

Annex F: City of Sherwood

1. Introduction

1.1. Planning Process Contact

The point of contact during the Washington County Natural Hazard Mitigation Plan (NHMP) planning process for the City of Sherwood was the Emergency Management Coordinator.

1.2. Annex Organization

This annex has six sections that satisfy mitigation requirements in the Code of Federal Regulations (CFR) Title 44, Part 201 (44 CFR §201):

- **Section 1:** Introduction
- **Section 2:** Planning Process
- **Section 3:** Hazard Identification and Risk Assessment
- **Section 4:** Capability Assessment
- **Section 5:** Mitigation Strategy
- **Section 6:** Action Items

The information provided in this annex is for the City of Sherwood alone. All pertinent information that is not identified in this annex is identified in other sections of this NHMP or within the respective appendices.

1.3. NHMP Adoption Process

Once the Washington County NHMP received the designation “Approvable Pending Local Adoption” from the Federal Emergency Management Agency (FEMA), the City presented the plan to City Council for final public comment and local adoption. A copy of the resolution was inserted into the NHMP and is held on file in the City of Sherwood and Washington County.

2. Planning Process

(In compliance with 44 CFR §201.6(c)(1))

2.1. Development and Adoption Process

To apply for certain types of federal aid, technical assistance, and most post-disaster funding, local jurisdictions and special districts must comply with 44 CFR §201.3, which sets forth the requirement that communities develop a plan outlining their present and proposed efforts to mitigate risks from natural hazards.

City officials recognize the benefits of having a long-term, all-hazards approach to mitigating natural hazards. The passage of the Disaster Mitigation Act of 2000 (DMA 2000) enabled City officials to recognize the benefits of having a long-term, all-hazards approach to hazard mitigation and mitigating natural hazards. The City's involvement in the Washington County NHMP represents the collective efforts of the NHMP Steering Committee members, all participating local Technical Committee members, the public, and stakeholders

The City developed this annex in accordance with guidance outlined in 44 CFR §201.6(c)(5) of DMA 2000. The complete NHMP and this annex identify hazards and mechanisms to minimize damages associated with these hazards as they occur in the geographical area of the City.

2.2. Organizing the Planning Effort

A comprehensive approach was taken in developing this NHMP. An open involvement process was established for the public and all stakeholders, which provided an opportunity for everyone to be involved in the planning process and make their views known.

Two teams worked simultaneously on this mitigation plan:

1. **Hazard Mitigation Steering Committee:** This committee consisted of points of contact from each plan participant. The group met to discuss countywide topics, including hazards and mitigation strategies. The points of contact were the leads of their local Technical Committee.
2. **Local Technical Committee:** Each plan participant had a Technical Committee that consisted of the Steering Committee representative for that jurisdiction or special district as well as designated representatives from within the organization. This team met to assess capabilities, hazards, and mitigation strategies within the planning area.

2.2.1. Technical Committee of the City of Sherwood

This annex within the NHMP was developed by the City of Sherwood's local Technical Committee with support from IEM, a consulting firm hired to assist with the planning process. The efforts of the committee were led by the City's Emergency Management Coordinator throughout 2022.

Table 204: City of Sherwood Technical Committee Members for the 2023 NHMP

Job Title and Department	Role in Committee and Planning Process
Emergency Management Coordinator, Public Works	General oversight, hazard identification, and plan development
Utilities Manager, Public Works	Hazard identification and plan development
Planning Manager, Planning	Hazard identification and plan development
Public Works Technician (GIS), Public Works	Hazard identification and plan development

IEM also supported or led the following activities associated with the development, approval, and adoption of the plan:

1. Facilitated the NHMP update process.
2. Based on committee direction and stakeholder and community input, prepared the first draft of the plan and provided technical writing assistance for plan review, editing, and formatting.

3. Submitted the proposed plan to the State of Oregon Department of Emergency Management (OEM) and FEMA for review and approval, and completed edits or revisions requested by these organizations.
4. Coordinated the plan adoption processes with the City, OEM, and FEMA.

2.3. Public Participation

Public participation is an important component of this NHMP and also a required element as outlined in 44 CFR §201.6(c)(5), FEMA's mitigation planning guidance. Public participation offered community members the opportunity to voice their ideas, interests, and opinions about hazards that affect them and the best way to mitigate hazard impacts. As the City implements the mitigation actions identified in this annex, there will be additional opportunities for public participation.

Plan participants used a survey to collect information about community perceptions of natural hazards and priorities. The Steering and Technical Committees used the results to inform their risk assessments and mitigation strategies. Community members were also provided an opportunity to comment on a draft of the NHMP. See Appendix B in the NHMP for additional information about the survey and opportunities for public comment.

3. Hazard Identification and Risk Assessment

(In compliance with 44 CFR §201.6(c)(2)(i), §201.6(c)(2)(ii), §201.6(c)(2)(ii)(A), §201.6(c)(2)(ii)(B), §201.6(c)(2)(ii)(C), §201.6(c)(2)(iii), and §201.6(c)(3)(ii))

The following information serves to assist the City of Sherwood in determining and prioritizing appropriate mitigation action items to reduce losses from identified hazards.

3.1. Community Profile

This section provides information on City-specific characteristics. Additional discussion of the planning area's community characteristics is outlined in Appendix A of the NHMP.

Some community characteristics may suggest how natural hazards may impact communities and how communities choose to plan for natural hazard mitigation. Identifying and considering the City-specific assets during the planning process may assist in identifying appropriate measures for natural hazard mitigation.

Table 205 below reflects the community demographics and vulnerable populations in the City. This information was gathered from the U.S. Census, Portland State University, and the City of Sherwood.

Table 205: Community Demographics*

Population	Total	Percent Change
2010 population ⁴⁴²	18,194	-
2021 population ⁴⁴³	20,496	+13%
2035 forecasted population ⁴⁴⁴	19,342	-6%
Race and Ethnicity ⁴⁴⁵	Total	Percent of Population
White alone	17,289	88%
Two or more races	1,226	6%
Hispanic/Latino/a/x of any race	979	5%
Asian alone	656	3%
American Indian and Alaska Native alone	86	0.4%
Native Hawaiian and Other Pacific Islander alone	43	0.2%
Black or African American alone	14	0.1%
Language Spoken at Home ⁴⁴⁶	Percent of Population	
English only	90%	
Indo-European languages	4%	
Spanish	3%	
Asian and Pacific Island languages	1%	
Other languages	2%	
Vulnerable Age Groups ⁴⁴⁷	Percent of Population	
Less than 15 years of age	23%	
65 years and older	10%	

⁴⁴² United States Census Bureau. (2010, April 1). QuickFacts: Sherwood City, Oregon. Accessed [September 7, 2022](https://www.census.gov/quickfacts/fact/table/sherwoodcityoregon/PST045221), from <https://www.census.gov/quickfacts/fact/table/sherwoodcityoregon/PST045221>

⁴⁴³ Portland State University Population Research Center. (2022). 2021 Certified Population Estimates, July 1. <https://www.pdx.edu/population-research/population-estimate-reports>

⁴⁴⁴ Oregon Metro. (2013, January 15). 2035 Forecast of Population by City and County. https://www.oregonmetro.gov/sites/default/files/2014/05/29/population_housing_forecasts_by_city_county.pdf

⁴⁴⁵ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Demographic and Housing Estimates, Table DP05. Accessed September 9, 2022, from <https://data.census.gov/cedsci/table?q=sherwood,%20oregon&tid=ACSDP5Y2020.DP05>

⁴⁴⁶ United States Census Bureau. (2021 July 1). 2016–2020 American Community Survey 5-Year Estimates, Language Spoken at Home, Table S1601. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20language&tid=ACSST5Y2020.S16012>

⁴⁴⁷ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Age and Sex, Table S0101. Accessed [September 12, 2022](https://data.census.gov/cedsci/table?q=sherwood%20oregon%20language&tid=ACSST5Y2020.S0101), from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20language&tid=ACSST5Y2020.S0101>

Disability Status of Non-Institutional Civilians ⁴⁴⁸	Percent of Population
Total	9%
Less than 17 years of age	6%
65 years and older	67%

* Due to how respondents identify and answer questions, there may be overlapping responses, and results may equal greater than 100% of the population. Percentages are rounded.

3.1.1. Geography, Topography, and Climate

Sherwood is located in southwest Washington County and has an area of 4.5 square miles.

It is bordered by the Tualatin River National Wildlife Refuge to the north, the Chehalem Mountains on the west, Yamhill County to the south, and the City of Tualatin to the east. The City is bisected by Cedar Creek and is also crossed by Rock Creek on the northeast. Sherwood boasts a historic downtown, miles of walking trails, a new Center for the Arts, and numerous annual community events.

Sherwood has a moderate climate. Mean daily temperatures range from highs around 81 degrees Fahrenheit (°F) in July and August to lows near 34 °F in December and January. Winters are mild, with primarily rain showers and little snow. The average annual rainfall is about 43 inches, compared to the national average of 37 inches. There is an average of 147 days with precipitation annually, with most precipitation between October and April.

3.1.2. Transportation, Infrastructure, and Housing

3.1.2.1. Transportation

Critical transportation routes in Sherwood include Oregon Route 99W, also called Pacific Highway, which is a primarily north-south route connecting Sherwood to Interstate 5 and the surrounding region. SW Tualatin Sherwood Road is a major east-west road that crosses the north part of Sherwood, connecting to the City of Tualatin on the east. SW Edy Road provides additional access to the northwest portion of the City from 99W. Another major east-west route is Sunset Boulevard, which transects the southern portion of the City. SW Sherwood Boulevard, SW Oregon Street, SW Meinecke Road, SW Langer Farms Parkway, SW Pine Street, and SW Main Street provide access to many city facilities, schools, parks, and businesses in the city center. SW Murdoch Road runs north-south along the east end of the City, connecting to SW Baker Road leading to the south, and SW Oregon Street to the north. SW Elwert Road and Old Highway 99 follow the city's western border.

In the City of Sherwood, 77.5% of workers drive a private vehicle alone to work, 11.5% work from home, and 7.7% carpool.⁴⁴⁹ Public transportation, walking, and other methods of transportation are less common. The average commute time is 26 minutes.⁴⁵⁰

The Tri-County Metropolitan Transit District (TriMet) provides commuter rail, light rail, and bus commuter service to several communities in Washington County and bus service throughout the tri-county region.

⁴⁴⁸ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Disability Characteristics, Table S1810. Accessed [September 12, 2022, from https://data.census.gov/cedsci/table?q=sherwood%20oregon%20disability&tid=ACSST5Y2020.S1810](https://data.census.gov/cedsci/table?q=sherwood%20oregon%20disability&tid=ACSST5Y2020.S1810)

⁴⁴⁹ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Commuting Characteristics by Sex, Table S0801. Accessed [September 12, 2022, from https://data.census.gov/cedsci/table?q=sherwood%20oregon%20commute&tid=ACSST5Y2020.S0801](https://data.census.gov/cedsci/table?q=sherwood%20oregon%20commute&tid=ACSST5Y2020.S0801)

⁴⁵⁰ City of Sherwood. (n.d.). Sherwood Demographics. <https://www.sherwoodoregon.gov/planning/page/sherwood-demographics>

Bus service is available within Sherwood and the Westside Express Service Commuter Rail is available in the neighboring City of Tualatin.

3.1.2.2. Infrastructure

The City of Sherwood critical and vulnerable facilities listed below in Table 206 may be vulnerable to one or more natural hazards.

Table 206: Critical Facility and Asset Inventory⁴⁵¹

Name of Infrastructure, Facility, or Resource	Type of Asset	Address
Sherwood City Hall	Infrastructure or Facility	22560 SW Pine Street
Sherwood Public Works	Infrastructure or Facility	15527 SW Willamette Street
Sherwood Police Department	Infrastructure or Facility	20498 SW Borchers Drive
Sherwood Emergency Operations Center	Infrastructure or Facility	20498 SW Borchers Drive
Sherwood Center for the Arts	Infrastructure or Facility	22689 SW Pine Street
Sherwood Senior Community Center	Infrastructure or Facility	21907 SW Sherwood Boulevard
Snyder Reservoir	Infrastructure or Facility	15365 SW Sunset Boulevard

3.1.2.3. Housing

Housing characteristics are an important factor in mitigation planning. The information below shows that most housing units are owner-occupied and consist of one-unit buildings built before 1999. The older the housing, the more at risk it can be to damage from natural hazards such as earthquakes and windstorms, including tornadoes.

Table 207: Housing Characteristics*

Households	Total
Total households ⁴⁵²	6,690
Units in Housing Structure ⁴⁵³	Percent of Housing
One-unit structures	83%
Structures with two or more units	16%
Manufactured homes and all other types	1%

⁴⁵¹ City of Sherwood 2023 NHMP Planning Documentation

⁴⁵² United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Households and Families, Table S1101. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20household&tid=ACSST5Y2020.S1101>.

⁴⁵³ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Households and Families, Table S1101. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20household&tid=ACSST5Y2020.S1101>.

Year Housing Structure Built ⁴⁵⁴	Percent of Housing
Pre-1979	13%
1980–1999	47%
2000 to present	40%
Housing Tenure and Vacancy	Percent of Housing
Owner-occupied ⁴⁵⁵	76%
Renter-occupied ⁴⁵⁶	25%
Vacant ⁴⁵⁷	3%

* Due to how respondents answer questions, there may be overlapping responses, and results may equal greater than 100%. Percentages are rounded.

3.1.3. Economy

Sherwood's largest industries include health care and social assistance, manufacturing, retail trade, and professional, scientific, management, and administrative services. Most of Sherwood's workers commute outside of the city for work. Sherwood's 2040 Comprehensive Plan identified goals to promote local business growth and economic development to balance the City's tax base and provide stable, high-wage jobs to residents.⁴⁵⁸

Table 208: Income Characteristics^{459*}

Households by Income Category	Percent of Households
Less than \$5,000	2%
\$5,000 to \$9,999	0%
\$10,000 to \$14,999	2%
\$15,000 to \$19,999	2%
\$20,000 to \$24,999	2%
\$25,000 to \$34,999	5%

⁴⁵⁴ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Physical Housing Characteristics for Occupied Housing Units, Table S2504. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20s2504&tid=ACSST5Y2020.S2504>

⁴⁵⁵ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Households and Families, Table S1101. Accessed September 12, 2022, from https://data.census.gov/cedsci/table?q=hillsboro_oregon_housing&tid=ACSST5Y2020.S1101 from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20household&tid=ACSST5Y2020.S1101>

⁴⁵⁶ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Households and Families, Table S1101. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20household&tid=ACSST5Y2020.S1101>

⁴⁵⁷ United States Census Bureau. (2021, July 1). 2020 Decennial Census, Occupancy Status, Table H1. Accessed September 12, 2022, from <https://data.census.gov/cedsci/table?q=sherwood%20oregon%20occupancy&tid=DECENNIALPL2020.H1>

⁴⁵⁸ City of Sherwood. (2022, September 7). Sherwood 2040 Comprehensive Plan Update. [Sherwood 2040 Comprehensive Plan Update | City of Sherwood Oregon](#)

⁴⁵⁹ United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Financial Characteristics, Table S2503. Accessed September 7, 2022, from <https://data.census.gov/cedsci/table?q=sherwood,%20oregon&t=Income%20%28Households,%20Families,%20Individuals%29%3AIncome%20and%20Earnings&tid=ACSST5Y2020.S2503>

Households by Income Category	Percent of Households
\$35,000 to \$49,999	7%
\$50,000 to \$74,999	15%
\$75,000 to \$99,999	13%
\$100,000 to \$149,999	26%
\$150,000 or more	28%
Median Household Income	
\$107,537	

* Due to how respondents answer questions there may be overlapping responses and results may equal greater than 100%. Percentages are rounded.

3.2. Natural Hazard Profiles

The City of Sherwood's Technical Committee utilized the OEM's hazard analysis methodology to examine hazard vulnerability and probability by collecting information about history, probability, vulnerability, and maximum threat for each hazard that impacts the City. This methodology does not compare hazards to each other or rank hazards against each other. Instead, this process provides a sense of hazard priorities or relative risk and allows comparison of the same hazard across participants.

Each of the hazards examined by this analysis was scored using a formula that incorporates the four rating criteria, a weight factor, and three levels of severity: low, medium, and high. The score range for this methodology is 24 (lowest possible) to 240 (highest possible). For additional detail about the OEM risk and hazard analysis methodology, see Volume I, Section 2.

All natural hazards included in the NHMP have the potential to impact the City. The scores for each hazard that impacts the City are presented below.

Table 209: Natural Hazard Risk Scores

Natural Hazard	History	Vulnerability	Maximum Threat	Probability	Score
Dam failure	Low	Medium	Medium	Low	74
Drought	Low	High	High	Medium	175
Earthquake: Cascadia (3–5-minute event)	Low	High	High	Medium	186
Earthquake: Crustal (1-minute event)	Low	Medium	Medium	Medium	158
Extreme heat	Medium	Medium	High	Medium	162
Flooding, including channel migration and streambed erosion	Medium	Low	Medium	Low	79
Landslide	Low	Low	Low	Low	61
Volcanic ash	Low	Medium	High	Low	119
Wildland fire	Medium	Medium	Medium	Medium	142
Windstorm, including tornado	Medium	Medium	High	Medium	178
Winter storm	High	High	High	High	208

Full descriptions of each hazard are provided in Volume I, Section 2. The potential effects of climate change on the magnitude and frequency of natural hazard events are described in each hazard description in this annex and in Volume I, Section 2.

The timeframe of data collected during the planning process for the City of Sherwood was from as far back as available to February 22, 2022. Hazard events that occurred during this period and were deemed significant by the City's Technical Committee are included in this annex's hazard profiles.

The following hazard profiles are in alphabetical order and include a brief hazard description, significant events since adoption of the 2017 NHMP, if applicable, and potential impacts and vulnerabilities. The potential impacts for each hazard are presented in the same order, as applicable: populations,

economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments.

3.2.1. Dam Failure

Due to geographic location and topography, the City cannot be directly impacted by dam failure. There are no high or significant hazard dams in proximity to the City of Sherwood. Scoggins Dam is the closest at approximately 30 miles away. Any impacts in the City due to dam failure are identified as secondary and minimal. Potential impacts of and vulnerabilities to dam failure are identified below. It is anticipated that flooding caused by a dam failure event would have similar impacts and create similar vulnerabilities as routine flooding.

3.2.1.1. Potential Impacts and Vulnerabilities

The potential impacts of and vulnerabilities to a dam failure event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event; however, all impacts and vulnerabilities are considered minimal to negligible.

- Oregon Route 99W, the City's main thoroughfare, could potentially flood and receive damage. Disruption of 99W could have significant economic impacts on the City.
- Cedar Creek and Rock Creek run through the City and may be affected by rising water levels. Agricultural land, property, and the natural environment could be vulnerable to rising waters along these creeks.

3.2.2. Drought

Drought typically occurs as a regional event and often affects more than one city and county simultaneously. Potential impacts of and vulnerabilities to drought are identified below.

3.2.2.1. Potential Impacts

The potential impacts of a drought event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Reduction or loss of water supply.
- Water use restrictions and lack of drinkable water supply.
- Health effects including increased heat-related, waterborne, and cardiorespiratory illnesses, as well as mental health conditions.
- Reduced economic productivity or business closures in such industries as agriculture, livestock, recreation, energy, tourism, timber, and fisheries.
- Supply chain restrictions, including food shortages.
- Loss of power or reduced availability of electricity due to infrastructure damage and high demand.
- Property and infrastructure damage due to expansive soils.
- Damage to natural environments, including low water levels in lakes, rivers, and other water bodies, reduced plant growth, local species reduction or extinction, increased water temperature, and deteriorated water quality, which may result in fish kills and increased waterborne pollutants.
- Concurrent hazards, including extreme heat, wildfire, flooding, and landslides.

3.2.2.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to drought. Specific vulnerabilities include:

- People in the City with preexisting health conditions, those without access to clean water, children, pregnant women, and older adults. This may include those spending time at the Sherwood Senior Community Center.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Other critical infrastructure, including the Snyder Reservoir and electric generating systems.
 - The City has three storage reservoirs totaling 31 million gallons of treated water storage capacity.
- The City's primary source for water comes from the Willamette River Water Treatment Plant.
- Two backup sources of water include local ground water wells and the Bull Run Watershed northwest of Portland.
- Natural environments, such as groundwater tables and parks.

3.2.3. Earthquake

The City could experience earthquakes that originate from the Cascadia subduction zone, Portland Hills fault zone, and Gales Creek fault zone. It may also experience liquefaction and coseismic landslides as the result of an earthquake. Potential impacts of and vulnerabilities to earthquake are identified below.

3.2.3.1. Potential Impacts

The potential impacts of an earthquake event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Mental health impacts, including post-traumatic stress disorder.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Collapsed buildings.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Blocked or impassible roads and rail transportation routes due to debris from trees and damaged property, ground deformation, and liquefaction.
- Downed or damaged power lines can lead to wildfires.
- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Change in water flows, including paths of rivers and streams.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including flood, wildland fire, and landslide.

3.2.3.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to earthquakes. These include:

- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Other critical infrastructure, including communication structures, in-ground water and power lines, and emergency generators.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Areas near the epicenter of an earthquake event are likely to incur a significant amount of damage to all buildings, infrastructure, facilities, and property.
 - 26% of buildings in Sherwood are designated as pre-code or low-code seismic design level and could be more prone to damage from a 6.7 magnitude Gales Creek fault earthquake event.⁴⁶⁰ Many public properties have not undergone seismic updates been seismically updated. Private structures also may not have undergone seismic updates.
 - Using 2022 Hazus®-MH information, it is estimated that a 6.7 magnitude Gales Creek fault earthquake event would result in 11 yellow-tagged buildings, one red-tagged building, and \$15,740,000 in total economic losses due to building damage.⁴⁶¹
- A 2018 Oregon Department of Geology and Mineral Industries (DOGAMI) report shows the following:
 - A Cascadia subduction zone magnitude 9.0 earthquake in “dry” soil conditions could result in \$140,000,000 in building repair costs, 87,000 tons of debris, 27 long-term displaced residents, and up to 144 deaths;
 - A Cascadia subduction zone magnitude 9.0 earthquake in “wet” soil conditions could result in \$217,000,000 in building repair costs, 113,000 tons of debris, 534 long-term displaced residents, and up to 263 deaths;
 - A Portland Hills fault magnitude 6.8 earthquake in “dry” soil conditions could result in \$148,000,000 in building repair costs, 80,000 tons of debris, 34 long-term displaced residents, and up to 114 deaths; and
 - A Portland Hills fault magnitude 6.8 earthquake in “wet” soil conditions could result in \$295,000,000 in building repair costs, 130 thousand tons of debris, 963 long-term displaced residents, and up to 341 deaths.⁴⁶²
- Commerce could be disrupted for an extended period, particularly by transportation infrastructure damage.
- Natural environments throughout the City.

⁴⁶⁰ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

⁴⁶¹ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

⁴⁶² Bauer, J.M., Burns, W.J., & Madin, I.P. (2018). Open-File Report 0-18-02: Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon. Oregon Department of Geology and Mineral Industries. [DOGAMI Open-File Report O-18-02, Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon \(oregongeology.org\)](https://www.oregongeology.org/pubs/ofr/O-18-02/Earthquake%20Regional%20Impact%20Analysis%20for%20Clackamas,%20Multnomah,%20and%20Washington%20Counties,%20Oregon)

3.2.4. Extreme Heat

Due to a rise in the frequency and severity of extreme heat events and the impacts of those events, extreme heat events, the NHMP Steering Committee chose to include this hazard for the first time in the Washington County NHMP. Previous significant events and the potential impacts of and vulnerabilities to extreme heat are identified below.

3.2.4.1. Significant Events

Extreme heat was not included in previous NHMPs. Although data on specific impacts to the City of Sherwood is not included, significant events have occurred in the region that provide insight into the impacts of extreme heat.

- **June 26–29, 2021:** A high-pressure heat dome over the region led to a stretch of extreme heat. Maximum temperature records were broken by 8 to 10 degrees. Throughout Washington County there were numerous fatalities, closures and postponements of businesses and events, and buckled roads, and cooling shelters were opened.⁴⁶³
- **August 11–12, 2021:** Peak afternoon temperatures of 100 °F to 105 °F drove people to seek relief in bodies of water. Heat caused slowdowns of MAX light rail (Portland Metro area) systems and some business closures. Cooling shelters were opened in several counties.⁴⁶⁴

3.2.4.2. Potential Impacts

The potential impacts of an extreme heat event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Heat illnesses, including heat rashes, heat cramps, heat exhaustion, and heat stroke, and death.
- Extended operational hours of City staff and resources needed for response to the event, including the operation of daytime cooling centers and overnight cooling shelters.
- Strain on or loss of water supply due to increased demand.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Supply chain and personal economic impacts, such as increased cost of food, goods, and services, including energy.
- Economic losses from less overall worker efficiency and effectiveness, and time lost on the job when people need to take more frequent or longer breaks to avoid overheating.
- Short-term duration economic impacts of closure of outdoor activities and events, such as farmers markets and concerts.
- Property damage, such as roof expansion, leading to warped, cracked, and leaking shingles; dry, cracked, and leaking caulking around flashing and joints; cracked foundations; excessive drying of wood structures; and melted siding.
- Disruption of essential infrastructure systems from overheated and damaged utilities, including power, water, transportation, and communication systems.

⁴⁶³ National Centers for Environmental Information (NCEI) Database: Excessive heat 1/1/1950 to 12/31/2021 Greater Portland Metro Area and Coast Range of NW Oregon Zones, Hazard History for Washington County

⁴⁶⁴ National Centers for Environmental Information (NCEI) Database: Excessive heat 1/1/1950 to 12/31/2021 Greater Portland Metro Area and Coast Range of NW Oregon Zones, Hazard History for Washington County

- Impacts to roadways as heat expands concrete or causes cracking and buckling. Public transit can also be impacted due to melted cables, sagging wires, and warping tracks.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Impacts to greenspaces, such as scorch and sunscald of new foliage, branches or tops of trees dying due to cavitation, and significant stress and die-off of native trees, particularly Douglas firs and cedars. These impacts are intensified if drought is also occurring.
- Concurrent hazards, including drought and wildland fire.

3.2.4.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to extreme heat.

Populations substantially vulnerable to extreme heat include:

- People who work or spend a significant amount of time outdoors, including those in construction, landscaping, maintenance and repair, roofing, and solid waste collection.
- Populations with higher heat sensitivity, including older adults, infants and children, pregnant women, people with preexisting or chronic diseases, and those who take certain medications that affect thermoregulation or block nerve impulses. This may include those spending time at the Sherwood Senior Community Center.
- People with limited mobility and no access to cooling systems who may not be able to travel to cooling centers or shelters.
- People who live in social isolation, including linguistic isolation or those living alone with few social relationships.
- People with mental health conditions. Extreme heat can be associated with higher levels of aggression, violence, and suicidal behavior.
- Factors including race and ethnicity, income, and educational attainment are correlated with heat-related illness.

Additional vulnerabilities to extreme heat include:

- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Other critical infrastructure, including communication structures and emergency generators.
- Bridge infrastructure is vulnerable to thermal expansion of bridge joints and paved surfaces and deterioration of steel, asphalt, protective cladding, coats, and sealants.
- Asphalt pavement is vulnerable to accelerated deterioration through softening, rutting, and migration of liquid asphalt.
- Equipment at the City's police department and public works facilities. Vehicles, including first responder vehicles, are vulnerable to engine overheating and tire deterioration.
- Aboveground utility and power lines can droop or sag and create a heightened fire risk.
- Plants, animals, ecosystems, and natural environments, such as those in the City's parks, are vulnerable to high rates of mortality due to excessive heat.

3.2.5. Flooding, Including Channel Migration and Streambed Erosion

The City experiences localized flooding typically from October through April; however, historically, it has not been significant or severe. Potential impacts of and vulnerabilities to flooding are identified below. It is anticipated that flooding caused by a dam failure event would have similar impacts and create similar vulnerabilities as routine flooding.

3.2.5.1. Potential Impacts

The potential impacts of a flooding event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Public health concerns, such as the spread of infectious diseases, exposure to chemicals, hazardous materials, and debris, and water quality issues.
- Need for widespread search and rescue operations, including high-water rescues.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to high water, debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Mobility or access issues for residents due to surrounding water.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Disruption of traffic due to flooded, damaged, or destroyed transportation systems.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, and parks.

3.2.5.2. Vulnerabilities

Population, economic, built environment, critical facility, infrastructure, and natural environment vulnerabilities to a flooding event include the following:

- Populations without access to private transportation.
- While the 100-year floodplains in the City largely overlap existing wetlands and creek beds, some individually developed lots lie within the floodplain.⁴⁶⁵ All structures within the floodplain are subject to damage, and others may be subject to damage from localized flooding.
- Properties without flood insurance.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Portions of the City outside of the mapped floodplains are subject to flooding from local storms.
- Oregon Route 99W, the City's main thoroughfare, could flood and incur damage. Disruption of 99W could have significant economic impacts on the City.
- Cedar Creek and Rock Creek run through the City and may be affected by rising water levels. Agricultural land, property, and the natural environment could be vulnerable to rising waters along these creeks.
- Flood loss estimates determined by Hazus-MH include⁴⁶⁶:
 - 10-year flood scenario
 - ◆ Number of buildings lost: 1
 - ◆ Loss estimate: \$10,000
 - 50-year flood scenario
 - ◆ Number of buildings lost: 1
 - ◆ Loss estimate: \$20,000
 - 100-year flood scenario
 - ◆ Number of buildings lost: 1
 - ◆ Loss estimate: \$30,000
 - 500-year flood scenario
 - ◆ Number of buildings lost: 1
 - ◆ Loss estimate: \$50,000
- Natural environments throughout the City.

⁴⁶⁵ City of Sherwood. (2016, October 18). Ordinance 2016-015: Amending Chapter 7 of Volume II of the Sherwood Comprehensive Plan and Adopting the Sherwood Stormwater Master Plan. https://www.sherwoodoregon.gov/sites/default/files/fileattachments/Engineering/page/504/ordinance_2016-015_amend_chap_7_stormwater_masterplan_10.18.16.pdf

⁴⁶⁶ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

Table 210: Land Use Type in the 100-Year Floodplain in the City of Sherwood

Land Use Type	Total Parcels in 100-Year Floodplain	Total Value of Exposed Parcels	Total Area in Jurisdiction (Acres)	Total Area in the 100-Year Floodplain (Acres)	Percentage of Area in the 100-Year Floodplain
Agriculture	0	\$0	17.02	0	0%
Commercial	6	\$23,463,330	492.79	64.51	13.0%
Forest	4	\$6,728,730	66.73	40.33	60.0%
Industrial	0	\$0	33.21	0	0%
Multi-Family Residential	13	\$2,152,480	46.36	0.13	0.03%
Public	45	\$10,023,880	594.94	165.34	28.0%
Single-Family Residential	13	\$15,717,100	995.8	44.86	0.5%
Vacant	2	\$422,100	74.7	1.74	0.2%
Other	4	\$818,830	260.74	45.11	17.3%
Total	87	\$59,326,450	2,582.29	362.02	0.14%

Table 211: Buildings in Sherwood within FEMA-Mapped Floodplains

Building Classification	Buildings within Sherwood	Buildings within 100-Year Floodplain	Buildings within 500-Year Floodplain	Buildings within Combined 500-Year & 100-Year Floodplain
Total Buildings	6,174	2	0	2
Percentage of Buildings within Sherwood	100%	0.03%	0%	0.03%

3.2.6. Landslide

The possibility of landslides occurring in the City is low, and any impacts in the City due to landslides are considered minimal. Potential impacts of and vulnerabilities to landslides are identified below.

3.2.6.1. Potential Impacts and Vulnerabilities

The potential impacts of and vulnerabilities to a landslide event are identified below. The type, magnitude, and extent of these can vary based on the scale of the event.

- The potential for landslide impacts in the City is minimal, with the possible exception of very small areas immediately adjacent to creek channels such as Rock Creek or Cedar Creek.
- Oregon Route 99W, the City's main thoroughfare, could receive damage from a landslide event. Disruption of 99W could have significant economic impacts on the City and cause traffic disruptions.
- Per DOGAMI,⁴⁶⁷ there are 83 buildings with high susceptibility and 1,972 buildings with moderate susceptibility to landslide exposure. This does not indicate that these properties will be impacted by a landslide event, but rather that they are exposed to the potential of a landslide occurring.
- Landslide hazard is ubiquitous in a large percentage of undeveloped land and may present challenges for future planning and mitigation efforts. Awareness of nearby areas of landslide hazard is beneficial for reducing risk for every community in Washington County.

⁴⁶⁷ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

3.2.7. Volcanic Ash

Volcanic activity is possible from mountains near Washington County. It is anticipated that ashfall from a volcanic eruption has the potential to impact the City, although the scale and types of impacts and vulnerabilities may differ depending on which volcano erupts, the level of eruption, and the wind direction during and after eruption. Potential impacts of and vulnerabilities to volcanic ash are identified below.

3.2.7.1. Potential Impacts

Though unlikely, the impacts of a significant ashfall event could be substantial. Impacts may include:

- Indirect injuries and deaths, such as those sustained during ash cleanup operations or in traffic accidents.
- Short-term health effects, including respiratory effects.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of City staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, drainage systems, telecommunications, and transportation routes.
- Blocked roads and rail transportation routes due to debris.
- Downed or damaged power lines can lead to wildfires.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.7.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to volcanic ash. These include:

- People in the City with chronic lung problems and other preexisting health conditions, children, pregnant women, and older adults. This may include those spending time at the Sherwood Senior Community Center.

- People without access to effective dust masks, eye protection, and drinking water and food uncontaminated by ash.
- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of volcanic ash, including manufactured homes and buildings and the people who live or work in them.
- Equipment at the City's police department and public works facilities.
- Other critical infrastructure, including communication structures, drainage systems, and emergency generators.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Potential for damage to heating, ventilation, and air-conditioning (HVAC) systems in public and private buildings and emergency generators.
- Business closures due to unsafe air conditions.
- Natural environments throughout the City.

3.2.8. Wildland Fire

Although the City could experience a wildland–urban interface event, historically it is more likely for the City to be affected by smoke and poor air quality due to wildland fires outside its boundaries. Potential impacts of and vulnerabilities to wildland fire and previous significant events are identified below.

3.2.8.1. Significant Events

The City has not been directly impacted by a wildland fire event. However, in September 2020, multiple wildfires occurred concurrently in Washington County, outside Washington County, and outside the state, and the City experienced significant smoke from the fires, resulting in unsafe air quality.

3.2.8.2. Potential Impacts

The potential impacts of a wildfire event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Exposure to wildfire smoke, which can lead to eye, nose, and throat irritation and the worsening of chronic heart and lung diseases.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of City staff and resources needed for response to the event.
- Strain on or loss of water supply due to increased demand.
- Economic impacts to governments, including costs for fire suppression, staff, equipment, supplies, transportation and mobilization of first responders, evacuations, sheltering operations, post-fire recovery, and rebuilding costs associated with government-owned buildings, property, and infrastructure.
- Economic impacts, including loss of local revenue due to business and property tax losses, agriculture production losses, and reduced recreation and tourism activity.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked roads and rail transportation routes.
- Downed or damaged power lines can lead to additional wildfires.

- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including flood, landslide and erosion, and air and water quality issues.

3.2.8.3. Vulnerabilities

Given the dynamic nature of wildland fires, all populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to this hazard. These include:

- People in the City with chronic lung problems and other preexisting health conditions, children, pregnant women, and older adults. This may include those spending time at the Sherwood Senior Community Center.
- Populations without access to private transportation.
- First responders and other personnel working directly on fire protection, suppression, and patrols or near a wildfire can experience burns, smoke exposure, heat-related impacts such as heat stroke, heat exhaustion, dehydration, physical fatigue, mental health challenges, injuries, and death.
- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Homes, businesses, and infrastructure, such as power lines and storm sewers, adjacent to the wooded areas near the creeks throughout the City.
- Potential for damage to HVAC systems in public and private buildings and emergency generators.
- Business closures due to unsafe air conditions.
- A community risk profile completed by DOGAMI shows 39 residents could be displaced due to a wildland fire event. The profile also indicates there are 12 buildings with a total value of \$3,241,000 at high risk of wildland fire exposure, 3 buildings with a total value of \$1,789,000 at moderate risk of wildland fire exposure, and 327 buildings with a total value of \$123,245,000 at low risk of wildland fire exposure.⁴⁶⁸
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Natural environments throughout the City.

⁴⁶⁸ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

3.2.9. Windstorm, Including Tornado

The City has an elevation of 193 feet and historically has not experienced the same frequency of windstorms as those parts of the County at higher elevations. Potential impacts of and vulnerabilities to windstorms and a previous significant event are identified below.

3.2.9.1. Significant Event

The City identified one significant windstorm event in 1996 that caused scattered damage throughout the area.

3.2.9.2. Potential Impacts

The potential impacts of a windstorm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of City staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems. Significant damage could lead to the complete loss of structures or totaled vehicles.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked roads and rail transportation routes.
- Downed or damaged power lines can lead to wildfires.
- Power outages.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.9.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to windstorms, including tornadoes. These include:

- Older buildings and infrastructure not built to withstand high winds, including manufactured homes and buildings.
- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Equipment at the City's police department and public works facilities.
- Aboveground utility and power lines.
- Natural environments throughout the City.

3.2.10. Winter Storm

Winter storm was scored as the highest hazard risk to the City. Potential impacts of and vulnerabilities to winter storms are identified below.

3.2.10.1. Potential Impacts

The potential impacts of a winter storm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths, including from carbon monoxide poisoning and falls from slick or icy conditions.
- Frostbite or hypothermia.
- Delayed emergency response times due to debris, blocked transportation routes, damaged infrastructure and vehicles, and difficulty using fire hydrants because of frozen or damaged water system components.
- Extended operational hours of City staff and resources needed for response to the event.
- Stranded travelers due to ice, snow, and transportation impacts.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- An increased number of house fires due to improper use of heating methods.
- Significant property damage due to thawing of frozen pipes.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked roads and rail transportation routes.
- Downed or damaged power lines can lead to wildfires, and tree debris can create fuel load for wildfire.
- Power outages.
- Frozen, damaged, or thawing pipes leading to loss of water.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including drought, wildfire, and flooding.

3.2.10.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments in the City are vulnerable to winter storms. These include:

- People who do not have access to sufficient heating, insulated clothing, or dry living conditions, including unhoused populations.
- Older adults and infants, people who take certain medications, people who have certain medical conditions, and people who have been drinking alcohol are at increased risk for hypothermia. This may include those spending time at the Sherwood Senior Community Center.
- People improperly using generators and heating devices.
- Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of snow and ice.
- Possible business closures due to staffing limitations, particularly if transportation routes are disrupted.
- Slick driving conditions can cause traffic accidents and associated increases in emergency response needs.
- All streets within the City are vulnerable to impacts of a winter storm, including snow and ice accumulation and slick driving conditions.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
- Critical infrastructure, including aboveground power lines and electric generating systems.
- Natural environments throughout the City.
- Tree located throughout the City may be damaged by accumulation of snow and ice.

3.3. Historical Events

Hazard events that have affected the entire planning area since adoption of the 2017 NHMP are detailed in Volume I, Section 2. The City has experienced limited impacts of widespread extreme heat, wildfire smoke, windstorms, and winter storm events.

One disaster declaration has been issued by the City. A disaster declaration for the COVID-19 pandemic was in effect from March 12, 2020, to March 26, 2020. Although pandemic is not a hazard included in this NHMP, this declaration is noted because many businesses were closed and many services were closed or altered, and FEMA provided support and Hazard Mitigation Grant Program (HMGP) funding during the event.

3.4. Overall Vulnerability

Based on the analysis completed by the Technical Committee, winter storms, earthquakes, windstorms, including tornado, drought, and extreme heat present the highest relative risk to the City of Sherwood. These hazards can create widespread events, and all populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City can be vulnerable to these hazards.

Areas of greatest vulnerability to these hazards within the City include:

- Populations with higher vulnerability, such as those with preexisting health conditions, older adults, children, and pregnant women. This may include those spending time at the Sherwood Senior Community Center.
- Populations that are unhoused, do not have access to private transportation, and/or are without access to air conditioning, cooling equipment, sufficient heating, and clean water.
- Populations with limited income and financial resources.
- Populations whose primary language is not English.
- Industries that can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Economic impacts to the City, including loss of local revenue due to business and property tax losses, reduced future revenues, reduced recreation and tourism activity, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Critical infrastructure and facilities, including city hall, the public works facility, the police department, the emergency operations center, the Sherwood Center for the Arts, the Sherwood Senior Community Center, and the Snyder Reservoir.
 - Older buildings and infrastructure not built to current building codes or seismic standards may be more vulnerable.
- Critical transportation routes and infrastructure, including Oregon Route 99W, SW Tualatin Sherwood Road, Sunset Boulevard, arterial roads and streets, and TriMet bus service.
- Equipment at the City's police department and public works facilities.
- Other critical infrastructure, including communication structures, emergency generators, and aboveground utility and power lines.
- Areas near the epicenter of an earthquake event are likely to incur a significant amount of damage to all buildings, infrastructure, facilities, and property.

- There are facilities that store hazardous materials within the City, which can become a secondary hazard during or after an earthquake.
- The City's primary source for water comes from the Willamette River Water Treatment Plant, the City's primary source of water. Two backup sources of water include local groundwater wells and the Bull Run Watershed northwest of Portland. This water source could be vulnerable to hazard events.
- Natural environments, such as those in the City's parks system.

4. Capability Assessment

(In compliance with 44 CFR §201.6(c)(3))

The following capability assessment and safe growth analysis examine the ability of the City to implement and manage a comprehensive mitigation strategy. Strengths, opportunities, and resources of the jurisdiction are identified to develop an effective hazard mitigation action plan. The capabilities identified in this assessment were evaluated collectively to develop feasible recommendations, which support the implementation of effective mitigation activities.

A capability questionnaire was distributed to the City of Sherwood Technical Committee to initiate this assessment. The survey included questions regarding existing plans, policies, and regulations that contribute to or hinder the ability to implement hazard mitigation activities, including legal and regulatory capabilities, administrative and technical capabilities, education and outreach capabilities, and fiscal capabilities. The Technical Committee also completed a safe growth analysis to identify potential gaps in growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

4.1. Planning and Regulatory Assessment

Planning and regulatory capabilities include plans, policies, codes, and ordinances within the City that can prevent and reduce the impacts of hazards.

The City's Comprehensive Plan, capital improvement plan, local emergency operations plan, continuity of operations plan, and stormwater management plan address natural hazards, identify projects that can be included in the mitigation strategy, and can be used to implement mitigation actions. Many of the goals and policies in the City's Comprehensive Plan are related to those in this NHMP and safe growth objectives. The monitoring and implementation section of the NHMP covers these and all other hazard mitigation strategies discussed in the plan. Safety is explicitly included in the City's growth and development policies in the Comprehensive Plan.

The Sherwood Transportation System Plan acknowledges the need to identify hydrological, topographical, and other geological constraints that could hinder alignment of planned streets, but it does not identify projects that can be included in the mitigation strategy and cannot currently be used to implement mitigation actions. The Sherwood Transportation System Plan limits access to identified hazard areas and is used to guide growth into safe locations. The City and the plan identify movement systems designed to function under disaster conditions, such as during an evacuation. The City's corridor plans recognize the need to avoid or mitigate natural hazards. The Regional Disaster Preparedness Organization and Metro are working to create Emergency Transportation Route maps, and the City is a part of this effort.

Land use planning and ordinances are adequately administered and enforced and are an effective measure for reducing hazard impacts. These include zoning, subdivision, and floodplain ordinances and

the utilization of flood insurance rate maps. City ordinances also address erosion prevention and sediment control, energy conservation, and fire prevention. The City has a future land use map that clearly identifies natural hazard areas. Additionally, land use policies discourage development or redevelopment within natural hazard areas, and the City's Comprehensive Plan provides adequate space for expected future growth in areas located outside natural hazard areas.

The City has environmental systems that prevent development in natural hazard areas or zones that have been identified and mapped and has policies that maintain and restore protective ecosystems, including land use policies and an Environmental Sustainability Plan. The City has policies that provide incentives to development outside protective ecosystems.

The City's Community Development Division includes the Planning, Engineering, and Building Departments and leads and facilitates review of land use applications and enforces site plan review requirements. The City of Sherwood utilizes the most current building codes as they are adopted by the State of Oregon.⁴⁶⁹ Tualatin Valley Fire & Rescue Station 33 has an Insurance Services Office (ISO) rating of 2 as of February 1, 2018.⁴⁷⁰

The City's building code contains provisions to strengthen or elevate construction to withstand hazard forces, and economic development or redevelopment strategies include provisions for mitigating natural hazards. The City has zoning ordinances that conform to the Comprehensive Plan in terms of discouraging development or redevelopment within natural hazard areas, including prohibiting development within, or filling of, wetlands, floodways, and floodplains. The ordinance also contains natural hazard overlay zones that set conditions for land use within such hazard zones. Rezoning procedures recognize natural hazard areas as off limits to any zoning changes that would allow for increased activity or development in the area. The City has subdivision regulations that restrict the subdivision of land within or adjacent to natural hazard areas, provide for conservation subdivisions or cluster subdivisions to conserve environmental resources, and allow density transfer where hazard areas exist. The City's infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.

4.1.1. National Flood Insurance Program Compliance

Participation in the National Flood Insurance Program (NFIP) is based on a voluntary agreement between a community and FEMA. For communities that adopt a floodplain management ordinance to reduce flood risks to new construction, federally backed flood insurance is made available to property owners in the community. Compliance with the NFIP, however, extends beyond participation in the program. The three basic components of the NFIP include floodplain identification and mapping risk, responsible floodplain management, and flood insurance.

A repetitive loss (RL) property is a property insured under the NFIP for which the program has paid at least two claims of more than \$1,000 in any 10-year period since 1978, regardless of any change(s) of ownership during that period. As of September 30, 2021, there were no FEMA-identified RL properties in the City.

4.1.1.1. National Flood Insurance Program Details

Insurance Summary

The number of NFIP policies, dollar amount of coverage in force, dollar amount of premiums paid annually, and number and dollar amount of claims paid in the City was not available at the time this NHMP was published. Identifying this information is an improvement for the next planning cycle.

⁴⁶⁹ City of Sherwood. (n.d.). Code Administration and Resources.

<https://www.sherwoodoregon.gov/building/page/code-administration-and-resources>

⁴⁷⁰ Tualatin Valley Fire & Rescue. (n.d.). Fire Protection Rating. <https://www.tvfr.com/344/Fire-Protection-Rating>

There is one building exposed to flood risk within the community.⁴⁷¹

Staff Resources

There are no barriers to running an effective NFIP program in the City. The City Engineer is the designated local Floodplain Administrator. This position is full-time and located in the Engineering Department. NFIP administration services in the City include permit review for new development, review of capital projects affecting the floodplain, and enforcement of the City's Code of Ordinances related to floodplains.

Compliance History

The City is in good standing with the NFIP, and there are no outstanding compliance issues. The most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC) was conducted by the State NFIP Coordinator on May 19, 2022, and involved the City Engineer, Civil Engineer, and Planning Manager for the City of Sherwood.

The City will continue NFIP compliance during the next five years of the Natural Hazards Mitigation Plan (NHMP) implementation by enforcing floodplain management requirements, including prohibiting of new construction and substantial improvements within the Special Flood Hazard Area (SFHA), maintaining and using floodplain mapping, and undertaking any code amendments needed to maintain compliance.

Regulation

The City entered into the NFIP on August 13, 1976, and has both digital and paper flood insurance rate maps (FIRMs). The initial FIRM was identified on January 6, 1982, and the current effective map date is October 19, 2018. Floodplain development regulations meet the minimum FEMA and state requirements. Permitting and review codes, policies, and regulations regarding development in the floodplain are detailed in the City's Code of Ordinances, Chapter 16.134. These rules ensure that floodway flow or floodplain capacity are not impeded and that floodplains in the City are preserved, protected, and effectively managed.^[2]

Community Rating System

The City does not participate in the Community Rating System.

4.2. Administrative and Technical Assessment

This portion of the assessment includes staff and their skills and tools that can be used for mitigation planning and implementing specific mitigation actions.

The City's Planning Commission is responsible for assisting the City Council to develop, maintain, update, and implement the City's Comprehensive Plan and development code provisions and to review and take action on development projects. The Community Development Department maintains compliance with Oregon's Statewide Planning Goals, provides support to the Planning Commission, and reviews projects for compliance with the City's codes and plans. The Mitigation Technical Committee works together effectively to update and maintain the NHMP.

The City's Parks and Recreation Department administers maintenance programs to reduce risk, including tree trimming, clearing drainage systems, and landscape maintenance of open spaces and rights of way.

⁴⁷¹ Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. <https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm>

^[2] City of Sherwood Code of Ordinances. (n.d.). Chapter 16.134-Floodplain (FP) Overlay. https://library.municode.com/or/sherwood/codes/code_of_ordinances?nodeId=TIT16ZOCODECO_DIVVIIIENRE_CH16.134FLFPOV_16.134.080FLDE

The City also has multiple effective mutual aid agreements and planning partnerships, including intergovernmental agreements and partnerships with the Oregon Water/Wastewater Agency Response Network, Washington County Emergency Management Cooperative, Regional Disaster Preparedness Organization, and Cooperative Public Agencies of Washington County.

The City of Sherwood has adequate staffing levels to enforce regulations, staff are trained on hazards and mitigation efforts, and coordination on mitigation initiatives with staff is effective. The Chief Building Official is part of the Community Development Department and is a full-time position. The Community Development Department also has several full-time positions, including planners. The City Engineer is the designated local Floodplain Administrator. This position is full-time and is located in the Engineering Department. The Emergency Management Office is located within the Public Works Department.

Multiple City departments have staff who can support the mitigation strategy, including planners and engineers with an understanding of natural hazards, engineers and professionals trained in construction practices related to buildings and infrastructure, staff with education or expertise to assess vulnerability to hazards, and geographic information system (GIS) staff and coordinators. The City utilizes a private company to execute surveying duties.

Additionally, the City has many technical capabilities that have been used to assess or mitigate risk and could be used in future efforts. Warning systems include Everbridge and OR-Alert in partnership with Washington County. Grant writing is completed by individual departments as needed. The City has a robust GIS program and has created mapping products specific to each department, and hazard data and information can be pulled from a variety of sources, including historical records and DOGAMI.

4.3. Education and Outreach Assessment

Education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information were assessed to determine the City's capabilities.

Fire prevention and safety information is distributed at annual community events such as the Robin Hood Festival. The City also uses social media to promote emergency preparedness, particularly during National Preparedness Month. Other public education and outreach efforts include distributing door hangers with information and online educational activities. Additionally, Sherwood is a Tree City USA and works with contractors to maintain landscaping and properties to reduce natural hazards vulnerabilities and impacts. Sherwood is working to establish a Community Emergency Response Team (CERT) to promote disaster preparedness and train members in basic disaster response skills.

There are many nonprofit organizations and community groups that can assist with implementing future mitigation actions, including those that provide food security resources and healthcare, sheltering and emergency assistance, extreme heat sheltering, and emergency management-specific groups. A partnership with the YMCA includes providing testing stations for COVID-19 and a cooling center during an extreme heat event. Other partners include the Regional Disaster Preparedness Organization, Washington County Emergency Management Cooperative, Local Emergency Managers group, and the Local Emergency Planning Committee.

4.4. Financial Assessment

The City has access to or may be eligible to use the following funding resources for hazard mitigation initiatives:

- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, and/or electric services

- Stormwater utility fees
- Incurrence of debt through general obligation bonds and/or special tax bonds
- Federal funding sources, including the Building Resilient Infrastructure and Communities (BRIC) and Hazard Mitigation Assistance grants
- State funding programs, including the State Homeland Security Program

The City's Capital Improvement Program does not currently provide funding for hazard mitigation projects identified in this NHMP; however, the program limits expenditures on projects that would encourage development in areas vulnerable to natural hazards.

4.5. Capability Expansion and Improvement

Actions that can expand and improve existing authorities, plans, policies, and resources for mitigation include continuing to update City plans as necessary to ensure they are current and reflect the needs of the community; continuing to seek out a variety of funding sources and increase grant writing capabilities; creating and implementing additional public education and outreach offerings; establishing a CERT; and solidifying staffing capabilities and training the new staff, as required.

5. Mitigation Strategy

(In compliance with 44 CFR §201.6(c)(3)(i), §201.6(c)(3)(ii), §201.6(c)(3)(iii), §201.6(c)(3)(iv), and §201.6(c)(4)(ii))

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) directs local mitigation plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a local mitigation plan lead to and support the mitigation strategy.

5.1. Mitigation Goals

The Steering Committee reviewed and evaluated goals from the 2017 Washington County NHMP, 2020 City of Beaverton NHMP, 2011 Cities of Cornelius and Forest Grove NHMPs, and 2020 State of Oregon NHMP. The goals from each plan were grouped by topic and then synthesized to create the seven goals detailed in Volume I, Section 3. These goals are the basis of this plan and summarize what the Steering Committee will accomplish by implementing this plan.

5.2. Plan Incorporation and Integration into Existing Planning Mechanisms

Based on mitigation plan requirement 44 CFR §201.6(c)(4)(ii), the vulnerability and capabilities assessments for the City were carefully reviewed and considered when developing the mitigation actions for this plan. The City's Technical Committee will establish a process in which the mitigation strategy, goals, objectives, and actions outlined in this plan will be incorporated into the existing local planning strategies.

Once the plan is adopted, the committee will coordinate implementation with the responsible parties in the City and with external stakeholders as needed. The primary means for integrating mitigation strategies

will be through the revision, update, and implementation of plans and regulations, such as comprehensive plans, capital improvement plans, and land development regulations, as feasible. The members of the City's Technical Committee will remain charged with ensuring the goals and strategies of new and updated local planning documents for their jurisdictions and special districts are consistent with the goals and actions in the NHMP and will not contribute to increased hazard vulnerability.

5.2.1. Comprehensive Plan

The City of Sherwood's 2040 Comprehensive Plan includes goals and policies related to hazard mitigation. Through a coordinated resiliency strategy, the City will focus on five goals related to natural hazards: minimizing risk, increasing preparedness, improving coordination, building resilience, and mitigating hazards. The City will enhance ordinances and standards as part of this effort—especially those relating to the siting of essential facilities and other development—minimizing the potential risk of natural hazards to people and property. Sherwood will also coordinate emergency preparedness, resilience building, and hazard mitigation efforts with local and regional partners in both the public and private sectors.⁴⁷² When the plan goes through a regular update, additional details about hazard mitigation will be added, as applicable.

5.2.2. Building and Zoning Codes

The City will continue to enforce building and zoning codes and adopt new codes as necessary. Sherwood's zoning code, known as the Community Development Code (CDC), addresses the mitigation of flooding hazards in Section 16.134.020. Updates to this section and additions for other areas of hazard mitigation strategies can be integrated into future CDC amendment efforts.

5.2.3. Public Engagement, Education, and Outreach

The City of Sherwood will ensure information about natural hazard measures is available to the public in a variety of formats, media, and languages. These efforts will focus on actionable items, such as informing residents on retrofitting structures for earthquake and personal preparedness supplies.

5.2.4. Day-to-Day Government Functions

The City of Sherwood will continue to enforce policies and review prioritized policies and update them as necessary. The City will maintain adequate supplies on hand to ensure day-to-day government and functions are operational, such as making certain that ample chlorine is available for water treatment activities.

5.2.5. Land Development Regulations

The City will continue to enforce land development regulations and adopt new regulations as necessary. The Sherwood 2040 Comprehensive Plan includes goals to minimize risk to life and property from natural and human-made hazards. As detailed in Governance and Growth Management Goal 8 of the Comprehensive Plan, the City prohibits development in the floodplain as well as regulating development in areas of runoff or erosion hazard. The plan also addresses the preservation and maintenance of natural resources as a means of mitigating the impact of natural hazards.

⁴⁷² City of Sherwood. (2021, December 7). Sherwood 2040 Comprehensive Plan. <https://www.sherwoodoregon.gov/planning/page/sherwood-2040-comprehensive-plan>

5.2.6. Floodplain Management Program and/or National Flood Insurance Program

The City of Sherwood Emergency Management Office will continue to review any RL properties and incorporate any new findings into the City's mitigation strategy, as appropriate.

The City's floodplain management program is implemented through CDC Section 16.134.020. Updates to this section and additions for other areas of hazard mitigation can be integrated into future CDC amendment efforts.

5.2.7. Economic Development Plans and Policies

The City will incorporate mitigation projects, policies, and procedures into public building spaces as applicable and appropriate. This includes incorporating solar power equipment where applicable.

5.2.8. Stormwater Management Plans and Procedures

The City will continue to enforce procedures and update plans as required. Sherwood updated its Stormwater System Master Plan in 2016. Findings from the Master Plan will be supported by future city projects, such as the creation of catch basins and filter island objects to filter out oil.

5.2.9. Emergency Plans That Address Evacuation and Sheltering

Evacuation and sheltering are addressed in an annex of the City's Emergency Operations Plan, and the City will continue to work with Washington County on sheltering efforts as needed.

5.2.10. Enforcement of Existing Policies

Current policies will continue to be enforced and upheld and will be updated as necessary to meet the needs of the City and residents.

5.2.11. Funding Opportunities

The City of Sherwood's Emergency Management Office will continue to review annual, post-disaster, and stand-alone grant opportunities for potential mitigation project funding opportunities, including BRIC, HMGP, and state funding sources.

5.2.12. Day-to-Day Development, Review, and Prioritization of Policies

The City will continue to enforce policies and review prioritized policies and update them as necessary to support a comprehensive mitigation strategy.

6. Action Items

Action items for the 2023 NHMP were determined by the City’s Technical Committee based on the review of its risk assessment, its existing capabilities, and the status of its previous action items. This comprehensive range of actions includes local plans and regulations, structure and infrastructure projects, natural systems protections, and education and awareness programs. A summary of these actions and full action item planning worksheets are provided in Sections 6.1 and 6.2 below. Additional information about how these actions were developed, evaluated, and prioritized is in Volume I, Section 3.

6.1. City of Sherwood Action Items: 2023 Washington County NHMP

Table 212: City of Sherwood Action Items

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
1	Coordinate with Washington County and GIS efforts to provide mapping to the public.	Dam failure	High
2	Educate the public on the risk potential and the potential effects of a dam failure, including water service, power utilities, and others.	Dam failure	High
3	Educate the community about water conservation.	Drought	Low
4	Install low-flow water fixtures in schools and public facilities.	Drought	Low
5	Plant drought-resistant xeriscape gardens and landscaping. Capture rainwater in cisterns and rain barrels for future use on gardens, trees, and other planted areas.	Drought	Low
6	Adopt future required seismic building code revisions as they become introduced. Enforce the current building code standards to ensure that only the appropriate land uses are allowed, especially in high hazard areas.	Earthquake, flooding, and landslide	Medium

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
7	Conduct seismic evaluations on identified community assets, including shelters, critical and essential facilities, and high-risk school and emergency service buildings. Implement appropriate structural and non-structural upgrades and mitigation strategies.	Earthquake	Low
8	Adopt codes and regulations that incentivize the installation of green roofs, solar panels, and solar parking area covers, which provide shade and remove heat from roof and paving surfaces and surrounding air. Incentivize and encourage cool roofing products, such as white roofs, that reflect sunlight and heat away from buildings. Increase tree plantings around buildings to shade parking lots and along public rights-of-way.	Extreme heat	High
9	Educate City employees on Occupational Safety and Health Administration rules and how the City will support operations during extreme heat events. Train employees and supervisors on heat illness indicators and prevention.	Extreme heat	High
10	Offer resources and material about cooling tips to vulnerable populations. Inform populations about rights and rules regarding landlord and housing regulations and how to get help if needed.	Extreme heat	Medium
11	Review and study the liquefaction survey to identify areas that may be prone to landslides. Monitor nearby infrastructure for vulnerabilities.	Flooding and landslide	Medium
12	Investigate flood risk within the jurisdiction and plan for high-water contingencies as appropriate.	Flooding	Medium
13	Build resilient infrastructure to combat the effects of floods and high water.	Flooding	Medium
14	Maintain flood insurance.	Flooding	Medium
15	Follow the stormwater program and maintenance procedures and enhance them as needed to fit evolving needs.	Flooding	Medium
16	Heighten awareness of flood risk by incorporating the procedures for tracking high water marks following a flood into emergency response plans.	Flooding	Medium
17	Landslide risk and damage can be mitigated by being aware of risk factors and development codes and regulations.	Landslide	Low

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
18	Identify critical facilities and industries that may be affected by ash fall and assist them in emergency response plan development.	Volcanic ash	Low
19	Collaborate with County environmental health staff for immediate warnings to communities about degraded air quality following volcanic eruptions, particularly in areas with high concentration of vulnerable groups (e.g., retirement facilities and schools).	Volcanic ash	Low
20	Collaborate with state agencies such as National Oceanic and Atmospheric Administration and DOGAMI, who can assist in developing ashfall models for Washington County and Sherwood.	Volcanic ash	Low
21	Increase public education and awareness of wildfire smoke by informing the public about wildfire smoke impacts. This includes producing and distribute family emergency preparedness information about wildfire smoke hazards. Including tips to mitigate impacts such as: staying indoors, limiting indoor pollution, staying cool, limiting driving, wearing a mask outdoors, and using an air purifier when possible.	Wildland fire, wildland fire smoke	Medium
22	Develop and implement defensible space programs to reduce risk to structures and infrastructure.	Wildland fire	Medium
23	Inform residents of shelter options and evacuation protocols.	Windstorm, including tornado	Low
24	Educate homeowners on the benefits of wind retrofits, provide outreach material to property owners on how to properly install temporary window coverings before a storm, and educate homeowners on larger tree maintenance and management.	Windstorm, including tornado	Low
25	Educate design professionals to include wind mitigation during building design.	Windstorm, including tornado	Low
26	Establish and enforce standards for all utilities regarding tree pruning around lines.	Winter storm	Low
27	Bury overhead power lines.	Winter storm	Low

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
28	Use designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.	Winter storm	Low
29	Install redundancies and loop feeds.	Winter storm	Low
30	Produce and distribute family and traveler emergency preparedness information about severe winter weather hazards, including safety strategies for severe weather in driver education classes and materials.	Winter storm	Low
31	Encourage homeowners to install carbon monoxide monitors and alarms and educate citizens that all fuel-burning equipment should be vented to the outside.	Winter storm	Low

6.2. Mitigation Action Information Worksheets

Table 213: Dam Failure – Provide Information on Risk

Mitigation Action Information	
Title of action	Dam Failure – Provide Information on Risk
Type of action	Plans/regulations <input type="checkbox"/> Natural systems protection <input checked="" type="checkbox"/> Structure and infrastructure project <input type="checkbox"/> Public education/awareness <input checked="" type="checkbox"/>
Action description	1. Coordination with the county and GIS efforts to provide mapping to the public. 2. Educate the public on risk potential and the effects of a failure. Including: water service, power utilities and others.
Hazard(s) addressed	Dam failure <input checked="" type="checkbox"/> Flood <input type="checkbox"/> Windstorm, incl. tornado <input type="checkbox"/> Drought <input type="checkbox"/> Landslide <input type="checkbox"/> Winter storm <input type="checkbox"/> Earthquake <input type="checkbox"/> Volcanic ash <input type="checkbox"/> Extreme heat <input type="checkbox"/> Wildland fire <input type="checkbox"/>
How does the action address identify current or future risks and vulnerabilities?	A high-volume water surge upstream from a catastrophic Scoggins Dam failure can cause the rise of downstream tributaries anywhere from 4 feet to 5 feet. High water surges can be devastating, causing flooding, severe bank erosion, and property damage along the immediate tributary. Furthermore, water can rise very rapidly due to the surge, posing a serious threat to people remaining in lower-lying inundation areas.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 <input checked="" type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 7 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 5 <input type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 6 <input type="checkbox"/>
Integration into other initiatives	
Alignment with existing plans and policies	Statewide Planning Goal 7, Comprehensive Plan (CH&S Goal 7), Emergency Operations Plan, The Disaster Mitigation Act of 2000
Mitigation Action Implementation Plan	
Priority	Low <input type="checkbox"/> Medium <input type="checkbox"/> High <input checked="" type="checkbox"/>
Lead position, office, department, or division responsible for implementation	Community Development, PW, Emergency Management, Army Corp of Engineers
Potential Funding Sources	
Non-Federal Funding Sources	Federal Funding Sources
General Fund	SHSP Citizen Corps Grant Program, UASI Citizen Corp Grant Program

Estimated Cost	Low – Less than \$50,000	
Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Table 214: Drought

Mitigation Action Information	
Title of action	Drought
Type of action	Plans/regulations <input type="checkbox"/> Natural systems protection <input checked="" type="checkbox"/> Structure and infrastructure project <input type="checkbox"/> Public education/awareness <input checked="" type="checkbox"/>
Action description	1. Educate community about water conservation. 2. Install low flow water fixtures in schools and public facilities. 3. Plant-drought resistant “xeriscape” garden and landscape. Capture rainwater in cisterns and rain barrels for future use on gardens, trees, and other planted areas.
Hazard(s) addressed	Dam failure <input type="checkbox"/> Flood <input type="checkbox"/> Windstorm, incl. tornado <input type="checkbox"/> Drought <input checked="" type="checkbox"/> Landslide <input type="checkbox"/> Winter storm <input type="checkbox"/> Earthquake <input type="checkbox"/> Volcanic ash <input type="checkbox"/> Extreme heat <input type="checkbox"/> Wildland fire <input type="checkbox"/>
How does the action address identified current or future risks and vulnerabilities?	Partner with local schools to implement water conservation strategies to maximize water use in schools and home.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 <input type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 7 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 5 <input type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 6 <input type="checkbox"/>
Integration into other initiatives	Comprehensive Plan (H&VE Goal 4)
Alignment with existing plans and policies	Comprehensive Plan, Water Management and Conservation Plan, The Disaster Mitigation Act of 2000
Mitigation Action Implementation Plan	
Priority	Low <input checked="" type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/>
Lead position, office, department, or division responsible for implementation	Public Works, Sherwood Schools District, USDA, ODOA, OSU Extension and Soil/Water Conservation
Potential Funding Sources	
Non-Federal Funding Sources	Federal Funding Sources
General Fund	Potential Federal Grant opportunity
Estimated Cost	Low – Less than \$50,000
Estimated Benefit	
Primary Benefit(s)	Financial Benefit(s)
Protect Life and Property	\$300,000

Project Timeline		
Expected Timeline for Completion		
Short-term <input checked="" type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input checked="" type="checkbox"/> Ongoing <input checked="" type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$600,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input checked="" type="checkbox"/> Ongoing <input checked="" type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$600,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input checked="" type="checkbox"/> Ongoing <input checked="" type="checkbox"/>		

Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/>		
Mid-term <input checked="" type="checkbox"/>		
Long-term <input type="checkbox"/>		
Ongoing <input type="checkbox"/>		

Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Table 220: LS – Landslide Monitoring and Awareness

Mitigation Action Information	
Title of action	LS – Landslide Monitoring and Awareness
Type of action	Plans/regulations <input type="checkbox"/> Natural systems protection <input checked="" type="checkbox"/> Structure and infrastructure project <input type="checkbox"/> Public education/awareness <input type="checkbox"/>
Action description	Review and study the liquefaction survey to see areas that may be prone to landslides. Monitor nearby infrastructure for vulnerabilities.
Hazard(s) addressed	Dam failure <input type="checkbox"/> Flood <input checked="" type="checkbox"/> Windstorm, incl. tornado <input type="checkbox"/> Drought <input type="checkbox"/> Landslide <input checked="" type="checkbox"/> Winter storm <input type="checkbox"/> Earthquake <input type="checkbox"/> Volcanic ash <input type="checkbox"/> Extreme heat <input type="checkbox"/> Wildland fire <input type="checkbox"/>
How does the action address identify current or future risks and vulnerabilities?	Landslides can also damage or temporarily disrupt utility services, roads, and other transportation/communication systems, including emergency response, fire, medical, police, etc.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 <input checked="" type="checkbox"/> Goal 4 <input checked="" type="checkbox"/> Goal 7 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 5 <input type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 6 <input type="checkbox"/>
Integration into other initiatives	Comprehensive Plan (CH&S Goal 8)
Alignment with existing plans and policies	The Disaster Mitigation Act of 2000
Mitigation Action Implementation Plan	
Priority	Low <input type="checkbox"/> Medium <input checked="" type="checkbox"/> High <input type="checkbox"/>
Lead position, office, department, or division responsible for implementation	Community Development, PW, Engineering
Potential Funding Sources	
Non-Federal Funding Sources	Federal Funding Sources
General Fund	Not Applicable
Estimated Cost	High – More than \$100,000
Estimated Benefit	
Primary Benefit(s)	Financial Benefit(s)
Protect Life and Property Environment	\$600,000

Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Table 222: FL – Flood Risk Assessment

Mitigation Action Information	
Title of action	FL – Flood Risk Assessment
Type of action	Plans/regulations <input checked="" type="checkbox"/> Natural systems protection <input type="checkbox"/> Structure and infrastructure project <input type="checkbox"/> Public education/awareness <input checked="" type="checkbox"/>
Action description	Heighten awareness of flood risk. Incorporating the procedures for tracking high water marks following a flood into emergency response plans. Incorporating the procedures for tracking high water marks following a flood into emergency response plans.
Hazard(s) addressed	Dam failure <input type="checkbox"/> Flood <input checked="" type="checkbox"/> Windstorm, incl. tornado <input type="checkbox"/> Drought <input type="checkbox"/> Landslide <input type="checkbox"/> Winter storm <input type="checkbox"/> Earthquake <input type="checkbox"/> Volcanic ash <input type="checkbox"/> Extreme heat <input type="checkbox"/> Wildland fire <input type="checkbox"/>
How does the action address identify current or future risks and vulnerabilities?	Conducting cumulative impact analyses for multiple development projects within the same watershed using GIS to map areas that are at risk of flooding. Obtaining depth grid data and using it to illustrate flood risk to citizens. Incorporating digital floodplain and topographic data into GIS systems, in conjunction with Hazus, to assess risk. Coordination with the county and GIS efforts to provide mapping to the public.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 <input checked="" type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 7 <input type="checkbox"/> Goal 2 <input type="checkbox"/> Goal 5 <input type="checkbox"/> Goal 3 <input type="checkbox"/> Goal 6 <input checked="" type="checkbox"/>
Integration into other initiatives	To be determined
Alignment with existing plans and policies	The Disaster Mitigation Act of 2000
Mitigation Action Implementation Plan	
Priority	Low <input checked="" type="checkbox"/> Medium <input checked="" type="checkbox"/> High <input type="checkbox"/>
Lead position, office, department, or division responsible for implementation	Community Development, Emergency Management
Potential Funding Sources	
Non-Federal Funding Sources	Federal Funding Sources
General Fund	Not Applicable
Estimated Cost	Low – Less than \$50,000

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input checked="" type="checkbox"/> Ongoing <input type="checkbox"/>		

Project Timeline		
Expected Timeline for Completion		
Short-term <input checked="" type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Table 225: Volcanic Ash – 2

Mitigation Action Information	
Title of action	Volcanic Ash – 2
Type of action	Plans/regulations <input type="checkbox"/> Natural systems protection <input type="checkbox"/> Structure and infrastructure project <input checked="" type="checkbox"/> Public education/awareness <input type="checkbox"/>
Action description	1. Collaborate with county environmental health for immediate warnings to communities about degraded air quality following volcanic eruptions, particularly in areas with high concentrations of vulnerable groups (e.g., retirement facilities and schools). 2. Work with state agencies such as NOAA and DOGAMI that can assist in developing ash fall models for Washington County and Sherwood.
Hazard(s) addressed	Dam failure <input type="checkbox"/> Flood <input type="checkbox"/> Windstorm, incl. tornado <input type="checkbox"/> Drought <input type="checkbox"/> Landslide <input type="checkbox"/> Winter storm <input type="checkbox"/> Earthquake <input type="checkbox"/> Volcanic ash <input checked="" type="checkbox"/> Extreme heat <input type="checkbox"/> Wildland fire <input type="checkbox"/>
How does the action address identify current or future risks and vulnerabilities?	Volcanic ash can lead to respiratory problems for vulnerable sectors of residents such as the elderly and youth. Increasing awareness through public outreach reduces the impact of a volcano on vulnerable groups residing in Sherwood.
Mitigation Action Integration	
Alignment with NHMP goals	Goal 1 <input checked="" type="checkbox"/> Goal 4 <input type="checkbox"/> Goal 7 <input type="checkbox"/> Goal 2 <input checked="" type="checkbox"/> Goal 5 <input type="checkbox"/> Goal 3 <input checked="" type="checkbox"/> Goal 6 <input type="checkbox"/>
Integration into other initiatives	Everbridge ENS
Alignment with existing plans and policies	County Environmental Health, Emergency Operations Plan, Facility Emergency Action Plan, City GIS, The Disaster Mitigation Act of 2000
Mitigation Action Implementation Plan	
Priority	Low <input checked="" type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/>
Lead position, office, department, or division responsible for implementation	USGS-CVO, DOGAMI, County Environmental Health, Emergency Management
Potential Funding Sources	
Non-Federal Funding Sources	Federal Funding Sources
General Fund	Not Applicable
Estimated Cost	Low – Less than \$50,000

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000-\$600,000
Project Timeline		
Expected Timeline for Completion		
Short-term <input checked="" type="checkbox"/> Mid-term <input type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
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Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		

Estimated Benefit		
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Estimated Benefit		
Primary Benefit(s)		Financial Benefit(s)
Protect Life and Property		\$300,000
Project Timeline		
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Short-term <input type="checkbox"/> Mid-term <input checked="" type="checkbox"/> Long-term <input type="checkbox"/> Ongoing <input type="checkbox"/>		