. The Comprehensive Framework Plan describes the policies that guide decisions made by the Land Use Planning Division as well as the policies adopted by the Metro Council and statewide planning agencies.

- **Date of Last Revision:** Adopted September 1, 2016, with an effective date of October 1, 2016.
- **Plan Owner:** Multnomah County, Department of Community Services.
- **Plan Cycle:** First adopted in 1977. Did not undergo major revisions prior to the current revision.
- **Relation to Hazard Mitigation:** Chapter 7 of the Comprehensive Framework Plan addresses natural hazards within the county. The Multnomah County Hazard Mitigation Plan is listed in the “Relevant Studies and Planning Process” section of Chapter 7. Relevant goals, objectives and actions from the previous Natural Hazard Mitigation Plan (NHMP) have been incorporated in the Comprehensive Framework Plan. The Comprehensive Framework Plan complies with State Land Use Goal 7 by considering the most current data to identify areas susceptible to natural hazards and adopting policies and strategies to mitigate those hazards.
- **Funding:** Oregon’s Department of Land Conservation and Development (DLCD) provides General Fund grants primarily for Oregon communities’ comprehensive planning and plan updates. Specifically, Periodic Review, Technical Assistance, and Community Development grants are available.
- **Implementation Suggestions:** Update the NHMP references in the Comprehensive Framework Plan, including the NHMP goals, objectives and actions.
- **URL:** <https://multco.us/landuse/comprehensive-framework-plan>

Multnomah County Development and Zoning Code

The Multnomah County Development and Zoning Code guides new development in the unincorporated portions of Multnomah County. Additionally, Multnomah County has five Rural Planning Areas: West Hills, Sauvie Island/Multnomah Channel, East of Sandy River, West of Sandy River, and the Columbia River Gorge National Scenic Area; and two Urban Planning Areas: Interlachen and Pleasant Valley. Development in these areas is guided by the zoning and development regulation in chapters 33-38 of the municipal code and chapters 11.15 and 11.45 of the Multnomah County Zoning Ordinance. Regulation for forest practices setbacks, fire safety zones, hillside erosion and development control, along with responses to an emergency/disaster event are found in these regulatory plans.

- **Date of Last Revision:** The most recent revision occurred September 22, 2016, with the adoption of Dark Sky exterior lighting standards (Ordinance 1236).
- **Plan Owner:** Multnomah County, Department of Community Services.
- **Plan Cycle:** The development and zoning code is periodically updated, typically with multiple amendments approved by the Board of County Commissioners every year.
- **Relation to Hazard Mitigation:** Development and zoning codes provide regulations that can minimize the risk posed to people and property from natural hazards.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Reference updated NHMP hazard exposure maps to inform the adoption of development regulations that minimize the risk of natural hazards to people and property.
- **URL:** <https://multco.us/landuse/zoning-codes>

Multnomah County Budget

The Multnomah County budget allocates county resources to each of the county's departments, to the General Fund, and to a fund for capital improvements.

- **Date of Last Revision:** July 1, 2016 (for fiscal year 2017).
- **Plan Owner:** Multnomah County, Department of County Management.
- **Plan Cycle:** Updated annually.
- **Relation to Hazard Mitigation:** The annual budget allocation provides funding that can be used for natural hazard mitigation efforts.
- **Funding:** General Fund allocation.
- **Implementation:** Seek opportunities for the county budget to fund NHMP action items.
- **URL:** <https://multco.us/budget>

Multnomah County Transportation System Plan (TSP)

The TSP envisions complementary transportation improvements and land use patterns that make it more convenient for people to walk, bicycle, use public transit and drive less to meet their daily needs.

Fundamental to both the Multnomah TSP and the Metro Regional Transportation Plan are strategies to reduce reliance on automobiles. The TSP outlines a 20-year plan to guide transportation improvements and enhance general mobility throughout the county. The TSP is required by State Planning Goal 12 (the Transportation Planning Rule) and must address all travel modes for both people and commodities. The TSP makes a single reference to landslides but no other hazards within the county.

- **Date of Last Revision:** Adopted September 1, 2016, with an effective date of October 1, 2016.
- **Plan Owner:** Multnomah County, Land Use Planning Division.
- **Plan Cycle:** Updates to the TSP are required as part of the DLCDC Periodic Review process and as necessary due to large infrastructure and development projects. The county intends to update the TSP every five to 10 years.
- **Relation to Hazard Mitigation:** The TSP has a goal of providing “safe and efficient transportation,” and natural hazards are a safety risk to the transportation system and its users.
- **Funding:** The Oregon Department of Transportation has limited funding to assist local jurisdictions with transportation planning projects through the Transportation and Growth Management (TGM) Program.
- **Implementation Suggestions:** Include natural hazards in the TSP as a “key transportation issue” (pgs. 3-4) and in the “Plans and Policies” section (pg. 7). Refer to the NHMP Risk Assessment to inform the prioritization of transportation improvements within the county.
- **URL:** <https://multco.us/file/55977/download>

Multnomah County Willamette River Bridges Capital Improvement Plan (Bridge CIP)

The 2015 Bridge CIP identifies a 20-year program of capital project and funding needed to maintain and seismically retrofit the county's six Willamette River bridges: the Broadway, Burnside, Hawthorne, Morrison, Sauvie Island and Sellwood bridges. These bridges serve approximately 200,000 people daily and are a vital transportation connection. However, four of the bridges lack the necessary seismic resiliency to withstand moderate to major earthquakes. Ten performance attributes were quantified for project prioritization, including emergency preparedness, the structure's ability to resist anticipated seismic and flood events, and regional alignment with emergency preparedness plans.

- **Date of Last Revision:** 2015.
- **Plan Owner:** Multnomah County, Department of Community Services.
- **Plan Cycle:** 20-year update cycle.
- **Relation to Hazard Mitigation:** The Bridge CIP seeks to address the vulnerability of the county's six Willamette River bridges to an earthquake event.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Incorporate into the Bridge CIP seismic data and analysis in the NHMP.
- **URL:** <https://multco.us/bridgeplan>

Transportation Capital Improvement Plan and Program (CIPP)

The 2015 Transportation CIPP is a two-part document. The Plan identifies and scores transportation projects needed in the next 20 years, while the Program assigns available revenues to high-priority projects for a five-year period. Ten performance attributes were quantified for project prioritization, including emergency preparedness, the structure's ability to resist anticipated seismic and flood events, and regional alignment with emergency preparedness plans.

In 2004, Multnomah County established a priority-based budgeting process to determine how General Fund dollars are spent. Priority-based budgeting places the focus on determining which are the most important services Multnomah County provides its citizens, and assuring that they are funded first. Multnomah County's priority-based budgeting starts with following established criteria on which to evaluate services:

1. Basic Living Needs
2. Safety
3. Accountability
4. A Thriving Economy
5. Education
6. Vibrant Economy

In particular, mitigation projects will fulfill the "safety" criteria because, by definition, the intent of these projects is to reduce future risk to people and property associated with hazards. Additionally, mitigation projects provide safety and security that help establish a "vibrant economy."

- **Date of Last Revision:** 2015.
- **Plan Owner:** Multnomah County, Department of Community Services.
- **Plan Cycle:** Updated every five years; with biennial review to reflect new and completed projects as well as the most current revenue projections. Next update is expected in 2020.
- **Relation to Hazard Mitigation:** Identify in the Transportation CIPP any major infrastructure upgrades proposed in the NHMP.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to the NHMP seismic and flood risk assessments to inform priority ranking of projects and funding in the Transportation CIPP.
- **URL:** <https://multco.us/transportation-planning/webform/transportation-capital-improvement-plan-and-program>

Multnomah County Stormwater Management Plan (SWMP)

Multnomah County owns and maintains a system of underground injection controls (UICs) to manage stormwater runoff from building roofs, facilities parking lots and public roadways. This system protects groundwater and waterways from contamination caused by stormwater runoff. Stormwater from urban areas that discharges to streams is managed under the Oregon Department of Environmental Quality (DEQ) National Pollutant Discharge Elimination System Stormwater Permit (NPDES). Stormwater that is infiltrated into shallow wells is managed under the DEQ Underground Injection Control Permit.

The SWMP is made up of best management practices that are grouped into the following seven categories:

1. Public involvement and education
 2. Operations and maintenance
 3. Illicit discharge detection and elimination
 4. Natural systems
 5. New development
 6. Structural controls
 7. Program management
- **Date of Last Revision:** 2015.
 - **Plan Owner:** Multnomah County, Department of Community Services, Road Services; and Multnomah County, Department of County Assets, Facilities & Property Management.
 - **Plan Cycle:** Annual review for data summary and report; biennial (two-year) review of site selection; five-year review of site selection and pollutant selection; 10-year review of monitoring data and overall strategy.
 - **Relation to Hazard Mitigation:** Proper stormwater management should result in reduction of risk to life, property and the environment during a flood event.
 - **Funding:** Multnomah County Road Services budget and CIP funding, and Multnomah County Facilities budget and CIP funding.
 - **Implementation Suggestions:** Existing policy and practice in place.
 - **URL:** <https://multco.us/water-quality-program/reports-and-plan>

Multnomah County Emergency Operations Plan (EOP)

The 2010 Multnomah County EOP is an all-hazard, all-scale plan that describes how the county will organize and respond to events. While the EOP is focused on response, this plan also addresses the four program phases of emergency management: mitigation, preparedness, response and recovery. The coordination of resources and activities and the cooperation between the various elements and levels of government — including federal, state, local and private-sector partners — are vital to each phase.

- **Date of Last Revision:** 2010.
- **Plan Owner:** Multnomah County, Office of Emergency Management.
- **Plan Cycle:** Updated every five years. Revision currently underway.
- **Relation to Hazard Mitigation:** The EOP describes the county's plans in the event of a natural hazard event.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update Section 2 Situation and Planning Assumptions in the EOP to reflect updated NHMP Risk Assessment.
- **URL:** <https://multco.us/file/39672/download>

Multnomah County Community Wildfire Protection Plan (CWPP)

The non-regulatory 2011 Multnomah County CWPP seeks to integrate wildfire awareness into public outreach and education, emergency operations and vegetation management programs to promote actions that create safe communities and a more wildfire-resilient landscape.

- **Date of Last Revision:** 2011.
- **Plan Owner:** Multnomah County, Office of Emergency Management.
- **Plan Cycle:** Review conducted every five years. Multnomah County will provide progress reports on plan implementation and is responsible for updating the plan.
- **Relation to Hazard Mitigation:** The goal of the CWPP is mitigation: to reduce wildfire risk to citizens, the environment and infrastructure throughout Multnomah County.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Data in the CWPP should align with the NHMP wildfire risk assessment. Or the CWPP could be fully integrated into NHMP.
- **URL:** <https://multco.us/em/community-wildfire-protection>

Multnomah County/City of Portland Climate Action Plan (CAP)

The 2015 Multnomah County/City of Portland CAP serves as a 40-year roadmap for the institutional and individual change needed to reduce community-wide greenhouse gas emissions 80% by 2050. The 2012 Multnomah County NHMP is included in the “Related City and County Plans” on page 143, and the CAP recognizes that natural hazards will be exacerbated by climate change.

- **Date of Last Revision:** 2015.
- **Plan Owner:** Multnomah County, Office of Sustainability.
- **Plan Cycle:** Actions in the CAP are updated every five years.
- **Relation to Hazard Mitigation:** The CAP recognizes that projected changes to our region’s climate are likely to lead to more heat waves, drought, wildfire, flooding and landslides.
- **Funding:** General fund allocation and other outside grants as available.
- **Implementation Suggestions:** Refer to the NHMP risk assessment in the CAP.
- **URL:** <https://multco.us/sustainability/2015-climate-action-plan>

Climate Change and Public Health Preparation Plan

The 2013 Climate Change and Public Health Preparation Plan addresses the public health implications of climate change, with particular focus on the health risks from increased heat, poorer air-quality and changes to vector-borne diseases.

- **Date of Last Revision:** 2013.
- **Plan Owner:** Multnomah County, Health Department.
- **Plan Cycle:** Updated based as needed and when funding is available.
- **Relation to Hazard Mitigation:** Natural hazards pose significant risk to people and property that will be exacerbated by climate change.
- **Funding:** This plan was funded by a grant from the Centers for Disease Control and Prevention through the Oregon Health Authority.
- **Implementation Suggestions:** Refer to the NHMP risk assessment and address the impact of a changing climate on natural hazards.
- **URL:** <https://multco.us/sustainability/public-health-and-climate-change>

Climate Change Preparation Strategy and Risk and Vulnerabilities Assessment (CCPS)

Portland and Multnomah County's climate change preparation work that has been published in two parts:

1) The Climate Change Preparation Strategy identifies actions to prepare for the changing climate in two ways: a) reduce climate-related vulnerabilities for residents and businesses, and b) respond to impacts when they do occur.

2) The Risk and Vulnerabilities Assessment report serves as the foundation for the Preparation Strategy and provides an overview of the science and a more detailed review of the potential impacts to health and human systems, natural systems, infrastructure and the built environment, as well as an overview other systems such as energy, the economy, food systems and climate migrants.

- **Date of Last Revision:** 2014.
- **Plan Owner:** Multnomah County, Office of Sustainability.
- **Plan Cycle:** Updated as need, based on best available science
- **Relation to Hazard Mitigation:** The CCPS recognizes that projected changes to our region's climate are likely to lead to more heat waves, drought, wildfire, flooding and landslides.
- **Funding:** General fund allocation and other outside funding as available.
- **Implementation Suggestions:** Refer to and align with then NHMP risk assessment in the CCPS Risk and Vulnerabilities Assessment. Also, the NHMP should refer to the CCPS for more local data on climate change projections and mitigation best practices.
- **URL:** <https://multco.us/sustainability/public-health-and-climate-change>

Multnomah County Facilities Maintenance Plan

The Facilities and Property Management (FPM) Division proactively and aggressively plans, maintains, operates and manages all county-owned and -leased properties in a safe, accessible and effective manner. Facilities dispatch is staffed 24 hours a day, 7 days a week, 365 days a year. In addition to reacting as quickly and efficiently as possible to maintenance issues, dispatch works closely with lead workers and management to continuously update an aggressive preventative maintenance program. Projects of a larger scope or cost are often managed by the FPM Capital Improvement Program section.

- **Date of Last Revision:** 2016.
- **Plan Owner:** Multnomah County, Department of County Assets, Facilities & Property Management.
- **Plan Cycle:** Updated as needed.
- **Relation to Hazard Mitigation:** Maintenance issues are resolved as quickly as possible to prevent small issues from becoming larger issues. As property is improved and new construction measures are taken, the risk to life and property from natural hazards is reduced.
- **Funding:** Facilities & Property Management budget and CIP funding.
- **Implementation Suggestions:** Standard process and procedure in place.
- **URL:** <https://multco.us/sustainability/cimate-change-preparation-strategy-0>

Multnomah County Recovery Framework

The Multnomah County Recovery Framework contains basic information about the functioning of the Multnomah County Recovery Agency and other recovery operations within and external to county government.

- **Date of Last Revision:** Draft framework was developed in 2012.
- **Plan Owner:** Multnomah County, Office of Emergency Management.
- **Plan Cycle:** Updated as needed.
- **Relation to Hazard Mitigation:** Recovery plans focus on how to restore, redevelop and revitalize the health, social, economic, natural and environmental fabric of the county to build a more disaster-resilient county.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Include current data in the NHMP during the development of the Multnomah County Recovery Plan.
- **URL:** Not online.

Gresham

City of Gresham Comprehensive Plan

The City of Gresham Comprehensive Plan forwards a vision for future development in Gresham that is consistent with Oregon's 19 Statewide Planning Goals.

- **Date of Last Revision:** 2009.
- **Plan Owner:** City of Gresham, Urban Design and Planning.
- **Plan Cycle:** Ongoing.
- **Relation to Hazard Mitigation:** The City of Gresham Comprehensive Plan addresses the extent and severity of natural hazards present in the City, in Volume 2, Chapter 1, 10.200 (Statewide Land Use Goal 7: Areas Subject to Natural Hazards).
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the NHMP references in the Comprehensive Plan, including the NHMP goals, objectives and actions.
- **URL:** <https://greshamoregon.gov/Comprehensive-Plan/>

Springwater Community Plan

The Springwater Community Plan was adopted by the City of Gresham and acknowledged by Metro and the State of Oregon in 2005. The urbanization plan provides comprehensive planning mechanisms, including a public facilities plan, a development code and a transportation system plan for the large rural area southeast of Gresham.

- **Date of Last Revision:** 2007.
- **Plan Owner:** City of Gresham, Community and Economic Development Department.
- **Plan Cycle:** Updated as needed.
- **Relation to Hazard Mitigation:** The Springwater Community Plan is a vision for urbanizing this region of the county, and planning must properly account for natural hazards to mitigate risk to people and property.
- **Funding:** General Fund allocation.

- **Implementation Suggestions:** Adopt NHMP hazard exposure maps into the Springwater Community Plan. Include the funding for transportation actions for the Springwater Community identified in the NHMP in the Transportation System Plan.
- **URL:** <https://greshamoregon.gov/Comprehensive-Plan/> (Appendices 44–46)

Pleasant Valley Concept Plan

In 2002, a Pleasant Valley Concept Plan was adopted for this southwest Gresham community. This plan is the basis for future regulations, action, and funding decisions. In 2005, the Pleasant Valley Plan District land use, natural resource, transportation, public facilities and annexations were adopted and incorporated into the City of Gresham Comprehensive Plan. Several code amendments to the Pleasant Valley Plan District were adopted in 2007.

- **Date of Last Revision:** 2007.
- **Plan Owner:** City of Gresham, Urban Design and Planning.
- **Plan Cycle:** Updated as needed.
- **Relation to Hazard Mitigation:** The Pleasant Valley community is subject to many natural hazards. Including natural hazard risk mitigation measures in the Concept Plan will reduce future losses to people and property.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Adopt NHMP hazard exposure maps into the Pleasant Valley District Plan. Identify funding in the transportation system and public facilities sub-plans to support transportation- and public facility-related action items for Pleasant Valley in the NHMP.
- **URL:** <https://greshamoregon.gov/Comprehensive-Plan/> (Appendices 42 and 43)

City of Gresham Development Code

The City of Gresham Development Code guides new development in the city.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Gresham, Community Development.
- **Plan Cycle:** Updated every three years. Next update is expected in 2019.
- **Relation to Hazard Mitigation:** Inspections of new construction are intended to ensure compliance with Oregon building codes and Gresham’s development code provisions that relate to hazard mitigation. Section 5.0100 of Gresham’s development code describes requirements for building in floodplain overlay zones, and section 5.0200 describes requirements within the Hillside Physical Constraint Overlay District.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Reference updated NHMP hazard exposure maps to inform the adoption of development regulations that minimize the risk of natural hazards to people and property.
- **URL:** <https://greshamoregon.gov/Development-Code/>

City of Gresham Budget

The City of Gresham budget allocates city resources to each of the city’s departments, to the General Fund, and to a fund for capital improvements. In 2005, the City of Gresham developed a priority-based budgeting process to determine how General Fund dollars are spent. Priority-based budgeting places the focus on determining which are the most important services Gresham provides its citizens, and assuring

that they are funded first. Gresham's priority-based budgeting starts with established criteria on which to evaluate services. The Finance Committee and City Council developed the following criteria:

1. Required and/or mandated functions
2. Internal and external impacts
3. Revenue potential
4. Sound business practices
5. Benefit to the community and/or quality of life

In particular, mitigation projects will fulfill the "sound business practices" criteria because, by definition, the intent of these projects is to reduce future costs associated with hazards. Additionally, mitigation projects provide a "benefit to the community and quality of life."

- **Date of Last Revision:** 2016.
- **Plan Owner:** City Council, Finance Committee.
- **Plan Cycle:** Updated annually.
- **Relation to Hazard Mitigation:** The annual budget allocation provides funding that can be used for natural hazard mitigation efforts.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Seek opportunities for the city budget to fund NHMP mitigation actions.
- **URL:** <https://greshamoregon.gov/budget/>

Transportation System Plan (TSP)

The TSP envisions complementary transportation improvements and land use patterns that make it more convenient for people to walk, bicycle, use public transit and drive less to meet their daily needs. A fundamental part of both the Gresham TSP and the Metro Regional Transportation Plan are strategies to reduce reliance on automobiles. The TSP outlines a 20-year plan to guide transportation improvements and enhance general mobility throughout the city. The TSP is required by State Planning Goal 12 (the Transportation Planning Rule) and must address all travel modes for both people and commodities.

- **Date of Last Revision:** 2015.
- **Plan Owner:** Department of Environmental Services, Transportation Planning.
- **Plan Cycle:** Undergoes periodic review and updates as needed.
- **Relation to Hazard Mitigation:** The TSP has a goal of providing a "safe, secure and attractive travel experience," and natural hazards are a safety risk to the transportation system and its users.
- **Funding:** The Oregon Department of Transportation has limited funding to assist local jurisdictions with transportation planning projects through the Transportation and Growth Management (TGM) Program.
- **Implementation Suggestions:** Refer to the NHMP to inform the prioritization of transportation improvements related to natural hazard mitigation.
- **URL:** <https://greshamoregon.gov/tsp/>

Capital Improvement Program (CIP)

The CIP is a five-year forecast that identifies major projects requiring the expenditure of public funds over and above routine annual operating expenses. It covers wastewater collection and treatment, water,

transportation, footpaths and bikeways, parks and open spaces, stormwater, general development and urban renewal.

- **Date of Last Revision:** 2015.
- **Plan Owner:** City of Gresham, City Council.
- **Plan Cycle:** Updated every five years. Next update is expected in 2020.
- **Relation to Hazard Mitigation:** The CIP funds major infrastructure projects that can significantly mitigate the risk of natural hazards to people and property.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Identify in the CIP infrastructure upgrades proposed in the NHMP that would be funded by the city.
- **URL:** <https://greshamoregon.gov/Capital-Improvement-Program/>

Gresham Stormwater Management Plan (SWMP)

The SWMP reduces pollutants from stormwater through street and stormwater maintenance activities, eliminating non-stormwater discharges, spill prevention and response, and public education and participation. Additionally, the city has developed basin-specific stormwater master plans as part of its management program for each of the city's four basins: West Gresham, Kelly Creek, Johnson Creek and Fairview Creek. The goal of these master plans is to outline a city strategy intended to proactively address stormwater capacity (e.g., flooding) and water quality issues.

- **Date of Last Revision:** 2013.
- **Plan Owner:** City of Gresham, Environmental Services.
- **Plan Cycle:** The city's NPDES Municipal Separate Storm Sewer System (MS4) Discharge Permit requires that the city's SWMP is updated on a regular basis.
- **Relation to Hazard Mitigation:** Proper stormwater management can result in a reduced risk to people and property from flood events.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Incorporate relevant data in the NHMP risk assessment into the SWMP and basin-specific stormwater master plan.
- **URL:** <https://greshamoregon.gov/Watershed-Documents-and-Forms.aspx>

City of Gresham Parks and Recreation, Trails and Natural Areas Master Plan

The City of Gresham Parks and Recreation, Trails and Natural Areas Master Plan identifies strategies and techniques for operation and development of parks, land acquisition and funding. Through this plan, the City of Gresham intends to continue improving the level and quality of its parks to meet the needs of current and future residents.

- **Date of Last Revision:** 2009.
- **Plan Owner:** City of Gresham, Parks and Recreation.
- **Plan Cycle:** Updated every ten years.
- **Relation to Hazard Mitigation:** Parks and natural areas can serve important roles in natural hazard mitigation, serving as buffers between development and areas of increased risk from natural hazards.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to the hazard exposure maps in the NHMP risk assessment to identify areas where land acquisition and green space projects can meet the needs of current and future residents while also mitigating risk to people and property.

- **URL:** <https://greshamoregon.gov/Parks-and-Recreation-Trails-and-Natural-Areas-Master-Plan/>

City of Gresham Emergency Operations Plan (EOP)

The EOP outlines the roles and responsibilities of city departments and personnel during major emergencies or disasters. The EOP also provides a clear line of succession in the case of executive vacancy resulting from loss of life, incapacitation or injury.

- **Date of Last Revision:** 2015.
- **Plan Owner:** City of Gresham, Office of Emergency Management.
- **Plan Cycle:** Updated every five years.
- **Relation to Hazard Mitigation:** The mission and goals of the NHMP support the EOP's mission to coordinate responses to disasters.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the EOP with current NHMP risk assessment data and maps.
- **URL:** <https://greshamoregon.gov/Citys-Emergency-Plan/>

Rockwood-West Gresham Renewal Plan

The Rockwood-West Gresham Renewal Plan is a 20-year plan for improving the economy and the community of Rockwood-West Gresham. The area has been designated as an Urban Renewal Area, and as such is eligible for tax increment financing for certain projects.

- **Date of Last Revision:** 2003.
- **Plan Owner:** City of Gresham, Urban Design and Planning and the Gresham Redevelopment Commission.
- **Plan Cycle:** The plan directs activities in the urban renewal boundaries for the next 20 years. Gresham voters must approve any substantial changes to the plan during that period through a process outlined in detail in the plan document.
- **Relation to Hazard Mitigation:** The Rockwood-West Gresham area is subject to natural hazards, and the Rockwood-West Gresham Renewal Plan can be used as a tool to guide development in a way that reduces risk to people and property from these natural hazards.
- **Funding:** Tax increment financing.
- **Implementation Suggestions:** Adopt NHMP risk assessment maps into the Rockwood-West Gresham Renewal Plan. Explore which mitigation actions in the NHMP may be eligible for funding through urban renewal tax increment financing.
- **URL:** <https://greshamoregon.gov/Urban-Renewal/>

Gresham City Council/Commission Work Plan

The Gresham City Council/Commission Work Plan outlines the council's adopted annual plan of work in two categories: (1) Investment in community safety and quality of life projects; and (2) Investment in infrastructure and community appearance.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Gresham, Gresham City Council.
- **Plan Cycle:** Updated annually.
- **Relation to Hazard Mitigation:** NHMP goals may be carried out as part of projects identified for the annual Council Work Plan.

- **Funding:** General fund allocation.
- **Implementation Suggestions:** Coordinate with Gresham City Council to identify NHMP goals, objectives and mitigation actions the city can support through targeted annual investment.
- **URL:** <https://greshamoregon.gov/councilworkplan/>

Gresham Water Division Emergency Response Plan

This plan describes actions for responding to water-related emergencies.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Gresham, Water Division.
- **Plan Cycle:** Annual updates.
- **Relation to Hazard Mitigation:** The plan describes actions the Water Division will take in the event of an emergency. While not technically a mitigation plan, this plan does suggest some mitigation projects.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the Gresham Water Division Emergency Response Plan with the NHMP flood maps and data.
- **URL:** Not online.

Fairview

Fairview Comprehensive Plan

The City of Fairview Comprehensive Plan forwards a vision for future development in Fairview that is consistent with Oregon's 19 Statewide Planning Goals.

- **Date of Last Revision:** Acknowledged in 2004. Goal 5: Natural Resources, Scenic and Historic Areas and Open Spaces was updated in 2012.
- **Plan Owner:** City of Fairview Oregon, Public Works Planning Division.
- **Plan Cycle:** The next review will be between 2018 and 2021.
- **Relation to Hazard Mitigation:** Chapter 7 of the City of Fairview Comprehensive Plan addresses the extent and severity of natural hazards present in the City of Fairview.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the NHMP references in the Comprehensive Plan, including the NHMP goals, objectives and actions.
- **URL:** <http://fairvieworegon.gov/DocumentCenter/Home/View/1461>

Fairview Development Code

The City of Fairview Development Code guides new development in the city.

- **Date of Last Revision:** Last comprehensive review in 2001.
- **Plan Owner:** City of Fairview Oregon, Public Works Planning Division.
- **Plan Cycle:** Updated as needed.
- **Relation to Hazard Mitigation:** The inspection of new construction is intended to ensure compliance with Oregon building codes and Fairview's development code provisions that relate to hazard mitigation. Section 19.105 of Fairview's development code describes requirements for building in floodplain overlay zones.
- **Funding:** General Fund allocation.

- **Implementation Suggestions:** Refer to the hazard exposure maps in the NHMP to inform the adoption of development regulations that minimize the risk of natural hazards to people and property.
- **URL:** <http://fairvieworegon.gov/index.aspx?NID=305> (Title 19 of Municipal Code)

City of Fairview Budget

The City of Fairview budget allocates city resources to each of the city's departments, to the General Fund, and to a fund for capital improvements.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Fairview, Finance Department.
- **Plan Cycle:** Updated annually.
- **Relation to Hazard Mitigation:** The annual budget allocation provides funding that can be used for natural hazard mitigation efforts.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Consider prioritizing relevant mitigation actions in the NHMP for funding through the city's annual budget process.
- **URL:** <http://fairvieworegon.gov/index.aspx?NID=262>

Transportation System Plan (TSP)

The TSP envisions complementary transportation improvements and land use patterns that make it more convenient for people to walk, bicycle, use public transit and drive less to meet their daily needs. A fundamental part of both the Fairview TSP and the Metro Regional Transportation Plan are strategies to reduce reliance on automobiles. The TSP outlines a 20-year plan to guide transportation improvements and enhance general mobility throughout the county. The TSP is required by State Planning Goal 12 (the Transportation Planning Rule) and must address all travel modes for both people and commodities. The TSP does not currently address natural hazards within the county.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Fairview, Planning Services.
- **Plan Cycle:** Reviewed every five to ten years.
- **Relation to Hazard Mitigation:** Goal 3 of the TSP is "safety" and natural hazards are a safety risk to the **transportation system and its users**.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** The Fairview TSP Update Policy Review Memo does not currently address natural hazards, however Goal 3 of the TSP is "Safety." Include relevant NHMP data and mitigation actions in the next TSP update.
- **URL:** <http://fairvieworegon.gov/index.aspx?NID=448>

Capital Improvement Program(CIP)

The City of Fairview's CIP is a five year plan for all utilities and General Fund facilities.

- **Date of Last Revision:** 2010.
- **Plan Owner:** City of Fairview Administration.
- **Plan Cycle:** The CIP is currently being updated. Going forward it will be updated annually.
- **Relation to Hazard Mitigation:** All facility upgrades to reduce risk to natural hazards need to be included in the CIP in order to be funded.

- **Funding:** General Fund allocation and various other sources such as grants.
- **Implementation Suggestions:** Coordinate Fairview's CIP with NHMP mitigation actions.
- **URL:** Not online.

Fairview Stormwater Management Plan (SWMP)

The SWMP reduces pollutants from stormwater through street and stormwater maintenance activities, eliminating non-stormwater discharges, spill prevention and response, and public education and participation.

- **Date of Last Revision:** 2011.
- **Plan Owner:** City of Fairview, Public Works Department.
- **Plan Cycle:** The City's NPDES MS4 Discharge Permit requires that the city's SWMP is updated on a regular basis.
- **Relation to Hazard Mitigation:** Proper stormwater management can result in a reduced risk to people and property from flood events.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Incorporate updated relevant flood data and mitigation actions in the NHMP into the SWMP.
- **URL:** <http://fairvieworegon.gov/index.aspx?NID=181>

Fairview Consolidated Stormwater Master Plan (CSMP)

The CSMP analyzed problem areas within Fairview along with the NPDES Stormwater Permit requirements and identified needed capital improvement projects. The improvements are required either to reduce flooding, improve stormwater conveyance, and/or improve stormwater quality. These projects were ranked and prioritized and placed in the final CSMP along with maps and project cost sheets.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Fairview, Public Works.
- **Plan Cycle:** Reviewed every five to ten years.
- **Relation to Hazard Mitigation:** The CSMP identifies needed capital improvement projects that are required to reduce flooding in Fairview.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Incorporate updated relevant flood data and mitigation actions in the NHMP into the SWMP.
- **URL:** <http://fairvieworegon.gov/index.aspx?NID=182>

City of Fairview Parks and Recreation/Open Space Master Plan

The City of Fairview Parks and Recreation/Open Space Master Plan identifies strategies and techniques for operation and development of parks, land acquisition and funding. Through this plan, the City of Fairview intends to continue improving the level and quality of its parks to meet the needs of current and future residents.

- **Date of Last Revision:** 2001.
- **Plan Owner:** City of Fairview, Parks and Recreation.
- **Plan Cycle:** Every five to ten years. Next revision scheduled to be complete in 2017.

- **Relation to Hazard Mitigation:** Parks and natural areas can serve important roles in natural hazard mitigation, serving as buffers between development and areas of increased risk from natural hazards.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to the hazard exposure maps in the NHMP risk assessment to identify areas where land acquisition and green space projects can meet the needs of current and future residents while also mitigating risk to people and property.
- **URL:** <http://fairvieworegon.gov/DocumentCenter/View/2703>

City of Fairview Emergency Operations Plan (EOP)

The EOP outlines the roles and responsibilities of city departments and personnel during major emergencies or disasters. The EOP also provides a clear line of succession in the case of executive vacancy resulting from loss of life, incapacitation or injury.

- **Date of Last Revision:** 2012.
- **Plan Owner:** City of Fairview Administration
- **Plan Cycle:** Every ten years.
- **Relation to Hazard Mitigation:** The EOP describes the city's plans in the event of a natural hazard event.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the Situation and Planning Assumptions sections in the EOP to reflect updated NHMP Risk Assessment.
- **URL:** Not online.

City Council Work Plan

Annually the Fairview City Council reviews its goals and sets staff objectives under each goal. Staff then develops a work plan for each goal objective. The Council receives quarterly status updates on the work plan and may adjust it at that time.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Fairview Administration.
- **Plan Cycle:** Annually.
- **Relation to Hazard Mitigation:** Hazard mitigation actions become a city priority through the work plan.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Align NHMP actions with the city's work plan.
- **URL:** <http://www.fairvieworegon.gov/documentcenter/view/3114>

Troutdale

City of Troutdale Comprehensive Land Use Plan

The City of Troutdale Comprehensive Land Use Plan forwards a vision for future development in Troutdale that is consistent with Oregon's 19 Statewide Planning Goals.

- **Date of Last Revision:** 2014.
- **Plan Owner:** City of Troutdale, Building and Planning Services Department.
- **Plan Cycle:** As needed.

- **Relation to Hazard Mitigation:** Chapter 7 of the City of Troutdale Comprehensive Plan addresses the extent and severity of natural hazards present in the City of Troutdale. Troutdale's Comprehensive Plan includes specific policy recommendations to ensure public safety and welfare. These include restrictions on development in highly hazardous areas, including steep slopes and flood-hazard areas.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the NHMP references in the Comprehensive Plan, including the NHMP goals, objectives and actions.
- **URL:** <http://www.ci.troutdale.or.us/planning/comprehensivelanduseplan.html>

Troutdale Town Center Plan

The Troutdale Town Center Plan seeks to implement the regional Metro 2040 Growth Concept by using infill and redevelopment to enable downtown Troutdale to thrive as a viable town center within the Portland region.

- **Date of Last Revision:** 1998.
- **Plan Owner:** City of Troutdale, Building and Planning Services Department.
- **Plan Cycle:** As needed; currently scheduled for revision in 2017.
- **Relation to Hazard Mitigation:** The Troutdale Town Center is subject to natural hazards, and the Troutdale Town Center Plan can guide development in a way that reduces risk to people and property from these natural hazards.
- **Funding:** Partial funding through Oregon Transportation and Growth Management Program grants.
- **Implementation Suggestions:** Adopt the relevant NHMP risk assessment data, maps and mitigation actions into the City of Troutdale Town Center Plan.
- **URL:**
 - *Current Plan:* <http://www.ci.troutdale.or.us/documents/towncenterplan.pdf>
 - *Plan Update:* <http://www.ci.wood-village.or.us/hot-topics/wood-village-town-center-master-plan-update/>

City of Troutdale Development Code

The City of Troutdale Development Code guides new development in the city.

- **Date of Last Revision:** 2014.
- **Plan Owner:** City of Troutdale, Planning and Community Development.
- **Plan Cycle:** Periodic review.
- **Relation to Hazard Mitigation:** Inspections of new construction are intended to ensure compliance with Oregon building codes and Troutdale's development code provisions that relate to hazard mitigation. Section 4.600 of Troutdale's development code describes requirements for building in the flood management area.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Reference updated NHMP hazard exposure maps to inform the adoption of development regulations that minimize the risk of natural hazards to people and property.
- **URL:** <http://www.ci.troutdale.or.us/planning/developmentcode.html>

City of Troutdale Budget

The City of Troutdale budget allocates city resources to each of the city's departments, to the General Fund, and to a fund for capital improvements.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Troutdale, Finance Department.
- **Plan Cycle:** Updated annually; next update expected in 2017.
- **Relation to Hazard Mitigation:** The annual budget allocation provides funding that can be used for natural hazard mitigation efforts.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Consider prioritizing relevant NHMP mitigation actions for funding through the annual budget process.
- **URL:** <http://www.troutdaleoregon.gov/finance/budget.html>

Transportation System Plan (TSP)

The TSP envisions complementary transportation improvements and land use patterns that make it more convenient for people to walk, bicycle, use public transit and drive less to meet their daily needs. A fundamental part of both the Gresham TSP and the Metro Regional Transportation Plan are strategies to reduce reliance on automobiles. The TSP outlines a 20-year plan to guide transportation improvements and enhance general mobility throughout the city. The TSP is required by State Planning Goal 12 (the Transportation Planning Rule) and must address all travel modes for both people and commodities.

- **Date of Last Revision:** 2014.
- **Plan Owner:** City of Troutdale.
- **Plan Cycle:** This plan is updated every five years, and undergoes periodic review and updates as needed.
- **Relation to Hazard Mitigation:** The TSP has a goal of providing a transportation system that is "safe, reduces length of travel and limits congestion," and natural hazards are a safety risk to the transportation system and its users.
- **Funding:** The Oregon Department of Transportation has limited funding to assist local jurisdictions with transportation planning projects through the Transportation and Growth Management (TGM) Program.
- **Implementation Suggestions:** Refer to the NHMP risk assessment to inform the prioritization of transportation improvements related to natural hazard mitigation.
- **URL:** http://www.ci.troutdale.or.us//publicworks/documents/InfrastructureMasterPlans/Final_tsp_03-04-2014.pdf

City of Troutdale Capital Improvements Plan (CIP)

The City of Troutdale CIP provides a plan for city-funded, capacity-enhancing capital improvements that the city anticipates will be needed over approximately the next 20 years.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Troutdale, Public Works Department.
- **Plan Cycle:** Annually.
- **Relation to Hazard Mitigation:** The CIP funds major infrastructure projects that can significantly mitigate the risk of natural hazards to people and property within the City of Troutdale.

- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Identify in the CIP infrastructure upgrades proposed in the NHMP as mitigation actions needing city funds.
- **URL:** <http://www.ci.troutdale.or.us/publicworks/documents/AdoptedCIP.pdf>

North Troutdale Storm Drainage Master Plan

The North Troutdale Storm Drainage Master Plan provides for the orderly provision of storm drainage and flood protection services within the North Troutdale drainage basin. The master plan identifies six capital improvement projects needed within the short term and within the next 10 years, depending on how rapidly the drainage basin develops.

- **Date of Last Revision:** 2007.
- **Plan Owner:** City of Troutdale, Stormwater Services.
- **Plan Cycle:** Ten years; undergoes periodic review and updates as needed.
- **Relation to Hazard Mitigation:** Stormwater management can play an important role in mitigating the risk of flooding, a natural hazard risk present in Troutdale.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to NHMP risk assessment data and maps when making updates to the North Troutdale Storm Drainage Master Plan. Ensure NHMP and mitigation actions and capital improvements in the Storm Water Drainage Plan are aligned, and not in conflict.
- **URL:** <http://www.ci.troutdale.or.us/stormwater/masterplans.html>

South Troutdale Storm Drainage Master Plan

The South Troutdale Storm Drainage Master Plan provides for the orderly provision of storm drainage and flood protection services within the South Troutdale drainage basin. The master plan identifies stormwater capital improvement projects needed over the next 20 years.

- **Date of Last Revision:** 2012.
- **Plan Owner:** City of Troutdale, Stormwater Services.
- **Plan Cycle:** Ten years; undergoes periodic review and updates as needed.
- **Relation to Hazard Mitigation:** Stormwater management can play an important role in mitigating the risk of flooding, a natural hazard risk present in Troutdale.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to NHMP Risk Assessment data and maps when making updates to the South Troutdale Storm Drainage Master Plan. Ensure NHMP and mitigation actions and capital improvements in the Storm Water Drainage Plan are aligned, and not in conflict.
- **URL:** <http://www.ci.troutdale.or.us/stormwater/masterplans.html>

City of Troutdale Parks Master Plan

The City of Troutdale Park Master Plan identifies strategies and techniques for operation and development of parks, land acquisition and funding. Through this plan, the City of Troutdale intends to continue improving the level and quality of its parks to meet the needs of current and future residents.

- **Date of Last Revision:** 2006.
- **Plan Owner:** City of Troutdale, Recreation Program.

- **Plan Cycle:** Ten years; undergoes periodic review and updates as needed.
- **Relation to Hazard Mitigation:** Parks and natural areas can serve important roles in natural hazard mitigation, serving as buffers between development and areas of increased risk from natural hazards.
- **Funding:** General Fund allocation
- **Implementation Suggestions:** Refer to the hazard exposure maps in the NHMP risk assessment to identify areas where land acquisition and green space projects can meet the needs of current and future residents while also mitigating risk to people and property.
- **URL:** <http://www.ci.troutdale.or.us/parks-facilities/documents/parksmasterplan.pdf>

City of Troutdale Emergency Operation Plan

The EOP outlines the roles and responsibilities of city departments and personnel during major emergencies or disasters. The EOP also provides a clear line of succession in the case of executive vacancy resulting from loss of life, incapacitation or injury.

- **Date of Last Revision:** 2010.
- **Plan Owner:** City of Troutdale, Executive Department.
- **Plan Cycle:** As needed.
- **Relation to Hazard Mitigation:** The EOP describes the city's plans in the event of a natural hazard event.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Review contact information, connect with Multnomah County Sheriff's Office on plan, and combine with NHMP risk assessment data and maps.
- **URL:** Not online.

Troutdale Riverfront Renewal Plan

The Troutdale Riverfront Renewal Plan is a 10-year plan for improving the economy and the community of the Troutdale Riverfront. The area has been designated as an Urban Renewal Area, and as such is eligible for tax increment financing for certain projects.

- **Date of Last Revision:** 2006.
- **Plan Owner:** City of Troutdale, Community Development.
- **Plan Cycle:** As needed.
- **Relation to Hazard Mitigation:** The Troutdale Riverfront is subject to natural hazards, and the renewal plan can guide development in the area in a way that reduces risk to people and property from these natural hazards.
- **Funding:** Tax increment financing.
- **Implementation Suggestions:** Adopt relevant NHMP risk assessment data and maps into the renewal plan. Mitigation actions in the NHMP that can reduce risk in riverfront renewal areas may be eligible for funding through urban renewal tax increment financing.
- **URL:** [http://www.ci.troutdale.or.us/mayor-council/documents/riverfrontrenewalplan\(revised\).pdf](http://www.ci.troutdale.or.us/mayor-council/documents/riverfrontrenewalplan(revised).pdf)

Troutdale Public Facilities Plan (PFP)

The PFP addresses facilities associated with water, wastewater, stormwater and transportation.

- **Date of Last Revision:** 2014.
- **Plan Owner:** City of Troutdale, Public Works Department.

- **Plan Cycle:** This plan will be revised as needed to reflect updates to specific master plans, significant proposals for new development within or outside the city that prompt the need for review of public facilities plans, or other similar factors or events.
- **Relation to Hazard Mitigation:** The water, wastewater and surface water management facilities addressed in this plan are susceptible to damage from natural hazard events.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to the NHMP to inform the prioritization of water, wastewater and surface water management facilities improvements within the City of Troutdale.
- **URL:**
http://www.ci.troutdale.or.us//publicworks/documents/InfrastructureMasterPlans/Troutdale_PFP_Final_5-28-14.pdf

Wood Village

Wood Village Comprehensive Plan

The City of Wood Village Comprehensive Plan forwards a vision for future development in Wood Village that is consistent with Oregon's 19 Statewide Planning Goals.

- **Date of Last Revision:** 1999.
- **Plan Owner:** City of Wood Village Administration.
- **Plan Cycle:** Updated as the need arises or if requested by regional or statewide planning agencies
- **Relation to Hazard Mitigation:** Chapter 7 of the City of Wood Village's Comprehensive Plan addresses the extent and severity of natural hazards present in Wood Village.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Update the NHMP references in the Comprehensive Plan, including the NHMP goals, objectives and actions.
- **URL:** <http://www.ci.wood-village.or.us/docs/comprehensiveplan.pdf>

Wood Village Town Center Master Plan (TCMP)

The TCMP focuses on the Wood Village Town Center and selects appropriate transportation solutions and land uses to create a conceptual master plan that includes economically viable residential land uses and employment opportunities.

- **Date of Last Revision:** 2012.
- **Plan Owner:** City of Wood Village.
- **Plan Cycle:** Updated or revised on an as-needed basis and must remain consistent with Comprehensive Plan and with City, County and Regional Transportation Plans.
- **Relation to Hazard Mitigation:** The Wood Village Town Center is subject to natural hazards, and the TCMP can guide development in a way that reduces risk to people and property from these natural hazards.
- **Funding:** The Oregon Department of Transportation has limited funding to assist local jurisdictions with transportation planning projects through the Transportation and Growth Management (TGM) Program.
- **Implementation Suggestions:** Refer to NHMP hazard data, maps and mitigation actions relevant to the Town Center during updates to the master plan.
- **URL:** <http://www.ci.wood-village.or.us/hot-topics/wood-village-town-center-master-plan-update/>

Wood Village Zoning and Development Code

Wood Village's building codes and zoning guide new development in the city.

- **Date of Last Revision:** 2009.
- **Plan Owner:** City of Wood Village, Planning and Zoning Division.
- **Plan Cycle:** Updated or revised on an as-needed basis and must remain consistent with Comprehensive Plan.
- **Relation to Hazard Mitigation:** Inspections of new construction are intended to ensure compliance with Oregon building codes and Wood Village's development code provisions that relate to hazard mitigation.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Reference updated NHMP hazard exposure maps to inform the adoption of development regulations that minimize the risk of natural hazards to people and property.
- **URL:** <http://www.ci.wood-village.or.us/planning-zoning/zoning-and-development-code/>

City of Wood Village Budget

The City of Wood Village budget allocates city resources to each of the city's departments, to the General Fund, and to a fund for capital improvements.

- **Date of Last Revision:** 2016.
- **Plan Owner:** City of Wood Village Administration.
- **Plan Cycle:** Updated annually.
- **Relation to Hazard Mitigation:** The annual budget allocation provides funding that can be used for natural hazard mitigation efforts.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Consider prioritizing relevant NHMP mitigation actions during the annual budget process.
- **URL:** <http://www.ci.wood-village.or.us/finance/annual-city-budget/>

City of Wood Village Transportation System Plan (TSP)

The City of Wood Village's TSP envisions complementary transportation improvements and land use patterns that make it more convenient for people to walk, bicycle, use public transit and drive less to meet their daily needs. A fundamental part of both the Wood Village TSP and the Metro Regional Transportation Plan are strategies to reduce reliance on automobiles. The TSP outlines a 20-year plan to guide transportation improvements and enhance general mobility throughout the city. The TSP is required by State Planning Goal 12 (the Transportation Planning Rule) and must address all travel modes for both people and commodities.

- **Date of Last Revision:** 2012.
- **Plan Owner:** City of Wood Village Administration.
- **Plan Cycle:** Updated as needed, and must remain consistent with the Comprehensive Plan map, the community's vision, other local plans and policies, and state plans.
- **Relation to Hazard Mitigation:** The TSP has a goal of providing safe transportation options, and natural hazards are a safety risk to the transportation system and its users.

- **Funding:** The Oregon Department of Transportation has limited funding to assist local jurisdictions with transportation planning projects through the Transportation and Growth Management (TGM) Program.
- **Implementation Suggestions:** Refer to the risk assessment and mitigation actions in the NHMP to inform the prioritization of transportation improvements within the City of Wood Village.
- **URL:**
 - Current Plan: <http://www.ci.wood-village.or.us/planning-zoning/>
 - Update Process: <http://www.ci.wood-village.or.us/hot-topics/wood-village-town-center-master-plan-update/>

Wood Village Water Master Plan

The 20-year Wood Village Water Master Plan provides a list of capital improvement projects necessary to provide the city's residential, commercial and industrial customers with quality water and adequate fire protection.

- **Date of Last Revision:** 2014.
- **Plan Owner:** City of Wood Village, Public Works Department.
- **Plan Cycle:** Every 20 years.
- **Relation to Hazard Mitigation:** The allocation of water resources and fire protection can play critical roles in mitigating natural hazards present in Wood Village.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer the risk assessment and mitigation actions in the NHMP pertinent to water infrastructure when updating the City of Wood Village Water Master Plan.
- **URL:** <http://www.ci.wood-village.or.us/parks-public-works/current-projects/>

Wood Village Wastewater Collection System Master Plan (WCSMP)

The Wood Village Wastewater Collection System Master Plan (WCSMP) presents criteria required for evaluating the wastewater system, identifies current and future system deficiencies, describes recommended improvements to correct them, and provides planning-level cost information for general budgeting and the development of a prioritized capital improvement program.

- **Date of Last Revision:** 2015.
- **Plan Owner:** City of Wood Village, Public Works Department.
- **Plan Cycle:** Every 15 years.
- **Relation to Hazard Mitigation:** Wastewater management can play an important role in mitigating the risk of flooding, a natural hazard risk present in Wood Village.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to NHMP risk assessment data and maps during the update of the WCSMP. Ensure NHMP and mitigation actions and capital improvements in the Wastewater Collection System Master Plan are aligned, and not in conflict.
- **URL:** <http://www.ci.wood-village.or.us/parks-public-works/current-projects/>

City of Wood Village Parks Master Plan

The City Wood Village Parks Master Plan guides the city's efforts to establish a path forward for providing high-quality, community-driven parks, trails and recreation amenities serving the city.

- **Date of Last Revision:** 2015.
- **Plan Owner:** City of Wood Village Public Works Department.
- **Plan Cycle:** Every five years.
- **Relation to Hazard Mitigation:** Parks and natural areas can serve as buffers between development and areas of increased risk from natural hazards.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** Refer to the hazard exposure maps in the NHMP risk assessment to identify areas where land acquisition and green space projects can meet the needs of current and future residents while also mitigating risk to people and property.
- **URL:** http://www.ci.wood-village.or.us/wp-content/uploads/2015/04/WV_OH1_boards_051915.pdf

City of Wood Village Emergency Operations Plan (EOP)

The EOP outlines the roles and responsibilities of city departments and personnel during major emergencies or disasters. The EOP also provides a clear line of succession in the case of executive vacancy resulting from loss of life, incapacitation or injury.

- **Date of Last Revision:** 2012.
- **Plan Owner:** City of Wood Village, Public Works Department.
- **Plan Cycle:** As needed.
- **Relation to Hazard Mitigation:** The NHMP mission and goals work together with the EOP to coordinate responses to natural disasters.
- **Funding:** General Fund allocation.
- **Implementation Suggestions:** The EOP should be updated with the current NHMP data and analysis of the probability, severity and vulnerability of natural hazards within the City of Wood Village.
- **URL:** <https://www.ci.wood-village.or.us/>

City of Wood Village Urban Renewal Plan(URP)

The City of Wood Village Urban Renewal Plan is a 21-year plan for improving the economy and the community of Wood Village. The area has been designated as an Urban Renewal Area, and as such is eligible for tax increment financing for certain projects.

- **Date of Last Revision:** 2010.
- **Plan Owner:** City of Wood Village Administration
- **Plan Cycle:** Updated as-needed and must remain consistent with the Comprehensive Plan. The city's URP is anticipated to take 21 years to implement with a maximum amount of indebtedness of \$11,750,000.
- **Relation to Hazard Mitigation:** The City of Wood Village is subject to natural hazards, and the City of Wood Village Urban Renewal Plan should guide development in a way that reduces risk to people and property from these natural hazards.
- **Funding:** Tax increment financing.

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- **Implementation Suggestions:** Adopt relevant NHMP risk assessment data and maps into the Urban Renewal Plan. Mitigation actions in the NHMP that can reduce risk in urban renewal areas may be eligible for funding through urban renewal tax increment financing.
- **URL:** <http://www.ci.wood-village.or.us/wp-content/uploads/Urban-Renewal-Plan.pdf>

Appendix G: Planning Process Documents

Contents

1. Meeting Materials
 - a. Steering Committee Meeting Agenda and Notes, May 27, 2014
 - b. Steering Committee Meeting Agenda and Notes, October 29, 2014
 - c. Steering Committee Meeting Agenda and Notes, May 5, 2015
 - d. Hazard Mitigation Strategy Workshop Agenda and Notes, October 1, 2015
 - e. Local Hazard Identification and Analysis Workshop Materials, June 1, 2016¹
 - f. Steering Committee Meeting Agenda and Notes, June 28, 2016
 - g. Steering Committee Meeting Agenda and Notes, August 11, 2016
 - h. Steering Committee Meeting Agenda and Notes, October 11, 2016
 - i. Steering Committee Meeting Email Summary, December 15, 2016
2. Other Planning Documents
 - a. Example of one-on-one meetings between Multnomah County Emergency Management and each jurisdiction
 - b. Action Prioritization Steps

¹ See section **3 Hazard Identification and Risk Assessment** and **Appendix C: Local OEM Hazard Analysis Scores** for the OEM methodology and the final local hazard scores.

G.1.a Steering Committee Meeting Notes, May 27, 2014, 1-3 p.m.

Location: Troutdale Police Facility, Community Room, 234 SW Kendall Ct., Troutdale, OR 97060

Attendees: Mike McBride, Multnomah County Facilities Management; Laureen Paulsen, Portland Bureau of Emergency Management (PBEM); Craig Ward, City of Troutdale; Scott Anderson, City of Troutdale Police Department (PD); Adam Barber, Multnomah County Land Use Planning; Joe Rizzi, Multnomah County Emergency Management (MCEM); Todd Felix, City of Gresham Emergency Management (EM); Chris Strong, City of Gresham Department of Environmental Services (DES); Joel Wendland, City of Troutdale PD; Mark Gunter, City of Wood Village; Allison Boyd, MCEM

1. Welcome and Introductions

- Joe Rizzi, director of MCEM, welcomed the group and asked everyone to introduce themselves.
- Joe discussed some of the benefits of multi-jurisdictional collaboration and planning, including more efficiently including stakeholders in one countywide process versus multiple separate planning processes.

2. Proposed Multi-Jurisdictional Organizational Structure

- Allison Boyd, resilience planner for MCEM, gave an overview of the proposed committee structure and annual meeting process.
- The group discussed this proposed structure and brought up several valid concerns, including: (1) the number of stakeholders to involve in subcommittees will be a large effort to coordinate; (2) the subcommittees proposed currently address only natural hazards, but we want to add additional human-caused hazards to the program; and (3) the additional stakeholders category will include almost everyone.

3. Steering Committee Roles and Responsibilities

- Allison led a discussion around the role of the steering committee as a decision-making and program administration body that has representation from all jurisdictions that adopt hazard mitigation plans. Responsibilities would include overseeing plan updates, stakeholder involvement, and making decisions concerning grant applications. The main concern that was voiced was that each jurisdiction have one vote when a vote is needed.
- The membership of the steering committee was discussed, and it was agreed that each jurisdiction should have up to three designated members, generally representing the disciplines of emergency management, community planning, and public works/facilities. Some jurisdictions will have fewer than three representatives. Wood Village anticipates having fewer and Portland will have only an emergency management representative, at least until their concurrent planning effort is complete.

4. Pursuing a Goal of a Countywide, Multi-Jurisdictional Plan

- The timing of each jurisdiction's plan update was discussed. Todd Felix, Gresham emergency manager, informed the group of the City of Gresham's 2013 plan update, and that they anticipate merging their plan into the countywide plan before their next five-year update. Lauren Paulsen, PBEM, explained that the City of Portland is in the process of updating their 2011 plan and are awaiting funding from a grant that they were awarded. They are currently unsure if they will participate in a countywide plan for the next iteration.
- The cities of Fairview, Troutdale and Wood Village all have an update approval deadline of January 2016, which means the plans will need to be submitted to the state and the Federal Emergency Management Agency (FEMA) for review processes no later than August 1, 2015. Multnomah County's deadline is July 2017, but the county will work toward meeting the cities' January 2016 deadline so the plans can be merged.
- The plan update/merging process was discussed, and more follow up will need to be done to determine if we need an intergovernmental agreement or a memorandum of understanding (MOU) to establish expectations for the multi-jurisdictional effort. This will be worked on over the summer along with a scope of work for the plan update.

5. Upcoming Grant Opportunities

- The grant application window for Federal Hazard Mitigation Assistance Grants for FY 2014 is currently open. While these grants are nationally competitive, the state expects to receive \$250,000 that will not be competitive and plans to use this to fund Natural Hazards Mitigation Plan (NHMP) updates for six counties, including Multnomah County. The Multnomah County Office of Emergency Management (MCEM) will contract with the Oregon Partnership for Disaster Resilience to provide technical assistance to the counties in updating their plans. They just released a pre-application to the counties, which is due June 6. They will decide based on the pre-application how to divide the funding between counties. There is a 25% match for the grant that we will cover with documentation of in-kind services.
- The grant performance period most likely will start between January 2015 and May 2015, so this needs to be considered in the technical assistance requested since the plan update needs to be drafted by July 2015. Questions were raised about the time period that in-kind match can be gathered; Allison will ask Dennis Sigrist, Oregon Hazard Mitigation Officer.
- The group discussed what priorities to include in the pre-application: (1) human-caused hazards (need to check state policy on this), (2) merging of plans and creation of new committees, (3) common understanding of hazard priorities across jurisdictions, (4) public education strategy.
- Allison also updated the group that post-disaster mitigation funds from the Winter Storm Declaration are all obligated to projects within the designated counties. It was discussed that we should continue to consider "shovel-ready" projects for situations when post-disaster grant funding could open up due to lack of ready projects or match in other communities. Project lists also should include planning projects, as there is also 5% post-disaster funding designated for planning projects.

6. Next Steps

- Allison and Tina Birch, MCEM, may request more information over the next week for the pre-application. Allison will send out the completed application next week prior to submission, but there will only be a day or so for comments.
- The next steering committee meeting will be in the fall. Allison and Tina will be in contact regarding IGA/MOU, plan update scope of work, and stakeholder lists between now and then. Each jurisdiction should designate their steering committee membership before the next meeting.
- We will pursue holding a wildfire subcommittee meeting this summer with the stakeholders from the Community Wildfire Protection Plan.

7. Meeting adjourned approximately 2:40 p.m.

G.1.b Steering Committee Meeting Notes, October 29, 2014, 1-3 p.m.

Location: Portland Emergency Coordination Center, Coffey Conference Room, 9911 SE Bush St., Portland, OR 97266

Attendees: Allan Berry, City of Fairview; Chief Johnson, City of Fairview; Jonna Papaefthimiou, PBEM; Craig Ward, City of Troutdale; Todd Felix, City of Gresham EM; Chris Strong, City of Gresham DES; Mark Gunter, City of Wood Village; Bill Peterson, City of Wood Village; Mike McBride, Multnomah County Facilities Property Management; Adam Barber, Multnomah County Land Use Planning; Allison Boyd, MCEM; Tina Birch, MCEM

1. Welcome, Introductions, Agenda and Minutes Review

- Allison Boyd welcomed the group and asked attendees to introduce themselves.
- Committee reviewed and approved minutes from the previous meeting.
- Committee reviewed and approved agenda for this meeting.

2. Program Organization Development

- The structure proposed will be multi-jurisdictional, with the steering committee as the lead organizational group. The steering committee will have designated membership from each participating organization.
- The time frame for this planning period is shorter and will necessitate a quicker planning process versus the future process of annual review and hazard-specific updates.
- The process to identify subcommittee members for specific hazards should begin soon. Participating organizations should provide key contacts from their respective organizations for specific hazards. We will also need to check for “umbrella” organizations that may be a central organizing source for contacts.

3. Updates on Grant Status

- MCEM has received a \$40,000 grant through the State Homeland Security Program for human-caused and technological risk assessment. The grant was written so that we have the option of including this information in NHMPs, but we are able to pick and choose what we want to include. Contractor selection will not be a full request for proposals (RFP) process. We are asking for a basic scope of work, incorporation of geographic information system (GIS) capabilities, and a gap analysis for all of the various plans that various agencies have done.
 - The committee listed the following human-caused and technological hazards as priorities: hazardous materials, transportation, infrastructure failure, public utilities. They requested the following be addressed only summarily: workplace/school/university violence, civil disorder, terrorism.

- There may be a need to restrict public access to areas of the document due to sensitive information around protected critical infrastructure and other sensitive areas. Separate documents for internal use and public release will be created.
- MCEM has received preliminary notice that a possible Pre-Disaster Mitigation Grant of \$40,000 to \$50,000 may be available, but this has not yet been confirmed. The work to be done with this funding was dependent on the timeframe in which it was received. This work will be contracted by OEM through the University of Oregon's Oregon Partnership for Disaster Resilience (OPDR). The grant includes 25% in-kind services. This can include meetings, time spent on work (including staff rates), etc., but cannot include federally funded/grant-funded staff. The primary area of work for this grant will be to update and enhance the action plan, merge jurisdiction-specific plans and improve usability, build the multi-jurisdictional organizational structure, and update and expand the risk assessment.

4. Proposed Scope of Work for Plan Update

- The committee reviewed and discussed the draft scope, planning deadlines, stakeholder participation and public involvement.
- The plans for the cities of Troutdale, Fairview and Wood Village are due in January 2016. This means that ideally a draft plan needs to be completed by August 31, 2015. This gives a large buffer for review by both OEM and FEMA. Each needs around 45 days for their review processes.

5. Goals and Objectives Review

- The committee discussed updating goals and objectives in the plan. Though both are included in current plans, we are required only to do goals. We will want to update our prioritization process. And since the individual groups are merging, there will need to be consensus on the priorities.
- Actions in the current plans will need to be updated in the future plan, including reasoning behind inclusion and why they haven't yet been completed. There are no consequences for not completing action items.

6. Other Updates/Questions/Concerns

- The committee discussed some of the various data updates that will be included in the plan: landslide data, flood zones, changes in development in hazard zones, liquefaction zones, changes in hazard or disaster occurrences, levee recertification, and social vulnerability analysis/most vulnerable populations. Need to look into assistance from OPDR and what analysis update we can do in-house.
- County staff will be handling most of the merging of plans and general editing. We will be looking for plan review and inputs on changes from participating organizations. County staff will also assist with providing presentations to city councils.

6. Next Steps

- Keep in mind information that will need to be gathered from each jurisdiction: public outreach opportunities, stakeholders, plans/reports to review, action updates.
- Review goals for revising at next meeting.

7. Meeting adjourned on time.

G.1.c Steering Committee Meeting Notes, May 5, 2015, 1-4 p.m.

Location: Multnomah County Yeon Annex, Columbia Room, 1600 SE 190th Ave., Portland, OR 97233

Attendees: Ben Harper, Multnomah County GIS; Ken Johnson, City of Fairview, Danielle Butsick, City of Portland Emergency Management; Angela Carkner, Multnomah County Drainage District (MCDD); Mike McBride, Multnomah County Facilities and Property Management; Mark Gunter, City of Wood Village; Chris Strong, City of Gresham; Tina Birch, Multnomah County Emergency Management (MCEM); Allison Boyd, MCEM

1. Welcome, Introductions, Agenda and Previous Meeting Minutes

- Allison Boyd welcomed the group and asked attendees to introduce themselves.
- Committee reviewed minutes from the previous meeting.
- Committee reviewed and approved agenda for this meeting.

2. Review Timelines and Tasks

- The group reviewed the planning process timeline included in the meeting slides.
- The focus for the month of May will be data updates. Items that must be updated will be looked at in detail.
- Plan goals and mitigation actions will need updating. The steering committee will need to meet again during the summer months to continue work on this.
- Public and stakeholder outreach will take place mostly during the summer.

3. Updates on Grants Implementation

- MCEM is a recipient of technical assistance through a Pre-Disaster Mitigation Grant administered by the state and contracted to the University of Oregon's OPDR program. The primary area of work for OPDR in our planning process will be assistance with action planning, public involvement and community profiles.
- MCEM received grant funding through the State Homeland Security Program for a human-caused and technological risk assessment. The contracting process was just completed. Atkins is the selected contractor. The grant funding has a September deadline which aligns with our overall planning timeline.

4. Risk Assessment Updates for 2015

- The state has received a sophisticated wildfire risk model. It provides additional detail to consider with the previous analysis used in the 2011 Community Wildfire Protection Plan (CWPP). A multi-criteria analysis was used for the modeling, including factors such as slope, vegetation, weather, community impact, emergency responder response times and historic fire events. The CWPP stakeholders group will be convened to review the maps.

- HAZUS-MH 2.2 includes updated census data for analyzing earthquake and flood scenarios. The basic modeling can be customized to include local data, such as essential facilities, building stock and land use information. We have been assessing at what point in the future we will be able to do these more advanced analyses and what our data availability is currently. The Regional Disaster Preparedness Organization (RDPO) recently approved a project for HAZUS earthquake analysis that we will find out more about to ensure our analyses will complement this future work.
- MCDD added that they are also working on modeling for levee breaches. Their input will be included into the NHMP update.
- Oregon Health Authority has just completed a social vulnerability analysis for climate change. The analysis is consistent with what the county was planning to conduct for disaster vulnerability, so we will be using the same data sets and include this in the plan.
- Other hazard risk data included in the plan is being reviewed to determine if there is readily available new data that we can use in the update.

5. Plan Format

- The multi-jurisdiction plan format will follow FEMA guidance and will address each jurisdiction specifically. Because the current plans for Multnomah County, Troutdale, Wood Village and Fairview were all developed by the same consultant, the format is already the same and will make merging the plans easier.
- It is difficult to create a brief, reader-friendly plan due to the extensive federal requirements for documentation and need for comprehensiveness on all hazards. To combat this issue, we are going to create community summaries that include only the pertinent information and hazard analysis for each jurisdiction/unincorporated communities to provide an alternative, shortened format. The goal is to make the community summaries easy to read, graphically and visually appealing, and informative for general public use. Community summaries will include:
 - A community profile
 - A brief summary for each hazard including:
 - hazard overview
 - hazard risk/vulnerability assessment
 - hazard maps and other visuals
 - historical hazard data
 - Mitigation actions
 - actions identified in the plan
 - actions that can be taken in the home/business
 - Additional community information resources

- Community summaries will be created for the following areas:
 - City of Troutdale
 - City of Fairview
 - It was discussed at the meeting that including the Interlachen community in the Fairview summary may not be politically acceptable, so we will most likely separate Interlachen into its own summary.
 - City of Wood Village
 - East County Unincorporated – Areas S/SE of Gresham and east of the Sandy River (we may break this into two areas)
 - West Hills/Sauvie Island

6. Public and Stakeholder Participation

- MCEM has scheduled outreach events within each of the focus jurisdictions/unincorporated communities (Fairview, Troutdale, Wood Village, Corbett, Sauvie Island). The strategy is to reach out to the public via pre-identified events and community meetings.
- It was suggested that libraries may be another place to do public outreach. Interlachen has an annual meeting but it may already have occurred. Friends of Fairview also has events.
- MCEM will distribute the list of stakeholders for review and requests input for any additional stakeholders that may have been overlooked. Given the short timeframe for planning, we will be conducting targeted outreach to many stakeholder groups and meeting with them individually for input and review rather than holding large mitigation-specific meetings. Stakeholder outreach will also include engagement with groups at their meetings whenever possible, e.g., attending Local Emergency Planning Committee (LEPC), etc.

7. Goals and Objectives Review

- The planning process includes an update of the plan goals. The current plan goals are lengthy, and revised goals should align with state NHMP goals and other related local plan goals. One of the goals is slightly out of the scope of the mitigation plan and more appropriate for emergency response plans. The 2010 plan also includes objectives with the goals. These are not required, and to be more reader-friendly, we may ensure that the intent of the objectives is included in the goals and then remove the objectives.
- Social vulnerability and historic and cultural preservation goals should be included.
- Goals should be linked to planning elements and actions.

8. Actions Review

- Action items from the 2010 plan need to be reviewed and updated. Many of the actions are identical across plans and are not specific enough to be easily implemented. Moving forward, we will be working to make actions more specific with a timeline within the scope of the plan (i.e., one to five years) and have a specific person/position as a contact for each item. Each jurisdiction

must have actions relative to its risks included in the plan, but we will also be opening up the action planning to other stakeholder groups within the county.

- The action items spreadsheet will be sent out to everyone and will include guidance on reviewing and updating the actions. Tina and Allison are available to assist with questions or meetings concerning updates of the actions.

9. Human-caused and Technological Hazards Risk Assessment

- Ryan Wiedenman from Atkins gave an introductory project presentation via a webinar and discussed the methodology options for the risk analysis. The PowerPoint will be made available.
- Meeting participants weighed the usefulness of a Priority Risk Index (PRI) vs. an asset-based prioritization. No decision was made at this meeting, although consensus leaned toward doing both but perhaps limiting the number of assets analyzed to fit the scope of work.

10. Hazard Prioritization Process

- The discussion on hazard prioritization was continued, also considering needs outside of the human-caused risk assessment project. OEM requires a hazard prioritization be done every 10 years as an Emergency Management Performance Grant requirement. The county's last prioritization was conducted in 2008, so it is not due yet. Public health and hospital stakeholders are also required to prioritize hazards annually and have expressed interest in basing their assessment on a countywide methodology. The NHMP is not required to "score" or rank hazards, however, much of the information needed to do rankings is required to be assessed as part of the Hazard Identification and Risk Assessment of the plan.

11. Other Updates/Questions/Comments

- No updates

12. Next Steps

- Convene a steering committee meeting in July/August prior to draft plan submission
- Identify stakeholders and input on actions
- Action status reporting

13. Meeting adjourned on time.

G.1.d Hazard Mitigation Strategy Workshop Notes, October 1, 2015, 1-3 p.m.

Location: Multnomah County East County Health Center, 1st Floor, Chinook Room, 600 NE 8th St., Gresham, OR 97030

Attendees: Adam Barber, Multnomah County Land Use Planning; Allison Boyd, Multnomah County Emergency Management (MCEM); Tina LeFebvre, MCEM; Mark Gunter, City of Wood Village; Todd Felix, NW Natural Gas; Steven Bullock, MCEM; Susan Denavit, Red Cross; Craig Ward, City of Troutdale; Mike McBride, Multnomah County Facilities and Property Management; Angela Carkner, Multnomah County Drainage District (MCDD); Tim Lynch, Multnomah County Office of Sustainability; Daniel Nibouar, Metro; Steph Sharp, Port of Portland; Justin Ross, Oregon Health & Science University (OHSU); Allan Berry, City of Fairview; Roy Iwai, Multnomah County Transportation; Harry Saporta, Trimet; Kelle Landavazo, City of Gresham Emergency Management.

1. Welcome

- Allison Boyd welcomed the group and asked attendees to introduce themselves. An update on the planning process to date was given. The purpose of this workshop is a critical component of the process – to develop the action plan.

2. Vision and Goals

- The proposed draft of the vision and goals for the 2015 NHMP update was introduced. The draft was the result of prior steering committee input, review of local and state goals, and review of national guidance and best practices. The attendees reviewed the vision and agreed to it as presented. The attendees then reviewed each goal and its objectives individually and the following comments were provided by the group:
 - Obj. 3.1: Benefit-cost analysis (BCA) is very specific and could mean extensive technical analysis by economists. Suggestions were to either specify that this is referring to a specific FEMA methodology for BCA or reword so that the concept can be implemented in a less technical manner.
 - Obj. 3.2: Provide a footnote definition of “underserved” and “underrepresented” communities.
 - Obj. 3.4: Include language that reflects community goals of universal design and accessibility.
 - Obj. 4.1: Include universal design and accessibility in reconstruction.
 - Under Goal 4: Include an additional objective that addresses equal access to funds post-event and public outreach on mitigation opportunities post-disaster.

3. Considerations for Actions and Prioritization Criteria

- A definition of mitigation action was given, noting that the focus is on long-term reduction of risk and less so on preparedness and response actions. The handout defining action categories was referenced. The metadata necessary for each action to be implemented was reviewed and included responsible organizations, participating jurisdictions, timeframe, capacity/funding needs, potential funding source and implementation mechanism.

- A question was asked about the plan expiration deadline (January 30, 2016, for Fairview, Troutdale and Wood Village): because the county has a later deadline and the cities are merging plans with the county, would they be out of compliance to wait and meet the county's deadline? It was believed they would, but it could be looked into. It was mentioned that since the planning process is short to meet the deadline, the county is treating this as the first phase of what will hopefully become a more incremental planning process, with portions of the plan worked on annually rather than once every five years.
- The screening criteria for determining if an action should be included in the plan was reviewed, and the following comments were provided:
 - No adverse social impacts: change "no" to "minimal" since there could be ways to mitigate the impacts; use "equity" instead of "adverse social impacts" to stay consistent.
 - No adverse environmental impacts: change "no" to "minimal" since there could be ways to mitigate the impacts.
 - Add screening criteria for financial impacts and cost effectiveness.
- The prioritization criteria was reviewed and the following comments were provided:
 - Benefit-Cost Ratio: change to "does not/may not meet the benefit cost ratio or may need more information."
 - Ensure safety is considered vs. cost-effectiveness (safety should be considered as a benefit).
 - Include risk as a category. How to do this was discussed as there is not a consistent methodology yet among the organizations within the county for ranking one hazard over another, and the county's hazard rankings (using the state-required methodology) have not been updated yet. The risk would also vary by jurisdiction. There are some implications of prioritizing hazards that may result in some jurisdiction's actions being prioritized lower just because they are not exposed to that hazard. Further suggestions included considering high frequency or high severity.
 - Timing: If risk is included as a criteria, then we may be able to remove timing criteria.
 - It was also suggested that we could weigh certain criteria to be more important than others.
- A brief review of equity considerations was provided, and the county's Equity Lens tool as well as questions and objectives from the Climate Action Plan were provided as references.

4. Hazard Risks

- The results of informal polls at public outreach events were graphically presented. At each event, attendees were asked to pick the hazards that were of most concern to their families over the next 20 years. Earthquake was the most popular response in each community.
- A quick overview of major issues for each hazard included in the plan was presented. Hazards include earthquake, flood, wildfire, volcano, landslide, and severe weather.

5. Action Ideas

- Before reviewing the action ideas, the stakeholders were asked to watch for gaps, such as each jurisdiction's risks and priorities being addressed and including actions to address the built environment.
- The attendees began discussing the action ideas and had the following comments:
 - **Action Idea #1:**
 - Red Cross would be a participating organization.
 - Are the current outreach programs not already addressing this?
 - Are there groups already working on this, e.g., the RDPO Messaging Work Group, that could have a mitigation representative added to ensure these topics are covered?
 - Should neighboring counties like Clackamas be included?
 - Current programs focus on homeowners.
 - Education on what specific disaster impacts to expect in a particular community is needed.
 - Action needs to be explored further and reworded.
 - **Action Idea #2:**
 - Jurisdictions are not interested in going to other jurisdictions for assistance or review of their comprehensive plan policies.
 - Needs to be reworded to be an individual jurisdictional effort to incorporate hazards into comprehensive plans.
 - **Action Idea #3 was skipped due to more time needed for discussion.**
 - **Action Idea #4:**
 - Jurisdiction representatives agreed to participate in action.
 - General consensus to keep the action.
 - Estimated to be a "big ticket" item in terms of cost/capacity.
 - Sooner the better for implementation.
 - **Action Idea #5:**
 - General consensus to keep the action; jurisdictions present agreed to participate.
 - MultCo Facilities could use courthouse project as a pilot for documenting the process.
 - Port is also doing similar work.

- **Action Idea #6:**
 - General consensus to keep the action; jurisdictions present agreed to participate.
- **Action Idea #7**
 - General consensus to keep the action.
- **Action Idea #8**
 - General consensus to keep the action; jurisdictions present agreed to participate.
 - Concern was raised over not having this already included in the implementation plan, but due to short timeframe of planning process we will not be able to get into the specific resource availability within each of our partners.
 - In order to adjourn on time, the action idea discussion ended at #8.

6. Additional Action Suggestions

- The attendees were asked if they had any additional actions they wanted to suggest. Angela Carkner from MCDD suggested adding an action for jurisdictions to include levee review zones into their comprehensive plan updates. She also suggested that the Levee Ready committee could be an entity to consider for action implementation.
- The group was encouraged to think of other ideas and to continue providing feedback.

7. Next Steps

- More feedback on the remainder of the actions and prioritization will be needed. Much of this will likely be done in small group meetings and phone calls to stakeholders. Updates will be forthcoming.

8. Meeting adjourned on time.

G.1.e Local Hazard Identification and Analysis Workshop Materials, June 1, 2016, 1-4 p.m.

Location: Multnomah County East County Health Center, 1st Floor, Blue Lake Room, Center, 600 SE 8th Street Gresham, OR 97030

Attendees: Adam Barber, Multnomah County Land Use Planning; Craig Ward, City of Troutdale; Mike McBride, Multnomah County Facilities and Property Management; Angela Carkner, Multnomah County Drainage District (MCDD); Kelle Landavazo, City of Gresham; Christopher Blanchard, Multnomah County Emergency Management (MCEM); Angela Carkner, Multnomah County Drainage District (MCDD).; Nolan Young, City of Fairview.

1. Welcome/Introductions

- Lisa Corbly welcomed the group, described the goals of the workshop: to identify the hazards and associated risk scores for each jurisdiction. Chris Blanchard provided pastries for the group.

2. Hazard risk assessment overview

- Lisa described federal requirements and the general layout of the risk assessment to give context to the day's tasks.

3. Natural hazard categories

- The group discussed the hazard types, groupings and naming conventions in each of the current NHMPs. They then agreed on the following for this update:
 - Earthquake: Cascadia Subduction Zone, Intraplate, Crustal
 - Flood: Riverine flooding, Urban Levee Failure, Dam Failure
 - Landslide: Slides, Flows, Spreads, Topples/Falls
 - Severe Weather: Heavy Rain, Windstorms, Snow and Ice, Thunderstorms, Hail, Lightning, Tornado, Drought/Heatwave
 - Volcano: Ashfall, Blast effects, Lahars/Mudflows, Landslides/Debris Flows
 - Wildfire: Wildland Urban Interface

4. OEM methodology

- See section **Appendix C: Local OEM Hazard Analysis Scores** for the OEM methodology, and the final local hazard scores.

5. Activity A : Natural hazards (small groups)

- Representatives from each jurisdiction completed the OEM methodology for the relevant hazards in their community. Each jurisdiction then reported out to the group their scores and scoring rationale. Following this workshop, representatives from each jurisdiction will vet the scores with the appropriate local leadership and adjust the scores as needed. Final scores will be emailed to Lisa.

- See section **Appendix C: Local OEM Hazard Analysis Scores** for the OEM methodology, and the final local hazard scores.

6. Activity B: Human-caused and technological hazards (one group)- time permitting

- Together the group reviewed the list of human-caused and technological hazards listed in **Annex I: Human-caused and Technological Hazard Identification and Risk Assessment (2015)** human-caused list for Gresham and Multnomah County, including:
 - Transportation incidents
 - Hazardous materials incidents
 - Pipeline incidents
 - Critical infrastructure failure
 - Utility interruption
 - Terrorism
 - Workplace/school/university violence
 - Fuel/resource shortage
- The group then discussed possible rankings for some of the new hazards, those hazards not on the 2015 hazard analysis.
- Following the meeting Multnomah County and Gresham Emergency Management each will consider the scores discussed and complete the human-caused assessment for the Oregon Office of Emergency Management.

7. Next Steps

- Each jurisdiction will vet their draft OEM Hazard Analysis scores with their local leadership, update the scores as appropriate, and email Lisa the final scores including the scoring sheets for documentation.
- Gresham and Multnomah Emergency Management will update their Human-caused and technological hazards scores and send to the Oregon Office of Emergency Management to fulfill the annual Emergency Management Program Grant requirement.
- There will be NHMP Steering Committee meetings every other month through 2016 — June, August, October, and December. The next meeting is June 28th.

G.1.f Steering Committee Meeting Notes, June 28, 2016, 1-4 p.m.

Location: Kellogg Community Room, 234 SW Kendall Ave., Troutdale, OR 97060

Attendees: Adam Barber, Multnomah County Land Use Planning; Lisa Corbly, Multnomah County Emergency Management (MCEM); Tricia Sears, MCEM; Chris Voss, MCEM; Chris Blanchard, MCEM; Craig Ward, City of Troutdale; Mike McBride, Multnomah County Facilities and Property Management; Nolan Young, City of Fairview; Scott Sloan, City of Wood Village; Bill Peterson, City of Wood Village; Danielle Butsick, City of Portland Bureau of Emergency Management (PBEM); Tim Couch, Sauvie Island Drainage District (SIDD).

1. Welcome

- Lisa Corbly welcomed the group and asked attendees to introduce themselves. The group, also referenced as the steering committee, agreed to forfeit breaks in order to adjourn 15 minutes early, at 3:45 p.m. The agenda and handouts were provided to all. Cookies were available as brain fuel.

2. Proposed Timeline

- **Timeline and deliverables**
 - Steering committee members agreed that the schedule on the NHMP Update – Timeline was acceptable.
 - Craig noted that the NHMP came up in discussion at the 6/27/16 public meeting regarding the revised FEMA flood maps. He will need to have a NHMP work session with the Troutdale City Council, possibly more than one. Lisa will work with Craig on the details of those meetings.
 - Steering committee members noted that each jurisdiction will need to provide public notice about the NHMP (e.g., newspaper, posting it online, mailed information, and so forth); each jurisdiction can determine best approach for their community.
 - Adam noted that we had discussed briefing the Planning Commission and asked if we plan to brief the county commissioners. Chris Voss responded that he will talk with each county commissioner and determine the appropriate steps.
- **Steering committee schedule: determine standing meeting time**
 - The steering committee meetings targeted for August, October and December were agreed as acceptable. Members suggested avoiding meeting dates on Fridays. Best times for members to meet will be identified by either a Doodle poll or a When2Meet poll coordinated by Lisa.
- **Hazard Management Grant Program (HMGP) projects?**
 - No one identified any HMGP projects. Lisa mentioned that MCDD may have a project related to levees. Lisa is working with MCDD and OEM to determine the eligibility of this project per federal requirements.

- **Conflicts?**

- No conflicts with the proposed timeline and deliverables were identified. Questions were discussed and described in the “timeline and deliverables” section above.

3. Table of Contents

- The Table of Contents was discussed . Lisa noted this update is a blend of the five current NHMPs for Multnomah County and the cities of Gresham, Fairview, Troutdale and Wood Village, and yet this update retains unique information about each jurisdiction. The Table of Contents is color coded in four categories: draft complete; draft in progress, almost complete; draft in progress; and not yet started. A draft copy of the risk assessment will be sent to steering committee members in July.

4. Mitigation Strategy

- Review vision, goals, action types and criteria
 - Lisa refreshed the group on prior decisions made regarding the Mitigation Strategy. This included a review of the vision, goals and objectives for the NHMP as well as types of mitigation actions.
- Discuss process to complete action updates
 - The group was reminded of the federal requirement that each jurisdiction identify at least one action to address each hazard to which it is subject. Additional requirements for each action include: aligning actions to the NHMP goals, determining a lead agency, prioritization, listing funding source(s) and identifying implementation mechanisms
 - The goal of this meeting is to continue to update the actions — this action update process began at the Mitigation Strategy Workshop in October 2015. Today the group will focus on refining each agreed-upon action and identifying the lead agency for each.
 - Between steering committee meetings, Lisa will work with each lead agency to further refine each action.
 - Danielle asked if the steering committee will meet after the plan is adopted. Lisa explained that after local adoption, during the maintenance and monitoring phase, a standing committee will meet at least twice per year, per federal requirements, to review new hazard and vulnerability data and update actions. These regular revisions will help reduce the amount of work needed during the next plan update. At the very least, the maintenance and monitoring group needs to include representation from all jurisdictions in the Planning Area, although others are welcome, including everyone on the steering committee.
- Update proposed mitigation strategy actions
 - The group discussed the Action Ideas for Review and Discussion document. Lisa applauded Allison’s work on blending and paring down 144 actions from the five current plans into fewer than 40 actions. Some updates and additional actions have since been added, resulting in a total of 45 actions.

- The Action Item document tracks the following changes: Text in black indicates actions have been carried over from current NHMPs and blended with any actions that were similar. **Text in green indicates revisions based on feedback at the workshop in October 2015. Text in red indicates revisions based on information gathered by MCEM since the 2015 workshop.**
- Representatives from each jurisdiction in the Planning Area discussed the pros and cons of each jurisdiction prioritizing actions versus the steering committee prioritizing all actions for all jurisdictions. Prioritization will be discussed at the next steering committee meeting, in August.
- The steering committee discussed the first 23 action items (of 45) in the document. Actions were edited, deleted or identified as needing further discussion before the group can vote on it. No new actions were proposed.
- Specific actions were updated as follows:
 - Accepted as is, or with minor wordsmithing: Actions 1-8, 10, 12, 14, 15, 18
 - Substantive changes were made to these actions:
 - Action 11: The group prefers to use an existing third-party equity group to provide guidance (i.e. the Multnomah County Equity Council), if available.
 - Action 16: Specify *public* buildings.
 - Delete these actions:
 - Action 13: The discussion about historic and cultural resources has already been expanded in the Community Profile for this update. The group decided to reference the National Historic Registry rather than list specific properties.
 - Action 19: Seismic upgrades for public buildings is covered in Action 16.
 - Action 22.
 - Further discussion needed:
 - Action 9: MCEM will refine and bring back to the steering committee.
 - Action 14: To keep this action, needs to be more than 'advocating'. MCEM will check with PBEM.
 - Action 17: Specify *all bridges along Emergency Transportation Routes and other arterial bridges*; Check with MC Bridges Department, Check nomenclature for 'arterial.'
 - Action 20: MCEM will check with PBEM.
 - Action 21: Recommend deletion; check with Gresham.

5. Next Steps

- Lisa will follow up with individual jurisdictions to further discuss the Mitigation Strategy actions. Lisa will send a Doodle or When2Meet poll to establish the August meeting date and time. At a minimum, the agenda for the August meeting will include the remaining action items, any new action items, and prioritization.

6. The meeting adjourned early at 3:45 p.m., as agreed.

G.1.g Steering Committee Meeting Notes, August 11, 2016, 9 a.m.-12 p.m.

Location: Kellogg Community Room, 234 SW Kendall Ave., Troutdale, Oregon 97060

Attendees: Adam Barber, Multnomah County Land Use Planning; Lisa Corbly, Multnomah County Emergency Management (MCEM); Chris Voss, MCEM; Chris Blanchard, MCEM; Craig Ward, City of Troutdale; Mike McBride, Multnomah County Facilities and Property Management; Nolan Young, City of Fairview; Scott Sloan, City of Wood Village; Danielle Butsick, Portland Bureau of Emergency Management (PBEM); Kelle Landavazo, City of Gresham; Peter O'Farrell, PBEM.

1. Welcome and Introductions

- Lisa Corbly welcomed the group and asked attendees to introduce themselves. Cookies and coffee were provided to help stir creative juices.

2. Meeting Notes

- The group reviewed notes from the June meeting. No changes were made by group.

3. Updates

- Risk assessment review period through August 19th
- The group extended the risk assessment review period another week, until August 26th.
- Special districts
- Lisa and Angela discussed the new FEMA requirement that special districts have an adopted NHMP, or be an annex to an adopted NHMP, in order to be eligible for some federal mitigation funding. The state is in the process of developing NHMP guidance for special districts. MCDD is exploring a potential HMGP project. If this project is eligible for HMGP funding, the new NHMP requirement for special districts would apply. MCEM and MCDD will coordinate on next steps as the new guidance becomes available.
- Public comment period
- Lisa outlined the federal requirement for each jurisdiction to have a public notice and public comment period for the draft NHMP. Each jurisdiction will determine its public notice approach by the next steering committee meeting. MCEM will post the draft NHMP on the county website and will receive and integrate comments. Public comment approaches, roles and responsibilities will be discussed at the committee meeting in October.

4. Working Session

- Update mitigation strategy actions
 - First the committee revisited actions that had been tabled at the last meeting and have since been updated or for which new information has been identified. Those actions were updated as follows:
 - Actions 9, 14, 20
 - Action 17: Keep as is, including new language to coordinate with school districts.
 - Action 21: Keep as is. Gresham needs to check status with wastewater project.
 - Then the committee reviewed the remaining actions and accepted as is, edited or deleted each:
 - Accepted as is, or with minor wordsmithing: 26, 27, 28, 31, 32, 33, 37, 38, 41, 42, 43, 44, 46, 47.
 - Substantive changes were made to:
 - ✓ Action 25: Gresham only.
 - ✓ Action 39: Keep first half of action, but the second half needs to be reworded, because the committee does not have authority over power companies.
 - ✓ Action 45: Align with Portland Mitigation Action Plan (MAP) and CWPP.
 - ✓ Action 40: Change to make more actionable: from *evaluate adequacy* to *encourage retrofits* to mobile homes for high winds.
 - More information needed:
 - ✓ Actions 24, 29, 33, 34, 35, 36: inquire with DOGAMI.
 - Deleted: no actions were deleted
 - Additions:
 - ✓ Action 48: Communicate with utility agencies the NHMP actions and priorities, and encourage integration into their planning.
 - ✓ Action 49: Consider regulations that require fire-safe construction in high-risk areas using wildland urban interface (WUI) overlays.
 - ✓ Action 50: Use best available data to consider impacts of wildfire risk when developing policy.
 - Lisa will follow up on the outstanding actions and update the action list accordingly.

- Decide prioritization criteria, approach, timeline
 - Lisa presented to the committee the draft action prioritization criteria, based on the existing criteria in current local and state NHMPs, feedback during the Hazard Mitigation Strategy Workshop in October 2015, and FEMA guidance. After some discussion about federal requirements and how the Portland MAP is organized, the group made some changes and ultimately agreed to the following:
 - Criteria:
 - ✓ Equity: Keep definition provided.
 - ✓ Benefit: Reference Portland MAP to develop this definition.
 - ✓ Cost: Reference Portland MAP to develop this definition.
 - ✓ Available Capacity/Funding: Keep definition provided.
 - Scoring: each criterion will have three weighted scoring options, High (3 points), Medium (2 points), and Low (1 point).
 - The group agreed that each jurisdiction will determine its own top actions and will score its top actions.

5. Next Steps

- Homework
 - Risk assessment review and comment: Due to MCEM August 26th.
 - Actions:
 - Lisa will update the prioritization table, develop a scoring worksheet and send it to the committee along with the updated action list by August 26th.
 - The group decided three weeks was ample time to identify and prioritize top actions. These will be due to MCEM by September 16th.
 - Review other draft sections and comment — coming later in September.
 - **Next meeting:** Thursday October 13, 9 a.m.-12 p.m.

6. The meeting was adjourned on time.

G.1.h Steering Committee Meeting Notes, October 11, 2016, 9 a.m.-12 p.m.

Location: Kellogg Community Room, 234 SW Kendall Avenue, Troutdale, Oregon

Attendees: Angela Carkner, Multnomah County Drainage District; Lisa Corbly, Multnomah County Emergency Management (MCEM); Mike McBride, Multnomah County Facilities and Property Management; Nolan Young, City of Fairview; Scott Sloan, City of Wood Village; Kelle Landavazo, City of Gresham Emergency Management.

1. Welcome/Announcements

- Lisa Corbly opened the meeting and the group discussed the imminent series of winter storms and likely impacts, including downed power lines from high winds and urban flooding from blocked storm drains.

2. Meeting Notes

- The group approved the minutes as is.

3. Updates

- Timeline
 - Lisa presented the timeline and the group discussed the Public Comment period. Public Comment is slated to open in November. Exact timing will be contingent on the Committee proving feedback on final draft sections of the plan, and completion of the action tables, in a timely manner and the level of feedback provided.
- Review of Draft Sections
 - Final feedback is due 10/15/2016, a Saturday. So MCEM extended the due date to the end of day (EOD) Monday 10/17/2016. Lisa highlighted that significant feedback is needed from each jurisdiction on Appendix: Implementation Mechanisms. The group discussed the importance of articulating which existing planning mechanisms can be used to further mitigation efforts.
- State Feedback
 - MCEM has been sending Oregon OEM draft sections of the plan for review and feedback, concurrent to Steering Committee review. Overall the State has confirmed that the draft plan seems to meet federal requirements. MCEM and Oregon OEM have discussed how the risk assessment data varies in granularity and content among jurisdiction, a function of merging five plans. The State recognizes this complication and suggests adding a statement in the Risk Assessment Introduction that explains data variances.
- Special Districts
 - MCEM and MCDD have been working with the Oregon OEM to determine NHMP requirements for levee districts. If the levee districts chose to adopt an NHMP, they will be able to append this NHMP once it is formally adopted.

4. Discussion

- Top Action, by Jurisdiction
 - The group reviewed the current action table that includes top actions and prioritization for all jurisdictions. Some actions require additional information. Final action tables are due EOD Monday 10/17/2016.
 - MCDD asked for clarification if each levee district needed to prioritize actions for their district. MCEM answered that it was possible that was the case. Angela will pose the question to Oregon OEM.
- Mitigation Actions: New/updated
 - The group was pleased a new action for the Joint Office on Homeless Services was added. MCDD clarified language in two actions to articulate the role of cities and the county in supporting Levee Ready Columbia.
- Public Comment: Timeline/Approaches
 - Lisa presented the public comment approaches for each community. MCEM will provide draft language by Friday 10/14/2016, for newsletters. That announcement will not include the exact public comment dates, because completion of the final draft will be contingent on the feedback provided by each jurisdiction, due 10/17/2016. The goal is to open public comment by 11/07/2016. The group agreed on a 4-week public comment period.
 - MCEM will send an email blast to a long list of stakeholders in the region and asked if other jurisdictions would be doing the same, or if they wanted to add their contacts to the MCEM email. All communities indicated a preference to email their own stakeholders directly. MCEM will provide the group a Google Doc with the MCEM stakeholder list to minimize redundancy.

5. Next Steps

- Homework: All comments on draft sections due EOD Monday 10/17
- The last Steering Committee meeting before the plan goes to the State OEM and FEMA will be: December 15, 9:00-12:00 @ the Troutdale Community Room

6. The meeting adjourned at 10:45.

G.1.i Steering Committee Meeting Email Summary, December 15, 2016

This meeting was cancelled due to inclement weather, poor driving conditions and government closures. In lieu of a meeting, the following email with the agenda and notes was sent to the committee:

From: Lisa Corbly, Multnomah County Emergency Management

To: Adam Barber, Multnomah County Land Use Planning; Angela Carkner, Multnomah County Drainage District (MCDD); Mike McBride, Multnomah County Facilities and Property Management; Nolan Young, City of Fairview; Scott Sloan, City of Wood Village; Kelle Landavazo, City of Gresham Emergency Management; Chris Voss, Multnomah County Emergency Management (MCEM); Christopher Blanchard, MCEM; Scott Anderson, City of Fairview Police; Allan Berry, City of Fairview; Bill Peterson, City of Wood Village; Chris Strong, City of Gresham Transportation; Craig Ward, City of Troutdale; Steve Gaschler, City of Troutdale Public Works; Tim Couch, Sauvie Island Drainage District (SIDD).

1. October meeting notes

- Comments due to Lisa by 12/20/2016.

2. Updates

- Public comment period lasted four weeks, from Monday November 7th through Friday December 2nd.
- Outstanding needs
 - Implementation mechanisms- outstanding items are due to MCEM by 12/20/2016.
 - Verify public comment outreach approaches- It is a federal requirement to list the public comment outreach approaches employed by each jurisdiction. Submit additional public outreach approaches to MCEM by 12/20/2016.
 - List of public comment contacts - Our state reviewer recommended that we maintain a list of all stakeholders/outlets/social media to which we sent the public comment period announcement. Email MCEM any additional contacts by 12/20/2016.

3. Discussion

- Public comments and responses- Comments or edits to responses are due to MCEM by 12/20/2016.
- State and FEMA review /timeline- We are on track and scheduled to send the final draft to Oregon OEM by early January.
 - Following the Oregon OEM review, the plan will be forwarded to FEMA for approval. The state and federal review and approval process could take up to four months. Possible timeline: January-April.
- Local adoption responsibilities- It is a federal requirement that each jurisdiction locally adopt the plan (by resolution). See attached power point for the specific CFRs. Upon approval of the plan by FEMA, each jurisdiction is required to go through the local adoption process. The first jurisdiction to adopt the plan sets the date of the plan. The plan will have a 5-year update cycle, for all jurisdictions, based on that plan date.

- Upon local adoption, each jurisdiction is required to publicize that the plan has been adopted. MCEM will send the group a reminder email to publicize their locally adopted plan. MCEM will host the final adopted plan on the MCEM website and all communities are welcome to link to our website.
- Maintenance and monitoring schedule- It is a federal requirement that a NHMP planning team meet at least once per year, during the 5-year cycle, to keep the plan up to date and to give status updates on our respective action items. MCEM will convene these meetings biannually. The first meeting will take place during the fourth quarter of 2017 (between October and December).

5. Next Steps

- Outstanding needs to Lisa by 12/20/2016.
- State review- MCEM will email the committee when the final draft is sent to Oregon OEM. MCEM will also email the group once the state has given the green light to send the plan to FEMA for their review and approval.

G.2.a One-on-one Meeting Agenda Example

- I. NHMP Timeline
 - a. June 2016 Meetings: 6/1, 6/28
 - b. HMGP: Feb 17, 2017
 - c. Local adoption: sufficient time?
 - d. Conflicts?

	2016	2017
	January February March April May June July August September October November December	January February March April May June July
Phase 1: Public Involvement, Draft	PC	
Phase 2: OEM, FEMA Review to APA		
Phase 3: Adoption by Local Jurisdictions		

PC: Public Comment period will be one month

- II. Table of Contents
- III. County-specific Questions
 - a. Profile
 - b. Risk Assessment
 - i. Types of each hazard that affect Fairview
 - ii. History: hazard events
 - iii. Mitigation success stories/examples
- IV. Anything Else?

G.2.b Action Prioritization Steps

Multnomah County Multi-Jurisdictional NHMP: **Action Prioritization**, 8/25/2016

Take these **5 steps** to fill out the Action Prioritization excel spreadsheet.
 Due to MCEM by Friday **September 16th**. Please contact Lisa if you would like assistance prioritizing actions for your community.

Step 1: Identify top actions for your jurisdiction

Requirements: Identify a comprehensive range of actions for hazards to which your community is subject — especially hazards to which you have high to moderate risk, based on the risk assessment (see risk score table below). Emphasize new and existing buildings and infrastructure.

Risk Scores*

	Unincorporated Multnomah County	Gresham	Troutdale	Fairview	Wood Village
Hign	Earthquake Flood Wildfire	Earthquake Severe Weather	Severe Weather	Severe Weather	Severe Weather
Moderate-High				Earthquake	
Moderate	Severe Weather	Flood Landslide	Earthquake Volcano Flood Wildfire	Volcano	Earthquake Volcano Landslide
Low-Moderate				Flood Landslide	Flood
Low	Landslide Volcano	Wildfire Volcano	Landslide	Wildfire	Wildfire

*This table shows the risk scores identified by each jurisdiction in the Planning Area.

Column G “Top Action”: Indicate **Yes** for all top actions for your community.

What are “top actions”? Top actions are those most likely to meet multiple NHMP goals and objectives¹, have benefits that exceed cost, and can be implemented over the life of this Plan, within the next 5 years. (See footnote for a list of the NHMP goals and objectives.) These actions will be the focus for each respective jurisdiction during this Plan’s 5-year cycle. As mitigation resources become available, the Planning Team will first consider these actions for implementation.

Actions not identified as a top action: Remaining actions will be evaluated and reviewed during the required semi-annual NHMP monitoring meetings. If the equity, benefits, costs, risk, or capacity and support change during this Plan’s 5-year cycle, the Planning Team will re-assess the prioritization ranking.

Column H “Jurisdiction”: For recommended actions only, type your jurisdiction’s name.

Step 2: Identify a Lead

Column I “Lead”: List one Lead department/entity responsible for each recommended action.

Step 3: Prioritize top actions

Columns J “Equity” through N “Capacity/Support”: Determine, Low (1 point), Medium (2 points), High (3 points) for your recommended actions, using the criteria and scoring method listed in the table below.

Column O “Priority Score”: One score will automatically be calculated for each recommended action.

Prioritization Criteria			
Criteria	High (3 points)	Medium (2 point)	Low (1 point)
Equity	Social benefits are highly likely, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral to positive, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.	Social impacts are likely to be neutral, especially for people in areas with high hazard exposure and for people who have been disproportionately impacted by natural disasters.
Benefits	Supports compliance with a legal mandate or will have an immediate impact on the reduction of risk exposure to life and property.	Will have a long-term impact on the reduction of risk exposure to life and property.	Long-term benefits of the action are difficult to quantify in the short term.
Costs	Possible to fund under existing budget. Project is or can be part of an existing ongoing program or would not require substantial effort to initiate or appropriate funds.	Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment.	Existing work plan and funding levels are not adequate to cover the costs of the proposed project.
Risk	Addresses a high-risk issue as described in the risk assessment. <i>See above risk table.</i>	Addresses a moderate-risk issue as described in the risk assessment. <i>See above risk table.</i>	Addresses a low-risk issue or has not been assessed for the level of risk. <i>See above risk table.</i>
Capacity	Capacity is highly feasible within 5 years.	Capacity is uncertain within 5 years.	Capacity is unlikely within 5 years.

Step 4: List potential funding

Column P “Potential Funding”: List known or possible funding sources for each of your community’s recommended actions. A diverse range of funding is preferred. Some funding sources may include local resources, state funded projects, or federal grants. When possible, be specific.

Step 5: List implementation mechanisms

Column Q “Implementation Mechanisms”: When appropriate, list other planning mechanisms through which each recommended action *could* be implemented. Some examples are: comprehensive plans, capital improvement plans, or local regulations.

¹ NHMP goals and objectives were identified during the Workshop in October 2015 and then refined by the Steering Committee. They include:

- Goal 1. Strengthen the capacity of the whole community¹ to reduce risk by increasing hazard awareness, creating partnerships, and leveraging multiple implementation mechanisms and funding opportunities.
 - Obj. 1.1. Ensure the risk assessment and related risk information materials are current with the best available science and appropriate for diverse audiences.
 - Obj. 1.2. Support community outreach activities that increase stakeholder awareness and understanding of hazard risk and mitigation options.
 - Obj. 1.3. Continue efforts to build effective partnerships with community-based organizations, businesses, and government agencies to identify and implement mitigation actions.
 - Obj. 1.4. Integrate risk reduction concepts, policies, and projects into existing planning and implementation mechanisms, such as comprehensive plans, development codes, and capital improvement plans.
 - Obj. 1.5. Seek various funding opportunities including mitigation-specific grant sources and local financing solutions.
 - Obj. 1.6. Enhance efforts to monitor vulnerability reduction and document progress towards resiliency.
- Goal 2. Develop mitigation actions that consider all community systems: economic, health and social services, housing, infrastructure, and natural and cultural resources.
 - Obj. 2.1. Consider strategies that support a prosperous and resilient economy and that would expedite economic restoration following an incident.
 - Obj. 2.2. Consider strategies that promote the health, independence, and well-being of the whole community.
 - Obj. 2.3. Consider strategies that mitigate existing housing risks and increase resilience in new construction, repair, and rebuilding.
 - Obj. 2.4. Consider strategies that strengthen essential infrastructure and services, decrease disruptions, and increase resilience in new construction, repair, and rebuilding.
 - Obj. 2.5. Consider strategies that conserve, protect, and restore the natural and cultural assets of the community.
- Goal 3. Prioritize mitigation actions that have a high benefit-to-cost ratio and increase social equity.
 - Obj. 3.1. Prioritize actions that have a positive benefit-cost ratio by estimating whether the expected long-term benefits of losses avoided will exceed the cost of the mitigation action.
 - Obj. 3.2. Prioritize the allocation of resources for mitigation actions that benefit underserved and under-represented communities¹, especially those in high hazard risk areas.
 - Obj. 3.3. Seek opportunities in which hazard mitigation also benefits other community goals, such as economic development, energy efficiency, public health, universal design, or environmental conservation.
 - Obj. 3.4. Consider the increased benefit an action may have that reduces risk from multiple hazards.
- Goal 4. Plan for including mitigation activities during post-disaster recovery and reconstruction.
 - Obj. 4.1. Integrate policies that reduce disaster risk into recovery plans and reconstruction standards by planning for recovery prior to a disaster.
 - Obj. 4.2. Educate stakeholders on post-disaster mitigation funding sources and opportunities to build back resiliently.
 - Obj. 4.3. Ensure policies and public outreach strategies are in place to provide equitable access to post-disaster mitigation opportunities.

Appendix H: Public Comments and Responses

Unique ID	Commenter Name	Commenter Affiliation	Comment Section	Comment	Response
1	Beth McGinnis	NW Oregon Health Preparedness Organization	2 Community Profile	<p>Our organization is concerned about a lack of healthcare/hospital infrastructure referenced in this plan. We were hoping it would be discussed in the Community profile (section 2) as there are hospitals in Multnomah County (outside of Portland city limits). They call out social services, but not health/medical.</p> <p>I imagine that natural hazards impact critical resources (i.e. hospitals and care facilities) that should be included in planning. The hospital facility that fit in the parameters of your plan area is: Legacy Mt. Hood Medical Center http://www.legacyhealth.org/locations/hospitals/legacy-mount-hood-medical-center.aspx</p> <p>The emergency manager for Legacy Health System facilities is Angela Heckathorn aheckath@lhs.org</p> <p>They may have some information on natural hazard mitigation for the hospital footprint and associated clinics in the area.</p>	<p>A section for Critical Facilities has been added to the Community Profile. Critical facilities are identified in Annex I: Human-Caused and Technological Hazard Identification and Risk Assessment as facilities needed to maintain government functions and protect the life, health, safety, and welfare of citizens.</p> <p>The critical facilities are grouped into three categories:</p> <ol style="list-style-type: none"> 1) Emergency services facilities: ambulance services, fire stations, hospitals, licensed medical facilities, law enforcement and urgent care centers. 2) Administrative critical facilities: airports, city halls, community centers, county assets and libraries. 3) Special population critical facilities: childcare facilities, homeless shelters, jails, residential care facilities and schools.

2	Janelle Mellor	Coalition of Community Health Clinics (CCHC)	4.2.3 Action Plan	<p>We are considering submitting the following action as an earthquake mitigation action (feel free to provide comment about how to frame this for your NHMP):</p> <p>Identify an external partner who is willing to provide a structural engineer to conduct building assessments for interested Coalition community health clinics.</p> <p>However, I do have a few follow up questions:</p> <ul style="list-style-type: none"> • We do not currently have any leads for finding a structural engineer. How feasible do you think this would be? By submitting an action, is this something that your group would be able to help us facilitate? Or would we be responsible for doing this on our own? • Can you clarify what exactly the Coalition and our Clinics would be committing to by submitting this action? My apologies for some repetition of yesterday's conversation, I just want to make sure that I fully understand the purpose of the mitigation plan and what the Coalition's role and responsibility would be. <p>For instance, would there be any obligation for seismic enhancement implementation following the assessments, or would our specific action for conducting the building assessments stand alone? My understanding is that this plan is more of a guiding document that can be used to assist in leveraging funding opportunities and partnerships as they become available rather than a contractual agreement, is this correct?</p>	<p>The Multnomah County Health Department Emergency Preparedness (MCHDEP) program has agreed to add a new action to provide CCHC technical support to identify and employ a structural engineer to conduct hazard assessments of CCHC clinics, as well as provide technical assistance to help CCHC prioritize improvements to CCHC clinics based on assessment findings.</p> <p>The NW Oregon Health Preparedness Organization (NWOHPO) may assist with identification of funding for the structural assessments through Urban Area Security Initiative grants.</p> <p>This action is contingent on approval of future MCHDEP and NWOHPO work plans to support this action.</p> <p>This new action has been added to section 4.2.3 Action Plan</p> <p>This plan is a roadmap that identifies the Planning Area's natural hazard mitigation priorities for the next five years. It is not a contractual agreement.</p>
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3	Tricia Sears	Oregon Department of Land Conservation and Development (DLCD)	1 Introduction	Nicely done. Concise.	Thank you.
4	Tricia Sears	DLCD	2 Community Profile	Voluminous amounts of data and information. My. However, it is presented simply (relatively speaking) with nice formatting and each topic is focused.	Equity — people and places disproportionately burdened by natural hazards — was a priority for this update.
5	Tricia Sears	DLCD	3 Hazard Identification and Risk Assessment	The Introduction is good! In the references section I noticed that the first two documents listed are repeated again a few lines down, only with the Oregon Climate Change Research Institute as the author instead, and the titles are not italicized like the first ones. Italic vs non italic titles appears to be inconsistent. For the individual hazard chapters, I like the first pages that have the “Level of risk” graphic. Overall I do like the format of and info within the chapters. Again, nice maps produced by Mult Co.	Source references and italics have been standardized and updated in this section and throughout the document.

6	Tricia Sears	DLCD	4 Mitigation Strategy	<p>Table 4.2-2 Mitigation Action Prioritization Criteria is striking in visual presentation and the criteria, which includes the term equity rather than social as used in the STAPLEE method. Seems to be a similar intent there. One thing that I noticed in that table was that the low score was “social impacts are likely to be neutral.” So if the impact was negative would the score be zero? That isn’t mentioned. There is no category for environmental. Table 4.2-3 Top Mitigation Actions is also striking in visual presentation. It conveys relevant information effectively.</p>	<p>Equity is a keystone value for Multnomah County. Equity is more comprehensive than STAPLEE²'s social criteria. Equity considers everyone who may be impacted by the mitigation action, with a special focus on individuals with disabilities and other access and functional needs as well as traditionally underserved and underrepresented communities.</p> <p>Only actions that would create (known) positive to neutral social impacts were considered. Actions with a (known) negative social impact would be scored as “0” for equity and were therefore not considered. This clarification has been added as a footnote in section 4.2.3 Action Plan.</p> <p>Environmental impacts are part of the risk analysis in section 3 Hazard Identification and Risk Assessment, and are therefore considered in the prioritization criteria “Risk.” This clarification has been added as a footnote in section 4.2.3 Action Plan .</p>
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² The STAPLEE method is a type of quantitative scoring method that considers seven criteria from which the acronym is created: Social, Technical, Administrative, Political, Legal, Economic, Environmental. The Natural Hazards Mitigation Plan Steering Committee decided to dive more deeply into the social criteria through the lens of equity. The remaining STAPLEE criteria are embedded in this NHMP’s prioritization criteria: benefits, costs, risk, capacity.

7	Tricia Sears	DLCD	5 Planning Process	<p>This is a concise section. More so than I anticipated given the size and length of the MJNHMP preparation process.</p>	<p>The update process for this plan was 30 months. Significant effort was made early in the update process to involve the public and gather information that would inform the plan's goals, objectives and actions.</p> <p>The Natural Hazards Mitigation Plan Steering Committee met six times over that time period to ensure multi-jurisdictional perspectives and priorities were reflected throughout the plan.</p> <p>Multiple other meetings with steering committee members, two workshops, regional coordination and personal communication with other stakeholders, scientists and subject matter experts helped inform this plan update.</p>
8	Tricia Sears	DLCD	Appendix D Multnomah County Building Priorities for Post-Disaster Restoration of Services	Very interesting!	The list of Multnomah County Building Priorities for Post-Disaster Restoration of Services was carried over from the 2012 Multnomah County Natural Hazard Mitigation Plan.
9	Nolan Young	City of Fairview	Appendix C: Local OEM Hazard Analysis Scores	<p>City council has asked that we change our Hazard Analysis Scores in Appendix C: By increasing our Earthquake score and lowering our Volcano Score. We propose to do this by:</p> <p>Earthquake: increase our probability to 10. This gives us a total Risk score of 182.</p> <p>Volcano: Lower both average and maximum Vulnerability to 4. This gives us a risk score of 76.</p>	<p>Changing Earthquake probability to 10 gives a total risk score of 222, the highest of all the risk rankings for the City of Fairview. The risk ranking is now HIGH.</p> <p>The risk score for Volcano has been updated to 76. This lower score changes the risk rank to MODERATE.</p> <p>Hazard Analysis Scores for the City of Fairview have been updated in Appendix C: Local OEM Hazard Identification and Analysis Scores and in all relevant sections of 3 Hazard Identification and Risk Assessment.</p>

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10	Nolan Young	City of Fairview	Appendix G: Implementation Mechanisms	Add Capital Improvement Program and City Council/Commission Work Program as implementation mechanisms employed by the City of Fairview.	Implementation Mechanisms is now Appendix F, and has been updated to include the City of Fairview's Capital Improvement Program and Council/Commission Work Programs on the list of existing mechanisms through which mitigation is implemented.
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